# United States Patent

**Klein et al.**

[15] **3,671,890**

[45] **June 20, 1972**


## [54] MANUALLY OPERABLE MOLDED CASE CIRCUIT BREAKER WITH SPECIAL TRIP TESTING MEANS


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[52] **U.S. Cl.** ..... **335/22**, 335/176

[51] **Int. Cl.** ..... **H01h 73/12**

[58] **Field of Search** ..... 335/22, 23, 45, 176; 337/79, 337/37



[56] **References Cited**

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| 3,103,565 | 9/1963 | Walker et al. | 335/45 |
| 3,480,890 | 11/1969 | Layton et al. | 335/23 |
| 1,891,015 | 9/1932 | Rich | 337/37 |



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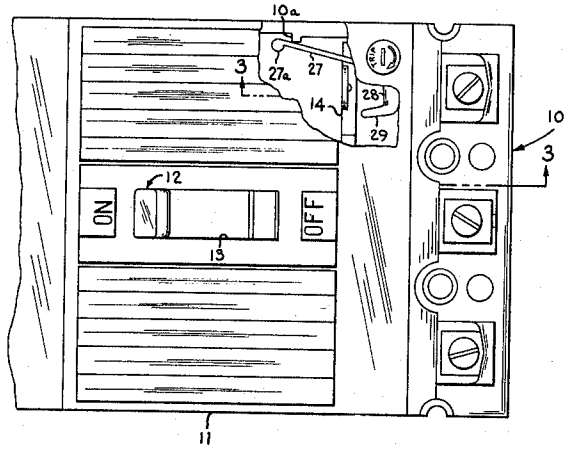
[57] **ABSTRACT**

A molded case circuit breaker with manually operable ON-OFF handle means, and a separate rotatable trip testing button in an opening in the cover of the breaker casing and flush with the surface thereof. The trip testing button includes two parts which when assembled trap the button rotatably in the casing cover. The interior portion of the trip testing button has two angularly extending arms and is of resilient plastic material. One of the arms engages the circuit breaker trip bar when the button is rotated, and causes tripping. The other arm of the trip testing button is thin and elongated and serves to position the button in normal unoperated position and to act as a spring to return the button from trip operating position to its normal position. Positive stops are also provided for limiting rotation in each direction.


**5 Claims, 4 Drawing Figures**



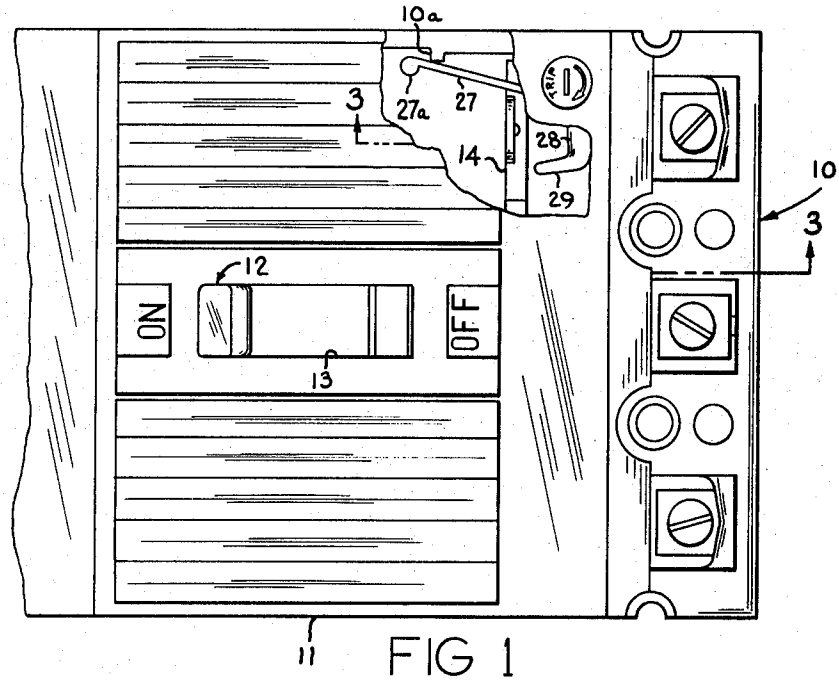



FIG 1

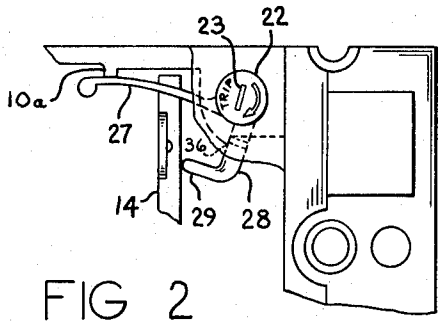



FIG 2

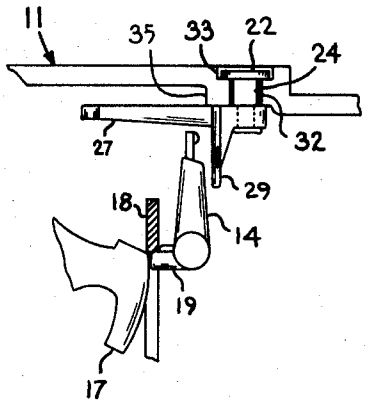



FIG 3

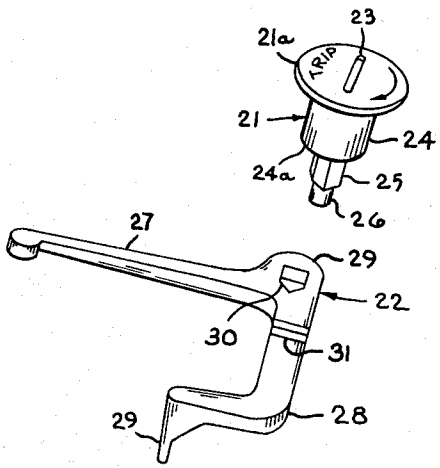



FIG 4

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# MANUALLY OPERABLE MOLDED CASE CIRCUIT BREAKER WITH SPECIAL TRIP TESTING MEANS

## SUMMARY OF THE INVENTION

The present invention relates to molded case electric circuit breakers having manually operable handle means for operating the circuit breaker between ON and OFF conditions, and particularly to such circuit breakers which also include a separate means for permitting manual tripping of the circuit breaker mechanism, for test purposes as well as to "exercise" the tripping mechanism. This may be done when the breaker is in ON position or when the breaker is in the OFF condition.

In circuit breakers of the type described, the means for manual tripping function of the mechanism, as distinguished from manually operating the circuit breaker to OFF position in the past has comprised a small pushbutton. Thus, U.S. Pat. No. 2,981,811 H. M. Steven et al. issued Apr. 25, 1961, and assigned to the same assignee as the present invention, includes a plunger or pushbutton **80** (FIG. 7) to facilitate testing of the mechanical operation of the trip unit when installed in a circuit breaker, (see column 7 lines 8–11) by simulating operation of a tripping member by current-responsive means. Also, U.S. Pat. No. 3,480,890, B. W. Layton et al., issued Nov. 25, 1969, includes a straight-line reciprocably operable plunger **126** for testing the tripping mechanism of the circuit breaker.

In addition, the prior art shows examples of molded case circuit breakers which include a first button for pushing to turn the circuit breaker ON, and a second button for pushing to turn the circuit breaker OFF. The OFF operation is in such devices accomplished by the OFF button serving to trip the circuit breaker. An example of the latter type arrangement is that of U.S. Pat. No. 3,158,711, B. A. Piteo, issued Nov. 24, 1964 and assigned to the same assignee as the present invention.

The structure of the Steven et al. patent is intended for use by the initially installing electrician, and for use if and when a "trip unit" is changed. After the breaker is installed, it is not readily accessible, since a front plate of the switchboard or other device normally covers all of the breaker except a portion of the front wall, whereas the trip button is located in one of the end walls.

The Layton et al. U.S. Pat. No. 3,480,890 has a trip-test button located in the exposed front wall surface of a circuit breaker. When a trip-test button is located so as to be readily accessible at all times, there is a danger that someone may operate it unintentionally or that some unauthorized person may operate it, even maliciously.

The Layton et al. patent attempts to minimize the danger of inadvertent or malicious operation by recessing the tripping plunger in a relatively small hole so that it cannot be operated directly by the finger, but requires a special tool or push-rod. While the trip button of the Layton et al patent cannot be depressed directly by the finger, however, a wide assortment of objects can be used as "tools" to cause such operation. Thus, for example, a conventional pencil or ballpoint pen can be used, as well as any piece of relatively stiff wire or a suitably sized ordinary machine screw or nail. Since objects of this type may readily be found in most places where such breakers are used, it is relatively easy for anyone to trip the circuit breaker.

Both of the aforesaid prior art structures also have disadvantages characteristic of any rectilinearly operable means extending through a wall of a molded case circuit breaker, and particularly such a member which is manually operable. One such disadvantage is that a small continuous opening exists around the pushbutton extending from the outside of the circuit breaker to the interior thereof. This constitutes an entry way through which dirt may enter the circuit breaker casing. In addition, if there is an automatic interruption of an overload or short circuit count while the test button is being depressed, it is possible that hot gases may escape around the button to the operator's hand. In addition, in prior art devices it is not only necessary to provide an insulating push rod or button, but also to provide a separate spring member to bias the push rod to its normal or inoperative position.



It is an object of the present invention to provide an electric circuit breaker of the molded-case type having a manually operable ON-OFF handle, and in addition, a test button for testing the mechanical functioning of the tripping mechanism of the circuit breaker which, although always visible and accessible, cannot be operated by a simple pushing motion, and which requires a particular kind and size of tool to operate it which is not readily accessible to most persons.

It is another object of the invention to provide a circuit breaker of the type described including a test operating button which has no continuous direct path for entry of moisture or dirt or for the escape of hot gases.

It is a further object of the invention to provide a circuit breaker of the type described including a test operating button which is simple and inexpensive to manufacture and which can be assembled and used without a separate spring biasing means such as by providing its own biasing or being usable with no biasing means at all.

It is a further object of the invention to provide, in a circuit breaker of the type described, a test button which requires no separate fastening or mounting means for holding it in place.

In accordance with the invention, an electric circuit breaker is provided including a generally rectangular insulating closure enclosing all of the parts except the handle, the handle being operable between ON and OFF positions to operate the circuit breaker for normal switching functions. The circuit breaker includes automatically operable "trip" means for causing automatic opening of the circuit breaker upon the occurrence of certain predetermined abnormal current conditions, or in response to reception of a tripping signal from a remote source. The circuit breaker also includes a testing button rotatably supported in an opening in the front surface of the circuit breaker casing. The testing button includes a cylindrical portion projecting through a hole in the circuit breaker casing, an enlarged head portion rotatably received in a counterbore portion of the hole, and an inner portion, also larger than the cylindrical portion. The trip-testing button is preferably constructed of resilient plastic insulating material, and the inner portion includes two elongated extensions. One of these extensions is disposed to engage and operate the circuit breaker trip bar when the test button is rotated from its normal position a predetermined amount. The other elongated extension normally rests against or closely adjacent a fixed portion of the inner wall surface of the circuit breaker casing. When the test button is rotated, this extension is resiliently deformed and acts as a spring to return the test button to its normal or inoperative position when it is released. If desired, this portion may be omitted, the button being returned to its normal position by the member that it acts against inside the breaker. The outer portion of the test button preferably is flush with or slightly below the outer surface of the circuit breaker housing, and is provided with a closed-end slot, permitting operation only by a screwdriver-type device of not more than a predetermined relatively small width.

The invention will be more fully understood from the following detailed description, and its scope will be set forth in the appended claims.

## DESCRIPTION OF FIGURES OF THE DRAWING

FIG. 1 is a fragmentary top plan view of a molded case circuit breaker incorporating the invention, a portion of the top wall of the breaker casing being broken away;

FIG. 2 is a fragmentary view showing a portion of the casing of the circuit breaker of FIG. 1, with the trip-testing button in trip-actuating position;

FIG. 3 is a fragmentary elevational view taken generally as indicated by the arrows 3—3 in FIG. 1, and

FIG. 4 is an exploded perspective view of the two cooperating parts of the test button prior to assembly in the circuit breaker.

Referring to the drawing, the invention is shown as incorporated in an electric circuit breaker having a molded insulating casing **10**. The insulating casing **10** is of generally box-like configuration, including a generally planar top cover portion **11**. The circuit breaker includes a swinging or toggle type operating handle **12** projecting through an opening **13** in the top wall of the insulating housing. The operating handle **12** is movable between ON and OFF positions to operate the circuit breaker in the manner of a switch. The circuit breaker includes operating mechanism, not shown, and electrically responsive means, also not shown, by means of which the circuit breaker is automatically operated from closed to open condition in response to abnormal current or voltage conditions. The current or voltage responsive means (not shown) acts on a trip bar **14** extending transversely across the interior of the circuit breaker. For illustration purposes, a three-pole circuit breaker is shown. A common trip bar **14** extends across all three poles so that it may be acted on by current responsive means of each of the poles. The common trip bar may also be acted on by voltage-responsive means, although only one such voltage responsive means is ordinarily used, if any. A circuit breaker mechanism of a type suitable for use in the circuit breaker shown in FIG. **1** is shown and described in detail in U.S. Pat. No. 3,005,066, issued Oct. 17, 1961, to D. B. Powell, and assigned to the same assignee as present invention. Circuit breaker mechanisms of the type referred to include, in addition to means for manually opening and closing the movable contacts of each of the poles of the circuit breaker, a normally latched releasable member such as member **17**, which is normally held by a latch member such as **18**. Latch member **18** is held in latching position, as described in the aforesaid patent, by a latch-restraining projection **19** carried by the common trip bar **14**. In the arrangement shown, rotation of the common trip bar in a counterclockwise direction moves the restraining projection **19** out of engagement with the latch member **18** and permits rotation of the latch member **18** in clockwise direction, permitting the releasable member **17** to move upwardly as shown, causing tripping of the circuit breaker mechanism.

For the purpose of simulating the actuation of the trip-bar by current-responsive means and operation of the operating mechanism in its tripping function, a trip-testing button is provided in accordance with the invention. The trip-testing button includes two parts, namely an outer portion **21** and an inner portion **22** (see FIG. **4**). Outer portion **21** includes a head portion **21A** which is generally disc-shaped and has a slot **23** therein which extends less than the full diameter of the head portion **21A**, for a purpose to be described. The outer portion **21** also includes a cylindrical portion **24**, a stem portion **25** and a deformable end portion **26**.

The inner portion **22** of the trip test button includes two elongated extending portions **27** and **28** respectively, and a hub portion **29** having a non-circular hole **30** therethrough. The elongated portion **28** is relatively wide, and preferably has a right-angle shaped cross-section to render it relatively stiff and non-flexible. The elongated portion **28** has a downwardly extending portion **29** at the outer end thereof, and also carries a raised abutment **30**, for purposes to be described. The elongated portion **27** is relatively thin and flat, rendering it relatively flexible, for a purpose to be described. At the end of the elongated arm **27** is an enlarged portion **27a**, which is provided for the purpose of facilitating molding of the part by providing a place for an ejection pin in the molding operation.

As shown particularly in FIG. **3**, the trip-test button assembly is mounted in the cover **11**. For this purpose the cover is provided with a hole **32** having an enlarged counterbore portion **33**. The hole **32** receives the cylindrical portion **24** of the trip-test button, while the counterbore portion **33** receives the head portion **21A**, with the upper surface of the head portion preferably being flush with or slightly below the outer surface of the cover **11**. After the outer portion **21** is assembled in the cover **11**, the inner portion **22** is assembled onto the stem portion **25**, so that the stem portion **25** extends through the hole **30**. The hole **30** is of non-circular configuration such that the stem **25** can extend through it in only one position. This assures that the marking of the word "Trip" on the outer portion of the head **21A** will be in the desired relation to the circuit breaker generally.

When the trip-test button assembly is mounted in place, as shown particularly in FIG. **1**, the free end portion of the arm **27** rests on or closely adjacent a rib or abutment **10A** of the casing **10**, preferably comprising a downwardly extending side portion of the cover member **11**. Likewise, the downwardly extending portion **29** of the elongated portion **28** extends closely adjacent the trip bar **14**.

In operation, the trip-test button assembly is rotated in clockwise direction by inserting the end of a tool such as a screwdriver, in the slot **23**. The slot **23** is intentionally made shorter than the full diameter of the head **22**, in order to require a particular small size screwdriver to be used for this purpose. As the trip testing button is rotated in clockwise direction, the extension **29** of the arm **28** engages the trip-bar **14**, rotating it in a counter-clockwise direction as viewed in FIG. **3**, causing tripping of the circuit breaker mechanism. The tripping position of the trip-test button assembly is shown particularly in FIG. **2**. It will be observed that as the trip test button assembly is rotated, the arm **27** is resiliently deformed against the stop **10a**. When the trip-test button is released, the arm **27** returns to its straightened condition, returning the assembly as a whole to its original position as shown in FIGS. **1** and **3**. The arm **27** therefore acts as a return spring, and no separate spring is required for this purpose. In order to facilitate this action, the trip-test button assembly is preferably molded of a resilient plastic material, and preferably a thermoplastic material. In one embodiment, the thermoplastic material Lexan (T.M.) sold by the General Electric Co., Pittsfield, Mass. was used.

If desired, the resilient return feature may be provided by a separate spring, or it may be omitted altogether. If omitted, the trip-button would have a small amount of free or loose motion before engaging the trip bar, or it might rest against the trip bar, depending on how the device is mounted with respect to the force of gravity. Such looseness may be considered by some users to be objectionable, and when resting on the trip bar, might make the breaker more subject to tripping due to mechanical shock or vibration. The integral spring action which positions the button and always returns it to the same position is achieved by the present invention at no significant cost and avoids these possible objections.

In order to prevent over-turning of the trip-test button which might cause damage to the trip bar assembly or which might break the resilient arm **27**, positive stop means is provided for limiting rotation of the trip-test button in both clockwise and counter-clockwise directions. This stop means includes the raised abutment **31** on the arm **28**, and also an abutment **35** extending downwardly from the inner surface of the cover **11** beneath the head **22** of the trip-test button assembly. A cut-away portion **36** (see FIG. **2**) is provided in the abutment **35** to permit limited movement of the button **31** while providing a positive stop for its travel in both directions.

After the inner portion **22** is assembled onto the stem **25** of the outer portion **21**, the end portion **26** is deformed in the manner of riveting, by application of heat which melts and flows the plastic material. The inner portion **22** rests against a shoulder **24a** (see FIG. **4**), so that when the parts are fastened together by deforming the end portion **26**, the portions are rigidly attached together, while proper clearance is provided to permit easy rotation of the assembly in the hole **32**.

It will be observed that since the trip-testing function can be achieved only by rotating the trip test-button, which is flush with or slightly below the outer surface of the cover **11**, this cannot be done by the hand alone, but requires use of a tool. Moreover, the tool required is a particular type of tool, since more than a simple pushing function is involved. Thus common objects, such as a pencil or a piece of stiff wire, nail, etc. cannot be used to cause tripping by an unauthorized person,

who might do so out of curiosity or even malice. It will further be observed that the dimensions are preferably such that an ordinary coin cannot be used. Instead, a small screwdriver, or the equivalent, must be used.

It will be appreciated that while a particular configuration has been shown for the gripping means in the outer portion of the head portion of the trip-test button (i.e., a slot), other formations may readily be used which also will require special tools, such as a "Phillips-head slot" or some special configuration.

It will also be observed that there is no direct straight line crack or crevice through the hole **32** to the interior of the circuit breaker casing. It will also be observed that no separate spring is required. Also, the trip-test button may be installed by simply assembling the two parts as described above, and then deforming the end portion **26** in the manner of the rivet.

While one particular embodiment of the invention has been disclosed, it will be readily apparent that many modifications may be made, such as using a metal member for the inner portion **22**. I therefore intend by the appended claims to cover such modifications as fall within the true spirit and scope of the invention.

I claim:

**1**. An automatic electric circuit breaker comprising:

a. a casing of molded insulating material having a generally planar cover portion with a manually operable handle projecting through an opening therein for operating said circuit breaker between ON and OFF conditions;

b. a trip bar in said casing movable from a normal position to a releasing position to cause automatic opening of said circuit breaker;

c. a trip-testing button rotatably supported in said insulating casing, said testing button including an outer portion having a head accessible for operation externally of said insulating casing and an inner portion within said insulating casing;

d. said inner portion of said trip testing button including a first elongated arm portion extending radially from the rotational axis of said button and terminating adjacent said trip bar;

e. said test button being rotatable from a normal position to a tripping position to cause said elongated radial extension of said inner portion to engage said trip bar and cause tripping of said circuit breaker, and

f. resilient means in said casing resiliently resisting rotation of said button from said normal position to said tripping position and returning said button to said normal position after rotation to said tripping position.

**2**. An automatic electric circuit breaker as set forth in claim **1** wherein said resilient means comprises a second elongated portion extending radially from the rotation axis of said test button and engaging an abutment in said circuit breaker casing to resiliently retain said trip testing button in said normal position.

**3**. An automatic electric circuit breaker as set forth in claim **2** wherein said inner portion of said trip-testing button comprises a unitary molded part of resilient plastic material, said first elongated portion of said inner portion being formed and dimensioned so as to be relatively rigid and not subject to significant deformation when said trip button is operated, and said second elongated extension being formed and dimensioned so as to be resiliently deformed upon rotation of said trip button.

**4**. An automatic electric circuit breaker as set forth in claim **2** wherein said outer portion comprises a member molded of thermoplastic insulating material and includes a generally cylindrical portion closely fitting in said opening in said cover portion of said casing, a non-circular section stem portion extending through a conforming shape hole in said inner portion, and an outermost portion extending beyond said inner portion and thermally deformed to positively connect said inner and outer portions.

**5**. An automatic electric circuit breaker as set forth in claim **2**, including means carried by said insulating casing for positively limiting rotation of said test button in both clockwise and counter-clockwise directions.

* * * * *

# REEXAMINATION CERTIFICATE (270th)


## United States Patent [19]

[11] B1 3,671,890

Klein et al.

[45] Certificate Issued Nov. 6, 1984


[54] MANUALLY OPERABLE MOLDED CASE CIRCUIT BREAKER WITH SPECIAL TRIP TESTING MEANS


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[73] Assignee: **General Electric Company**



**Reexamination Request:**
No. 90/000,527, Mar. 19, 1984

**Reexamination Certificate for:**

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| Patent No.: | **3,671,890** |
| Issued: | **Jun. 20, 1972** |
| Appl. No.: | **129,915** |
| Filed: | **Mar. 31, 1971** |

[51] **Int. Cl.**[3] ..... **H01H 73/12**
[52] **U.S. Cl.** ..... **335/22**; 335/176
[58] **Field of Search** ..... 335/22, 23, 45, 176; 337/37, 79



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| 3,103,565 | 9/1963 | Walker et al. | 335/45 |
| 3,480,890 | 11/1969 | Layton et al. | 335/23 |

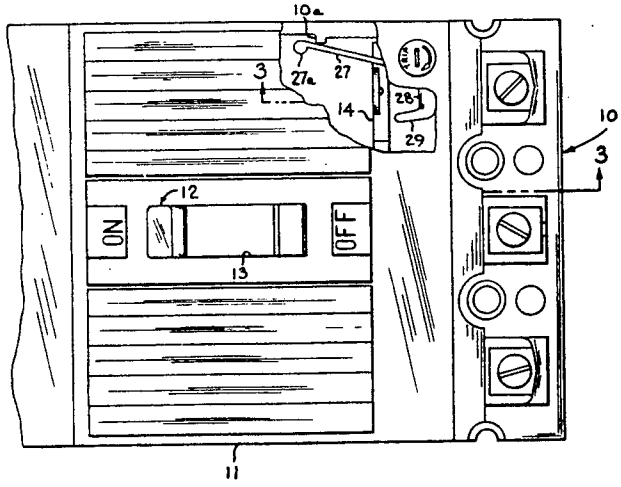


*Primary Examiner*—Harold Broome



[57] **ABSTRACT**

A molded case circuit breaker with manually operable ON-OFF handle means, and a separate rotatable trip testing button in an opening in the cover of the breaker casing and flush with the surface thereof. The trip testing button includes two parts which when assembled trap the button rotatably in the casing cover. The interior portion of the trip testing button has two angularly extending arms and is of resilient plastic material. One of the arms engages the circuit breaker trip bar when the button is rotated, and causes tripping. The other arm of the trip testing button is thin and elongated and serves to position the button in normal unoperated position and to act as a spring to return the button from trip operating position to its normal position. Positive stops are also provided for limiting rotation in each direction.

# REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307.

NO AMENDMENTS HAVE BEEN MADE TO THE PATENT.



AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims **1–5** is confirmed.

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