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Padulo

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[54] **COMBINED HANDLE-GUARD AND GRIP FOR PLUG-IN CIRCUIT BREAKERS**

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[51] **Int. Cl.**[7] **H01H 9/02**

[52] **U.S. Cl.** **200/43.16**; 200/50.02; 200/333

[58] **Field of Search** ..... 200/17 R, 43.01, 200/43.11, 43.14, 43.15, 43.16, 43.19, 43.21, 50.01, 50.02, 50.11, 400, 401, 500, 501, 318, 327–333, 334

[56] **References Cited**

U.S. PATENT DOCUMENTS

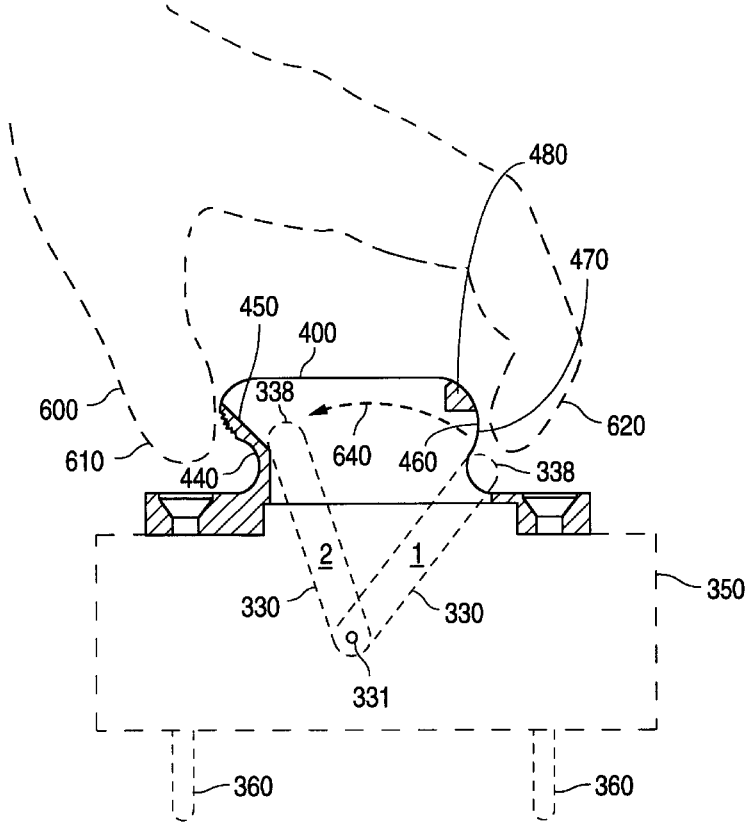
3,863,042	1/1975	Nicol	200/153 T
4,151,386	4/1979	Nicol et al.	200/303
4,358,810	11/1982	Wafer et al.	361/93
4,761,521	8/1988	Beck et al.	200/50
4,978,816	12/1990	Castonguay et al.	200/43.14
5,060,107	10/1991	Castonguay	361/115
5,120,921	6/1992	DiMarco et al.	200/401
5,148,910	9/1992	Williams	200/43.19
5,495,082	2/1996	Zaffetti et al.	200/400
5,500,495	3/1996	Benda et al.	200/43.14
5,717,178	2/1998	Turner et al.	200/50.01
5,719,363	2/1998	Händler	200/50.02
5,796,060	8/1998	Füchsle et al.	218/79
5,853,305	12/1998	Bedrossian	439/787
5,907,140	5/1999	Smith	200/43.19

Primary Examiner—Michael Friedhofer
Attorney, Agent, or Firm—Coudert Brothers

[57] **ABSTRACT**

A combined handle-guard and grip protects the actuator-handle of a circuit breaker from being inadvertently displaced during normal circuit breaker operation while also positioning a user's fingers to automatically trip the circuit breaker into a non-conducting state whenever the user grasps the grip surfaces of the handle-guard to remove or install the circuit breaker. In a preferred embodiment, the shield surfaces form a slot dimensioned to permit the unrestricted movement of the circuit breaker handle. A first grip surface is disposed at one of the slot. A second grip surface is disposed at the other end of the slot. A passageway in the second grip surface is shaped and positioned so that a distal portion of the circuit breaker actuator-handle extends through the passageway when the circuit breaker is in an on-position. When the user grasps the second grip surface, pressure is applied to the actuator-handle, tripping the circuit breaker into a non-conducting state whenever the circuit breaker is inserted or removed.

18 Claims, 8 Drawing Sheets



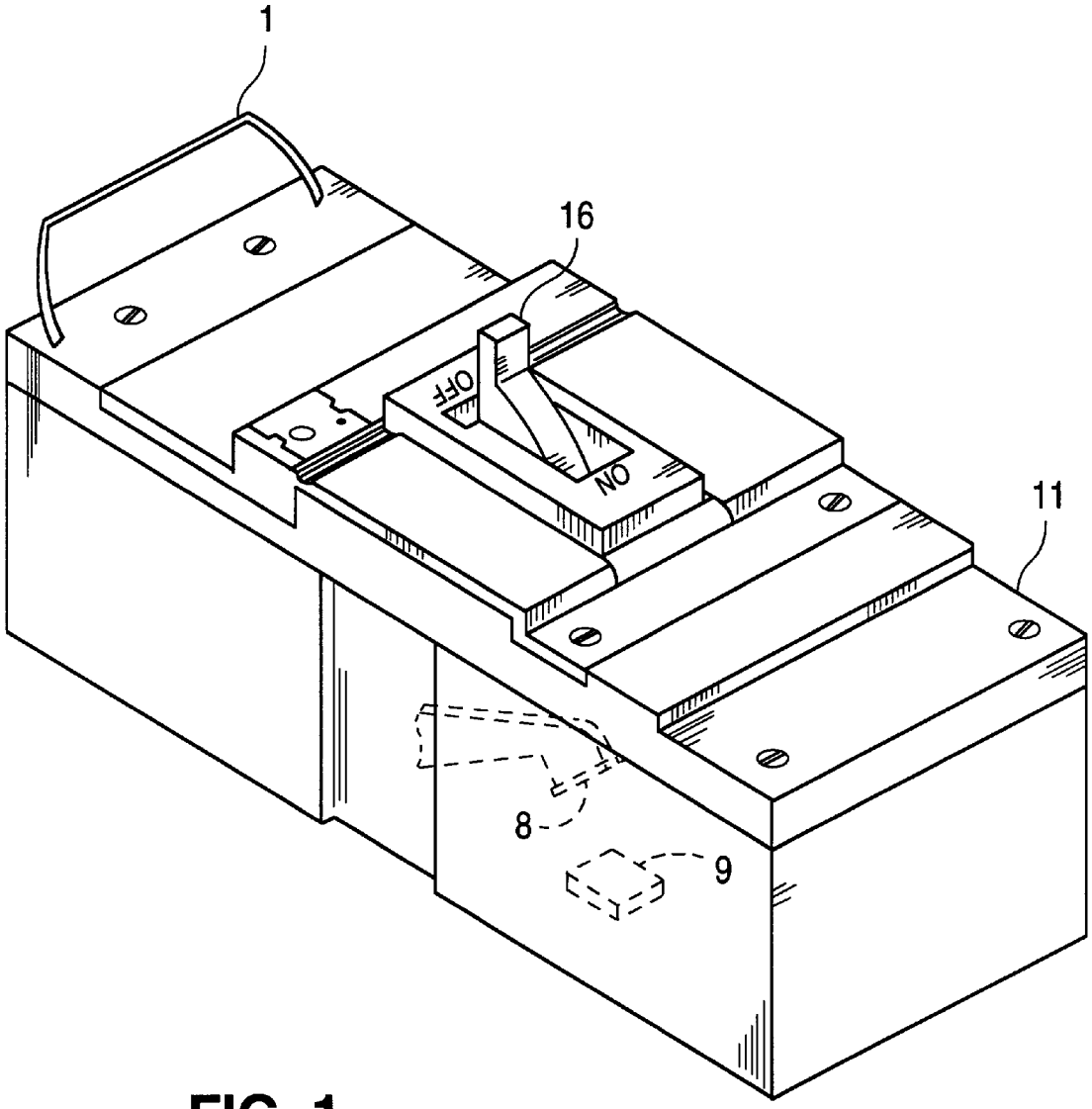


FIG. 1
(PRIOR ART)

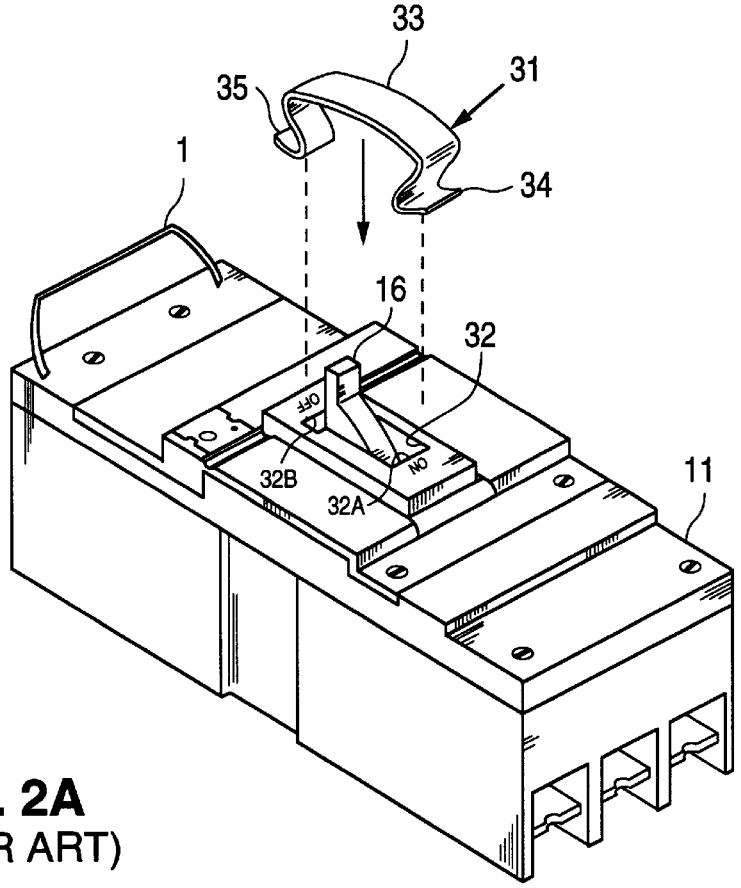


FIG. 2A
(PRIOR ART)

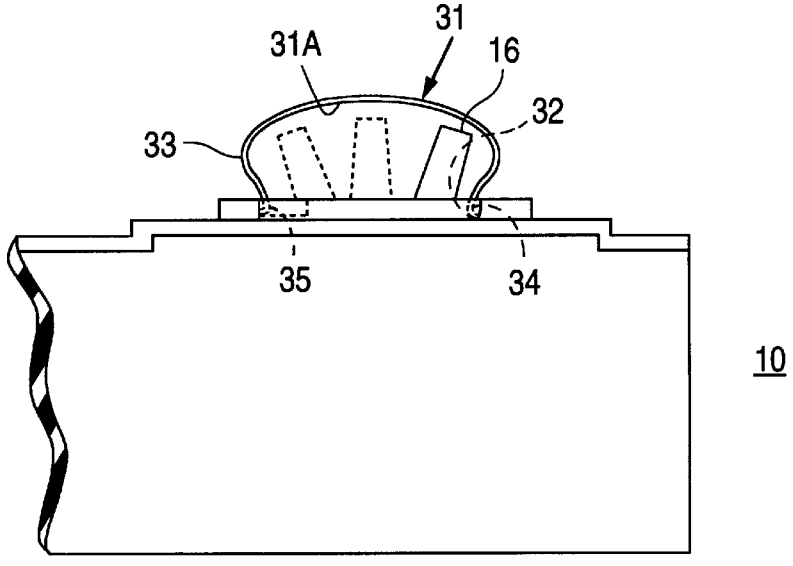


FIG. 2B
(PRIOR ART)

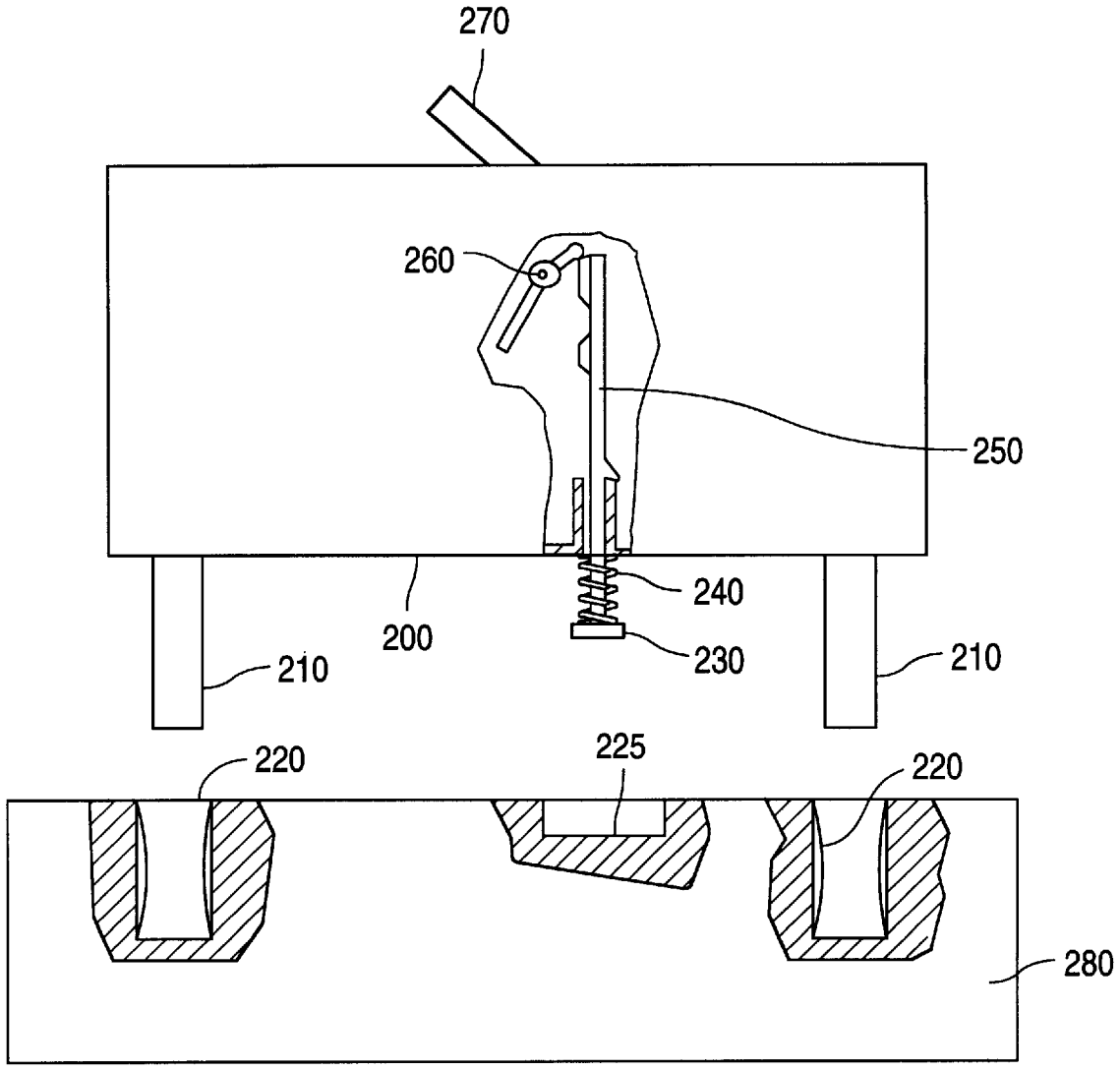


FIG. 3
(PRIOR ART)

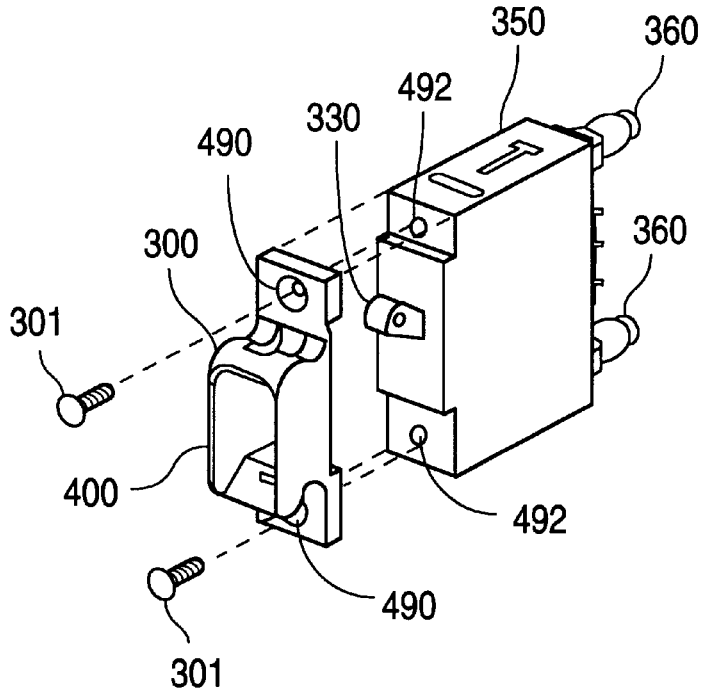

350
360
492
330
490
360
300
301
400
492
490
301

FIG. 4

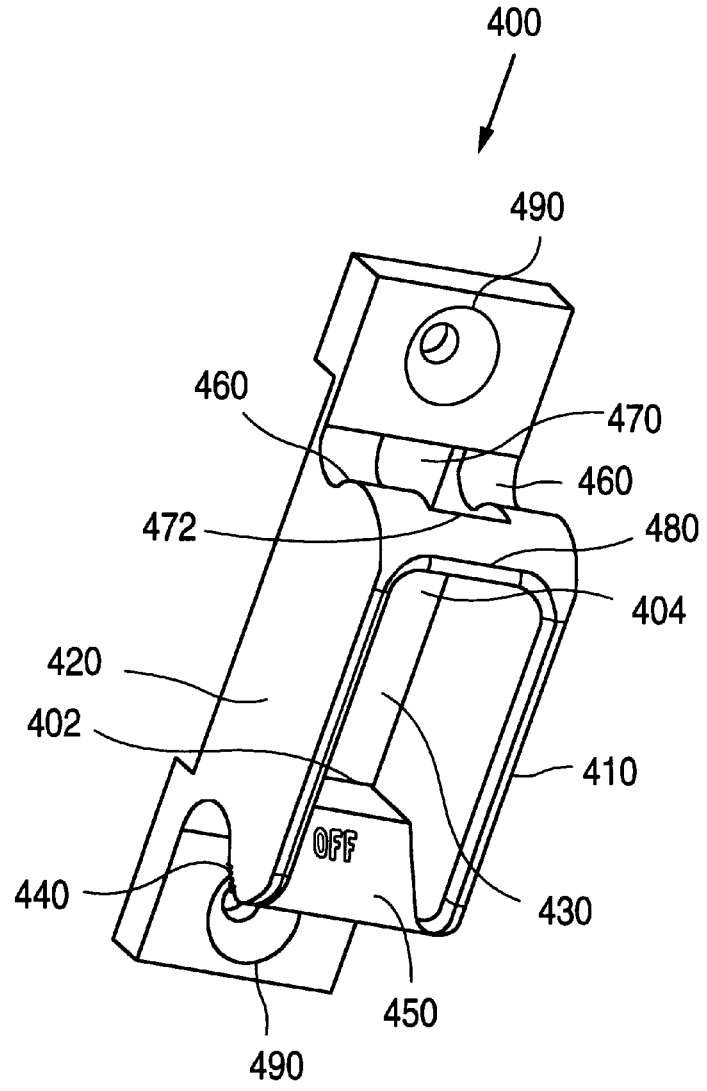

400
490
460
470
460
472
480
404
420
402
410
OFF
440
430
450
490

FIG. 5

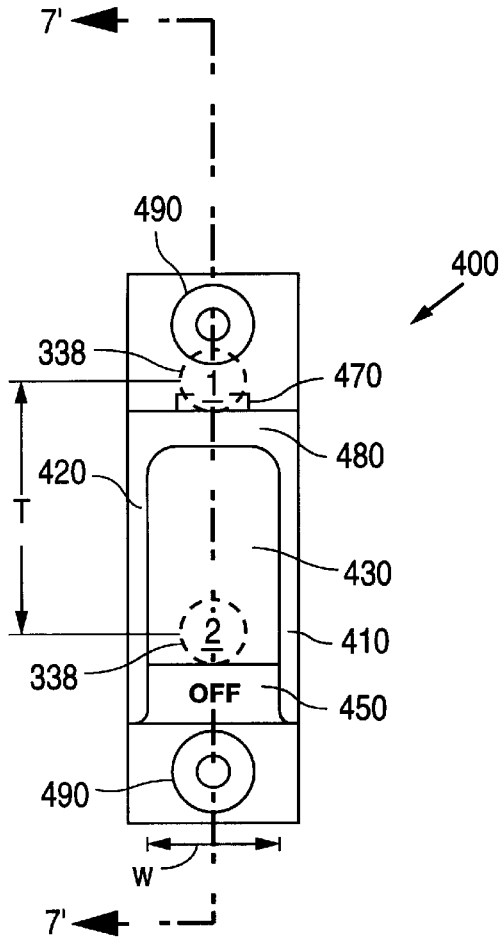


FIG. 6

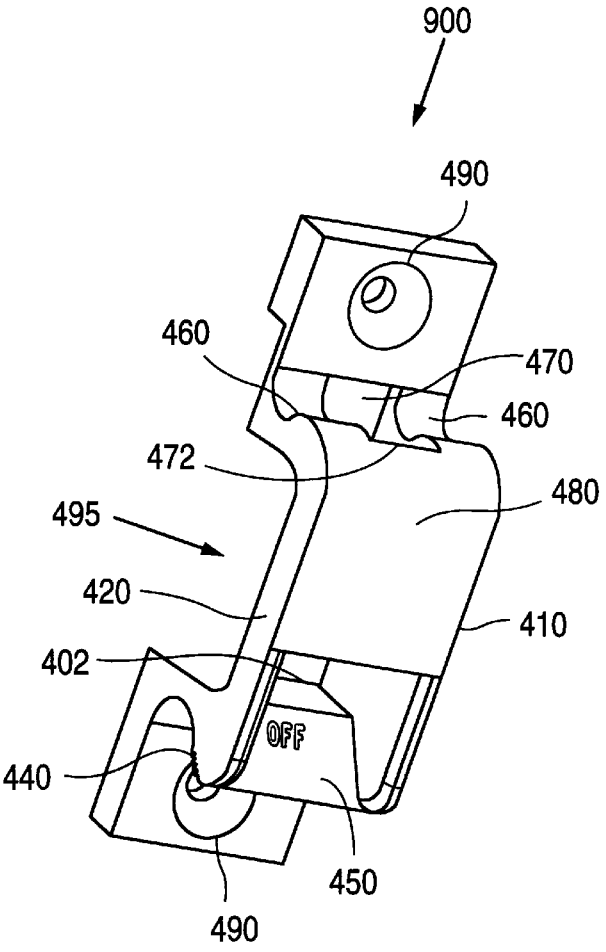


FIG. 9

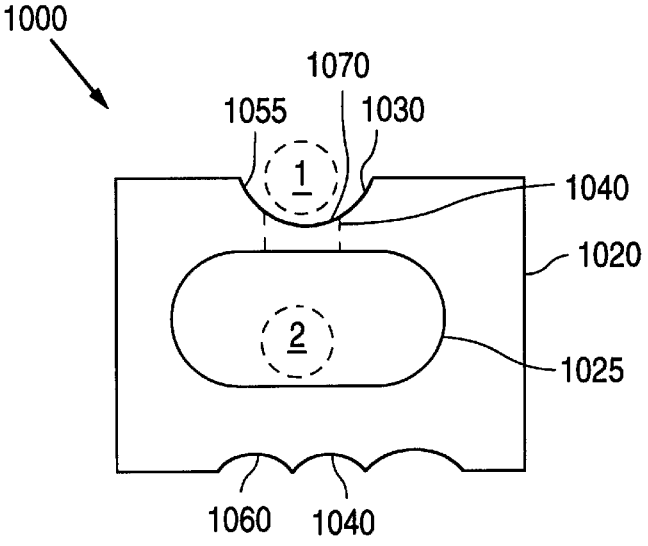


FIG. 10

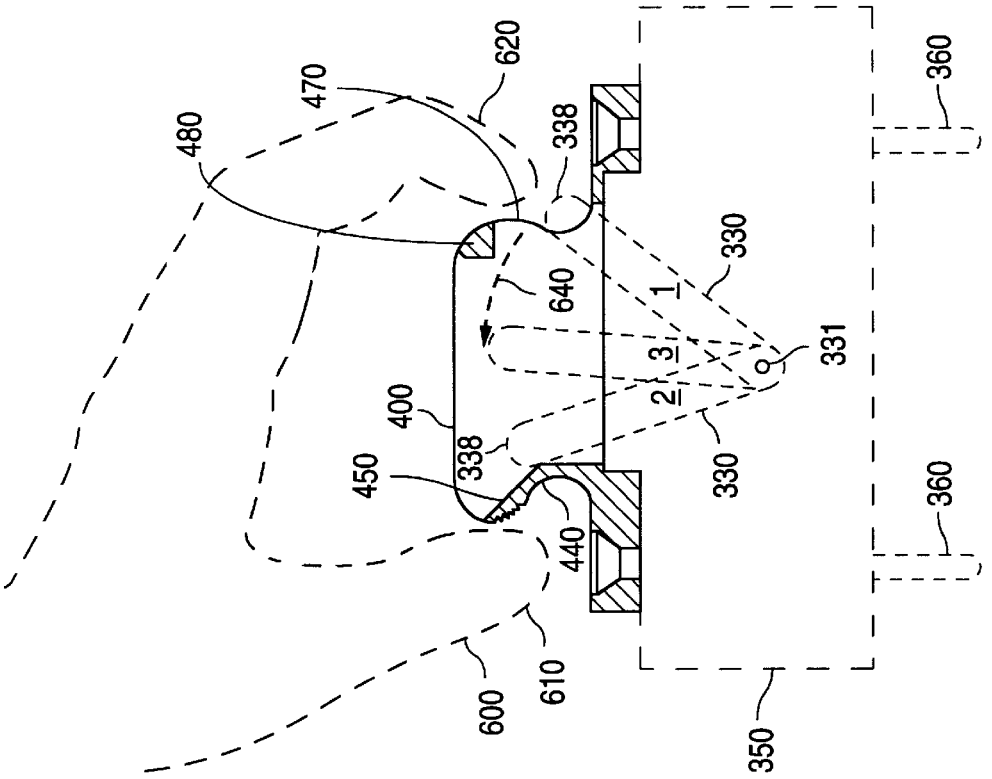

620
470
480
338
360
330
640
1
331
3
2
400
338
450
330
360
440
610
600
350

FIG. 8

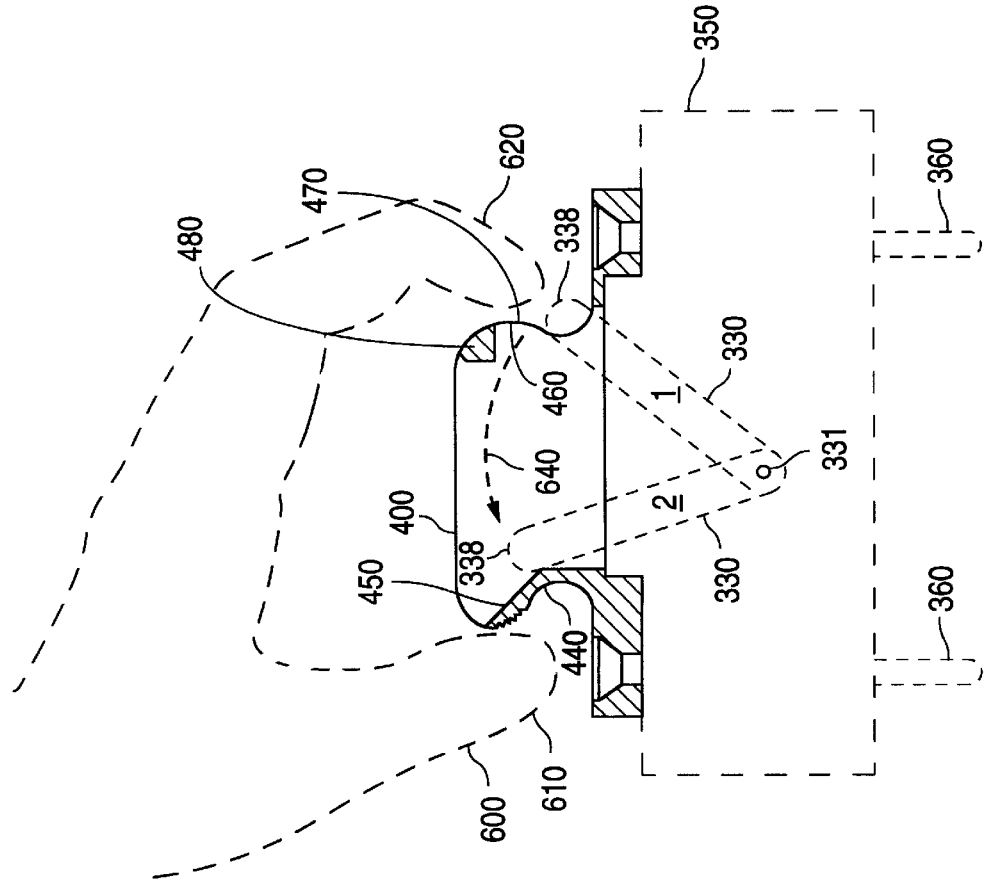

350
620
470
480
338
360
330
460
1
640
331
7
2
400
338
450
330
360
440
610
600

FIG. 7

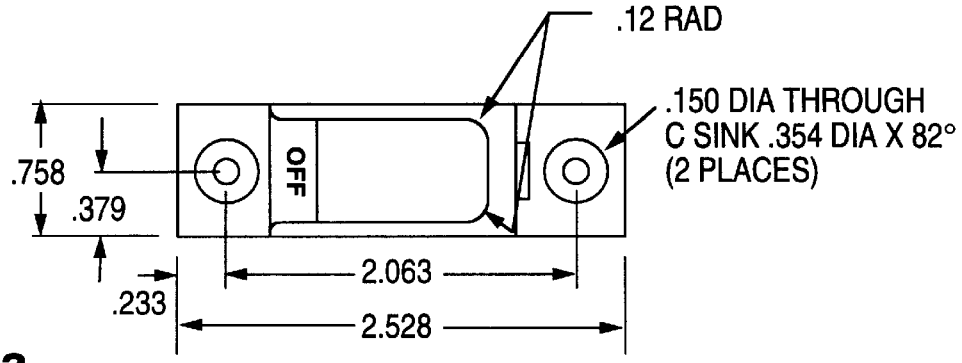


FIG. 11a

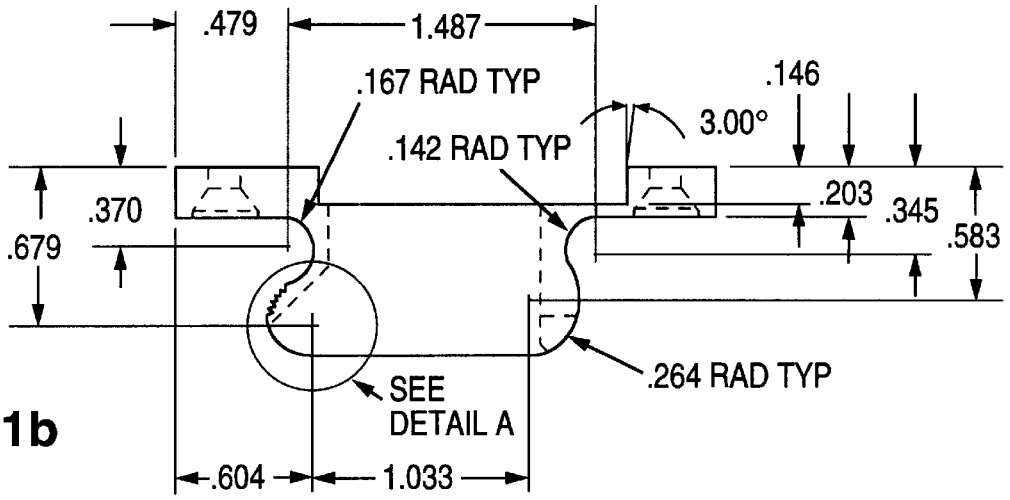


FIG. 11b

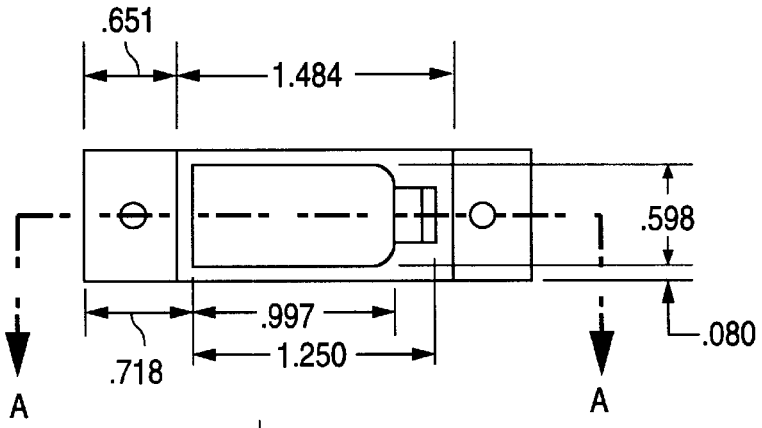


FIG. 11c

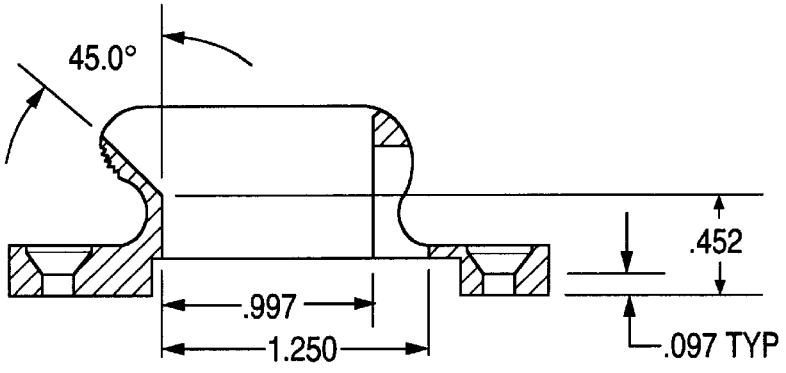


FIG. 11d

FIG. 11e

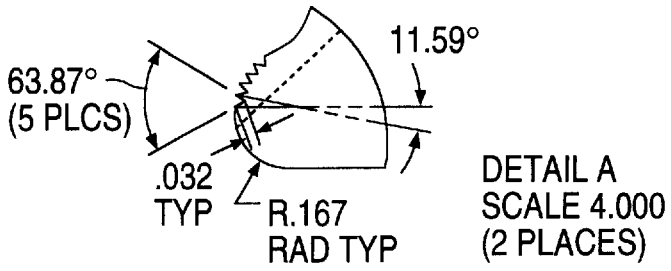


FIG. 11f

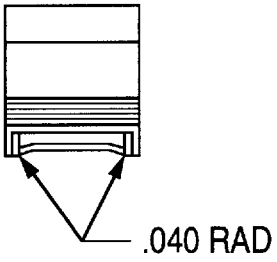


FIG. 11g

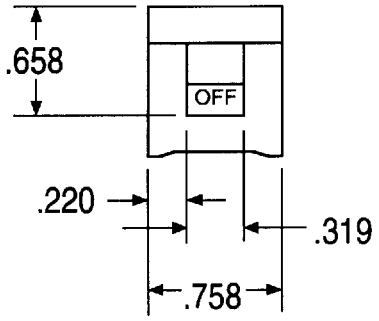
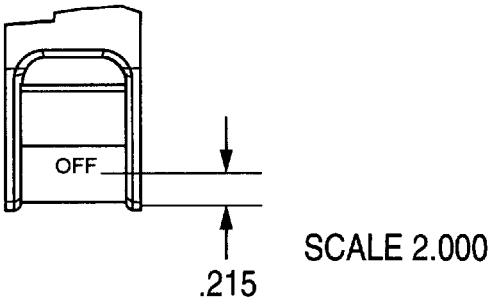


FIG. 11h



COMBINED HANDLE-GUARD AND GRIP FOR PLUG-IN CIRCUIT BREAKERS

FIELD OF THE INVENTION

The present invention relates generally to handle-guards to protect the actuator-handle of a circuit breaker from accidentally being tripped. More particularly, the present invention is directed towards a handle-guard and grip structure for a plug-in circuit breaker, wherein the grip structure ensures that the actuator-handle is not in an on-state when the circuit breaker is being installed or removed.

BACKGROUND OF THE INVENTION

Circuit breakers are important components of many electronic systems, such as power supplies. Circuit breakers commonly comprise a movable electrical contact and a stationary contact. The movable electrical contact is typically coupled to an electromagnetic device that opens the breaker contacts when an over-current condition is detected. During normal circuit operation an actuator mechanism couples the stationary and movable breaker contacts so that the circuit breaker is in a conducting, or on-state. However, when an over-current condition is detected, the circuit breaker trips and the actuator mechanism separates the breaker contacts so that the circuit breaker enters a non-conducting, or off-state.

FIG. **1** is a perspective view of an exemplary prior art circuit breaker **11**. As is seen, when the prior art circuit breaker **11** is designed to be plugged in or removed, it will typically have a grip **1** to facilitate the user grabbing circuit breaker **11**. The principles of circuit breaker operation are well known. Breaker contacts **8**, **9** open in response to an over-current condition. The mechanism that opens breaker contacts **8**, **9** is commonly known as an actuator.

An additional linkage mechanism (not shown in FIG. **1**) couples the interior actuator mechanism (not shown in FIG. **1**) to an actuator-handle **16**. Actuator-handle **16** is also known in the prior art as a "handle" although sometimes the terms "actuator" or "actuator switch" are also used to describe actuator-handle **16**. In the present application handle **16** is described as an "actuator-handle" to avoid potential confusion with the interior actuator mechanism and with grip **1**.

The actuator-handle **16** provides several functions. First, the position of the actuator-handle **16** provides a visual indication of the operating state of the circuit breaker. Typically the actuator-handle **16** is mechanically coupled so that it rotates and/or translates relative to the surface of the circuit breaker to indicate the operating state of the circuit breaker. Additionally, the actuator-handle **16** is mechanically coupled to the actuator so that the user is able to manually set/reset the circuit breaker to an on-state or an off-state depending on the position of the actuator-handle. The actuator-handle **16** is useful, for example, to reset a circuit breaker after it has been tripped by an over-current condition. Additionally, the actuator-handle **16** is often used to intentionally cause the circuit breaker to be non-conducting, e.g., when maintenance or repair of the electronic system is planned. The actuator-handle **16** of a circuit breaker is commonly configured so that a slight pressure applied to the actuator-handle in its on-position results in the circuit breaker actuator-handle moving to a position where the current breaker is non-conducting.

A problem with the actuator-handle **16** of a conventional circuit breaker **11** is that its position may be inadvertently changed, resulting in the circuit breaker, and thus the electronic systems to which the circuit breaker is attached, being turned on or off at an inappropriate time. This is highly undesirable since it may result in damage to the electronic systems or may cause injury to users. Consequently, it is desirable in many applications to use a safety mechanism to prevent the inadvertent displacement of the handle.

FIG. **2**A is an exploded perspective view of a prior art circuit breaker **11** with an actuator-handle **16** disposed in a slot **32** with two slot ends **32**A, **32**B corresponding to on/off states of the circuit breaker. A handle-guard **31**, in the shape of a C-shaped spring clip **33** having S-shaped ends **34**, **35** is designed to fit in slot **32**. When the handle-guard **31** is in place, it protects actuator-handle **16** from being inadvertently displaced while still providing sufficient clearance for actuator-handle **16** to translate from its on-position to its off-position when an over-current condition is detected. Handle-guard **31** may be removed from slot **32** to enable the actuator-handle **16** to be manually repositioned.

FIG. **2**B shows a partial side view of circuit breaker **11** with handle-guard **33** in place. The motion of the actuator-handle **16** to a tripped state is indicated in phantom. As can be seen in FIG. **2**B, there is sufficient clearance that actuator-handle **16** is free to move underneath the bottom surface **31**A of handle-guard **31**. End surfaces **34**, **35** of handle-guard **31** fit into end regions of slot **32**, but are not rigidly connected to slot **32**.

While the prior art handle-guard of FIG. **2**A provides a safety benefit, it has several drawbacks. One drawback is that handle-guard **31** substantially blocks access to actuator-handle **16**. Consequently, the user needs to remove handle-guard **31** every time they want to change the position of actuator-handle **16**. Another drawback is that handle-guard **31** blocks a front (head-on) view of the position of actuator-handle **16**. This may make it hard to determine the position of actuator-handle **16** where there is poor background lighting or in electronic systems where circuit breaker **11** is located close to a wall or other obstacle so that the user cannot obtain a side view of actuator-handle **16**.

Conventional handle-guards **31** protect the actuator-handle **16** but do not provide a grip or grip surface. Commonly, a separate grip **1** is provided if the user is intended to grasp circuit breaker **11**, e.g., when the circuit breaker is being installed in a breaker panel. Another problem with prior art circuit breakers is that there is no mechanism for ensuring that the circuit breaker is in a non-conducting state when the circuit breaker is installed or removed. It is comparatively easy for users to mistakenly install or remove a circuit breaker with the actuator-handle **16** in an on-position. This is a problem for all types of circuit breakers. However, it is likely to be a more severe problem for circuit breakers that are designed to be rapidly installed/removed, such as plug-in circuit breakers. Compact plug-in circuit breakers typically have male plug connections that are inserted or removed from female sockets in a base connector. This has the advantage that old circuit breakers may be quickly removed and new circuit breakers quickly installed. However, if the circuit breaker is removed/installed with the actuator-handle in an on-position, unwanted and undesirable electrical conduction may occur. For example, with the actuator-handle inadvertently positioned in an on-position, sparking may occur between the male plugs and female sockets when the male plugs are disposed a short distance from the female sockets during insertion or removal. Additionally, undesirable currents may flow if the circuit breaker is installed/removed with the actuator-handle inadvertently left in the on-position. For example, inserting a plug-in circuit breaker into its base may

result in the premature flow of current in an electrical system if the actuator-handle is accidently positioned in the on-position. This may result in a current that causes damage to the electrical system and/or causes an electrical shock to the user.

Mechanical interlock means are one solution to the problem of inserting/removing plug-in circuit breakers. FIG. **3** shows a side view of a prior art circuit breaker with a mechanical apparatus to automatically turn-off (i.e., open the electrical contacts) of a circuit breaker whenever it is installed or removed. Plug-in circuit breaker **200** may have grips to facilitate a user grabbing circuit breaker **200**. As shown in FIG. **3**, a plug-in circuit breaker **200** has plugs **210** dimensioned to fit into sockets **220** of a base connector **280**. A plunger **230** coupled by a spring **240** is dimensioned to fit into a plunger socket **225** which adjusts the position of a linkage mechanism **250**, **260** so that actuator-handle **270** automatically is switched into an off-position whenever circuit breaker **200** is removed from base connector **280**. The mechanical plunger apparatus shown in FIG. **3** provides an important safety benefit. However, it requires a comparatively complicated linkage mechanism. This increases the cost, complexity, and size of circuit breaker **200** compared to conventional plug-in circuit breakers lacking the desired safety interlock feature. Moreover, plunger **230** must be designed to have a long operating lifetime, i.e., not deteriorate during normal use. However, a spring plunger mechanism can degrade over time due to a variety of physical mechanisms, such as a change in spring characteristics of the spring, corrosion of moving parts, and dust/debris entering sockets and/or moving parts.

The previously described drawbacks of conventional handle-guards and mechanical interlocks are of particularly concern in the context of miniature plug-in circuit breakers used in distribution modules, such as those used in telecommunications applications. A conventional handle-guard, such as that shown in FIG. **2**A may make it awkward to visually determine the state of the circuit breaker, particularly during removal/installation. A conventional safety plunger mechanism, such as that shown in FIG. **3**, substantially increases the cost and complexity of a miniature plug-in circuit breaker. Moreover, combining the handle-guard of FIG. **2**A with the safety plunger of FIG. **3** results in a circuit breaker that had the drawbacks of both safety devices.

What is desired is an improved safety device for plug-in circuit breakers that provides the benefits of protecting the actuator-handle from being inadvertently displaced during normal use while also ensuring that the actuator-handle is automatically switched to an off-state during insertion/removal of the circuit breaker.

SUMMARY OF THE INVENTION

The present invention is directed towards a combined handle-guard and grip that prevents the actuator-handle of a circuit breaker from being inadvertently tripped during normal operation while also automatically tripping the actuator-handle, when it is in an on-position, into a non-conducting position when the circuit breaker is removed or installed.

The present invention generally comprises: a shield shaped to surround the actuator-handle to protect the actuator-handle of the circuit breaker from being inadvertently tripped while permitting the free movement of the actuator-handle, the shield having an opening to allow manual displacement of the actuator-handle and to enable the present position of the actuator-handle to be viewed; a first grip portion forming a portion of said shield; a second grip portion forming another portion of said shield; and a passageway formed in said shield shaped and dimensioned so that a distal portion of the actuator-handle extends through the passageway adjacent the exterior surface of the first grip portion when the actuator-handle is in an on-position.

In a preferred embodiment, the shield is shaped to form a slot and first and second grip portions are disposed at opposite ends of the slot with the passageway extending through the first grip portion. An indicator surface is preferably disposed on an interior surface of the second grip portion to facilitate a user visually verifying that the circuit breaker actuator-handle is in an off-position. The first grip portion preferably forms an overhang that protects the distal portion of the actuator-handle in its on-position.

One object of the present invention is a handle-guard that protects the actuator-handle of a circuit breaker from being inadvertently tripped.

Another object of the present invention is a handle-guard in which the user automatically trips the circuit breaker actuator-handle into a non-conducting position whenever the user grasps the grip portions of the handle-guard.

Still another object of the present invention is a handle-guard that facilitates the quick resetting of a tripped circuit breaker. The opening in the shield of the present invention permits a user to view the present position of the actuator-handle and to manually reset a tripped circuit breaker.

Still yet another object of the present invention is a thermally insulating grip that facilitates a user removing a hot circuit breaker.

These and other objects of the present invention will become apparent to those skilled in the art from the following detailed description and from the detailed drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a prior art circuit breaker.

FIG. **2**A is a perspective view of a prior art handle-guard for a circuit breaker.

FIG. **2**B is a partial side view of the prior art handle-guard of FIG. **2**A.

FIG. **3** is a side view of a prior art spring-plunger mechanism to automatically switch a plug-in circuit breaker into an off-position whenever the circuit breaker is removed from its socket.

FIG. **4** is an exploded perspective view showing a preferred embodiment of the handle-guard of the present invention mounted on a plug-in circuit breaker.

FIG. **5** is a detailed perspective view of the handle-guard of the present invention.

FIG. **6** is a front view of the handle-guard of the present invention.

FIG. **7** is a cross-sectional view of the handle-guard of the present invention along line **7**—**7** of FIG. **6** showing the motion of the actuator-handle between an on-position and an off-position.

FIG. **8** is a cross-sectional view of the handle-guard of FIG. **7** showing the motion of the actuator-handle between an on-position and a tripped-position.

FIG. **9** shows a perspective view of a second embodiment of the handle-guard of the present invention.

FIG. **10** shows a front view of a third embodiment of the handle-guard of the present invention.

FIG. **11** shows preferred dimensions of the handle-guard of the present invention for common plug-in circuit breakers.

DETAILED DESCRIPTION OF THE INVENTION

The present invention generally comprises a combined handle-guard and grip apparatus for circuit breakers which: 1) protects the actuator-handle of the circuit breaker from being inadvertently displaced; 2) provides grip surfaces to facilitate a user removing or installing the circuit breaker; and 3) provides the additional safety benefit of automatically positioning the circuit breaker actuator-handle into a non-conducting state whenever the user grasps the grip surfaces to remove or install the circuit breaker.

FIG. **4** is an exploded perspective view of a preferred embodiment of the handle-guard **400** of the present invention fitted onto the surface of a conventional plug-in circuit breaker **350**. As shown in FIG. **4**, circuit breaker **350** has male plugs **360** dimensioned to fit into conventional base-socket (not shown in FIG. **3**). Circuit breaker **350** has a conventional actuator-handle **330** on its front face that moves from an on-position to a non-conducting position when an over-current is sensed by circuit breaker **350**. Most commonly, this corresponds to actuator-handle **330** having two positions: an on-position and an off-position. However, actuator-handle **330** may also have three positions: an on-position, a tripped-position, and an off-position.

Handle-guard **400** may be sold as an individual unit that is mounted onto a separately manufactured circuit breaker **350** by screws **301**. Screw holes **490** and threaded holes **492** in circuit breaker **350** enable screws **301** to fasten handle-guard **400** onto a circuit breaker **350** as shown in FIG. **4**, although other conventional ways known in the art to fasten handle-guard **400** onto the front face of circuit breaker **350** may be used, e.g., using glue, clips, etc. Additionally, handle-guard **400** may also be manufactured as an integral part of circuit breaker **350**.

FIG. **5** shows a detailed perspective view of handle-guard **400**. Handle-guard **400** is preferably manufactured from a material that is a good electrical and thermal insulator. The actuator-handle **330** is shielded by a handle shield comprised of two side-shields **410**, **420** and two distal grip portion ends **440**, **460** which are spaced apart from each other to form a slot **430** dimensioned to accommodate the movement of actuator-handle **330** (not shown in FIG. **4**) between different operational states of a circuit breaker **350** (not shown in FIG. **4**). A first grip portion **460** is disposed at one end **404** of slot **430**. A passageway **470** in first grip portion **460** connects to slot **430**. A transverse shield surface **480** preferably connects side shields **410**, **420** and forms one upper surface **472** of passageway **470**. A second grip portion **440** is disposed at another end **402** of slot **430**. An indicator surface **450** is preferably disposed on an inner surface of second grip portion **440**. As shown in FIG. **4**, indicator surface **450** is preferably a surface labeled with writing, letters, or symbols to indicate when the actuator-handle of the circuit breaker is in an off-position.

FIG. **6** is a front view of handle-guard **400**. A distal portion **338** of actuator-handle **330** is shown in phantom in an on-position **1** and in an off-position **2**. It can be seen that in its off-state, the distal portion **338** of actuator-handle **330** is disposed adjacent indicator surface **450**. However, in its on-position **1** distal portion **338** of actuator-handle **330** extends out slightly from passageway **470** adjacent the exterior surface of first grip portion **460**. As indicated in phantom, actuator-handle **330** moves between positions **1**,**2** by a transverse distance T. It can also be seen in FIG. **6** that the width, W, of slot **430** is wider than that of actuator-handle **330**.

Handle-guard **400** is designed so that the user will automatically trip the actuator-handle **330** of circuit breaker **400** into a non-conducting position every time that the user inserts or removes a circuit breaker by grasping the grip portions **440**, **460** of handle-guard **400**. FIG. **7** is a cross-sectional view of handle-guard **400** along line **7'**—**7'** of FIG. **6** illustrating the motion of the actuator-handle for the case that the actuator-handle has two operating positions corresponding to an on-position and an off-position. Circuit breaker **350** is shown in phantom, along with actuator-handle **330** in on-position **1** and off-position **2**. Arrow **640**, shown in phantom, indicates the direction of motion of actuator-handle **330** from on-position **1** to off-position **2**. A user's hand **600** is shown in phantom to illustrate how grip surfaces **440**, **460** may be grasped by fingers **610**, **620**, e.g., a thumb and index finger of one hand **600**.

As can be seen in FIG. **7**, when circuit breaker **350** is to be inserted or removed, one finger **610** of hand **600** grips an exterior surface of second grip portion **440**. Second grip portion **440** preferably has an exterior surface shaped and textured to form an ergonomic finger grip surface. A second finger **620** is shown gripping first grip portion **460** (not shown in detail in FIG. **7** because the section is through passageway **470**) around passageway **470** and transverse shield surface **480**. For the purposes of illustration, actuator-handle **330** is shown as pivoting about pivot point **331**, although more generally actuator-handle **330** may move between on-position **1** to off-position **2** by a combination of pivoting and translation.

Handle-guard **400** has slot **430** (not shown in FIG. **7**) and passageway **470** dimensioned to accommodate the movement of actuator-handle **330** between on-position **1** and off-position **2**. Passageway **470** is also shaped and positioned so that a portion of actuator-handle **330** extends through passageway **470** in on-position **1**. As can be seen in FIG. **7**, a distal portion **338** of actuator-handle **330** extends in on-position **1** outside of passageway **470**. Preferably, distal portion **338** is comparatively small in length so that the handle shield of handle-guard **400**, including transverse shield surface **480**, protects the distal portion **338** from being inadvertently displaced during normal use. As can be seen in FIG. **7**, the act of gripping first grip portion **460** by a finger **620** results in the user applying pressure to distal portion **338** of actuator-handle **330**, which will trip actuator-handle **330** to off-position **2**. Consequently, the ergonomic design of handle-guard **400** results in the user automatically tripping handle **330** into an off-position **2** whenever the user grasps grip portions **440**, **460** to remove or insert circuit breaker **350**. Referring to FIG. **6**, once circuit breaker is **350** is inserted into place, distal portion **338** of actuator-handle **330** may be moved from its off-position **2** to its on-position **1** by reaching into the opening of slot **430** and pushing actuator-handle **330** using a finger or a tool.

Handle-guard **400** is preferably fabricated from a material that is both an electrical and thermal insulator. A thermally resistive handle-guard **400** assists a user to safely remove a hot circuit breaker. Handle-guard **400** is preferably formed as a molded plastic piece using conventional plastic molding processes.

It will be recognized that while the handle-guard **400** of the present invention has been discussed in regards to a circuit breaker that has an actuator-handle **330** with two

positions, the handle-guard of the present invention may also be used with circuit breakers that have an actuator-handle with three positions corresponding to an on-position, tripped position, and off-position. This is shown in FIG. **8**, which corresponds to a cross-section along line **7**—**7** of FIG. **6** for a circuit breaker with an on-position **1**, a tripped position **3**, and an off-position **2**. As can be seen in FIG. **8**, arrow **640** indicates that the user will automatically trip the circuit breaker into tripped position **3** by grasping grip surfaces around passageway **470**.

Referring again to FIG. **7**, it can be seen that the precise dimensions of the surfaces comprising handle-guard **400** will depend upon the shape of actuator-handle **330** and the path which actuator-handle **330** moves when tripped from its on-position to its off-position. As indicated by arrow **640**, the shape and position of passageway **470** and shield surface **480** should be selected to permit the free movement of actuator-handle **330** between on-position **2** and off-position **1**. Actuator-handle **330** preferably moves substantially within slot **430**, i.e., shield surfaces **410**, **420** are dimensioned and shaped so that shields **410**, **420** protect actuator-handle **330** along its path of movement. Preferably first grip portion **460** and transverse shield surface **480** of handle-guard **400** are shaped to form an overhang so that distal portion **338** of actuator-handle **330** is protected from being inadvertently displaced during normal operation of circuit breaker **350**. Additionally, grip portions **440**, **460** are preferably ergonomic in the sense of having exterior surfaces shaped and dimensioned so that the user automatically grasps the grip surfaces with different fingers.

It will be recognized that while FIG. **5** shows a preferred embodiment with a slot **430**, more generally any shield shaped to surround actuator-handle **330** while permitting free movement of the handle and which has an opening to allow manual displacement of handle **330** is within the scope of the present invention. While a handle-guard **400** with a slot **430** with side shield surfaces **410**, **420** and two distal grip portions **440**, **460** is a preferred embodiment, more generally any shield shaped to surround an actuator-handle **330** which has an opening to allow manual displacement of the handle may be used. FIG. **9** is a first alternate embodiment of a handle-guard **900** of the present invention. As shown in FIG. **9**, transverse shield surface **480** extends substantially over slot **430**. Extending transverse shield surface **480** substantially over slot **430** may provide the benefit of greater protection from inadvertent displacement of the actuator-handle **330**. Transverse shield surface **480** may also comprise a transparent plastic to permit a head-on view of the position of the actuator-handle **330**. As shown in FIG. **9**, one of the side-shields **420** of handle-guard **900** has a side opening **495** to permit handle **330** to be manually displaced by the user (e.g., using a screwdriver).

It will be recognized that while FIG. **5** shows a preferred grip configuration, other grip configurations may be used which provide the same function of forcing the user to trip the circuit breaker whenever they grasp grip surfaces adjacent a passageway **470**. FIG. **10** is a front-view of a second alternate embodiment 1000 of a handle-guard of the present invention. As shown in FIG. **10**, the shield **1020** does not require an inner surface **1025** shaped as a slot with a rectangular cross-section but may form a cavity with any shape consistent with the free motion of actuator-handle **330** between on-position **1** and off-position **2**. Grip portions **1030**, **1040** are shown as forming part of shield **1020**. As shown in FIG. **10**, grip portions **1030**, **1040** have exterior grip surfaces **1055**, **1060** wherein the surface **1055** of one of the grip portions **1030** is adjacent to the exterior opening **1070** of a passageway **1040** (shown in phantom as extending through grip portion **1030**) so that the user automatically presses upon a distal portion of actuator-handle **330** when they grasp grip portions **1030**, **1040** with two or more fingers of one hand. Grip portions **1030**, **1040** may be shaped to form an ergonomic grip with any combination of the fingers of one hand (e.g., thumb and index finger; thumb, index finger and middle finger; or thumb and four fingers).

FIG. **11** shows detailed views of a preferred embodiment of handle-guard **400** for plug-in circuit breakers **350** used in telecommunications applications with preferred dimensions labeled in inches. FIG. **11**(*a*) shows a top view of handle-guard **400**. FIG. **11**(*b*) shows a side view of handle-guard **400**. FIG. **11**(*c*) shows a bottom view of handle-guard **400**. FIG. **11**(*d*) shows a cross-section of FIG. **11**(*c*) along line A—A. FIG. **11**(*e*) shows a side view of a preferred grip surface **440**. FIG. **11**(*f*) shows a front-view of grip surface **440**. FIGS. **11**(*g*) and **11**(*h*) show views of indicating surface **450**.

In summary, the present invention is generally directed to a combined handle-guard and grip for circuit breakers. The present invention provides the benefits of: 1) a shield shaped to protect the actuator-handle from being inadvertently displaced during normal operation; 2) an ergonomic design in which the user automatically trips the circuit breaker to a non-conducting state by grasping the grip portions during insertion or removal of the circuit breaker; 3) providing an indicator surface to permit the user to visually verify that the circuit breaker is tripped; 4) providing an opening in the shield for the user to quickly reset the circuit breaker after it is tripped; and 5) providing a thermally insulating grip to facilitate removal of hot circuit breakers.

Although a preferred embodiment of the present invention and modifications thereof have been described in detail herein, it is to be understood that this invention is not limited to those precise embodiments and modifications, and that other modifications and variations may be affected by one of ordinary skill in the art without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A combined handle-guard and grip for a circuit breaker having an actuator-handle, comprising:

a shield shaped to surround the actuator-handle to protect the actuator-handle of the circuit breaker from being inadvertently tripped while permitting the free movement of the actuator-handle, said shield having an opening to allow manual displacement of the actuator-handle between an on-position and an off-position;

a first grip portion forming a portion of said shield;

a second grip portion forming another portion of said shield; and

a passageway formed in said shield shaped and dimensioned so that a distal portion of the actuator-handle extends through the passageway adjacent the exterior surface of said first grip portion when the actuator-handle is in the on-position.

2. The handle-guard of claim **1**, wherein said passageway extends through said first grip portion.

3. The handle-guard of claim **2**, wherein said first grip portion is shaped to form an overhang over said passageway to partially shield the distal portion of the handle in the on-position.

4. The handle-guard of claim **1**, wherein said shield opening enables direct viewing of the position of said actuator-handle, said handle-guard further comprising: an indicator surface disposed on the interior surface of said second grip portion.

5. The handle-guard of claim 1, wherein said circuit breaker is tripped to a tripped-position when the user grasps the grip portions.

6. The handle-guard of claim 1, where said circuit breaker is tripped to the off-position when the user grasps the grip portions.

7. The handle-guard of claim 1, wherein said shield forms a slot and said first and second grip portions are disposed at opposite ends of said slot.

8. The handle-guard of claim 7, wherein the length and width of said slot and the shape of said first and second grip portions are selected so that the handle-guard may be grasped by the thumb and index finger of one hand.

9. The handle-guard of claim 8, further comprising a mechanical coupler to attach the handle-guard to the surface of the circuit breaker.

10. A safety handle-guard for a circuit breaker, comprising:

a shield shaped to form a slot to protect a handle of the circuit breaker from being inadvertently tripped while permitting the free movement of the handle, said shield having an opening to allow manual displacement of the actuator-handle;

a grip portion disposed at one end of said slot; and

a passageway formed in said grip portion linking said slot to the exterior surface of said grip portion, said passageway shaped and dimensioned so that a distal portion of the handle extends through the passageway when the handle is in an on-position.

11. The handle-guard of claim 10, wherein said grip portion is shaped to form an overhang over said passageway to partially shield the distal portion of the handle in the on-position.

12. The handle-guard of claim 11, further comprising: an indicator surface disposed on the interior surface of said second grip portion.

13. The handle-guard of claim 11, wherein said second grip portion has an exterior grip surface.

14. A safety handle-guard for a circuit breaker, comprising:

a first shield;

a second shield spaced apart from said first shield to form a slot with a first end and a second end, said slot shaped and positioned to permit the movement of an actuator-handle of the circuit breaker;

a first grip portion coupled between said first shield and said second shield at said first end, said first grip surface forming a passageway coupling the exterior surface of said first grip portion to said slot; and

a second grip portion coupled between said first shield and said second shield at said second end;

wherein a distal portion of the circuit breaker handle extends through said passageway when said actuator-handle is in an on-position so that a user automatically trips said circuit breaker into a non-conducting state when the user grasps the exterior surface of said first grip portion.

15. The handle-guard of claim 14, wherein said first grip portion is shaped to form an overhang over said passageway to partially shield the handle in the on-position.

16. The handle-guard of claim 14, wherein said shield opening enables direct viewing of the position of said actuator-handle, said handle-guard further comprising: an indicator surface disposed proximate the second end of said slot.

17. The handle-guard of claim 16, wherein said indicator surface is disposed on an interior surface of said second grip portion.

18. A handle-guard for a circuit breaker, comprising:

shield means to protect an actuator-handle of the circuit breaker from being inadvertently tripped while permitting the free movement of the actuator-handle;

grip means for grasping the circuit breaker; and

passageway means for a distal portion of the actuator-handle to extend proximate to a region where the user grips the handle-guard so that the user automatically trips the handle into an off-position by grasping the circuit breaker.

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