

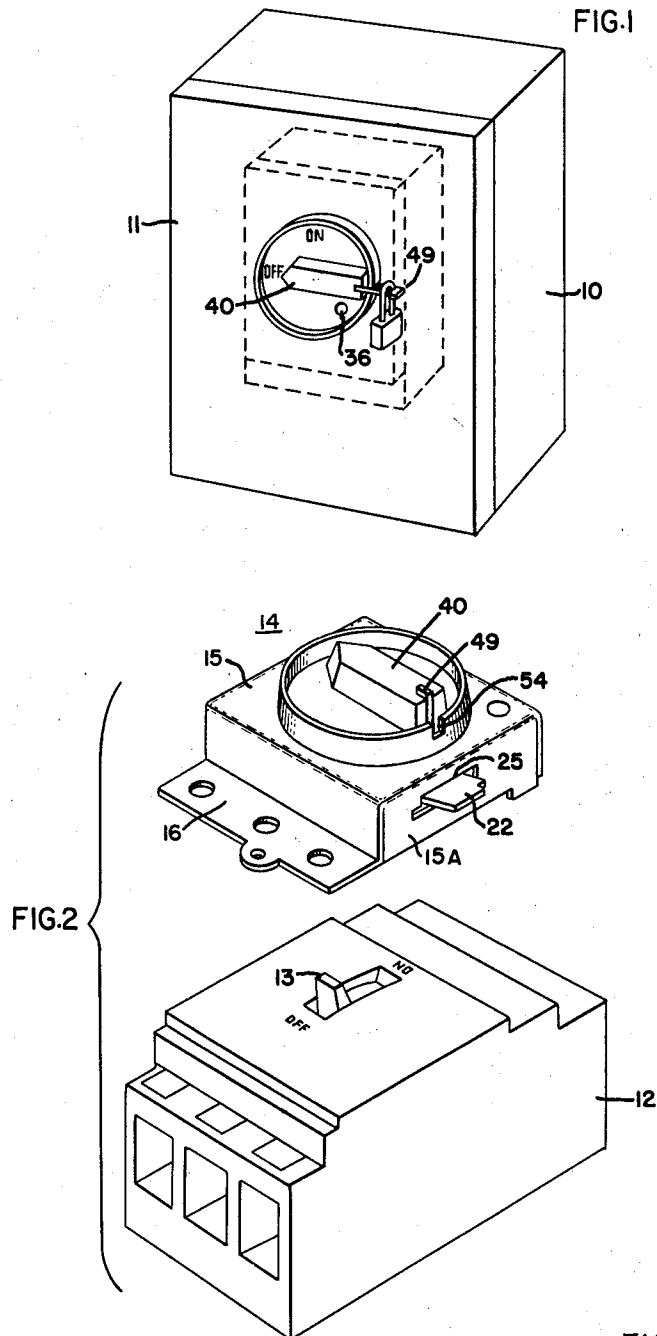
June 29, 1965

H. M. DIMOND ETAL
ENCLOSED ELECTRIC SWITCH WITH COVER-INTERLOCKING
AND HANDLE-OPERATING INTERLOCKS

3,192,334

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3 Sheets-Sheet 1



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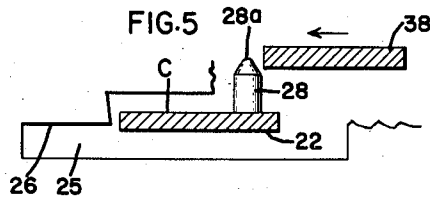
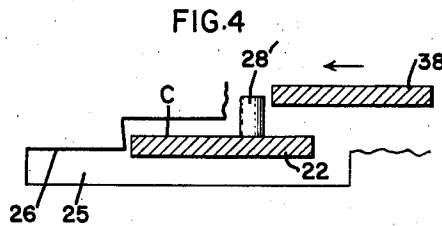
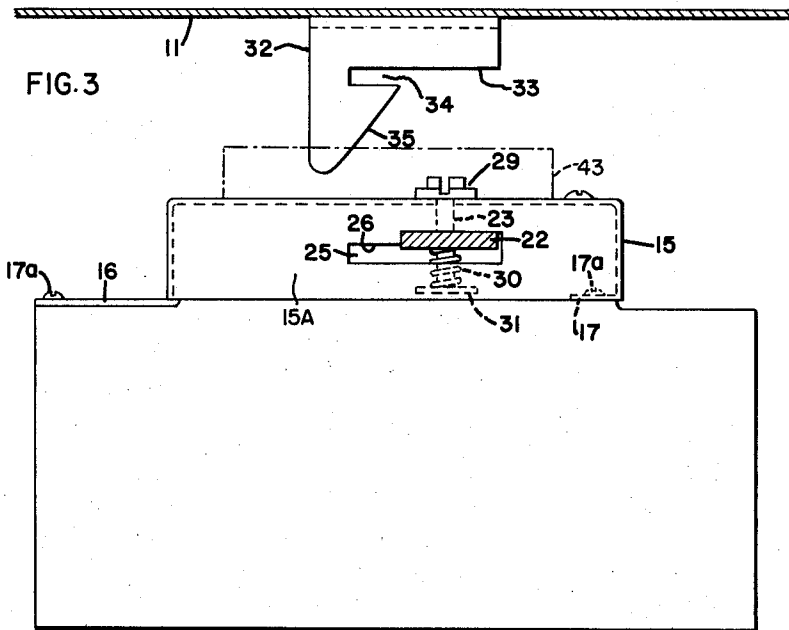
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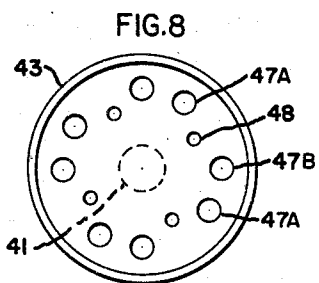
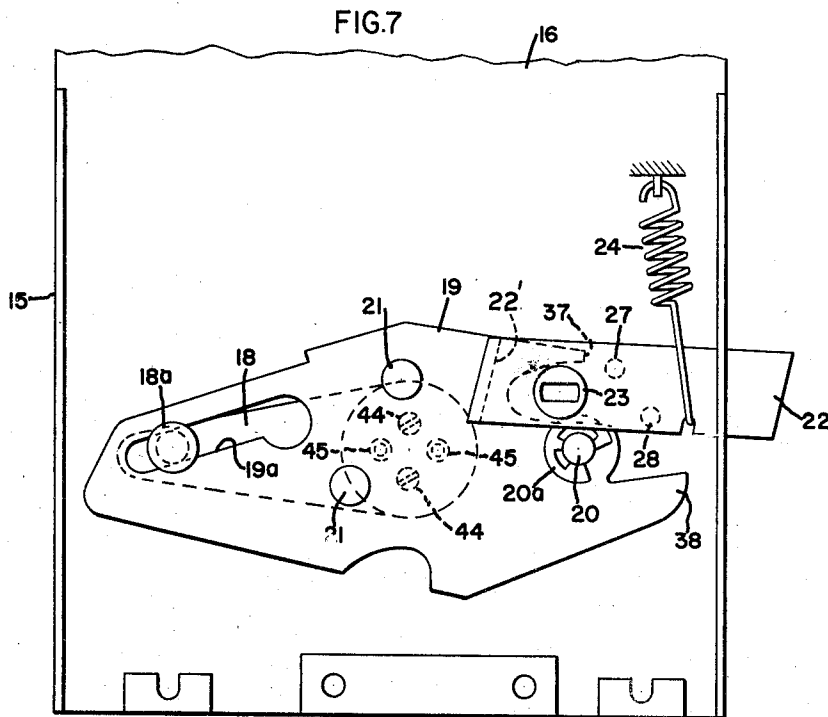
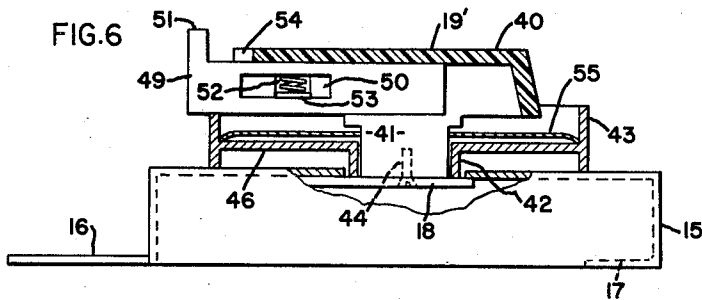
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ENCLOSED ELECTRIC SWITCH WITH COVER-INTERLOCKING AND HANDLE-OPERATING INTERLOCKS

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Filed Sept. 15, 1961, Ser. No. 138,526
5 Claims. (Cl. 200—50)

The present invention relates to electric switches and circuit breakers, and particularly to electric switches and circuit breakers of the type including an oscillatable or "toggle" type operating member and a rotary or "twist" type manually engageable handle member connected to the toggle type operating member by an adapting mechanism. More particularly, the invention relates to such switches and circuit breakers which are adapted for use with an enclosure having a cover overlying all portions of the switch except the manually engageable handle portion, and interlock means operated by the enclosure cover and by the manually engageable handle for preventing actuation of the switch and/or opening of the cover under certain predetermined conditions.

An electric circuit breaker construction comprising a conventional molded-case circuit breaker and a separable adapting operating mechanism is disclosed in copending application Serial Number 138,363, filed September 15, 1961, now Patent No. 3,171,908, issued March 2, 1965, and assigned to the same assignee as the present invention. The basic circuit breaker includes a toggle-type operating mechanism, and the adapting mechanism provides a rotatable or twist-type handle as well as handle and cover interlocking means.

It is an object of the present invention to provide an enclosed switch or circuit breaker of the type shown in the aforementioned application which shall be highly dependable in operation, inexpensive to manufacture, and which shall provide the desired locking and interlocking functions.

In accordance with the invention, an enclosed switch or circuit breaker is provided including a basic switching device having a toggle type operating handle, and a twist or rotary operating type adapter mechanism mounted on the basic switch or circuit breaker. The adapter mechanism includes means for operating the toggle type handle and also includes a single interlock lever for locking the handle and interlocking with the enclosure cover.

The invention will be more fully understood from the following detailed description, taken in conjunction with accompanying drawings, and its scope will be pointed out in the appended claims.

In the drawings,

FIGURE 1 is a perspective view of an enclosed switch or circuit breaker incorporating the invention;

FIGURE 2 is an exploded perspective view of the basic switch mechanism and accompanying adapter mechanism of the device of FIGURE 1;

FIGURE 3 is a side elevation view of the switching device and adapting mechanism of FIGURE 1, together with a portion of the enclosure cover, showing particularly the interlocking mechanism;

FIGURE 4 is a fragmentary view showing portions of the interlocking mechanism, showing a first construction;

FIGURE 5 is a view similar to FIGURE 4, showing an improved construction;

FIGURE 6 is a sectional view of the adapter mechanism of FIGURES 1 and 2;

FIGURE 7 is a bottom plan view of the adapter mechanism of the invention, and

FIGURE 8 is a plan view of the handle escutcheon or mounting plate.

In the drawings, the invention is shown as embodied in an enclosed electric circuit breaker incorporating an enclosure or box 10 having a cover 11 and enclosing an electrical control device comprising a molded case circuit breaker 12 having an operating handle 13, and a removable operating adapter mechanism 14.

The operating mechanism 14, as shown more particularly in FIGURES 3-8, comprises a supporting pan or base 15 having a projecting flange 16 and mounting tabs 17 by which the plate is adapted to be fixedly mounted on the circuit breaker 12 by suitable means such as by means of screws 17A.

Referring to FIGURE 7, the operating mechanism includes a first operating lever 18 which is pivotally supported on the plate 15 by being bolted to the shaft of a rotatable handle member 40.

The operating lever 18 is connected, by means of a pin 18a in a slot 19a, to a second operating plate 19. The plate 19, in turn, is pivotally supported on the base 15 by means of a pivot pin 20, to which it is retained by means of retaining washer 20a.

The plate 19 includes a pair of spaced apart upstanding studs 21 which are adapted to engage the operating handle 13 of the circuit breaker 12 when the mechanism 14 is mounted thereon.

Thus rotational movement of the external operating handle 19' causes swinging movement of the plate 19 by means of the pin and slot connections 18a, 19a, which in turn acts on the operating handle 13 through the agency of the studs 21 to operate the handle 13 in an oscillating fashion.

For the purpose of providing various interlocking functions to be described, an interlock lever 22 is provided which is pivotally supported on the pan 15 by means of a stud 23. The stud 23 is non-rotatably fixed to the lever 22 and is rotatably supported in the pan 15. The interlock lever 22 is biased counterclockwise about the pivot pin 23 as viewed in FIGURE 7 by means of a tension spring 24. The lever 22 projects through an irregular elongated opening 25 having an enlarged portion providing a step or shoulder 26 in a wall member 15a of the pan 15 (see FIGURES 3-5). The lever 22 also carries a pair of spaced studs 27 and 28 projecting upwardly toward the inner surface of pan 15, for purpose to be described. The stud 23 has an enlarged head 29 above the surface of the pan 15, and carries a compression spring 30 which exerts a compressive force between the lever 22 and a retaining washer 31 carried by the stud 23. The effect of the spring 30 is to urge the lever 22 upwardly against the upper surface of the opening 25, and to urge the stud 23 downwardly, pressing the head 29 against the upper surface of the pan 15.

For cooperation with the interlock lever 22, the cover 11 of the enclosure is provided with a stationary catch member 32 as shown in FIGURE 3, having an edge portion 33, a slot portion 34 and a sloping cam surface 35.

As previously noted, the lever 22 is always biased toward the latched condition, that is, toward the left as viewed in FIGURE 3, so as to enter the slot 34 in the catch 32. When the operating handle is moved toward "on" position, the lever 22 is permitted to move to the left as viewed in FIGURE 3 to the latched condition, and enters the slot 34 in the catch 32. This prevents the opening of the cover 11 unless the interlock is defeated in a manner to be described.

For the purpose of permitting the defeat of the interlock mechanism, the stud 29 is made accessible through an opening 36. Through this opening, a screwdriver may be inserted to manually twist the stud 23 and thereby retract the lever 22 against the bias of the spring 24, permitting opening of the cover. When the handle is moved to "off" position, however, a projection 37 on the plate 19

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engages the stud 27 on the lever 22 and rotates the lever 22 to the right as viewed in FIGURE 3, withdrawing it from the position in which it would latch with the catch 32. Thus the cover may be opened when the switch is in the "off" position without the necessity of defeating an interlock.

It will thus be observed that according to the present invention there is provided a "cover interlock" mechanism, whereby the cover may not be inadvertently opened while the switch is in the "on" position, that is, it is necessary to defeat a releasable interlock before opening the cover, but nevertheless the cover may be readily opened without the necessity of releasing an interlock when the switch is in the "off" condition.

While the switch may be readily operated from "off" to "on" and vice versa in the absence of any padlocking, to be described, so long as the cover of the enclosure is closed, it is desirable, for safety reasons to guard against the turning "on" of the switch while the cover is open, unless this is clearly intended to be done. For this purpose there is provided a "handle interlock" which prevents the turning of the handle from "off" to "on" position while the cover is open, unless an interlock is released. This function is also provided by the lever 22 in the following manner. Lever 22 has a downwardly bent end 22', which rests on the plate 19 and acts as a pivotal support for the lever 22.

Referring to FIGURE 3, it will be observed that the opening 25 permits some movement in the wider portion thereof of the lever 22 in a direction normal to its general plane. It has also been mentioned that the compression spring 30 exerts an upward force on the lever 22 pushing it against the upper surface of the slot 25. In normal operation, the lever 22 is held in a position adjacent the bottom edge of the opening 25 by means of the surface 33 of the catch 32 carried by the cover 11. Thus so long as the cover is closed, the lever 22 is held in a downward position. In this position, the stud 28 permits passage of a second projection 38 on the plate 19.

When the cover is opened, (the switch normally being in "off" condition) the lever 22 is permitted to rise to the upper portion of the slot 25. In this condition, the end of the stud 28 projects into the path of movement of the projection 38, and when it is attempted to turn the switch handle to the "on" position, while the cover is open, the projection 38 strikes the stud 28 and prevents such movement.

If it is desired, nevertheless, to turn the switch to the "on" position while the door is open, this is possible by depressing the lever 22 manually while turning the handle. When this is done, the lever 22 moves into the narrower portion of the slot 25 where it is retained while the switch is in the "on" position. When the switch is again turned to the "off" position, however, the lever 22 slides off of the shoulder portion 26 and rises again to interlocking position.

It will be observed that the spacing between the projections 37 and 38, as compared to the spacing between the studs 27 and 28, is such that as the switch is moved toward the "off" position, the projection 38 moves out from under the stud 28 before the projection 37 engages the stud 27, thereby insuring that the lever 22 will be free to move to interlock position when the cover is open.

Referring now to FIGURES 4 and 5 particularly, it will be observed that there is a critical relation between the height of the pin 28 and the position of the lever 22 as depressed by the cover. Thus it will be observed that once the lever 22 has been depressed enough to pass over the shoulder 26 of the opening 25, the stud 28 should be below the projection 38 of the plate 19. If this did not occur, it would not be possible to turn the switch to the "on" position even though the cover was closed and latched. If, on the other hand, the stud 28' were made sufficiently short to insure that it would always be below the projection 38 when the lever 22 is depressed to the

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level of the shoulder 26, there might be a possible position in which the lever 22 could be held by the door in which it would not be quite beyond the shoulder 26, and yet the upper end of the stud 28' would be below the projection 38. In such a situation, it would then be possible to turn the switch to the "on" position even though the cover was not latched closed. Either of these conditions is undesirable from a safety standpoint. At the same time, however, it is virtually impossible to manufacture enclosures in volume and to mount such devices within such enclosures with extremely accurate spacings provided.

In order to overcome this extremely critical situation, the stud 28 is modified in accordance with the invention as shown in FIGURE 5, in which it will be observed that the upper end of the stud 28 is provided with a tapered portion 28a. With this construction, it is only necessary for the cover C to depress the lever 22 to a depth which is within the range in which the projection 38 will strike the stud 28 at some point on the tapered surface. When this is done, turning the switch toward the "on" position exerts a force on the projection 38 transmitted to the stud 28 which cams the stud 28 and the member 22 downwardly and forces it over the shoulder 26, insuring that it will move to the fully latched position.

It will also be observed that since the surface 33 of the catch 32 is the portion of the cover which strikes the lever 22, the lever 22 will be assured of moving into the slot 34 when it clears the shoulder 26. This would of course not necessarily be the case if some other projection on the cover were used to depress the lever 22.

Referring to FIGURE 6, the manually engageable handle assembly includes a manually engageable handle member 40 which is generally rectangular in outline and has a pointed end and a blunt end. The handle 40 has a cylindrical boss 41, which rides in a sleeve portion 42 of a circular handle escutcheon member 43. The cylindrical boss 41 is connected to and supports the operating lever 18, to which it is connected by suitable means such as screws 44. An extra set of mounting holes 45 is provided to permit mounting of the handle 40 at any of four different relative positions with respect to the operating arm 18.

The escutcheon 43 comprises a circular rim portion and a base or floor portion 46. A series of holes 47a, 47b, 48 are provided at each mounting location (see FIGURE 8). At each mounting location, one of the openings 47A affords access to the head 29 of the stud 23 to permit defeat of the interlock lever 22. The adjacent opening 47B affords access to the head, not shown, of the stud 20 for assembly purposes. The adjacent opening 48 is tapped to receive a retaining screw, not shown, inserted upwardly from the pan 15 to positively retain the escutcheon 43 on the pan 15.

The handle 40 is provided with a slot extending inwardly from one end thereof, and a locking slide member 49 formed of flat sheet metal and having an elongated opening 50 therein for a purpose to be described, and a raised end projection 51, to facilitate manual operation of the slide. The locking slide 49 is frictionally retained for sliding movement in the handle 40 by means of a compression spring 52 which is trapped against movement in the handle 40 but which presses against a fixed retaining member 53 at one end and against the upper edge of the opening 50 at the other end. A retaining member 53 also acts as a stop to limit the outward movement of the slide 49. For the purpose of cooperating with the slide 49, a notch 54 is provided in the raised edge of the escutcheon 43, permitting the slide 49 to be drawn out when the handle is in the "off" position, as indicated in FIGURE 1, in which position one or more padlocks may have the hasp portion thereof inserted through the opening 50 thereof as indicated in FIGURE 1. In order to provide for optional locking of the handle when in the "on" position, a notch shaped portion of the edge of the escutcheon ring 43 is provided which is thinner and may be easily broken out to provide a second clearance notch for this position.

It will be observed that when the slide 49 is drawn out and locked as shown in FIGURE 1, the handle is locked in the particular position it occupies, and, since the slide at such time overlies a portion of the outer cover 11 of the enclosure, the enclosure is locked in the closed position simultaneously. Certain aspects of the invention relating to the described structure for padlocking purposes are disclosed and claimed in our divisional application serial No. 408,938, filed November 4, 1964, and assigned to the same assignee as the present invention.

For the purpose of improving the appearance and for carrying a suitable on-off indication, an indicator plate 55 is provided which is trapped between the handle 40 and the escutcheon floor or base 46.

While the invention has been shown and described in only one embodiment, it will be readily appreciated that many modifications thereof may be made, and it is therefore intended by the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. An enclosed electric control device comprising:

- (a) an electric switch,
- (b) an enclosure for said electric switch including an openable cover having a handle-opening therein,
- (c) a manually operable handle, means mounting said manually operable handle on said switch for movement between "on" and "off" positions,
- (d) means supporting said switch in said enclosure with said manually operable handle projecting through said opening,
- (e) an interlocking lever carried by said switch,
- (f) a cover catch carried by said openable cover,
- (g) means supporting said interlocking lever for movement to a first position when said manually operable handle is moved to said "on" position, in which it interlocks with said cover catch and for movement to a second position when said handle is moved to said "off" position, in which it is out of engagement with said cover catch,
- (h) a wall member carried by said electric switch and having an opening therein elongated in a direction parallel to the plane of said openable cover, said interlocking lever moving in reciprocating fashion within said elongated opening between said first and second positions,
- (i) means biasing said interlocking lever toward said openable cover and against an upper edge portion of said opening,
- (j) means carried by said cover engaging said interlocking lever when said cover is closed and holding said interlocking lever away from said upper edge portion,
- (k) the upper wall of said opening having a stepped portion defining a narrow portion of said opening and a wider portion thereof, said interlocking lever when in said first position being in said narrow portion of said opening and when in said second position being in said wider portion of said opening,
- (l) said lever when in said wider portion of said opening being moved upwardly by said biasing means upon opening of said cover and against said upper edge portion and being blocked by said stepped portion from movement toward said narrow portion,
- (m) and means interconnecting said interlocking lever and said manually operable handle and preventing movement of said handle from said "off" to said

"on" positions while said interlocking lever is in said second position.

2. An enclosed electric control device as set forth in claim 1 wherein said means interconnecting said interlocking lever and said manually operable handle comprises an operating member connected to said manually operable handle and a projection carried by said interlocking lever, said projection being engaged by said operating member when said interlocking lever is in said upper portion of said opening in said wall member and in engagement with said upper edge of said opening, said projection having a rounded end portion, said operating member acting on said rounded end portion and exerting a cam action thereon when said interlocking lever is in a position intermediate said first and second positions and camming said interlocking lever out of the path of movement of said operating member.

3. An electric control device as set forth in claim 2, said device also comprising: biasing means carried by said switch and biasing said interlocking lever toward said first position at all times, said operating member having first and second spaced projections, said first projection engaging said interlocking lever and moving said interlocking lever from said first to said second position when said manually operable handle moves from said "on" to said "off" position, and said second projection engaging said interlocking lever when said interlocking lever is in said wider portion of said opening in said wall member and in engagement with said upper edge portion of said opening and preventing substantial movement of said manually operable handle from said "off" toward said "on" position, whereby to prevent movement of said manually operable handle from said "off" to said "on" position when said enclosure cover is open.

4. An enclosed electric control device as set forth in claim 3, said projections of said operating member being positioned with respect to said interlocking lever such that said manually operable handle must be moved more than half-way from said "on" to "off" positions before said first projection moves said interlocking lever entirely into said wider portion of said opening in said wall member.

5. An enclosed electric control device as set forth in claim 3, wherein said cover catch carried by said openable cover comprises a generally hook-shaped member having a slot therein receiving a portion of said interlocking lever when said interlocking lever is in said first position and said cover is closed, said cover catch also having a surface thereof substantially in alignment with said slot, said surface portion engaging said interlocking lever when said interlocking lever is in said second position and depressing said interlocking lever against said mean biasing said interlocking lever toward said cover, and holding said interlocking lever in a position in alignment with said slot.

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