Sept. 12, 1967 S. A. MRENNA ET AL 3,341,672

ENCLOSED CIRCUIT INTERRUPTING STRUCTURE WITH IMPROVED LATCHING MECHANISM

Original Filed March 13, 1964

3 Sheets-Sheet 1

Fig.6.

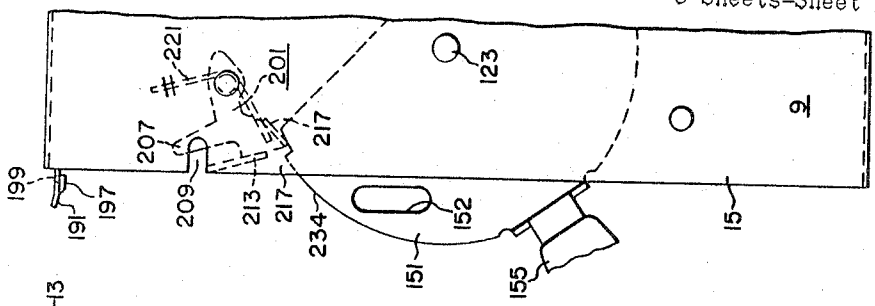


Fig.7.

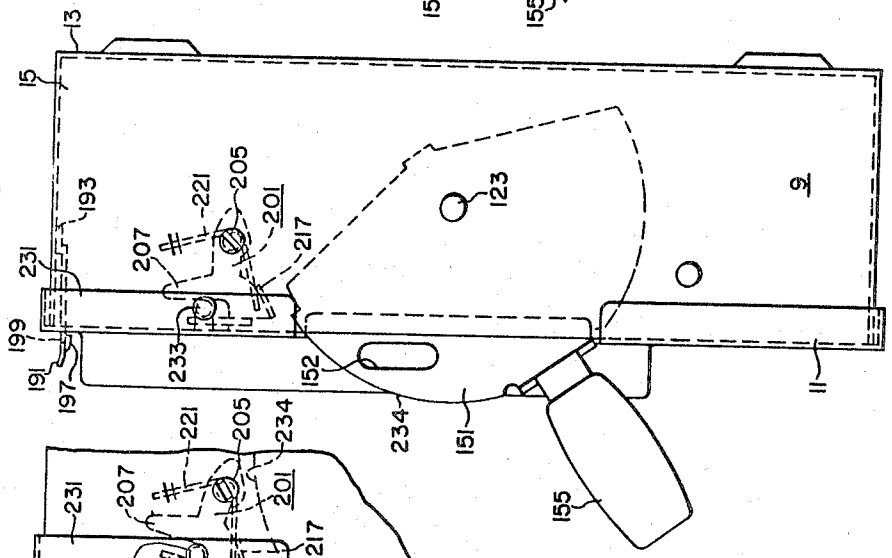
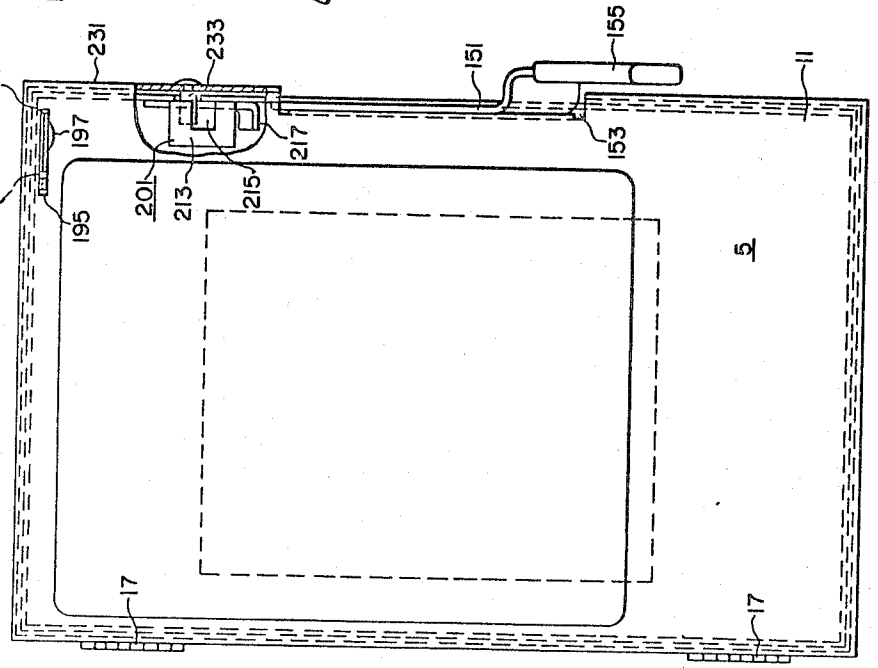


Fig.8.

Fig.1.



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WITH IMPROVED LATCHING MECHANISM

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Fig. 3.

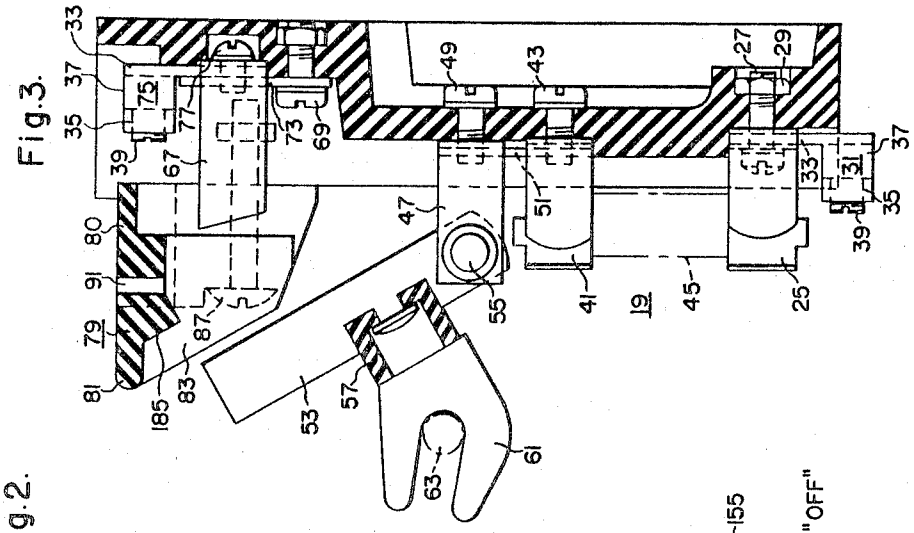
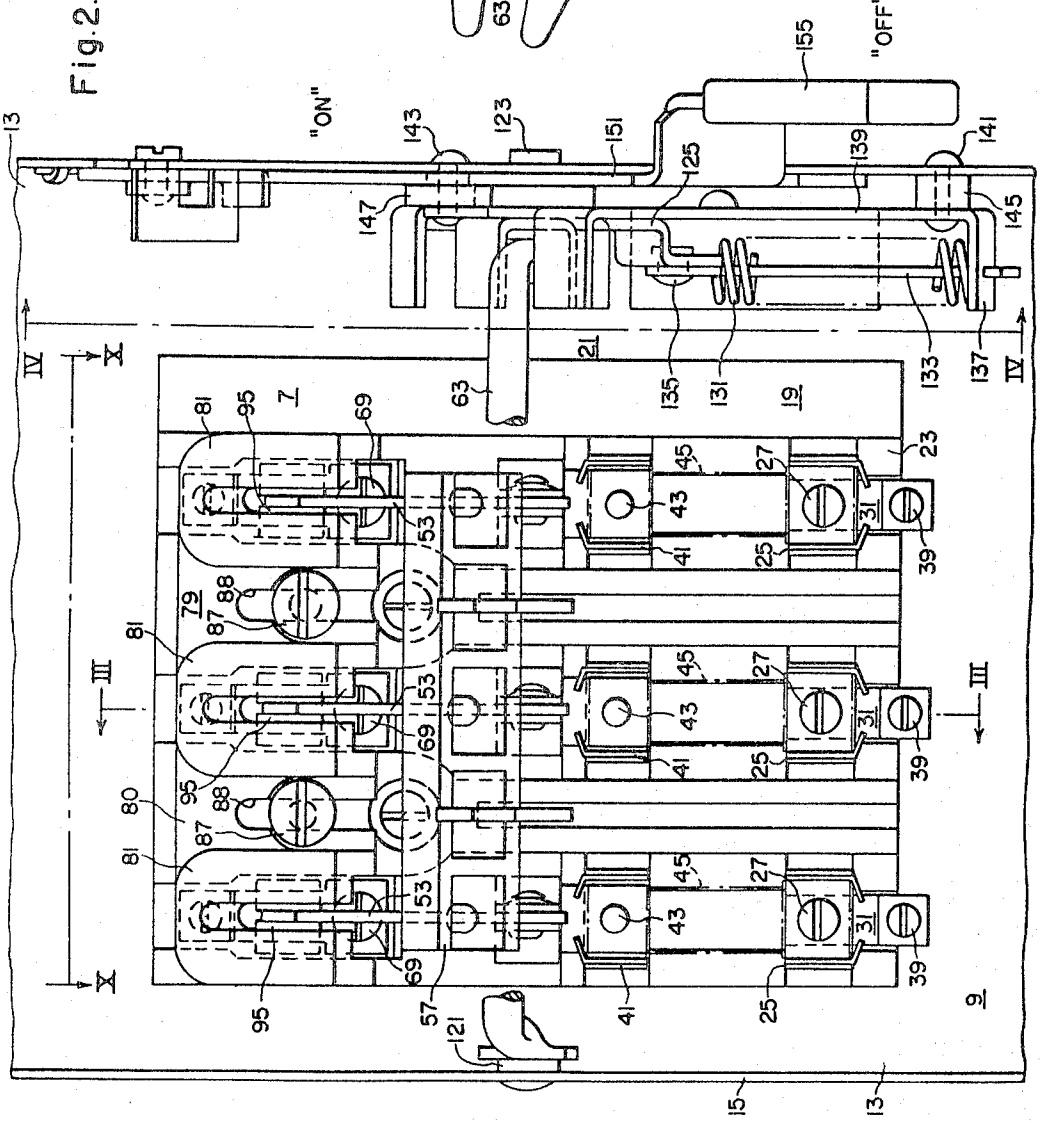


Fig. 2.



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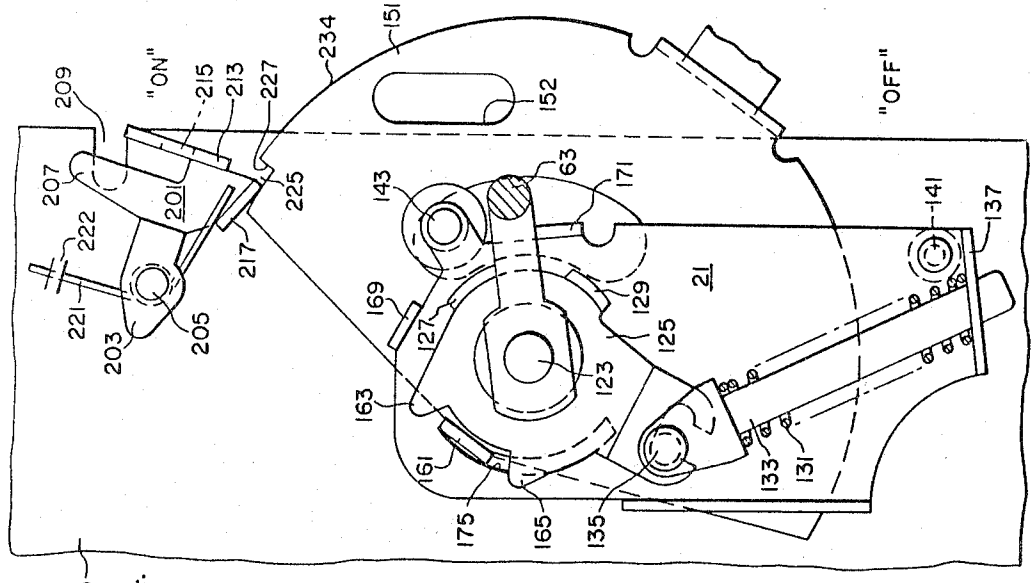


Fig.4.

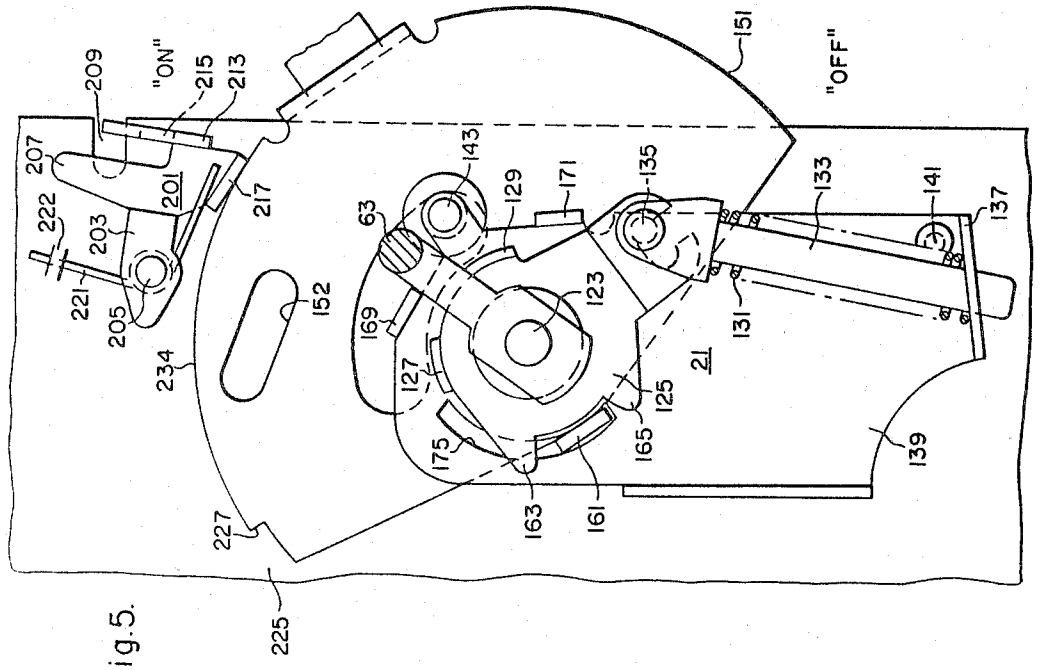


Fig.5.

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3,341,672

ENCLOSED CIRCUIT INTERRUPTING STRUCTURE WITH IMPROVED LATCHING MECHANISM

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Original application Mar. 13, 1964, Ser. No. 351,725, now Patent No. 3,278,710, dated Oct. 11, 1966. Divided and this application Mar. 1, 1966, Ser. No. 530,922

8 Claims. (Cl. 200—50)

This application is a division of our parent application, Ser. No. 351,725, filed Mar. 13, 1964, now Patent No. 3,278,710.

This invention relates generally to circuit interrupting devices and more particularly to enclosed safety switches.

An object of this invention is to provide an enclosed switch structure with improved latching means providing a safer switch installation.

Another object of this invention is to provide an improved enclosed safety switch with a defeatable latch member that is automatically moved into a latching position to latch the cover closed when the cover is moved to the closed position which defeatable latch member operates automatically to latch the switch open when the switch is open and the cover is moved to the open position.

A general object of this invention is to provide an improved relatively inexpensive and compactly constructed enclosed safety switching device.

The novel features that are considered characteristic of this invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description when read in conjunction with the accompanying drawings.

In said drawings:

FIGURE 1 is a plan view, with parts broken away, of an enclosed switching device embodying principles of this invention;

FIG. 2 is a partial plan view, with the cover and certain other parts broken away, of the enclosed switching device seen in FIG. 1;

FIG. 3 is a sectional view taken generally along the line III—III of FIG. 2;

FIG. 4 is a partial sectional view taken generally along the line IV—IV of FIG. 2;

FIG. 5 is a view similar to FIG. 4 showing the switch operating mechanism in the closed position; and

FIGS. 6, 7 and 8 are partial views illustrating certain operating positions of the latching means of this invention.

Referring now to the drawings, there is shown, in FIGS. 1 and 2 an enclosed safety switch 3 comprising an enclosure 5 and a switching device 7. The enclosure 5 comprises a receptacle 9 (FIG. 7) and an openable cover 11. The receptacle 9 comprises a sheet metal base 13 and four sheet metal side walls 15 extending up from the base to form an opening at the front of the receptacle. The cover 11 is pivotally supported on hinges 17 (FIG. 1) to enable the receptacle 9 to be opened and closed in a manner well known in the art.

Referring to FIGS. 2 and 3, the switching device 7 comprises a switch structure 19 and an operating mechanism 21. The switch structure 19 comprises a unitary insulating base or support member 23 that is fixedly secured to the enclosure base 13 by suitable securing means.

As can be seen in FIG. 2, the switch structure 19 comprises three similar pole units disposed in a generally side-by-side relationship. Each of the pole units comprises a

first fuse clip 25 that is secured to the insulating support 23 by means of a bolt 27 and nut 29. The bolt 27 and nut 29 also secure a terminal device indicated generally at 31 to the insulating support 23. The terminal device 31 is a conducting structure comprising an elongated part 33 that has an opening therein through which the bolt 27 passes. The terminal device 31 also comprises a block part 35 having a generally horizontal end opening 37 (FIG. 3) therein and a vertical tapped front opening therein into which a threaded pressure securing member 39 is screwed.

Each pole unit of the switch device also comprises a fuse clip 41 that is supported to the insulating support 23 by means of a screw 43. A fuse, indicated in broken lines, is clipped into each pair of fuse clips 25, 41 in a well-known manner. Each pole unit also comprises a conducting contact support clip 47 that is secured to the insulating block 23 by means of a screw 49. A conducting strip 51 is secured in place by means of the screws 43 and 49, to electrically connect each fuse clip 41 with the associated contact support clip 47. A generally flat conducting movable contact member 53 is pivotally supported on each of the contact supports 47 by means of a pivot pin 55. Each of the three moving contact arms 53 is fixedly secured to a common insulating tie bar 57 by suitable securing means. In between each pair of adjacent contact arms 53, a metallic bifurcated connecting member 61 is fixedly secured to the common insulating tie bar 57. An operating rod 63 is disposed within the bifurcations of each of the two connecting members 61. The operating rod 63 is movable between two operating positions to operatively move the common tie bar 57 to simultaneously pivot all three of the movable contact members 53 to the open and closed positions in a manner to be hereinafter more specifically described.

In each pole unit, the flat knife-blade type contact 53 cooperates with a generally U-shaped stationary contact 67 that comprises two spaced generally resilient conducting legs that resiliently engage the opposite flat sides of the associated contact arm 53 in the closed position of the contacts. Each stationary contact 67 is secured to the insulating support 23 by means of a screw 69 and nut 71 that serve to bias a plate 73 into engagement with a front surface of the support 23 to secure the stationary contact 67 and a terminal structure 75 to the front of the support 23. Each pole unit is provided with a terminal structure 75 that is constructed similar to the previously described terminal structure 31. For this reason, the same specific reference characters are used to identify parts of both of the terminals 31 and 75. In each pole unit, the stationary contact structure 67 and terminal structure 75 are secured together by means of a screw 77 that passes through an opening in the base of the contact 67 and through an opening in the conducting extension 33 of the terminal structure 75 to be threaded into a tapped opening in a conducting plate 73.

A common insulating arc-shield or arc-hood structure 79 is supported on the front of the insulating support 23. The insulating arc-hood structure 79 (FIGS. 2 and 3) comprises a unitary insulating block 80 formed with three arc-hoods 81 each of which arc-hoods forms a cavity 83. A recess is provided between each pair of adjacent arc-hoods 81. A mounting screw 87, which is disposed in each of the recesses passes through an elongated slot 88 in the insulating block 81. Each of the screws 87 is threaded into a tapped opening in the supporting block 23 whereby the two screws 87 secure the arc-hood structure 79 to the insulating support 23. As is seen in FIG. 3, an opening 91 is provided in each of the arc-hoods 81 to vent the gas from the arc-hood cavity 83.

As is best seen in FIG. 2, a relatively narrow slot 95 is provided in the front of each of the arc-hoods 81 of the

arc-extinguishing device **79** to permit movement of the associated knife-blade type contact **53** into and out of the associated arc-hood cavity **83** so that the contact can be moved into and out of engagement with the associated stationary contact **67**. The insulating arc-extinguishing device **79** disclosed in FIGS. 2 and 3 comprises three insulating cavities **83** in which three arcs are drawn and extinguished when the switch is operated to the open position. The arc gases are forced out of the cavities **83** under pressure through the openings **91**.

Referring to FIGS. 2, 4 and 5, the operating rod **63** is operated to simultaneously operate the three movable contacts **53** by operation of the operating mechanism **21**. The operating rod **63** is a generally U-shaped member that is pivotally supported on the opposite side walls of the receptacle **9**. As can be seen in FIG. 2, one leg of the operating rod **63** is pivotally supported on a pin **121** and the other leg is pivotally supported on a pin **123**. The operating rod **63** is operated by operation of an actuating member **125** (FIGS. 4 and 5) that is also pivotally supported on the pin **123**. The actuating member **125** has two projections **127** and **129** that extends from the main plane of the generally flat member **125** and engage one leg of the operating rod **63** to move the rod in a manner to be hereinafter specifically described. Snap action of the operating mechanism is effected by means of a compression spring **131** that is supported on a rod structure **133** that is pivotally supported at one end on the actuating member **125** by means of a pin **135**. The other end of the rod structure **133** protrudes through an opening in a flange **137** of a stationary supporting bracket **139**. The bracket **139** is rigidly supported on the side wall of the receptacle by means of rivets **141** and **143**. As can be seen in FIG. 2, spacers **145** and **147** are provided on the rivets **141** and **143** respectively to space the bracket **139** relative to the receptacle side wall **15**. A generally flat operating member **151** protrudes through an opening **153** (FIG. 1) in the cover **11** and an external operating handle **155** (FIGS. 1 and 2) is provided on the operating member **151** to permit manual operation of the switching device when the cover **11** is in either the closed or opened position. The member **151** has an elongated opening **152** therein to receive the hasps of from one to three padlocks which may be used to lock the member in the "off" position and, if the cover is closed, to lock the cover in the closed position. As can be seen in FIGS. 4 and 5, the member **151** is pivotally supported on the pivot pin **123** and a projection **161**, that is bent-over at the bottom of the member **151**, is disposed between two leg portions **163** and **165** on the actuating member **125**. Two bent-over projections **169** and **171** are provided on the supporting bracket **139** to limit movement of the operating rod **63** in the two operating positions. As is seen in FIGS. 4 and 5, the extension **161** protrudes through an opening **175** in the stationary bracket **139**.

The switch operating mechanism is shown in the "on" or closed position in FIG. 5. When the switch is connected and in the closed position, the circuit in each pole unit extends from a line conductor (not shown in FIG. 2) that would be attached to the solderless terminal connector **75** by means of the screw-type connector **39**, through the conducting strip **33**, the stationary contact **67**, the movable contact **53**, the conducting contact support **47**, the conductor **51**, the fuse clip **41**, the fuse **45**, the fuse clip **25**, the conducting strip portion **33** of the terminal connector **31**, the load terminal connector **31**, to the conductor (not shown) that would be connected to the load terminal connector **31** by means of the screw type connector **39**.

In order to operate the switch to the open-circuit position (FIGS. 2–4), the external operating handle **155** (FIG. 2) is rotated from the "on" to the "off" position to rotate the operating member **151** in a clockwise (FIG. 5) direction about the pivot **123**. During this motion, the projection **161** on the operating member **151** engages the foot **163** on the actuating member **125** to rotate the actuating member in a clockwise (FIG. 5) direction about the pivot **123** during which motion the operating rod **133** is moved from the FIG. 5 to the FIG. 4 position. As the member **133** is moved from the FIG. 5 to the FIG. 4 position, the spring **131** is initially compressed and then it passes an over-center position to discharge to move the parts to the FIG. 4 position with a snap-action. As the member **125** moves from the FIG. 5 to the FIG. 4 position, the extension **127** on the member **125** engages the leg of the operating rod **63** to move the operating rod **63** in a clockwise (FIG. 5) direction about the pivot **123** to the "off" or open circuit position in which it is seen in FIG. 4. In order to close the switch structure, the operating member **151** is rotated in a counterclockwise direction whereupon the extension **161** engages the leg **165** of the actuating member **125** to pivot the actuating member **125** counterclockwise about the pivot pin **123** from the FIG. 4 to the FIG. 5 position during which movement the over-center spring **131** is actuated to the FIG. 5 position to move the member **125** to the FIG. 5 position with a snap-action. As the member **125** moves from the FIG. 4 to the FIG. 5 position, the extension **129** thereon engages the leg of the operating rod **63** to rotate the rod **63** in a counterclockwise direction to the closed position seen in FIG. 5.

Referring to FIGS. 2 and 3, when the operating rod **63** is moved to the "off" or open position, the rod **63** moves the two connecting members **61** to thereby move the insulating tie bar **57** to thereby simultaneously pivot the three movable contacts **53** about the pivots **55** to the open position seen in FIGS. 2 and 3. When the operating mechanism is operated to the "on" or closed position, the operating rod **63** is moved to move the tie bar **57** to simultaneously pivot the three movable contacts **53** about the pivots **55** to the closed position in which position each of the knife-blade type movable contacts is disposed between and engages the resilient twin conducting members of the stationary clip-type contact structure **67** in a manner well known in the art.

When the switch is operated to the "off" position to open a circuit an arc is drawn between each movable contact **53** and the associated stationary contact **67** which arc will be extinguished within the associated arc-hood of the arc-extinguishing structure **79**. The gases generated during extinction of the arc are expelled at the end of the breaker in each pole unit through the associated opening **91**.

Referring to FIGS. 1 and 2, it will be noted that the receptacle part of the enclosure is opened at the front by pivotal movement of the cover **11** about the hinges **17**.

Referring to FIGS. 1 and 6–8, a resilient cover latching member **191** is welded or otherwise rigidly secured to one of the internal side walls of the receptacle **9** and it is bent over at **193** (FIG. 7) so that the main part thereof is disposed along a plane that is parallel to and spaced from the side wall to which the member is secured. As can be seen in FIG. 1, the cover **11** has an opening or elongated slot **195** therein and the generally resilient cover latch **191** is provided with a tang portion **197** bent over and formed in the member by means of a stamping operation. When the cover **11** is moved to the closed position, the cover engages the tang **197** to flex the resilient member **191** and when the cover reaches the fully closed position the resilient member **191** snaps back into the latching position wherein the tang **197** is disposed over a portion of the cover to latch the cover in the closed position. An opening **199** is provided in the latch **191** to receive the hasp of a padlock so that the cover can be padlocked in the closed position. When it is desired to open the cover, if there is a padlock secured to the member **191**, the padlock is removed and the member **191** is manually flexed to a position aligning the tang **197** with the cover opening **195** and the cover is then pivoted to the open position.

There is shown, in FIGS. 4 and 5, a latching member **201** comprising a unitary sheet-metal type member formed with a supporting leg **203** having a pivot pin **205** thereon that extends through an opening in the sidewall **15** to pivotally support the member **201** on the one side wall **15** of the receptacle **9**. The unitary latch member **201** is provided with a projecting part **207** that is disposed adjacent a slot **209** in the upper part of the side wall **15**. The latching member **201** is also provided with a first latching part **213** that is bent over from the plane of the part **207** (FIG. 1) which part **213** has an opening **215** therein for a purpose to be hereinafter specifically described. The latching member **201** is also provided with a second latching part **217** thereon bent over and extending out of the plane in which the part **207** is disposed (FIGS. 4, 5 and 1). As can be seen in FIG. 4, when the switch is in the "off" or open circuit position, and the enclosure cover is in the open position, a torsion spring **221** that is fixed at one end in a part **222** of the side wall **15**, and that engages the projection **217** at the other end thereof, biases the latching member **201** in a clockwise (FIG. 4) direction to move the latching part **217** into a notch **225** in the operating member **151** so that if there is an attempt to move the operating member **151** from the "off" to the "on" position, the latching part **217** will engage a ledge **227** on the operating member **151** to prevent this operative closing movement of the operating member **151**. As can be seen in FIG. 4, the pivot **205** is to the left of the line of action between the part **227** of the member **151** and the latching part **217** of the latch member **201** so that the force of rotation of the member **151** will operate through pivot **205** preventing movement of the operating member **151** to the "on" or circuit closed position. Referring to FIGS. 1, 7 and 8, the cover **11** is provided with a flange part **231** and a pin **233** is welded or otherwise rigidly secured to the flange part **231**. When the cover **11** is pivoted to the closed position, the pin **233**, that is secured to the cover, moves into the slot **209** (FIGS. 4, 5 and 6) in the side wall **15** and engages the projecting portion **207** of the latch member **201** to rotate the latch member against the bias of the torsion spring **221** to a position wherein the latching projection **217** clears the notch **225** so that when the cover **11** is moved to the closed position, the switch operating member **151** can be freely operated between the "on" and the "off" positions. If the circuit interrupter is "off" when the cover **11** is moved to the open position, the pin **233** will release the portion **207** whereupon the spring **221** will automatically move the member **201** back to the latching position seen in FIG. 4. If the circuit interrupter is "on" or closed when the cover is moved to the open position, the spring **221** will move the latching member **201** to a position wherein the projection **217** engages the outer surface or edge **234** of the member **151** so that, if the switch is thereafter moved to the "off" position, the spring **221** will automatically snap the member **201** back to the latching position seen in FIG. 4 when the edge **227** clears the projection **217**. Thus, the circuit interrupter will again be latched in the "off" position.

Referring to FIG. 4, the parts are shown therein with the switch "off" and the cover open. When the cover **11** is moved into the closed position, the pin **233** (FIGS. 1 and 6–8) that is attached thereto engages the projection **207** (FIG. 4) to rotate the member **201** to clear the latch part **217** from the notch **225** of the operating member **151** in the manner hereinbefore described. As the latch member **201** rotates, the extension or latching projection **213** thereon moves over top of the pin **233** to the position seen in FIG. 1. If the enclosed switch is in the "off" position and the cover is moved to the open position, as the pin **233** moves away from the part **207** (FIG. 4) the torsion spring **221** will rotate the latch **201** to the position seen in FIG. 4 and the extension **213** will be rotated out of the latching position over top of the pin **233** so that the pin **233** and cover **11** will be readily moved to the open position. If, however, the switch is moved to the "on" or closed position when the cover is in the closed position, the extension or projection **217** on the member **201** will engage the outer edge **234** of the member **151** so that the spring **221** will not be able to rotate the latch member **201** to the unlatching position seen in FIG. 4 and the projection **213** will overlie and engage the pin **233** (FIG. 1) to prevent opening of the cover **11** when the switch structure is in the "on" or closed position. An authorized worker will readily know how to defeat this latching function. As can be seen in FIGS. 7 and 8, the pin **205**, which is pivotally supported in an opening in the side wall **15** and to which the latch member **201** is attached, has an external slot therein to receive a screw driver or other tool. Thus, when the switch and cover are both closed, an authorized worker can rotate the member **201** to a position wherein the opening **215** (FIG. 1) is aligned with the pin **233** and the worker can then release the latch **191** and pivot the cover to the open position with the pin **233** moving through the opening **215** (FIG. 1) of the latch member **201**. With the torsion spring **221** biasing the latch **201** into the latching position, it can be understood that a worker will hold the latch **201** with one hand and operate the cover latch **191** with the other hand to release the cover **11** so that the cover **11** can be operated to the open position.

The cover **11** can be moved into the closed position when the enclosed switch is in the "on" position. When the parts are in the position seen in FIG. 5, the cover is open and the switch is in the "on" or closed position. If the cover **11** is moved to the closed position, the pin **233** on the cover will engage the top of the projection **213** and pivot the latch member **201** in a counterclockwise (FIG. 5) direction against the bias of the spring **221** until the pin **233** is aligned with the opening **215** (FIG. 1) whereupon the pin will move through the opening **215** as the cover is moved into the closed position, and when the cover has reached the closed position the spring **221** will automatically move the latch **201** in a clockwise (FIG. 5) direction back to the latching position which clockwise latching movement will be stopped by engagement of the projection **217** against the edge **234** of the operating member **151**. The projection **213** will then be disposed over the pin **233** (FIG. 1) to again latch the cover in the closed position in the same manner as hereinbefore described.

From the foregoing, it can be understood that the invention comprises an improved latch comprising a unitary pivotally supported spring biased member that serves to defeatably latch the switch in the "off" or open position when the enclosure cover is opened and to defeatably latch the enclosure cover closed when the switch is in the "on" or closed position and the cover is in the closed position. When the enclosure cover is opened and the switch is closed, the cover can be moved into the closed position during which movement the latch member will be cammed to a position permitting closing of the cover, and when the cover reaches the closed position the latching member will automatically be moved to a position latching the cover in the closed position. When the cover is in the closed position, the enclosed switch can be freely manually operated by means of the external operating handle. The operating member is also provided with means for receiving at least three padlocks to permit the switch to be padlocked in the open position. If the switch is padlocked in the open position with the enclosure cover closed, this padlocking operation will also serve to lock the cover in the closed position. The enclosure is also provided with a resilient cover latch that is spaced from the pivotally supported latch and that must be operated in order to permit the cover to be opened. Since the two latch members are in a spaced relationship and because they are both spring biased toward the latching position, a worker must operate both of the latch members simultaneously in order to effectively unlatch the cover for a cover opening operation. Thus, it is less likely that an unauthorized

person will be readily able to either accidentally or intentionally open the enclosure cover. The resilient latching member also has an opening therein for receiving a padlock to permit the cover to be padlocked in the closed position.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details and arrangements and parts may be made without departing from some of the essential features of the invention. It is desired, therefore, that the language of the appended claims be given as reasonably broad an interpretation as the prior art permits.

We claim as our invention:

1. An enclosed control structure comprising an enclosure, said enclosure comprising a receptacle having a receptacle opening, an openable cover structure supported on said receptacle and movable to open and close said receptacle opening, a control device supported within said receptacle and comprising a pair of cooperable contacts, an externally operable operating member operable to an "off" position to open said contacts and to an "on" position to close said contacts, a latch member pivotally supported on a fixed pivot on said receptacle, resilient means biasing said latch member in a first pivotal direction toward a first position, with said operating member in the "off" position and said cover structure in the open position, said resilient means maintaining said latch member in said first position wherein said latch member is in the path of movement of said operating member to engage said operating member to prevent operation of said operating member to the "on" position, when said operating member is in the "off" position and said cover structure is moved to the closed position, said cover structure engaging said latch member and pivoting said latch member against the bias of said resilient means in a second pivotal direction opposite said first pivotal direction to a second position, said latch member in said second position being out of the path of movement of said operating member whereby said operating member can be freely moved to the "on" position when said cover structure is in the closed position, when said cover structure is in the closed position and said operating member is moved to the "on" position said operating member being in the path of movement of said latch member to engage said latch member to prevent movement of said latch member in said first pivotal direction to said first position, said latch member and said cover structure being constructed and arranged such that when said cover structure is moved toward the open position with said operating member in the "on" position said cover structure engages said latch member tending to pivot said latch member in said first pivotal direction toward said first position which pivotal movement of said latch member is restrained by the engagement of said latch member with said operating member whereby said engagement of said latch member with said cover structure prevents opening movement of said cover structure.

2. An enclosed control structure according to claim 1, and when said cover structure is moved toward the open position with said operating member in the "off" position said latch member pivoting in said first pivotal direction to said first position during which movement said latch member releases said cover structure whereby said cover structure can be moved to the open position when said operating member is in the "off" position.

3. An enclosed control structure according to claim 1, said latch member being movable in said second pivotal direction from said second position to a third position when said operating member is in said "on" position, said latch member in said third position being out of the path of movement of said cover structure whereby said cover structure can be opened when said operating member is in said "on" position and said cover structure is in the closed position, and said latch member being externally operable to said third position when said operating member is in said "on" position and said cover structure is in the closed position.

4. An enclosed control structure according to claim 2, and externally accessible means operable to move said latch member in said second pivotal direction to a third position out of the path of movement of said cover structure when said operating member is in said "on" position.

5. An enclosed control structure according to claim 1, said receptacle comprising a generally planar base and side wall means extending from said base generally normal to said base to form said receptacle opening at the front of said receptacle, and said latch member being pivotally mounted on said side wall means.

6. An enclosed control structure according to claim 4, said receptacle comprising a generally planar base and side wall means extending from said base in a direction generally normal to the plane of said base to form said receptacle opening at the front of said receptacle, and said latch member being pivotally mounted on said side wall means.

7. An enclosed control structure according to claim 2, said receptacle comprising a generally planar base and side wall means extending from said base generally normal to the plane of said base to form said receptacle opening at the front of said receptacle; said latch member being pivotally mounted on said side wall means; said latch member comprising a member supported for unitary movement and comprising a first part, a first latch part and a second latch part; said cover comprising a cover latch part; in said first position said first latch part of said latch member being in the path of movement of said operating member; upon a closing operation of said cover structure said cover latch part engaging said first part of said latch member and pivoting said latch member to said second position; and in said second position said second latch part of said latch member overhanging said cover latch part to prevent opening of said cover structure.

8. An enclosed control structure according to claim 7, and externally operable means operable when said operating member is in said "on" position and said cover structure is in said closed position to move said latch member in said second pivotal direction to a third position wherein said second latch part of said latch member is free of said cover latch part to permit movement of said cover structure to the open position when said operating member is in said "on" position.

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