June 20, 1961 T. F. BROWN 2,989,612

ENCLOSED ELECTRIC SWITCH

Original Filed Dec. 11, 1957 4 Sheets-Sheet 1

Fig. 1.

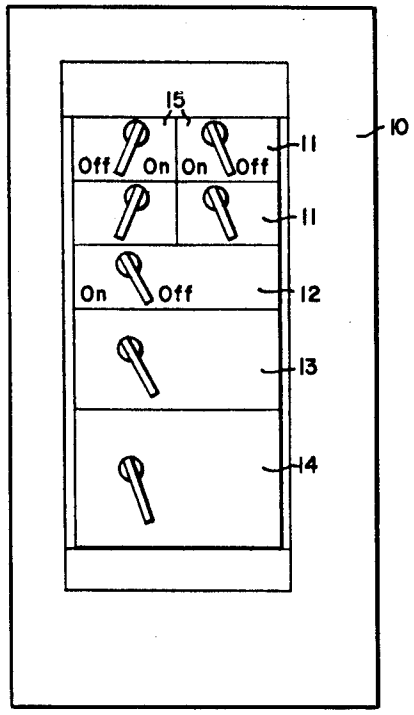
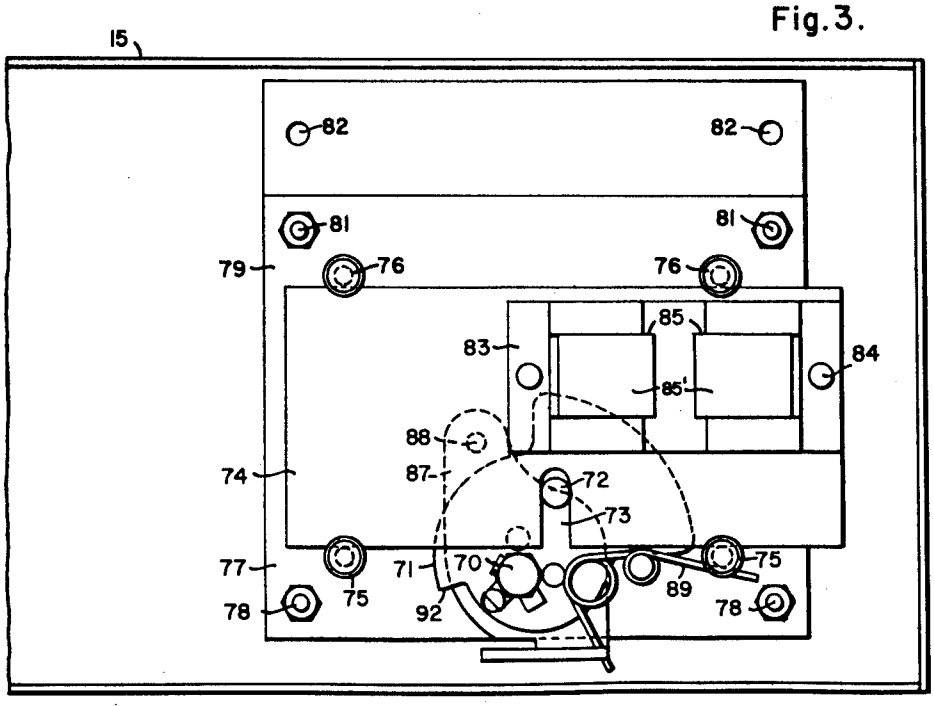


Fig. 3.

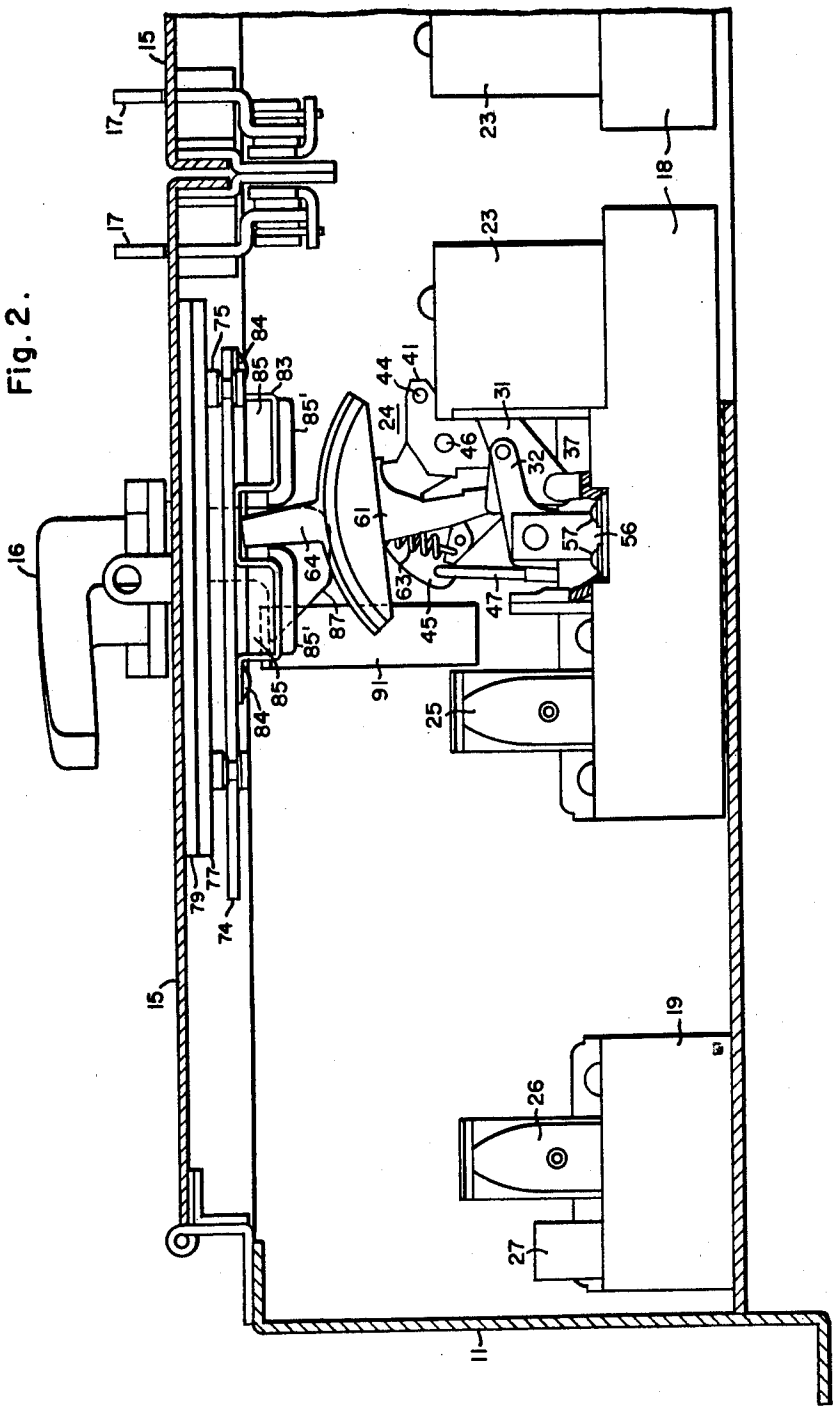


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Fig. 2.



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ENCLOSED ELECTRIC SWITCH

Original Filed Dec. 11, 1957 4 Sheets-Sheet 3

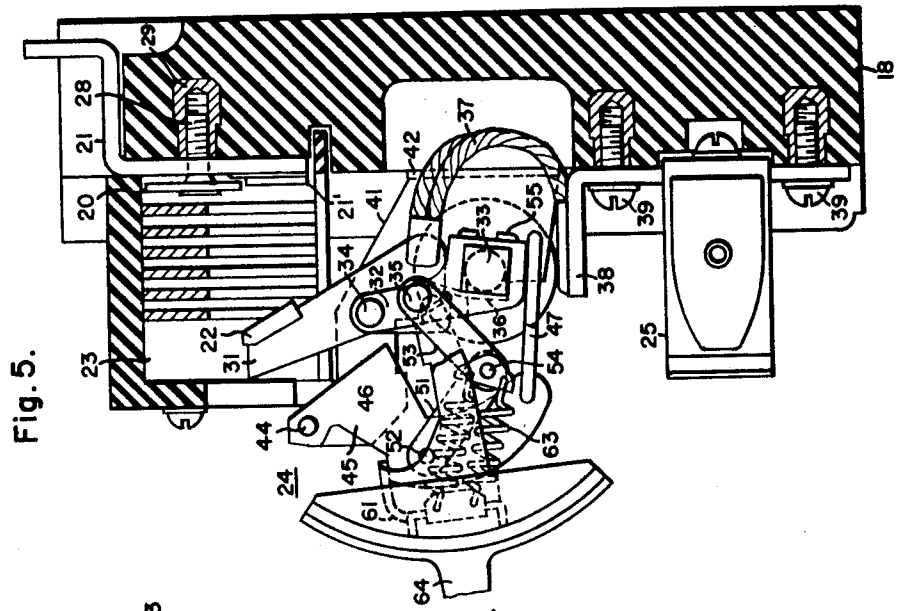


Fig. 5.

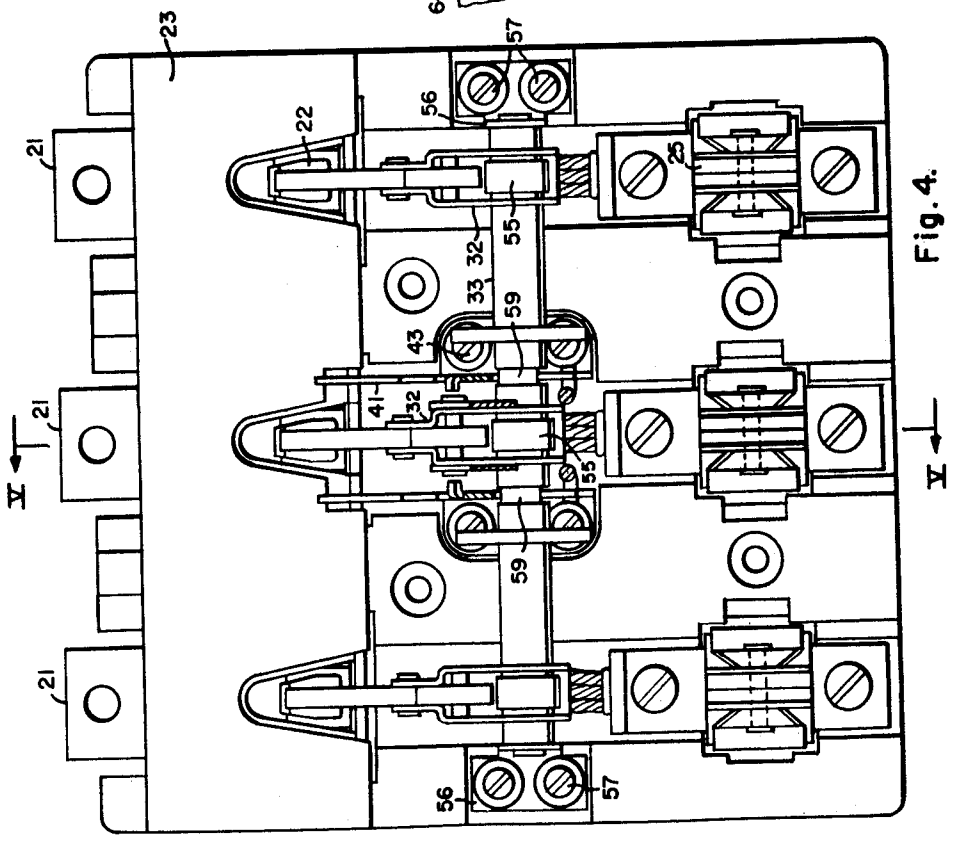


Fig. 4.

Fig. 6.

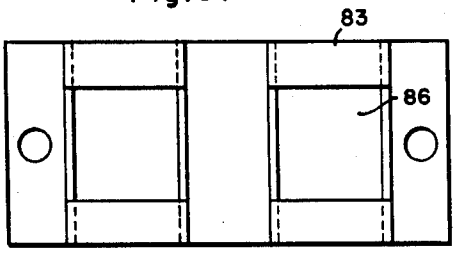


Fig. 8.

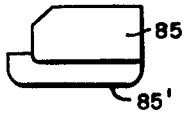


Fig. 7.



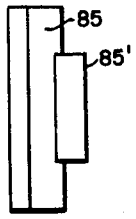


Fig. 9.

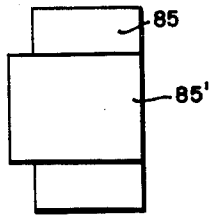


Fig. 10.

Fig. 11.

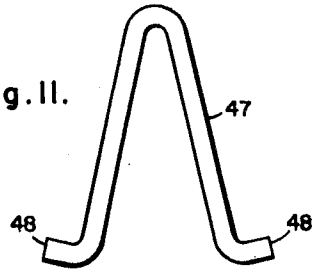
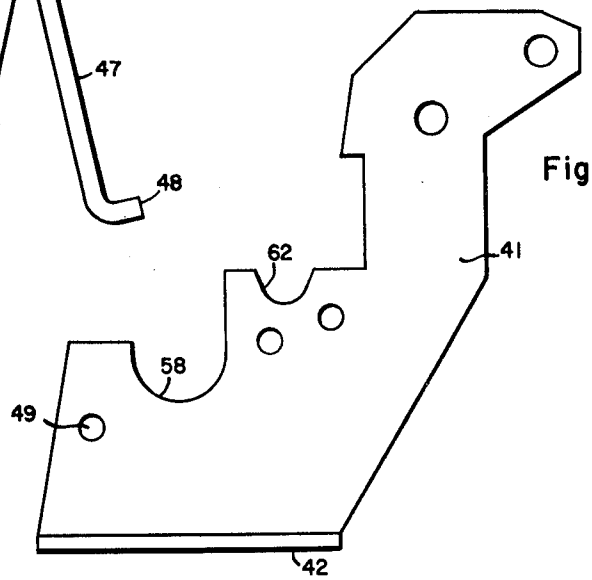


Fig. 12.



United States Patent Office 2,989,612 Patented June 20, 1961

2,989,612

ENCLOSED ELECTRIC SWITCH

Thomas F. Brown, Belleville, N.J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Original application Dec. 11, 1957, Ser. No. 702,029. Divided and this application Oct. 8, 1958, Ser. No. 765,992

3 Claims. (Cl. 200—168)

This invention relates, generally, to enclosed electric switches and, more particularly, to enclosed switches suitable for utilization in panelboard and switchboard structures.

This application is a division of my copending application Serial No. 702,029, filed December 11, 1957.

In order to protect the apparatus and the operating personnel, manually operable circuit breakers and switches are enclosed in metal boxes or cabinets which may be mounted in a panelboard or switchboard structure. The circuit breaker or switch mechanism is operated by an operating member or handle composed of a molded insulating material which is actuated by an external handle on the door of the enclosing cabinet. The operating mechanism in the door is disengaged from the breaker or switch handle when the door is opened.

It is desirable to preclude the possibility of breaking the operating member of the switch when the door of the cabinet is closed. It is also desirable that the external handle should always indicate the position of the switch handle when the door is closed, thereby signifying whether the switch is opened or closed.

In order to accomplish the first purpose, mechanisms of the type described in Patent No. 2,550,125, issued April 24, 1951 to A. E. Schueler et al. were developed. In the aforesaid mechanism two spaced spring arms were provided for engaging the breaker operating member or handle. The resilience of the spring arms permitted the cover to be closed regardless of the respective positions of the external handle and the breaker handle without damaging the breaker handle because the spring arms yielded upon engaging the breaker handle if the two handles were not in corresponding operative positions. A spring arm remained in a deflected position until the external handle was actuated to the position corresponding to the position of the breaker handle at which time the breaker handle entered the space between the spring arms. However, in the meantime, the external handle did not indicate the position of the breaker handle and there was a possibility of someone being misled into thinking that the breaker was open when it was actually closed or vice versa.

For applications where it was very important that the external handle should always indicate the correct position of the breaker handle when the cover was closed, mechanisms, such as those described in a copending application of I. G. Portman et al., Serial No. 481,622, filed January 13, 1955, now Patent No. 2,806,098, were developed. In one such mechanism, a plate was slidably mounted on the inside of the cover and an operating plate was adjustably attached to the inner side of the slidable plate which was reciprocated by means of the external handle. Two spaced rigid operating arms were attached to the operating plate. The breaker handle was disposed in the space between the opposing ends of the operating arms when the cover was closed. Since the operating arms were rigid, there was danger of breaking the molded breaker handle by it being struck by one of the operating arms if the positions of the external handle and the breaker handle did not correspond when an attempt was made to close the cover.

An object of the invention is to provide an enclosed

electric switch having an external operating handle mounted on the door of the enclosure, which handle must be in a position corresponding to the position of the switch mechanism handle to permit closing the door of the enclosure.

A further object of the invention is to prevent breakage of the molded switch handle when attempting to close the cabinet door with the external handle and the switch handle in dissimilar positions.

Another object of the invention is to utilize parts of the actuating mechanism for the switch as intermediate bearing supports for an insulating cross-bar of the switch.

A still further object of the invention is to provide a simplified and improved toggle mechanism for actuating the contact members of the switch.

Still another object of the invention is to provide an operating mechanism which may be utilized with enclosed switches of different ratings.

Other objects of the invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of the invention, two spaced blocks, composed of an elastomeric or rubber-like material, are mounted in a slidable member to engage the molded handle of an enclosed switch, thereby operating the switch by means of an external handle on the cover of the enclosure. The operating mechanism is so constructed that slides and blocks of different sizes may be utilized with switches of different ratings. The blocks are wide enough to prevent closing the door of the enclosure unless the external operating handle and the switch handle are in corresponding positions, but the switch handle is not broken if it is struck by one of the blocks. Spaced supports for the toggle mechanism of the switch function as bearing members for the cross-bar to which switch arms are attached.

For a better understanding of the nature and objects of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a reduced view of a panelboard structure containing switch units embodying the principal features of the invention;

FIG. 2 is a view, partly in section and partly in elevation, of one of the switch units, the contact members of the switch being in the "off" or open position;

FIG. 3 is a view, in plan, of the operating mechanism for the switch, the mechanism being in "on" or closed position;

FIG. 4 is a view, partly in section and partly in plan, of the main base assembly for the switch, the actuating handle being removed for clearance;

FIG. 5 is a view, in section, taken along the lines V—V in FIG. 4;

FIGS. 6 and 7 are enlarged detail views of an operating clip utilized in the operating mechanism;

FIGS. 8, 9 and 10 are enlarged detail views of a rubber bushing or block utilized in the operating clip;

FIG. 11 is an enlarged detail view of a cradle retaining spring utilized in the toggle mechanism for the switch; and

FIG. 12 is an enlarged detail view of a mounting plate for the toggle mechanism.

Referring to the drawings, and particularly FIG. 1, the structure shown therein comprises a panelboard housing **10** in which is mounted a plurality of switch units **11**, **12**, **13** and **14**. The switch units are of different sizes and ratings, the units **11** being of a relatively small current rating, the unit **12** being of a higher rating, and the units **13** and **14** being of still higher ratings. In this application a unit **11**, which is one of the smaller units, is described. One of the larger units is described in my copending appli-

cation, Serial No. 700,635, filed December 4, 1957. As shown, two complete switch assemblies of the smaller ratings may be housed in one box or cabinet.

As shown in FIG. 2, each box or cabinet **11** has two openable covers **15**. Each cover provides access to one of the switch assemblies contained within the cabinet **11**. An external operating handle **16** is rotatably mounted on each cover **15**. A spring-biased latch **17** is provided for retaining each cover **15** closed. As will be described more fully hereinafter, an interlocking device is also provided for normally retaining the cover **15** closed when the switch is in the "on" position.

Each switch assembly comprises a main base **18** and a secondary or fuse base **19** which is spaced from the main base **18** in the cabinet **11**. Line terminal members **21**, contact members **22**, arc extinguishers **23** and an actuating mechanism **24** for a three-pole switch are mounted on the main base **18**. A fuse clip **25** for each pole is also mounted on the base **18**. Another fuse clip **26** and a load terminal connector **27** for each pole are mounted on the secondary base **19**. The bases **18** and **19** are preferably molded from a suitable insulating material.

As shown more clearly in FIG. 5, each pole of the switch structure comprises a line terminal assembly which includes the terminal **21**, a fixed contact member **21'** which may be brazed to the terminal **21**, and an arc runner **20** attached to the terminal **21** by a screw **28** which also retains the terminal **21** on the base **18**. The screw **28** is threaded into a metal insert **29** provided in the base **18**.

The movable contact member **22** for each pole is secured to a contact arm **31** which is pivotally mounted on an actuating arm **32** attached to an insulating cross-bar or shaft **33**. The contact arm **31** is pivoted on a pin **34** disposed in the actuating arm **32**. The contact arm **31** has a clearance hole therethrough for a pivot pin **35** to which a toggle mechanism is connected as will be described more fully hereinafter. The clearance hole about the pin **35** limits the movement of the contact arm **31** about its pivot point **34**. A torsion spring **36**, which surrounds the pin **35** and has one end engaging the shaft **33**, is provided for maintainng a predetermined contact pressure between the movable contact member **22** and the fixed contact member **21'** when the contact members are closed.

A flexible conductor **37** connects the contact arm **31** to an angle-shaped conductor **38** to which the fuse clip **25** is attached. The conductor **38** is attached to the base **18** by screws **39** threaded into metal inserts **29** in the base **18**. Thus, an electrical crcuit is established between the terminal member **21** and the fuse clip **25** when the contact members **22** and **21'** are engaged. A fuse (not shown) may be inserted in the fuse clips **25** and **26**, thereby completing the circuit through each pole of the switch.

The toggle mechanism for actuating the movable contact members of the switch is supported between a pair of spaced mounting plates **41**, one of which is shown in detail in FIG. 12. Each mounting plate has an angularly-extending foot **42** for attaching the plate to the base **18** by screws **43** as shown most clearly in FIG. 4. The upper ends of the two plates **41** are secured together by a spacing stud **44**.

A cradle member **45** is disposed between the plates **41** in a fixed position. The cradle member is mounted on a pin **46** which extends between the mounting plates **41**. One end of the cradle member **45** is attached to the spacing stud **44**. The other end of the cradle member is anchored to the mounting plates **41** by means of a generally V-shaped spring **47** which is shown in detail in FIG. 11. The ends of the legs of the V-shaped spring **47** have angularly extending projections **48** thereon which are disposed in holes **49** provided in the mounting plates **41**. The spring tension of the V-shaped member biases the legs of the V outwardly, thereby retaining the projections **48** in the holes **49**. Thus, the spring **47** may be readily assembled in the toggle mechanism.

Toggle links **51** are pivotally connected to the cradle member **45** by a pin **52**. Toggle links **53** are pivotally connected to the actuating arm **32** of the middle pole of the switch by means of the pin **35**. The toggle links **51** and **53** are pivotally connected together by a toggle pin **54**. The actuating arm **32** is secured to the shaft or cross-bar **33** by a staple **55**.

The cross-bar **33** is composed of an insulating material in order to electrically insulate the poles of the switch from each other. Each end of the shaft or cross-bar **33** is mounted in a bearing bracket **56** attached to the base **18** by screws **57**. In order to prevent bending the cross-bar **33**, additional support for the bar is provided by the mounting plates **41**. As shown most clearly in FIGS. 4 and 12 each mounting plate has a bearing surface **58** for a grooved portion **59** of the shaft **33**. Thus, deflection of the shaft **33** during operation of the switch is prevented.

The ends of the legs of a generally U-shaped operating lever **61** are pivotally mounted in rounded portions **62** of the mounting plates **41**. Overcenter toggle springs **63** are connected between the toggle pin **54** and the base of the U-shaped operating lever **61**. An actuating handle **64** is attached to the base of the lever **61** for operating the toggle mechanism, thereby actuating the movable contact members of the switch.

In order to provide for operating the switch by means of the external handle **16**, a cam shaped plate **71** is attached to the inner end of a shaft of the handle which extends through the cover **15**. The plate is attached to the shaft by means of a screw **70**. The plate **71** carries a pin or anti-friction roller **72** which is disposed in a slot **73** in a slidable operating plate **74**. The plate **74** is supported for sliding movement between grooved studs **75** and **76**. The studs **75** are attached to a supporting plate **77** which, in turn, is attached to the inside of the cover **15** by screws **78**. The studs **76** are attached to a second supporting plate **79** which is attached to the first supporting plate **77** and the cover **15** by screws **81**.

As shown in FIG. 3, additional holes **82** are provided in the first supporting plate **77** for attaching the plate **79** to the plate **77** in a different position from that shown in FIG. 3. Thus, the position of the studs **76** may be changed to permit a wider operating plate **74** to be utilized for switches of a higher current rating which require a heavier and stronger operating mechanism.

As explained hereinbefore, it is desirable to prevent the cover of the cabinet from being completely closed unless the external handle **16** and the actuating handle **64** are in corresponding positions. As also explained it is desirable to prevent breaking the actuating handle **64**, which is composed of a rigid molded resinous plastic insulating material, when an attempt is made to close the cover **15** without the external handle **16** and the handle **64** being in corresponding positions.

In order to provide both of the foregoing features in the same operating mechanism, an operating clip **83** is attached to the operating plate **74** by means of screws or rivets **84**. Two bushings or blocks **85** are mounted in the operating clip **83** which is shown in detail in FIGS. 6 and 7. The blocks **85** are made from a rubbery or otherwise elastomeric organic material which has the property of being soft or elastic enough to prevent breakage of the rigid molded resinous material of the handle **64** when the cover **15** is slammed closed and the lower surface **85'** of either block **85** comes down on the top of the handle **64**. At the same time, the portions **85** of elastomeric material are rigid enough that the top of the handle **64** cannot be pressed up into either portion far enough to permit the cover to be closed and the cover latch **17** engaged, without the top of the handle **64** being properly positioned in the slot or space between the two portions **85**. Furthermore, the elastomeric material has the property of being resilient or elastic in that its surface **85'** returns to its original position and shape after it has been deformed by being banged down on the top of the handle **64**. Various elastomeric organic materials having such

properties may be used, such for example as natural or synthetic rubbers having a Shore durometer A hardness as low as 50 or 60 or as high as 75 or 80. A preferred material for the blocks **85** is composed of rubber or a rubber compound such as GRS or Buna S synthetic rubber having a Shore durometer A hardness of approximately 70.

The rubber-like material is particularly suitable for this purpose in view of its elastic resilience or ability to absorb energy elastically. Therefore, it absorbs the shock resulting from one of the blocks **85** striking the handle **64** in case an attempt is made to close the cover **15** without the handle **16** and the handle **64** being in corresponding positions. The blocks **85** are sufficiently rigid to prevent closing the cover, but not rigid enough to break the handle **64**.

As shown in FIG. 6 the operating clip **83** is provided with openings **86** in which the blocks **85** are inserted. As shown in FIGS. 8, 9 and 10, the blocks **85** are so shaped and proportioned that they may be inserted into the clip **83** prior to its attachment to the operating plate **74**. The blocks **85** are retained in the clip **83** when it is attached to the plate **74**.

As shown in FIG. 2 the handle **64** is disposed in the space between the blocks **85** when the cover **15** is fully closed. Thus, rotation of the handle **16** rotates the cam-shaped plate **71** which reciprocates the plate **74** and the operating clip **83** by means of the pin and slot connection **72—73**. The blocks **85** engage the actuating handle **64** to operate the switch.

In order to normally prevent opening the cover **15** while the contact members of the switch are closed, an interlocking latch **87** is pivotally attached to the cover **15** by means of a screw **88**, the head of which is disposed on the outside of the cover and the inner end of which is fixed to the latch so that the latch will turn with the screw. The interlocking latch **87** is biased by a spring **89** to engage a locking element **91** attached to the side of the cabinet **11**, thereby retaining the cover closed. When the handle **16** is actuated to the "open cover" position, a projection **92** on the cam plate **71** engages the interlocking latch **87** to disengage the latch from the locking element **91**, thereby permitting the cover to be opened when the contact members of the switch are open. However, the interlocking latch **87** may be actuated by means of the screw **88** to which the latch **87** is attached to release the latch when the operating handle **16** is in the "on" position, thereby permitting access to the switch by a person who knows the function of the screw **88**.

From the foregoing description it is apparent that the present invention provides a switch structure having the desirable safety feature of ensuring that the external operating handle and the switch handle are in corresponding positions when the cover of the enclosure for the switch is fully closed. Furthermore, the present invention precludes the possibility of breaking the switch actuating handle by attempting to close the cover when the external handle and the switch handle are not in corresponding positions. The present invention provides an operating mechanism which is simple in construction and it may be readily adapted for operating switches of different ratings and sizes.

Since numerous changes may be made in the above-described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a multipole circuit interrupter, in combination, an insulating base, a plurality of fixed contact members mounted on the base in spaced relation, a corresponding number of contact arms having contact members thereon for engaging said fixed contact members, a rotatable shaft for actuating said contact arms, a pair of spaced mounting plates attached to said base and having bearing surfaces thereon for said shaft, an actuating arm secured to the shaft, a cradle member disposed between said mounting plates in a fixed position, toggle links connecting the cradle member to the actuating arm, a generally V-shaped spring member connecting one end of the cradle member to the mounting plates, an operating lever pivoted on said mounting plates, overcenter toggle springs connected between said lever and said toggle links, and an actuating handle on said lever.

2. In a multipole circuit interrupter, in combination, an insulating base, a plurality of fixed contact members mounted on the base in spaced relation, a corresponding number of contact arms having contact members thereon for engaging said fixed contact members, a rotatable shaft for actuating said contact arms, bearing brackets mounted on the base for supporting the ends of said shaft, a pair of spaced mounting plates attached to the base and having bearing surfaces thereon for supporting the shaft between said bearing brackets, an actuating arm secured to the shaft, a cradle member disposed between said mounting plates in a fixed position, toggle links connecting the cradle member to the actuating arm, a spring member having two legs and an intermediate portion connecting one end of the cradle member to said spaced mounting plates, an operating lever pivoted on said mounting plates, overcenter toggle springs connected between said lever and said toggle links, and an actuating handle on said lever.

3. In a multipole circuit interrupter, in combination, an insulating base, a plurality of fixed contact members mounted on the base in spaced relation, a corresponding number of contact arms having contact members thereon for engaging said fixed contact members, a rotatable shaft for actuating said contact arms, bearing brackets mounted on the base for supporting the ends of said shaft, a pair of spaced mounting plates attached to the base and having bearing surfaces thereon for supporting the shaft between said bearing brackets, an actuating arm secured to the shaft, a cradle member disposed between said mounting plates in a fixed position, toggle links connecting the cradle member to the actuating arm, a generally V-shaped spring member having its intermediate portion attached to one end of the cradle and angularly extending portions on the ends of its legs engaging said mounting plates, a generally U-shaped operating lever having its legs pivoted on said mounting plates, overcenter toggle springs connected between the base of the U-shaped operating lever and the toggle links, and an actuating handle attached to the base of the operating lever.

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