July 21, 1964 D. F. DALY ETAL 3,141,947

FRONT-OPERATED SWITCH WITH BAIL TYPE HANDLE

Filed Dec. 4, 1959 3 Sheets-Sheet 1

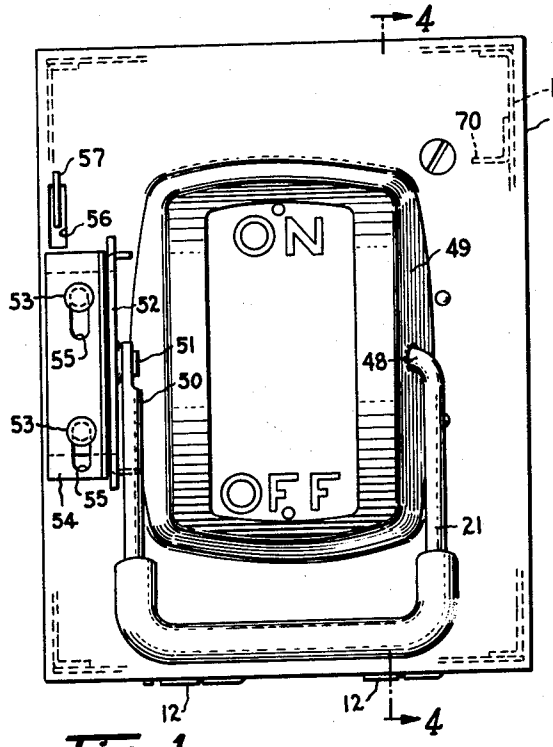


Fig. 1

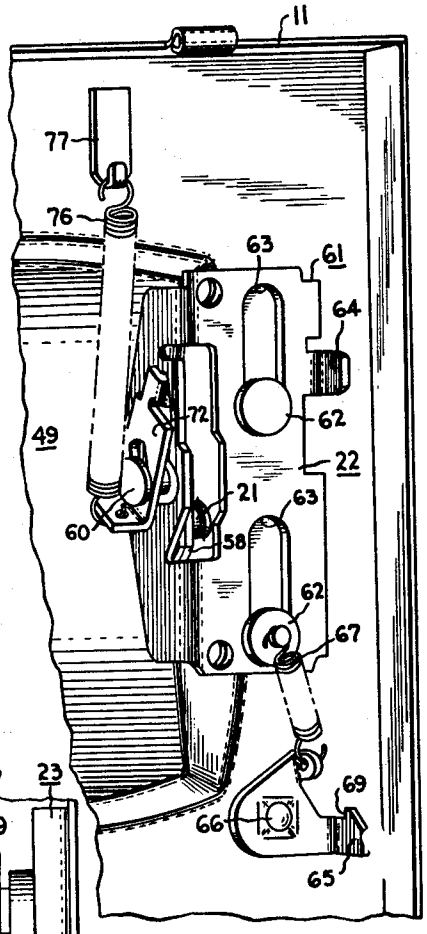


Fig. 2

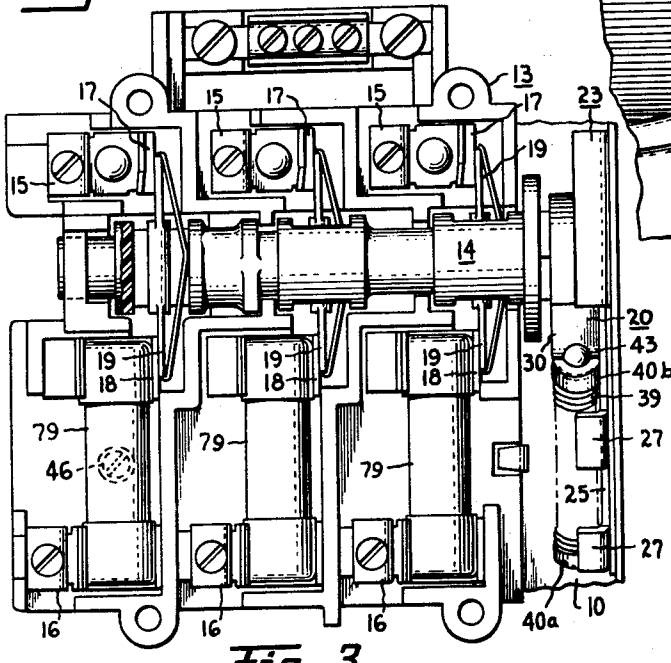


Fig. 3

INVENTORS.
DANIEL F. DALY,
ROBERT S. TILLSON
BY Robert T. Casey
ATTORNEY

July 21, 1964 D. F. DALY ETAL 3,141,947

FRONT-OPERATED SWITCH WITH BAIL TYPE HANDLE

Filed Dec. 4, 1959 3 Sheets-Sheet 2

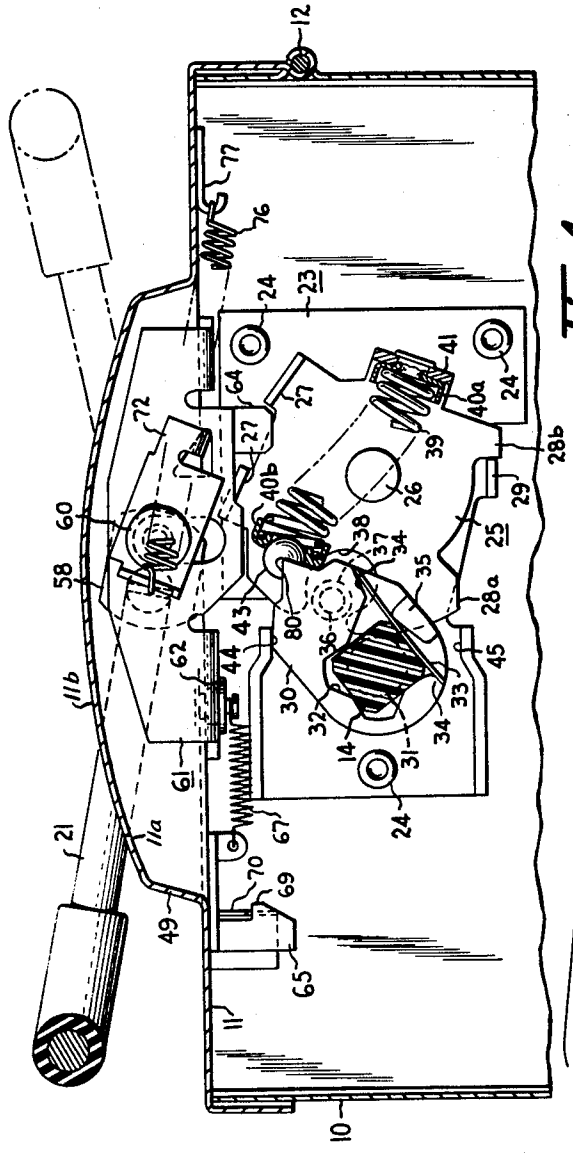


Fig. 4

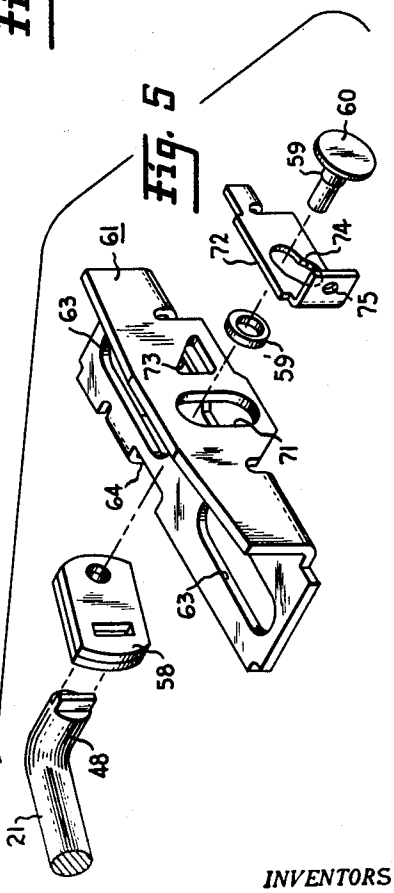


Fig. 5

INVENTORS.
DANIEL F. DALY,
ROBERT S. TILLSON
BY Robert T. Casey
ATTORNEY

July 21, 1964 D. F. DALY ETAL 3,141,947

FRONT-OPERATED SWITCH WITH BAIL TYPE HANDLE

Filed Dec. 4, 1959 3 Sheets-Sheet 3

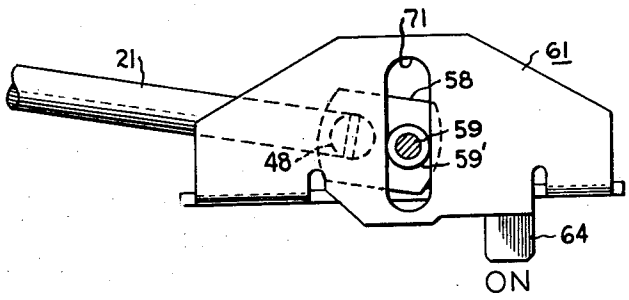


Fig. 6

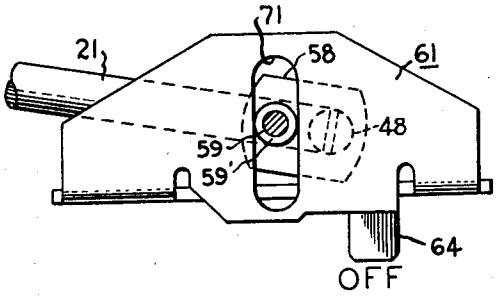


Fig. 7

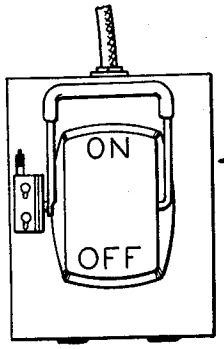
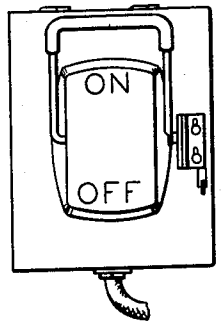


Fig. 8

NORMAL MOUNTING

Fig. 9



REVERSED MOUNTING

INVENTORS.
DANIEL F. DALY,
ROBERT S. TILLSON
BY Robert F. Casey
ATTORNEY

United States Patent Office 3,141,947 Patented July 21, 1964

3,141,947

FRONT-OPERATED SWITCH WITH BAIL TYPE HANDLE

Daniel F. Daly, Hartford, and Robert S. Tillson, Bristol, Conn., assignors to General Electric Company, a corporation of New York

Filed Dec. 4, 1959, Ser. No. 857,396
5 Claims. (Cl. 200—172)

Our invention relates to enclosed electric switches, and particularly to electric switches of the type including an electric switching device contained within a metallic enclosure and provided with mechanism for operating the switching device from outside of the enclosure.

According to the prior art, enclosed switches have ordinarily included an operating handle which is either (1) mounted on the front or cover of the enclosure on an axis perpendicular to the back of the enclosure to provide a "front-operated" type of enclosed switch, or (2) on the side wall of the enclosure on an axis parallel to the back of the enclosure to provide a "side-operated" type of enclosed switch. "Side-operated" types of switches have certain advantages in that the operating handle moves in a rectilinear fashion upwards and downwards and it is very easy to perceive the "on" or "off" condition of the switch even without reading the markings on the switch. Thus according to traditional practice, the upward position is normally "on" and the downward position is "off." Side-operated switches, however, have the disadvantage that they cannot be mounted closely adjacent each other, since room must be left for the operator to grasp the operating handle.

Front-operated switches, on the other hand, have the advantage that they can be mounted closely side-by-side, thereby conserving space. Since the handles of prior art front-operated switches are mounted on an axis perpendicular to the back wall of the enclosure, they must be operated by a rotary or twisting motion, rather than a vertical reciprocal motion. This makes such switches more difficult to operate, and also makes it more difficult to detect the "on" or "off" condition of the switch.

In addition, prior art switches having a vertical reciprocating handle are so constructed that the "on" and "off" positions of the handle are predetermined and unchangeable. This requires that the switch be mounted in a particular orientation when in use in order that the "on" position will be upward and the "off" position downward. For ease in wiring the switch, however, it is sometimes desirable to mount the switch in an inverted position so that incoming wires may enter from the end of the enclosure which is closest to the line terminals of the interior switching device. This has not been possible with prior art switches since this would place the "on" position of the handle downward and the "off" position upward, which is not desirable for safety reasons.

The term "switch" or "electric switch," as used herein, means any repetitively operable electric circuit making and breaking device whether or not such device includes means for automatically operating, and specifically includes switching devices known as "circuit breakers."

It is an object of the present invention to provide an enclosed electric switch having a manually operable handle accessible for operation from the front of the switch, which does not require that the operator's hand project beyond the side of the switch, and which is nevertheless operable in a vertically reciprocating manner.

It is another object of the invention to provide an enclosed electric switch which may be mounted in a first position or in a second position which is inverted end-for-end with respect to the first position, and which includes a reciprocating type handle and means whereby the switch may be modified so that the "on" position of the handle

may be at either extreme of its movement as desired, whereby the switch may be mounted on a vertical wall, and the "on" position of the handle may always be upward, regardless of the upright or inverted condition of the entire switch.

It is another object of the invention to provide an enclosed electric switch including electric switching means contained within an enclosure and operating means carried by the enclosure, wherein the switching means may be readily removed from the enclosure without disturbing the manually operable means.

Another important object of the invention is to provide an enclosed switch having a snap-acting mechanism which has no "dead-center" condition, which is positive in operation (i.e., will operate the switch even though the over-center spring is broken) and which will operate an insulating rotor without danger of breakage.

Additional objects will in part become obvious from the following detailed description, and in part be set forth therein.

In accordance with the invention in one form, an enclosed electric switch is provided including an enclosure, electric switching means within the enclosure having an operating member, and manually operable means carried by the cover of the enclosure and comprising a generally U-shaped bail type handle, pivotally supported upon the cover of the enclosure and operably interconnected with the interior switch operating member.

In accordance with one aspect of the invention, means is provided for maintaining the manually operable handle in either of its two extreme positions even when the cover is disengaged from the switch enclosure.

In accordance with another important aspect of the invention, the switch operating mechanism includes means which is selectively connectible in either of two conditions to provide a predetermined desired relation between a given position of the manually operable handle and the circuit open or closed condition of the switching means within the enclosure.

In accordance with a still further aspect of the invention, a snap-acting mechanism is provided including a pair of rotatable operating members and a compression spring acting therebetween to bias the members to one side or the other of the line connecting their pivots, and a cam-and-roller interconnection between the two members. The relation of the biasing spring mounting to the cam-and-roller interconnection is such as to minimize the possibility of stalling the mechanism on a dead-center position.

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

In the drawings:

FIGURE 1 is a front elevation view of an electric switch incorporating the invention and shown as mounted on a vertical wall surface;

FIGURE 2 is a fragmentary view in perspective showing the portion of the operating mechanism carried by the enclosure cover;

FIGURE 3 is a front elevation view of the interior switch unit of FIGURE 1;

FIGURE 4 is a side elevation view partially in section taken generally on the line 4—4 of FIGURE 1, and showing particularly the snap-acting mechanism;

FIGURE 5 is an exploded perspective view of the portions of the mechanism shown in FIGURE 2;

FIGURE 6 is a side elevation view of a portion of the operating mechanism shown connected in a first condition;

FIGURE 7 is a view similar to FIGURE 6 and showing the parts connected in a second condition;

FIGURE 8 is a front elevation view of an electric switch in accordance with the invention shown mounted in a first or "normal" mounting position;

FIGURE 9 is a view similar to FIGURE 8 but showing the electric switch mounted in a second or "reversed" mounting position, inverted with respect to the first position and after modification of the operating mechanism to alter the "on-off" direction of the handle.

In the drawings, the invention is shown as embodied in an electric switch comprising a generally rectangular enclosure **10** having an openable cover **11** hinged thereto by suitable hinge means **12** and containing an electric switching device **13** (FIG. 3) having an operating rotor **14**. The switching device **13** may be of any suitable type such as a conventional switch or circuit breaker. The particular switch means illustrated is similar to that shown in copending application Serial Number 857,384, filed December 4, 1959, and assigned to the same assignee as the present invention. Since the particular construction and operation of the electric switch is not critical to the present invention, it will be described only in general terms here.

The switch **13** includes an insulating base, line terminals **15**, and load terminals **16**. The line and load terminals are connected to pairs of spaced, relatively stationary contacts **17** and **18** respectively, which are adapted to be bridged and interconnected by contact blades **19** carried by the rotor **14**, in one position of the rotor. Fuses **79** are inserted in series between the load terminals **16** and the stationary contacts **18**. When the rotor is rotated through a predetermined angle, the bridging contacts **19** are moved out of engagement with the pairs of stationary contacts, and the circuit is interrupted between the line and load terminals.

For the purpose of operating the electric switch member **14** between its "on" and "off" positions, there is provided an operating mechanism including a snap-acting mechanism **20** mounted on the side wall of the enclosure **10**, a manually operable handle **21**, and intermediate operating mechanism **22** carried by the cover **11**.

The Snap-Acting Mechanism

Referring particularly to FIGURE 4, the snap-acting mechanism **20** carried by the side of the enclosure **10** includes a main supporting plate **23** which is attached to the side wall of the enclosure **10** by suitable means such as by rivets **24**. A first operating plate **25** is pivotally supported on the plate **23** by pivot pin **26** and has a pair of upwardly bent projections **27** for the purpose of receiving an operating member carried by a cover mechanism in a manner to be described. The plate **25** also includes a pair of spaced projections **28***a* and **28***b*, adapted to coact with the stop projection **29** carried by the supporting plate **23** to limit the angular movement of the plate **25** about the pin **26**. An operating hub **30** is likewise pivotally supported on the plate **23** by means of a pivot pin **31**. The operating hub **30** has an irregularly shaped recess **32** in the outer surface thereof for the purpose of receiving the laterally projecting end of the actuating member or rotor **14** of the switching means. The end of the switch rotor **14** is preferably made nonsymmetrical so as to be receivable in the recess **32** in only one position. An elongated flat leaf spring **33** is mounted on the hub **30**, being retained thereon by being trapped between the shoulders **34** and the projection **35**. The leaf spring **33** serves to resiliently retain the operating member **14** normally in predetermined relation position within the recess **32**, while permitting a small amount of lost-motion during operation. The hub **30** also includes a projecting pin **36** having a roller **37** supported thereon and received within a generally circular recess **38** in the operating plate **25**. The edge portions of the plate **25** adjacent the recess **38** are adapted to act as cam means upon the roller **37** to cause movement of the hub **30** upon rotational movement of the operating

plate **25**. The relation of the cam surface **38** to the roller **37**, however, is such that a lost motion is provided between the two pieces **25** and **30**.

A compression spring **39** is provided having one end seated in a generally cup-shaped retaining member **40***a* mounted on an upwardly bent projection **41** of the plate **25**. The opposite end of the spring **39** is seated in a cup-shaped retaining member **40***b* having an opening in the bottom wall thereof guided on a spherical retaining member **43** comprising an integral portion of the hub member **30**, and adapted to rock about the apex **80** of an adjacent generally V-shaped projection of the hub **30**.

In operation, referring to FIGURE 4, as the plate **25** is moved counterclockwise about its supporting pivot pin **26**, the cam surface **38** engages the roller **37** and moves the hub member **30** clockwise about its supporting pivot pin **31**. As the motion of these two parts proceeds, the compression spring **39** is compressed and at a predetermined point in the movement, the line of action of the spring passes from one side to the other of the center line of the pivot pin **26** and the pivot pin **31**, and the mechanism snaps further in the same direction.

The arrangement of the cam-and-roller interconnection is so related to the mounting of the spring **39** that when one end of the spring **39** is in line with the center-line of the members **25** and **30**, the other end is out of such line.

In addition the spring **39** is preferably of such length that it assumes a slightly S-shaped condition at each extreme of movement. Thus as the overcenter point of the mechanism is approached, the spring itself has an overcenter action as the cup **40***b* rocks about the apex **80** of the hub **30**.

These structural characteristics of the snap-acting mechanism make it virtually impossible to stall the mechanism in a dead-center position. In addition, if the compression spring **39** were to fail such as by breaking, the cam-and-roller interconnection provides a means for positively operating the switch.

The rotational movement of the hub **30** is limited in each direction by the projections **44** and **45**, bent up from the plate **23**.

The switch unit **13** may be readily separated from the snap-acting mechanism **20** and removed from the enclosure **10** by removing the mounting screw **46** and sliding the switch unit along the back wall of the enclosure away from the hub member **30**, to withdraw the end of the operating member **14** from the recess **32**.

The Handle Mechanism

For the purpose of operating the snap-acting mechanism, a handle mechanism is provided, including a manually operable handle member **21** which is generally U-shaped and which has one end thereof, **48**, bent inwardly and journalled in a drawn opening in the side portion of the dome or "bump" **49** of the cover **11**. The opposite end **50** of the handle is pivotally supported upon a pivot pin **51** which is carried by a generally L-shaped bracket **52** attached to the cover **11** by shouldered rivets **53**. A second generally L-shaped member **54** is slidably supported on top of the bracket **52** under the heads of the rivets **53**. The second bracket **54** has a pair of elongated slots **55** through which the rivets **53** project. Thus the bracket **52** is fixedly mounted on the cover, while the bracket **54** is slidable by the amount permitted by the slots **55**. In addition, both the brackets **52** and **54** have openings therein, not shown, in the upstanding portions thereof, which are adapted to register when the bracket **54** is slid forwardly to a first position. The cover **11** also has an elongated slot **56** positioned just forwardly of the bracket **54** adapted to receive a generally hook-shaped catch **57** which is pivotally supported on the side wall of the enclosure **10** and which includes a portion which is adapted to overlie the top surface of the cover **11** when the cover is in its fully closed position. The catch **57**

may normally be retracted by pivoting about its pivot pin to permit opening of the cover. When the bracket **54** is slid to a forward position, however, and locked in this position, such as by passing a padlock through the registering openings in the two brackets, it interferes with the retracting movement of the catch **57** and thereby prevents opening of the cover.

The inwardly bent end of **48** of the handle **21** has a non-circular cross-section and is fitted into a corresponding opening in an operating link or crank-arm **58**, see FIG. 5. The link **58** has a cam pin **59** rigidly attached thereto, and a cam roller **59'** is supported on the pin **59** and retained thereon by the enlarged head **60**.

An intermediate operating plate **61** is slidably supported on the inner surface **11***a* of the cover **11** by means of enlarged shouldered rivets **62**, see FIG. 2, extending through elongated slots **63** in the plate **61**. The plate **61** also has an upwardly bent operating tongue or projection **64** which is adapted to extend between the projections **27** of the operating member **25** of the snap-acting mechanism to cause operation of the member **25** upon operation of the plate **61**.

An interlock catch **65** is pivotally supported upon a pin **66** mounted on the cover **11**, and is biased by a tension spring **67** constantly in a counterclockwise direction as viewed in FIG. 2. The interlock catch **65** includes a generally hook-shaped portion **69** which is adapted to interengage with a stationary bracket **70** rigidly mounted on the side wall of the enclosure **10** when the interlock member **65** is in its farthest counterclockwise direction of movement as viewed in FIGURE 2. When the slide member **61** is moved to one extreme of its movement, however, it engages the interlock catch **65** and rotates it out of interlocking engagement. On the other hand, when the slide **61** moves away from the interlock member **65** to its opposite extreme of movement, corresponding to the "on" position, it is permitted to move to its farthest counterclockwise direction and into interlocking engagement. This serves normally to prevent opening of the switch cover when the switch parts are in the "on" condition. The operating plate **61** includes a portion bent upwardly at substantially 90 degrees with respect to the first portion and including an elongated slot **71** for the purpose of receiving the cam roller **59'** carried by the cam pin **59**.

For the purpose of providing a desired biasing action on the handle **21**, a supplementary link **72** is provided which is pivotally supported in the upstanding portion of the plate **61** in a generally V-shaped notch **73**. The link **72** has an elongated slot **74** therein, through which the cam pin **59** also passes. The link **72** is biased for rotation about its pivot point by an elongated tension spring **76** which is anchored to the cover **11** by the hook **77** at one end and which has its other end engaged in an aperture **75** in the upwardly bent end of link **72**.

In operation, rotation of the handle member **21** about the pivotal axis formed by the bearing of the portion **48** in the cover **11** and the bearing of the end **50** on the pin **51**, causes rotation of the link **58** about the bearing point of the inturned handle end **48**. This causes movement of the cam roller **59'** in an arc and the roller **59'** in turn acts upon the sides of the slot **71** to move the operating plate **61** in rectilinear fashion along the inner surface of the cover. This sliding movement of the plate **61** causes movement of the operating plate **25** of the snap-acting mechanism to operate the switch.

At both extremes of movement of the manually operable handle **21**, the link **72** is biased in a clockwise direction about its pivot point **73** as viewed in FIGURE 4. It will be observed that the result of this is to cause the link **72** to exert a force on the cam roller **59'** and the cam pin **59** which is directed generally upwardly as viewed, i.e., toward inner surface **11***a* of the cover **11**. Since the cam pin **59** is carried by the link **58**, the link **58** is also urged toward the inner surface **11***a* of the cover **11**, and the outer portion of the handle **12** is urged toward the outer surface **11***b* of the cover **11**. It will also be observed that the result of such an upwardly directed force on the cam roller **59'** in each extreme of its positions is such as to retain the handle in its then existing extreme position. This is important, since it is desirable that the handle retain itself in the position it occupies when the cover of the switch is opened so that the parts will register again when the switch cover is closed.

Reversibility of Mechanism

Referring now particularly to FIGURES 6 and 7, FIGURE 6 shows certain portions of the mechanism connected in the relation similar to that shown in FIGURES 1–5, in which the link **58** projects beyond the end of the handle **21**. As previously described, rotation of the handle **21** beween extreme arcuate positions causes movement of the slide **61** between corresponding rectilinearly displaced positions. For the purpose of reversing the relation between the extreme positions of the handle **21** and the extreme positions of the slide member **61**, the mechanism is so constructed that the link **58** may be removed and reassembled on the handle **21** in a position which is 180 degrees reversed, as shown in FIGURE 7. When the parts are assembled in this manner, it will be observed that the relationship of the positions of the slide member **61** and the positions of the handle has been reversed. In other words, although the handle **21** is in the same position, in both FIGURES 6 and 7, the position of the slide **61** has changed from the "on" position to the "off" position.

By this means it is possible to mount the switch of the present invention in either of two positions when mounted on a wall and still provide that the operating handle shall be in the upper position when the switch is "on" and in the lower position when the switch is "off." This is illustrated in FIGURES 8 and 9. FIGURE 8 illustrates a common method of mounting such a switch, in which the electric power or "line" enters the switch at the top and the handle movement is upwardly to "on" position and downwardly to "off" position. In FIGURE 9, there is shown an application where the power feed line enters from below the switch but the handle movement is still in the same direction. In changing from the installation of FIGURE 8 to the installation of FIGURE 9, the entire switch is inverted 180 degrees and is mounted upside down with respect to the position in FIGURE 8. The only changes made in the switch are the reversal of the nameplate which carries the "on"–"off" designation, and the change in linkage described above.

The ability to mount the switch in an inverted position is important because the line terminals are usually desired to be closest to the point of entry of the line wiring to prevent the necessity of having to bring the line wires through the entire box to the opposite end and the load wires likewise through the box to the opposite end.

Since many modifications of the invention will readily occur to those skilled in the art, it is 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 switch comprising a generally rectangular box-like body having a back wall and upstanding side and end walls and an open top wall, an electric switch unit mounted in said box body on said back wall and including an operating member movable between "on" and "off" positions, an openable cover mounted on said box body and closing said top wall, said cover having a generally planar peripheral portion and a generally central outwardly deformed enlargement or bump providing a chamber on said communicating with the interior of said box body, a manually operable handle member comprising a generally U-shaped member having its ends pivotally supported on said cover on an axis extending parallel to the plane of said peripheral portions,

said handle including a manually engageable bight portion parallel to said axis, said manually engageable portion being entriely within the space defined by the planes of said side walls extended, an intermediate operating member slidably supported on the inner surface of said peripheral planar portion of said cover and including a portion projecting into said cover chamber, an elongated aperture in said portion of said intermediate member, means connected to one end of said handle and extending into said aperture for causing reciprocating sliding motion of said intermediate operating member upon pivotal movement of said handle member about said axis, said intermediate operating member also including an extension projecting into said box body chamber and having a releasable engagement with said operating member of said switch unit.

2. An enclosed electric switch comprising a generally box-like enclosure having an open top wall, an openable cover supported on said enclosure and closing said top wall, an electric switch mounted in said enclosure and including an operating member movable between on and off positions, an operating handle rotatably carried by said cover and including a portion accessible for manual operation externally of said switch when said cover is closed, an intermediate operating member movably supported on the inner surface of said cover and having a releasable connection with said operating member of said switch unit, said intermediate operating member having an elongated slot therein, said operating handle including an extension extending through said cover, an operating link rigidly carried by said extension inside said cover and including a cam projection spaced from the axis of rotation of said handle and extending into said slot of said intermediate member to cause movement of said intermediate member so as to move said operating member of said switch unit between on and off positions upon movement of said operating handle, means for mounting said operating link selectively in first and second mounting positions displaced 180 degrees with respect to each other on said shaft, said cam projection being engageable in said slot when said link is in each of said positions, whereby reversal of the mounting position of said link causes reversal of the operating relation of the manually operable handle member to the operating member of the contained switch.

3. An enclosed electric switch comprising a generally box like body having an open top wall, an openable cover supported on said box body and closing said top wall, an electric switch unit mounted in said box body and including an operating member movable between "on" and "off" positions, an operating handle pivotally supported on said cover, an intermediate operating member within said enclosure operably connected to said switch unit operating member, said intermediate operating member having an elongated slot therein, operating means including a member interconnecting said operating handle and said intermediate operating member, said operating means including a cam projection receivable in said slot of said intermediate operating member, said operating means being selectively mountable in first and second positions displaced 180 degrees with respect to each other about the axis of rotation of said operating handle with said cam projection engageable in said slot in each of said positions, whereby reversal of the mounted position of said operating means causes reversal of the operating relation of the operating handle to the operating member of the said switch unit.

4. An electric switch comprising a generally rectangular enclosure having a back wall and upstanding side and end walls and an open top wall, an openable cover mounted on said box body and normally closing said open top wall, an electric switch unit contained within said enclosure and including an operating member movable between open and closed circuit positions, a manually operable handle member pivotally supported on said cover and comprising a generally U-shaped member having its ends pivotally supported on a common axis parallel to said top wall, an intermediate operating member slidably mounted on the inner surface of said cover, means releasably interconnecting said intermediate operating member with said operating member of said switch unit, said manually operable handle including an operating shaft portion extending within said enclosure parallel to said top wall, a crank arm rigidly connected to said operating shaft within said enclosure, an elongated aperture in said intermediate operating member, a cam roller carried by said crank arm eccentric of said operating shaft and extending into said elongated aperture in said intermediate operating member to produce reciprocating sliding movement of said intermediate operating member upon rotational movement of said manually operable member, and biasing means for retaining said manually operable handle member in each of its two extreme positions when said cover is open, said biasing means comprising an elongated link pivotally supported on said intermediate operating member and biasing means tending to urge said link for rotation about its pivotal support toward the inner surface of said cover and into engagement with said cam member whereby to urge said cam member toward the inner surface of said cover and to urge the outer portion of said handle toward the outer surface of said cover, when said handle is in each of its two extreme positions.

5. An electric switch comprising an insulating base, at least one pair of relatively movable contacts supported on said base, a contact operating member supported on said base and movable to move said movable contacts between open and closed circuit positions, means for operating said operating member comprising a support, a first operating link pivotally supported on said support, a second operating link pivotally supported on said support on a pivot spaced from said pivot of said first link and operatively connected to said contact operating member, a cam-and-follower interconnection between said first and second links, a compression spring between said first and second links and disposed and arranged to shift its line of action from one side to the other of the center line of said pivots of said first and second links, said compression spring extending between a point eccentric of said first link and a point eccentric of said second link, said points of connection of said spring being positioned so that when one of said points is on said center line, the other of said points is disposed to one side of said center line.

References Cited in the file of this patent

UNITED STATES PATENTS

1,460,542	Griswold	July 3, 1923
2,237,530	Olley	Apr. 8, 1941
2,646,488	Platz	July 21, 1953
2,771,523	Stoecklin et al.	Nov. 20, 1956
2,917,593	Groves et al.	Dec. 15, 1959

FOREIGN PATENTS

162,356	Sweden	Mar. 4, 1958