Oct. 4, 1966 R. M. BACON 3,277,253

SAFETY INTERLOCK MECHANISM FOR AN ELECTRIC SWITCH AND RECEPTACLE UNIT

Filed May 25, 1964 2 Sheets-Sheet 1

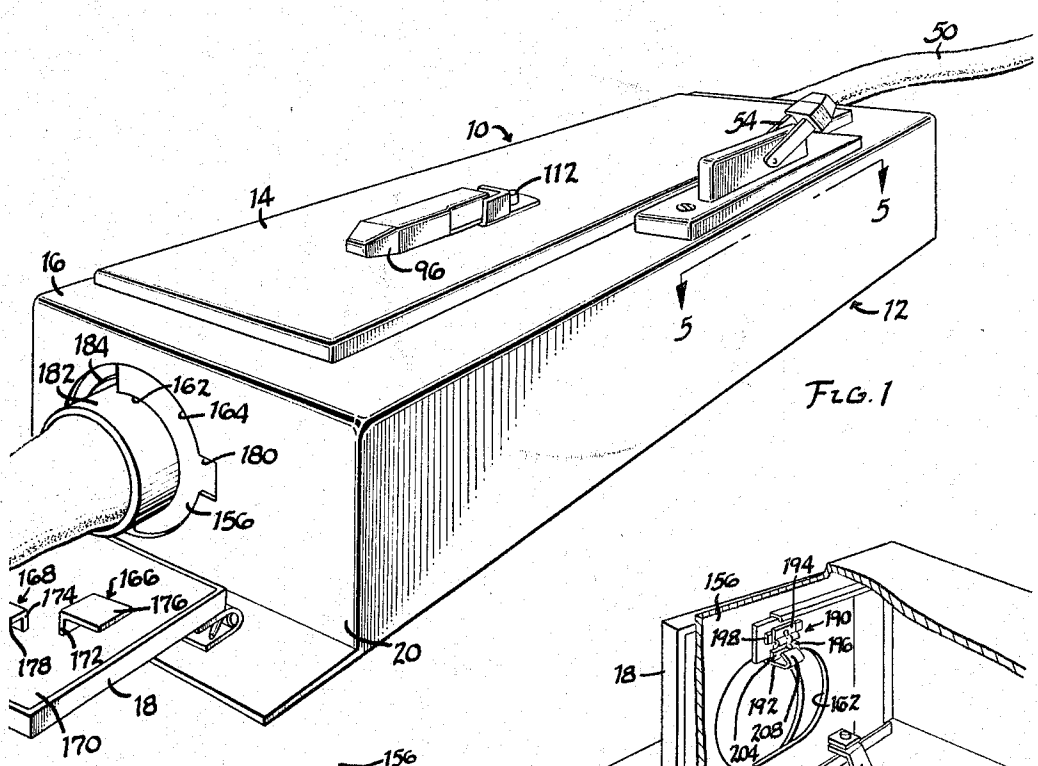


FIG. 1

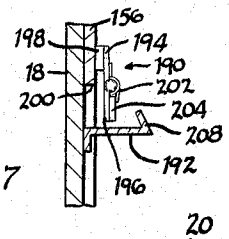


FIG. 7

FIG. 6

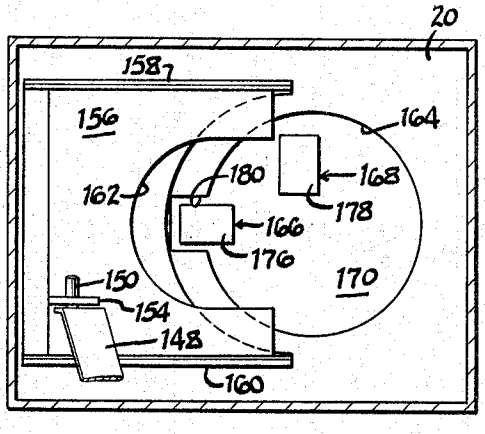


FIG. 3

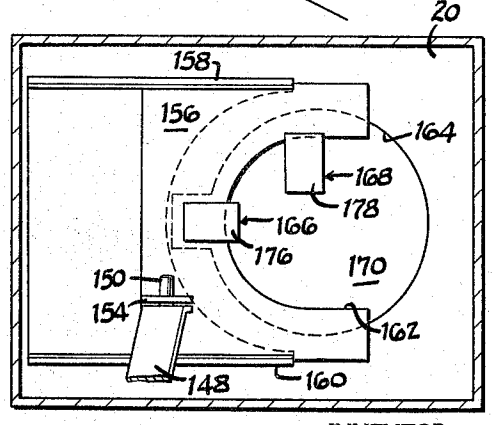


FIG. 4

INVENTOR.
ROBERT M. BACON
BY
WILSON, SETTLE & CRAIG
ATTORNEYS

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SAFETY INTERLOCK MECHANISM FOR AN ELECTRIC SWITCH AND RECEPTACLE UNIT

Filed May 25, 1964 2 Sheets-Sheet 2

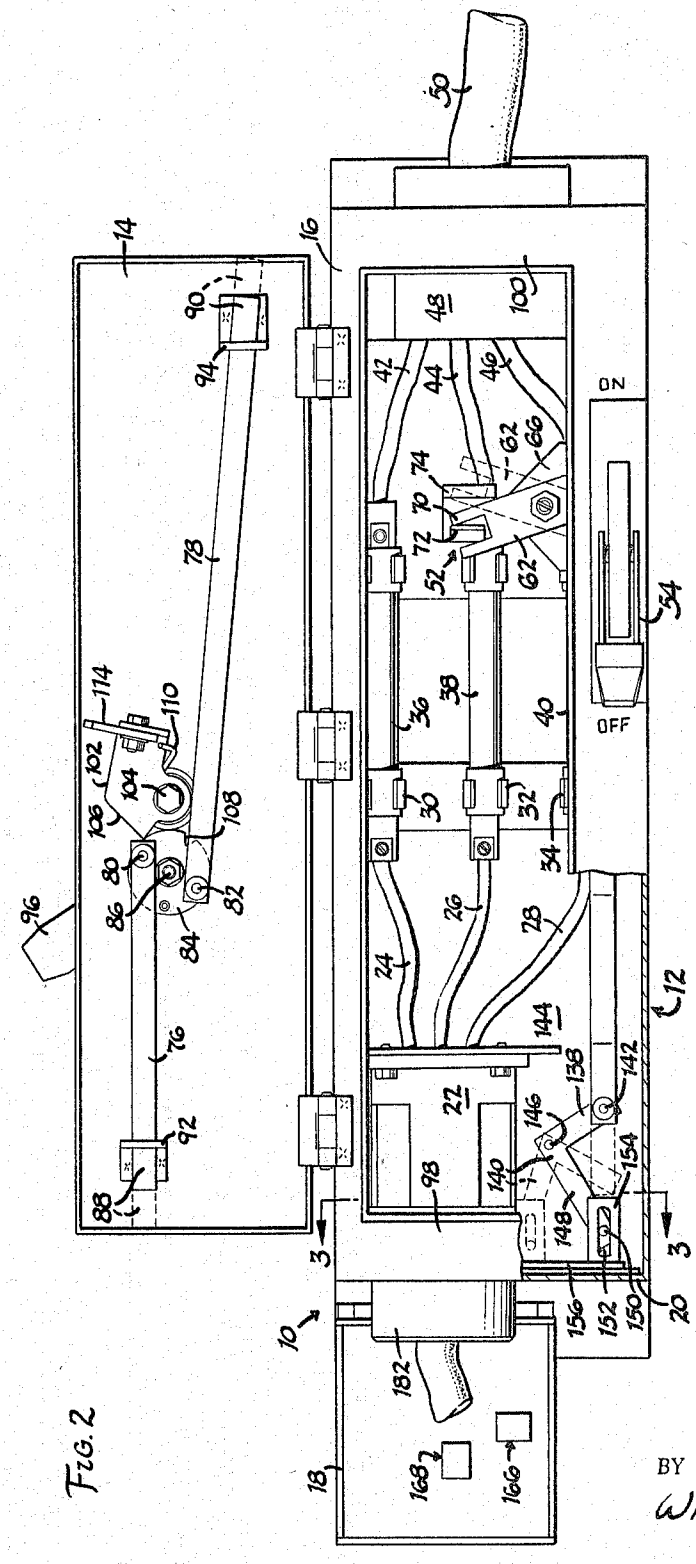


FIG. 2

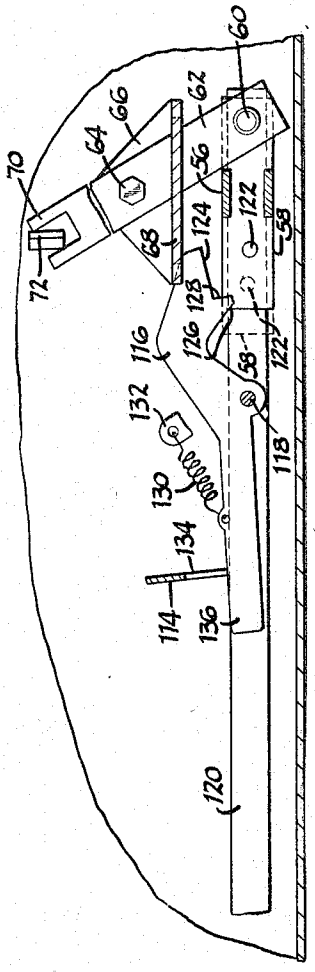


FIG. 5

INVENTOR.
ROBERT M. BACON
BY
WILSON, SETTLE & CRAIG
ATTORNEYS

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3,277,253

SAFETY INTERLOCK MECHANISM FOR AN ELECTRIC SWITCH AND RECEPTACLE UNIT

Robert M. Bacon, 25455 Powers Road, Farmington, Mich.

Filed May 25, 1964, Ser. No. 369,866
10 Claims. (Cl. 200—50)

The present invention relates to the safety interlock mechanism for an electrical switch and receptacle unit, and more particularly to an interlock mechanism which prevents opening of the main access door or removal or insertion of a plug when the switch is in the "on" position.

Switch and receptacle units to which the present invention is particularly adapted are of the type generally used in industry for supplying electrical power to high power devices such as portable welding machines.

As will be appreciated, the electrical power available at such units is lethal. It is highly desirable that workmen be unable to contact energized portions of the units when the switch is in the "on" position. It is conventional to provide an interlock structure for the main access door of such units to prevent opening of the main access door when the unit is energized. However, heretofore, structure has not been provided in such units to prevent insertion or withdrawal of a plug from the receptacle when the unit is energized. In accordance with the present invention, means are provided to lock the access opening to the receptacle when the unit is energized.

An object of the invention is to provide a switch and receptacle unit having an interlock to prevent access to the receptacle when the switch is in the "on" position.

Another object of the invention is to provide such an interlock system which cooperates with the interlock system provided in the unit for locking the main access door when the switch is in the "on" position.

A further object of the invention is to provide a door closing the access opening to the unit receptacle when there is no plug inserted into the receptacle.

A further object of the invention is to provide a sliding panel interiorly of the unit casing which partially blocks the access opening to the receptacle when the switch is in the "on" position to thereby prevent insertion of a plug.

A still further object of the invention is to provide latching means on the inner surface of the door for the receptacle access opening, the latching means interlocking with the sliding panel when the door is closed and the switch is in the "on" position.

An additional object of the invention is to utilize structure on the plug to cooperate with the sliding panel to lock the plug in place when the swtich is in the "on" position.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIGURE 1 is a view in perspective of one embodiment of the switch and receptacle unit of the present invention;

FIGURE 2 is a front view of the unit of FIGURE 1 with the main access door and the receptacle access door in open positions;

FIGURE 3 is a sectional view taken substantially along the line 3—3 of FIGURE 2 looking in the direction of the arrows but with the plug removed and the receptacle access door closed illustrating the condition of the interlock system when the switch is in the "off" position;

FIGURE 4 is a sectional view similar to FIGURE 3 but with the switch in the "on" position;

FIGURE 5 is a sectional view taken substantially along the line 5—5 of FIGURE 1 looking in the direction of the arrows with the switch in the "off" position;

FIGURE 6 is a view in perspective of a modified locking structure for the receptacle access door; and

FIGURE 7 is a cross-sectional view of the locking structure of FIGURE 6.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

The switch and receptacle unit **10** includes a casing **12** having a main access door **14** on the front wall **16** and a receptacle access door **18** on the bottom wall **20**. The casing **12** is adapted to be mounted on a suitable support surface such as a wall.

As will be noted in FIGURE 2, a receptacle **22** is mounted within the casing **12** adjacent to the bottom wall **20**. The receptacle **22** is for 3-phase A.C. power and has three leads **24, 26, 28** extending therefrom into connection with the binding posts for three fuse holders **30, 32, 34**. Fuses **36, 38, 40** are mounted in the fuse holders. Leads **42, 44, 46** extend from the fuse holders into a connector unit **48** from which extends a cable **50** which is ultimately connected to a source of power.

An on-off switch **52** is provided to control the application of electrical power to the receptacle **22**. The switch **52** includes a pivotal switch arm **54** mounted exteriorly of the casing **12** on the front wall **16**. The switch arm **54**, as shown in FIGURE 2, is pivoted to the "off" position and in FIGURE 1, the arm **54** is pivoted to the "on" position. As shown in FIGURES 2 and 5, the switch arm **54** is connected, by linkage **56**, to a reciprocal element **58** which is positioned within the casing **12**. One end **60** of a pivotal element **62** is pivotally connected to the reciprocal element **58**. The pivotal element **62** is pivotally mounted intermediate its ends at **64** to a fixed support element **66**. A slot is provided in the wall **68** of the support element **66** to permit pivoting of the element **62**. The end **70** of element **62** is forked and receives a projection **72** of a switch element **74**. The switch element **74** actuates the contacts (not shown) of the switch **52** to the open and closed positions. As shown in full lines in FIGURE 2, the pivotal element **62** has been pivoted to move the switch element **74** to a position wherein the switch contacts are open. As shown in dotted lines, the pivotal element **62** has been pivoted to position the switch element **74** to close the contacts of the switch **52**.

An interlock system is provided to lock the main access door **14** in the closed position when the switch **52** is in the "on" position.

As will be noted in FIGURE 2, a pair of elongated locking bars **76, 78** are provided on the inner surface of the main door **14**. The inner ends of the locking bars are pivotally attached at **80, 82** to a pivotal disc **84**, the disc **84** being pivotally attached by bolt **86** to the door **14**. The outer ends **88, 90** of the locking bars **76, 78** extend through guides **92, 94**. The disc **84** is spring urged to the position illustrated in full lines in FIGURE 2 wherein the outer ends **88, 90** of the bars **76, 78** are drawn inwardly.

A handle **96** is provided on the exterior of the door **14**. The handle **96** is operatively connected to the disc **84** by the bolt **86**. The handle **96**, when moved to the position shown in FIGURE 1, causes outward movement of the locking bars **76, 78** to the dotted line positions illustrated in FIGURE 2. When the locking bars are so extended and the door is closed, the ends **88, 90** extend beneath the portions **98, 100** of the casing front wall **16** to lock the door in the closed position.

The door **14** is maintained in the locked position by means of a latching element **102**. As will be noted in FIGURE 2, the latching element **102** is pivotally mounted by means of bolt **104** adjacent the disc **84**. The latching element **102** has a tooth **106** which, when the disc **84** is pivoted in the counterclockwise position as viewed in FIGURE 2, will engage a notch **108** provided in the disc **84** to thus maintain the disc **84** in a position wherein the locking bars **76**, **78** are extended. The latching element **102** is urged into the locking position by means of a spring **110**. The bolt **104** has a slotted head **112** which is accessible exteriorly of the door **14**. The latching element **102** may be pivoted out of engagement with the disc **84** by applying a screwdriver to the head **112**. However, means are provided to prevent such pivoting of the latching element **102** when the switch **52** is in the "on" position.

As will be noted in FIGURES 2 and 5, a camming element **114** extends at approximately right angles from the latching element **102**. The cam **114** is adapted to engage a pivotal locking element **116** when the switch **52** is in the "on" position. As shown in FIGURE 5, the locking element **116** is pivotally attached at **118** intermediate its ends to an elongated link **120**. The link **120** is fixedly attached to the reciprocal element **58** which, as will be recalled, moves forwardly and rearwardly in response to actuation of the switch arm **54**. The member **58** has a pin **122** which engages the locking element **116** and prevents pivoting thereof when the switch is in the "on" position and disengages this element to permit pivoting thereof when the switch is in the "off" position. As will be noted, the locking element **116** has a straight portion **124** which abuts against the pin **122** when the pin is in the position shown in full lines, this being the position of the pin when the switch is in the "off" position. A projection **126** extends from the locking element **116** towards the pin **122**. When the pin **122** is in the position shown in dotted lines, which is the "on" position of the switch, the surface **128** of the projection **126** abuts against the pin **122** and prevents pivoting of the locking element **116** in the counterclockwise direction as viewed in FIGURE 5.

A spring **130** is connected at one end to the locking element **116** and at the other end to a support bracket **132**. The spring **130** biases the locking element **116** toward the pin **122**. The cam **114** has a cam surface **134** which engages the edge **136** of the locking element **116**. When the switch **52** is in the "off" position, the latching element **102** may be pivoted, with the cam surface **134** forcing the locking element **116** out of the way, to thus permit retraction of the locking bars **76**, **78** and opening of the door **14**. However, when the switch **52** was in the "on" position, the latching element **102** cannot be pivoted because of the engagement of the locking element **116** with the pin **122**. Thus, the locking bars **76**, **78** cannot be retracted and the door **14** cannot be opened.

The link **120** also actuates the interlock system for the receptacle access door **18**. As will be noted, this link extends forwardly to a point adjacent the bottom wall **20**. The link **120** is pivotally attached to one leg **138** of an L-shaped link **140** at **142**. The link **140** is pivotally attached to the back wall **144** of the casing **12** at **146**, this being the juncture of the legs **138**, **148**. A pin **150** extends from the end of the leg **148** into a slot **152** provided in a projection **154** which extends from a slidable panel **156**.

The panel **156** is mounted in guides **158**, **160** for sliding across the face of the bottom wall **20**. As will be noted in FIGURES 3 and 4, the panel **156** has an arcuate cut-out portion **162** adjacent the circular receptacle access opening **164**.

The receptacle access door **18** has a pair of offset tabs **166**, **168** on the inner face **170**. The tabs **166**, **168** are spaced approximately 90° apart around the periphery of an imaginary circle. The tabs **166**, **168** include legs **172**, **174** which extend at right angles from the door face **170**, each leg **172**, **174** having a tab portion **176**, **178** extending therefrom towards the periphery of the access opening **164**. A notch **180** is provided in the bottom wall **20** to permit passage of the tab **166**. The tab **168** clears the opening **164** without the necessity of a notch.

As illustrated in FIGURE 3, when the switch **52** is in the "off" position, the panel **156** is moved away from the access opening **164**. As will be noted in FIGURE 2, movement of the switch arm **54** to the "off" position moves the link **120** towards the right as viewed in FIGURE 2, causing pivoting of the link **140** in the counterclockwise direction to thus slide the panel **156** away from the receptacle access opening **164**. When the panel **156** is in this position, the door **18** may be opened and a plug **182** inserted through the opening **164** into connection with the receptacle **22**.

FIGURE 4 illustrates the condition wherein the switch **52** is in the "on" position and no plug is connected to the receptacle **22**. Referring to FIGURE 2, it will be noted that when the switch arm **54** is moved to the "on" position, the link **120** is moved to the left, causing the link **140** to pivot in clockwise direction and slide the panel **156** into engagement with the tabs **166**, **168** provided on the access door **18**. It will be appreciated that this door is thus locked in the closed position when the switch **52** is in the "on" position.

The plug **182** is provided with an annular projection **184**. When the plug **182** is inserted into connection with the receptacle **22** and the switch **52** is closed, the arcuate portion **162** of the panel **156** partially surrounds the plug **182** and engages the projection **184**, which is positioned interiorly thereof, to thus prevent withdrawal of the plug **182**. It will be appreciated that instead of an annular projection **184**, an annular recess could also be utilized for the reception of the arcuate portion **162** of the panel **156** to lock the plug in position when the switch **52** is closed.

It will thus be appreciated that the present invention provides, in a single interlock system, means for locking both the main door **14** and access door **18** or plug **182** in position when the switch **52** is closed. Conversely, each of these elements may be opened or removed, respectively, when the switch **52** is in the "off" position. Further, if the access door **18** is not closed when the switch **52** is closed, then the panel **156** will partially block the opening **164** and prevent insertion of a plug. It is thus virtually impossible for a workman to contact any of the electrically energized elements of the switch and receptacle units **10** when such elements are energized. It will be appreciated that this is an important safety factor and prevents injury to the workman as a result of his carelessness or lack of understanding of the dangers inherent in manipulating the switch unit **10** when the switch **52** is closed. It will also be understood that the invention may be applied to a switch unit having a plurality of receptacles and receptacle access doors.

An alternate locking structure for the receptacle access door **18** is illustrated in FIGURES 6 and 7. As will be noted, the tabs **168**, **176** are eliminated. In place of the tabs, a hinge-type latching mechanism **190** is provided on the panel **156** to cooperate with an inwardly projecting finger **192** provided on the door **18**.

The locking mechanism **190** comprises a hinge having leafs **194** and **196**. The upper leaf **194** is secured to a small plate **198** as by welding and the plate **198** is secured in the same manner to the inner face of the panel **156** a short distance above the arcuate portion **162**.

The lower leaf **196** forms a latching element. Leaf **196** is free to pivot and is normally positioned in front of a cutout **200** in the panel **156**. The cutout **200** is slightly wider than the leaf **196**. The leaf **196** is biased by a spring **202** to the position shown. A second small plate **204** is secured to the inner face of the leaf **196**. The plate **204** is wider than cutout **200**. The leaf **196**

may thus be pivoted inwardly but is prevented from pivoting through the cutout **200** by abutment of the plate **204** against the panel **156**.

The finger **192** on the door **18** is in alignment with the cutout **200**, when the panel **156** is moved to the position shown by closure of the switch **52**. The cutout **200** is wider than the finger **192** thus permitting passage of the finger thereby. The door **18** is biased by a spring **206** to the closed position illustrated.

The finger **192** terminates in an upwardly angled portion **208**. The portion **208** extends above the lower edge of the plate **204**.

In operation, when the switch **52** is closed, the panel **156** is moved to the position as shown in FIGURES 6 and 7 as previously described. When the door **18** is released, it will swing to the closed position under the action of spring **206**. The finger **192** will contact hinge leaf **196** and pivot the leaf **196** and plate **204** inwardly. As soon as the finger portion **208** has passed by the plate **204**, the hinge spring **202** will bias the leaf **196** back towards the panel **156**. The door **18** cannot then be opened because the finger portion **208** is engaged by the plate **204** which abuts against the panel **156**. It will be noted that any force tending to open the door **18** is taken directly by the plate **204** thus avoiding any stress on the hinge spring **202**.

The door **18** may, of course, be opened when the switch **52** is opened. As previously described, opening of switch **52** causes sliding of panel **156** out of its obstructing position.

The embodiment of FIGURES 6 and 7 is even more foolproof than the previously described receptacle access door locking mechanism. Whenever the door **18** is released and the switch **52** is closed, the finger **192** will engage the plate **204**. In the embodiment of FIGURES 3 and 4, if the door **18** is held open while the switch **52** is being closed, the tabs **166**, **168** will not subsequently engage the panel **156**.

Having thus described my invention, I claim:

1. In an electrical switch and receptacle unit, a casing, said casing having a main access door and a receptacle access door, a receptacle within the casing, a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, and an interlock structure operatively connected to the switch actuating member to lock the main access door closed and lock one of a plug connected to the receptacle and the closed receptacle access door in place when the switch actuating member is positioned to close the switch.

2. In an electrical switch and receptacle unit, a casing, said casing having a main access door and a receptacle access door, a receptacle within the casing, and a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, said casing including first latching structure to lock the main access door in the closed position, said casing including second latching structure to lock one of a plug connected to the receptacle and the closed receptacle access door in place, and linkage within the casing operatively connected between the switch actuating member and the first and second latching structures to lock said latching structures in place when the switch actuating member is positioned to close the switch.

3. An electrical switch and receptacle unit comprising a casing, a receptacle within the casing, said casing having a receptacle access opening, said casing having a receptacle access door for said opening, a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, and an interlock structure within the casing operatively connected to the switch actuating member to lock one of a plug connected to the receptacle and the closed receptacle access door in place when the switch actuating member is positioned to close the switch.

4. An electrical switch and receptacle unit comprising a casing, a receptacle within the casing, said casing having a receptacle access opening, said casing having a receptacle access door for said opening, a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, a latching structure within the casing adjacent to the receptacle access opening, means on the interior of the casing adjacent to the receptacle access opening for engagement with said latching structure, a plug for connection with the receptacle, said plug having means for engagement with said latching structure, and linkage within the casing interconnecting the latching means and switch actuating member operative to move the latching structure into engagement with one of the closed receptacle access door and plug when the switch member is positioned to close the switch.

5. An electrical switch and receptacle unit comprising a casing, a receptacle within the casing, said casing having a receptacle access opening, said casing having a receptacle access door for said opening, a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, a plug having locking structure thereon, said plug being receivable through the receptacle access opening and connectable to the receptacle with the locking structure of the plug positioned within the casing, said receptacle access door having locking structure on the interior face thereof, the locking structure of the receptacle access door being positioned within the casing when the door is closed, a movable latching member within the casing engageable with one of the locking structure of the plug and access door, and linkage within the casing between the latching member and switch actuating member to move the latching member to a position for engagement with one of the locking structure of the plug and access door upon movement of the switch actuating member to close the switch.

6. An electrical switch and receptacle unit comprising a casing, a receptacle within the casing, said casing having a receptacle access opening, said casing having a receptacle access door for said opening, a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, a plug having locking structure thereon, said plug being receivable through the receptacle access opening and connectable to the receptacle with the locking structure of the plug positioned within the casing, said receptacle access door having locking structure on the interior face thereof, the locking structure of the receptacle access door being positioned within the casing when the door is closed, a movable latching member movable to a position for obstructing the receptacle access opening and for engagement with one of the locking structures of the plug and access door, and linkage within the casing between the latching member and switch actuating member to move the latching member, upon movement of the switch actuating member to close the switch, to a position for partially blocking the receptacle access opening and engagement with one of the locking structures of the plug and access door.

7. An electrical switch and receptacle unit comprising a casing, a receptacle within the casing, said casing having a receptacle access opening, said casing having a receptacle access door for said opening, a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, a plug having locking structure thereon, said plug

being receivable through the receptacle access opening and connectable to the receptacle with the locking structure of the plug positioned within the casing, said receptacle access door having locking structure on the interior face thereof, the locking structure of the receptacle access door being positioned within the casing when the door is closed, a latching plate slidably mounted within the casing, said latching plate being slidable to a position partially blocking the receptacle access opening, said latching plate having a recess on one edge thereof for engagement of the plate with one of the locking structures of the plug and access door, and linkage within the casing between the latching plate and switch actuating member to slide the latching plate to a position partially blocking the receptacle access opening for engagement with one of the locking structures of the plug and access door upon movement of the switch actuating member to close the switch.

8. An electrical switch and receptacle unit comprising a casing, a receptacle within the casing, said casing having a receptacle access opening, said casing having a receptacle access door for said opening, a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, a plug having a projection on the exterior thereof, said plug being receivable through the receptacle access opening and connectable to the receptacle with said projection positioned within the casing, said receptacle access door having a tab structure on the interior face thereof, the tab structure of the receptacle access door being positioned within the casing when the door is closed, a latching plate slidably mounted within the casing engageable with one of the projection of the plug and access door tab structure, and linkage within the casing between the latching plate and actuating member to move the latching plate to a position for engagement with one of the projection on the plug and access door tab structure upon movement of the switch actuating member to close the switch.

9. In a switch and receptacle unit, a casing, said casing having a main access door, a receptacle within the casing, a switch within the casing having a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, said casing having a receptacle access opening, said casing having a receptacle access door for said opening, a plug having locking structure thereon, said plug being receivable through the receptacle access opening and connectable to the receptacle with the locking structure of the plug positioned within the casing, said receptacle access door having locking structure on the interior face thereof, the locking structure of the receptacle access door being positioned within the casing when the door is closed, a movable

latching member within the casing engageable with one of the locking structure of the plug and access door, locking structure on the main access door to lock the main access door closed, and linkage within the casing operatively connected to the switch actuating member and having latching means associated therewith to engage the main access door locking structure and prevent unlocking thereof and to move said movable latching member to a position for engagement with one of the locking structure of the plug and access door upon movement of the switch actuating member to close the switch.

10. An electrical switch and receptacle unit comprising a casing, a receptacle within the casing, said casing having an access opening, said casing having a receptacle access door for said opening, said receptacle access door including spring means biasing the door to the closed position, a switch within the casing, a switch actuating member connected to the switch to open and close the switch, said switch actuating member including means for operation thereof exterior of the casing, a plug having locking structure thereon, said plug being receivable through the receptacle access opening and connectable to the receptacle with the locking structure of the plug positioned within the casing, a finger on the interior face of the access door, said finger projecting into the casing when the door is closed, a latching plate slidably mounted within the casing, said latching plate being slidable to a position partially blocking the receptacle access door, said latching plate having a recess on one edge thereof for engagement of the plate with the locking structure of the plug, said latching plate having an opening therein separate form the recess for the passage of said finger when the door is closed, a latching element pivotally mounted on the interior surface of the latching plate in alignment with said opening, said latching element being larger than the opening to prevent pivoting thereof outwardly of the receptacle casing, said finger having a detent thereon to engage the latching element when the door is closed and the latching plate is positioned to partially block the receptacle access opening to thus prevent opening of the door, and linkage within the casing between the latching plate and switch actuating member to slide the latching plate to a position partially blocking the receptacle access opening upon movement of the switch actuating member to close the switch.

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