Aug. 4, 1970 D. F. DALY 3,523,166

ENCLOSED SWITCH WITH COVER AND CONNECTOR INTERLOCK

Filed July 23, 1968 4 Sheets-Sheet 1

FIG. 2

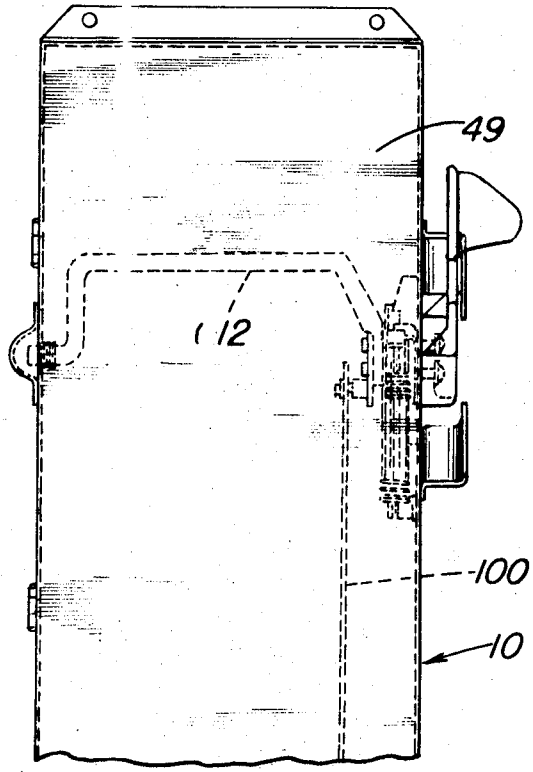
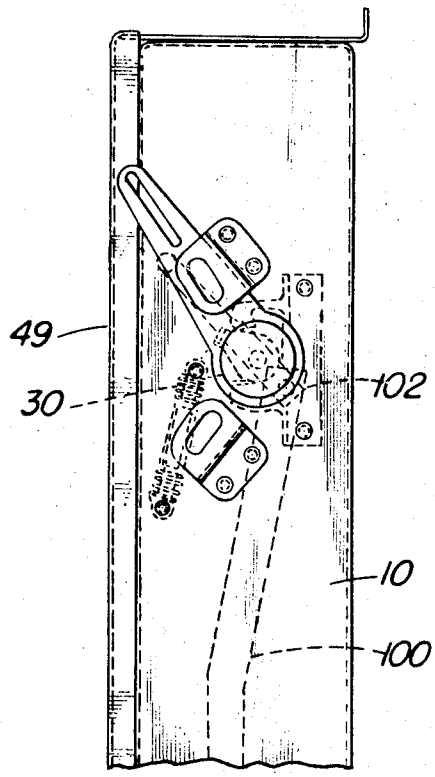
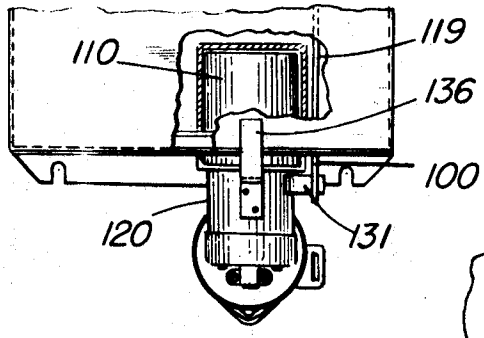
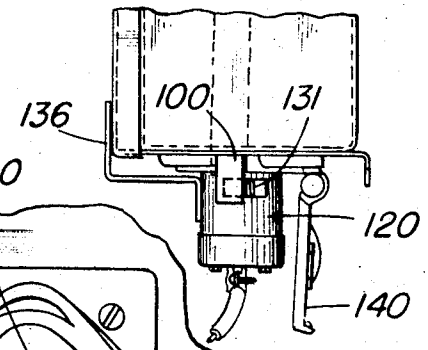


FIG. 1







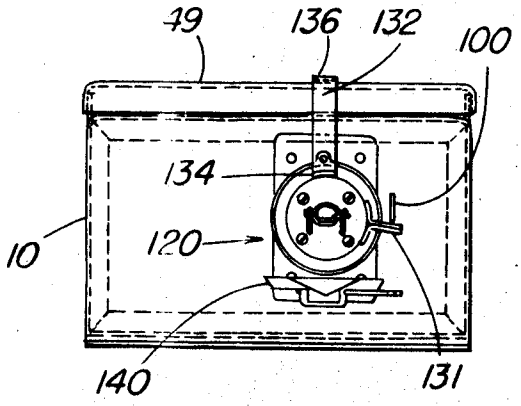


FIG. 3

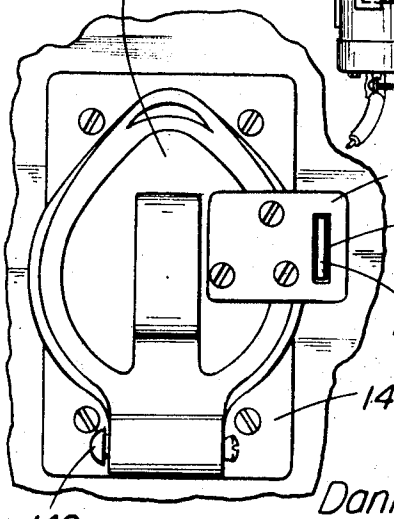


FIG. 7

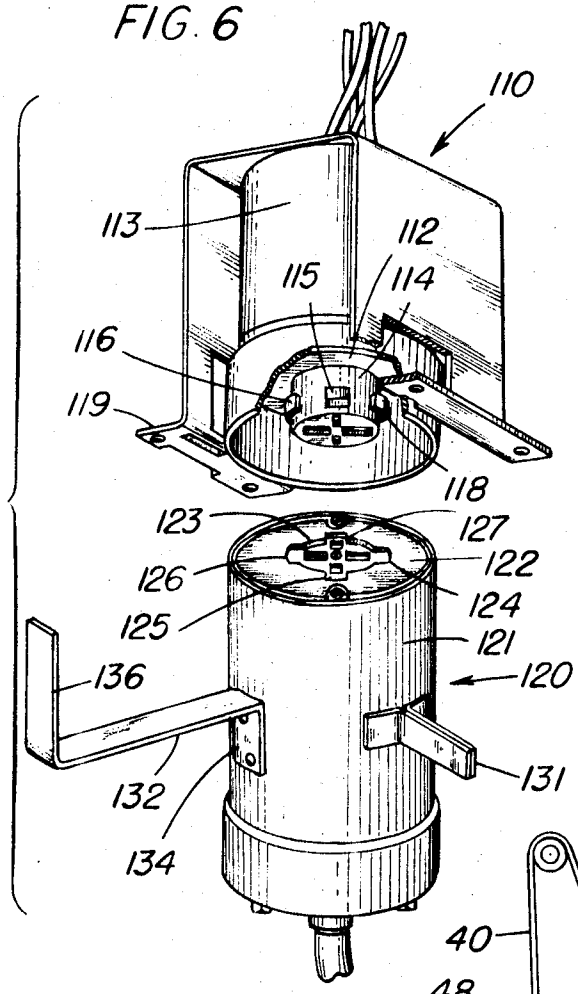
INVENTOR.
Daniel F. Daly
By Davis, Hoxie, Faithfull & Hapgood
Attorneys

Aug. 4, 1970 D. F. DALY 3,523,166

ENCLOSED SWITCH WITH COVER AND CONNECTOR INTERLOCK

Filed July 23, 1968 4 Sheets-Sheet 2

FIG. 6



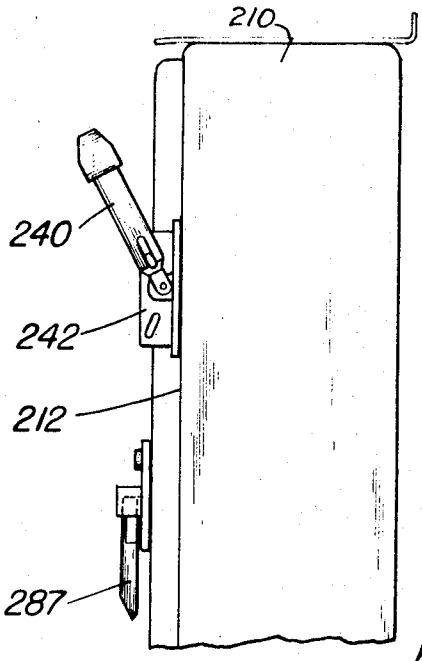


FIG. 8

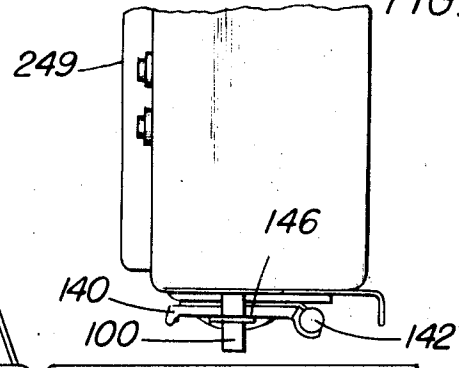


FIG. 4

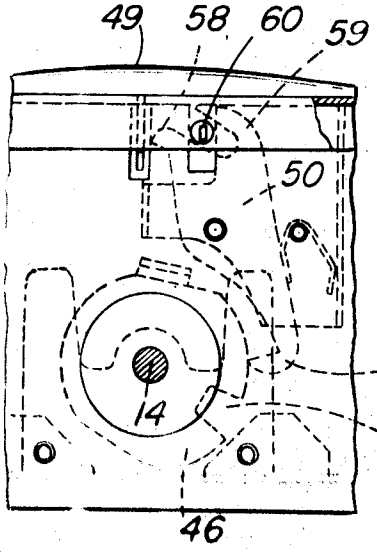


FIG. 5

INVENTOR.
Daniel F. Daly
By Davis, Haxie, Faithfull & Hapgood
Attorneys

Aug. 4, 1970 D. F. DALY 3,523,166

ENCLOSED SWITCH WITH COVER AND CONNECTOR INTERLOCK

Filed July 23, 1968 4 Sheets-Sheet 3

FIG. 11

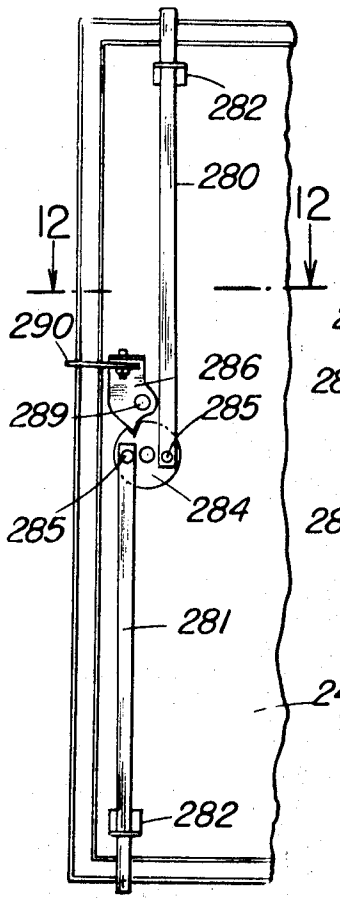


FIG. 10

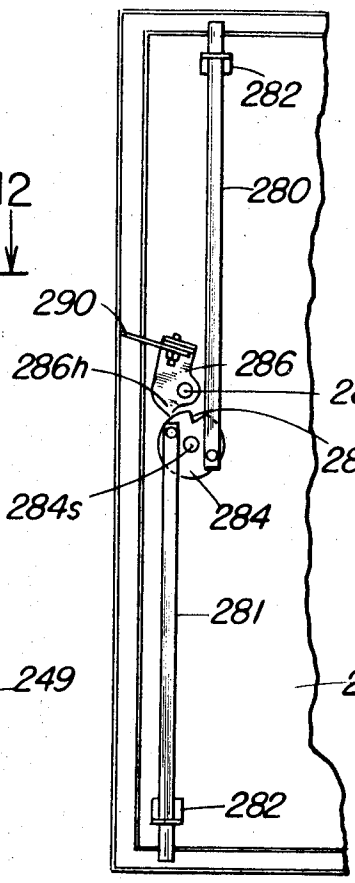
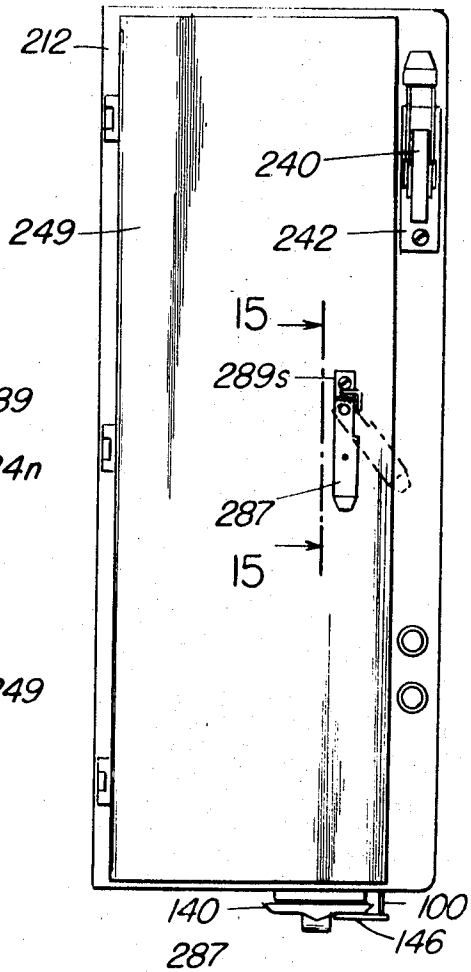


FIG. 9



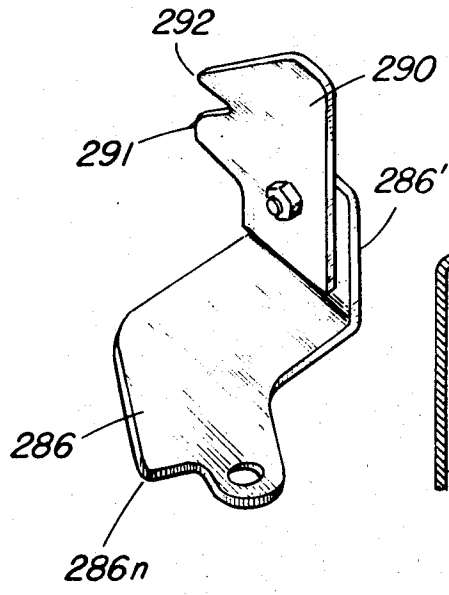


FIG. 13

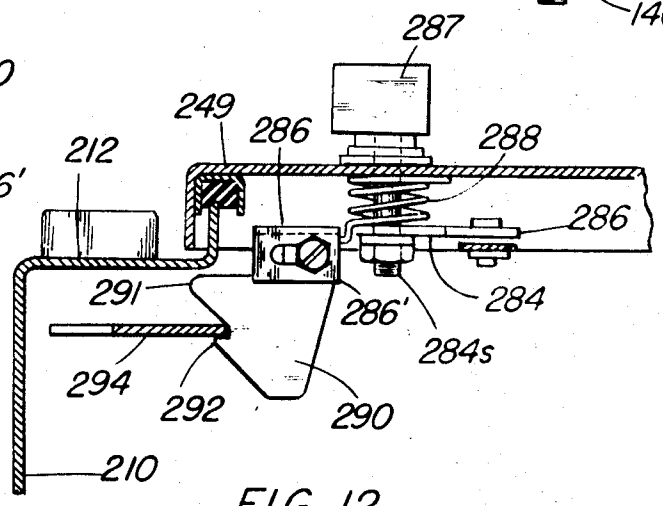


FIG. 12

INVENTOR.
Daniel F. Daly
By Davis, Hoxie, Faithfull & Hapgood
Attorneys

ENCLOSED SWITCH WITH COVER AND CONNECTOR INTERLOCK

Filed July 23, 1968 4 Sheets-Sheet 4

FIG. 14

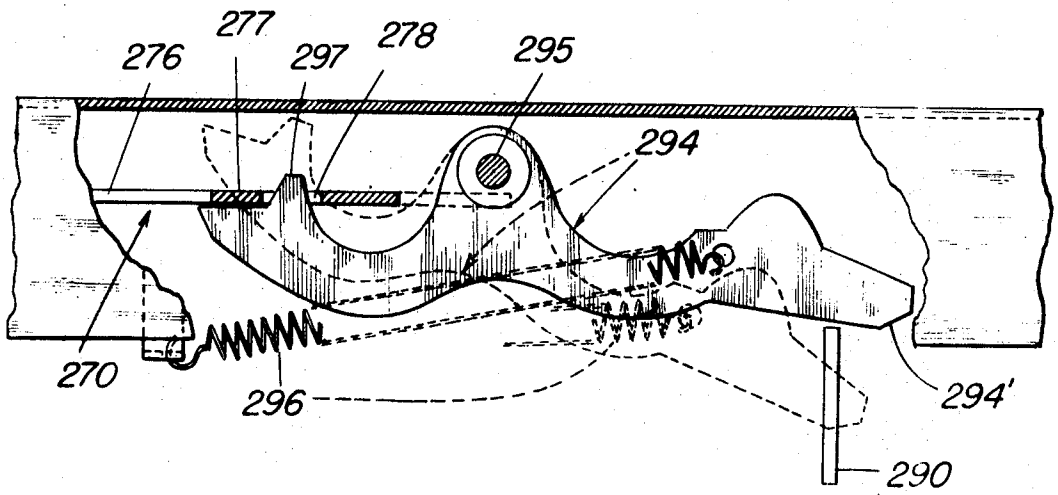
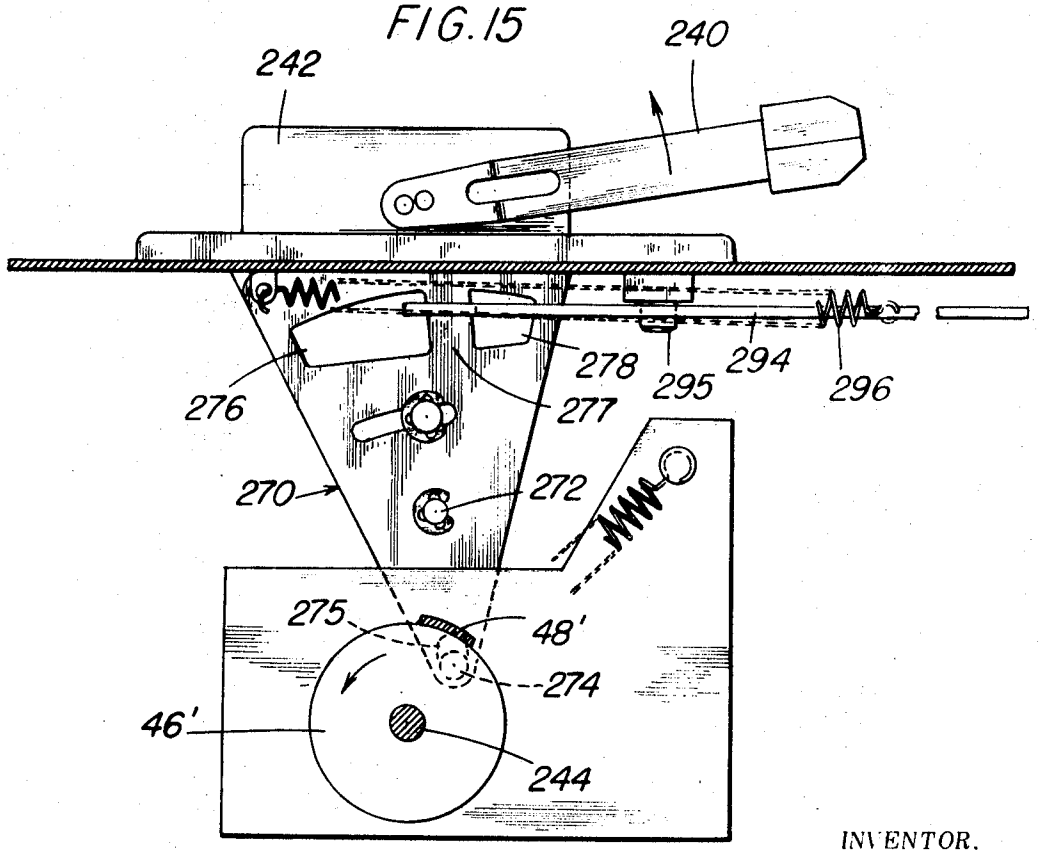


FIG. 15



INVENTOR.

Daniel F. Daly

By Davis, Hoxie, Faithfull & Hapgood

Attorneys

United States Patent Office 3,523,166 Patented Aug. 4, 1970

3,523,166

ENCLOSED SWITCH WITH COVER AND CONNECTOR INTERLOCK

Daniel Francis Daly, Newington, Conn., assignor to Arrow-Hart, Inc., Hartford, Conn., a corporation of Connecticut

Filed July 23, 1968, Ser. No. 746,812
Int. Cl. H01h 9/20
U.S. Cl. 200—50 8 Claims

ABSTRACT OF THE DISCLOSURE

An electric switch is enclosed in a box. The one part of a two-part electrical connector is mounted on the box. The switch is interlocked with the cover of the box so that the switch cannot be closed if the cover is open and the cover cannot be closed or opened unless the switch is in open position. The connector is interlocked with the switch mechanism so that the cover cannot be closed or opened if the connector parts are connected; and because the switch cannot be closed while the cover is open, the switch cannot be closed if the plug is inserted while the cover is open. A sequence must be followed in connecting up and energizing the combination; and a reverse sequence must be followed to de-energize and disconnect the connector and obtain access to the interior of the box.

This invention relates to enclosed electric switches in which the cover of the enclosure is interlocked with the switch and cannot be opened when the switch is in closed-circuit position. Additionally, the invention relates to the provision in connection with such switches of two-part detachable connectors including a plug part and a receptacle part which cannot be separated or connected while the switch is in closed-circuit position.

My patent, U.S. 3,277,251, discloses an improved interlocking arrangement beween a connector plug, its receptacle and a control switch mechanism which prevents the connector parts from being separated while the switch is closed, but which allows the connector parts to be separated when the switch is in open-circuit position. That arrangement also provides means for preventing connection of the connector parts while the switch is closed.

The improvement of that patent is embodied in a combination including an enclosed switch wherein the cover of the switch enclosure can only be opened when the switch is in open-circuit position and in which the switch cannot be closed while the cover is open, the details of which are fully disclosed and described in U.S. Pat. 3,274,-353 of myself and J. M. O'Malley.

Some structures having the foregoing provisions are also provided with means by which authorized personnel may defeat the interlock between the cover and switch mechanism and may then open the cover while the switch contacts are engaged and while the connector parts are connected. It is desirable to have an interlock between the cover and connector which will prevent both opening and closing of the cover while the connector parts are engaged. In other words, if it is desired to inspect the switch while the switch contacts are in closed-circuit position, that should be possible only if the load is disconnected, by separation of the connector parts. It is also desirable to require a sequence to be followed for connecting a connector to the switch and then closing the switch.

Therefore, according to the present improvement, means is provided which acts, while the plug and connector parts are connected, to prevent closing of the cover and also to prevent opening of the cover. The improvement, in combination with the other interlocking means, prevents closing of the switch while the connector parts are

connected and while the cover is open—since the open position of the cover prevents closing of the switch.

In the drawings:

FIG. 1 is a side elevation view of an interlocking connector and enclosed switch combination embodying the invention.

FIG. 2 is a plan view of the device of FIG. 1 with the cover partly broken away.

FIG. 3 is an end elevation view of the structure of FIGS. 1 and 2 but with the handle broken away.

FIG. 4 is an interior side elevation view of the switch operating mechanism and parts of the cover locking and connector locking mechanism.

FIG. 5 is a exterior side elevation view similar to FIG. 4. but with the switch in a transient position and with the cover closed and locked.

FIG. 6 is an exploded perspective view of the connector parts as used in FIGS. 1 and 2.

FIG. 7 is a fragmentary end view like FIG. 3 but with the connector parts separated and with flap cover closed.

FIG. 8 is a side elevational view similar to FIG. 1 but of a box and switch with switch handle mounted on the front wall.

FIG. 9 is a front elevation view of the front-operated form of FIG. 8.

FIG. 10 is a fragmentary view of the interior of the door of the form in FIGS. 8 and 9, with parts in unlocked position.

FIG. 11 is a fragmentary view of the interior of the door of the form of FIGS. 8 and 9, with the parts in locked position.

FIG. 12 is a fragmentary section view of the door when locked, to the box, with the section taken along line **12—12** of FIG. 11.

FIG. 13 is a detail perspective view of the keeper and catch plate used in the structures of FIGS. 10–12.

FIG. 14 is a fragmentary front view, partly in section and partly broken away, of the front-operated form, with the front wall partly broken away to show the interlocking lever.

FIG. 15 is a partial longitudinal section view perpendicular to the door, with the section along line **15—15** of FIG. 9.

Referring to the drawings, the invention is shown in connection with an enclosed switch having mechanism to lock the cover closed and maintain it so, as long as the switch is closed, as fully described in said Daly and O'Malley Patent 3,274,353, to which application reference may be had for full structural details and operation thereof.

The enclosure may be a rectangular metal box **10** on the walls of which the operating mechanism is mounted. The movable switch contacts may be of any suitable type, such as for example pivoted knife-blade contacts which engage with the usual flexible jaw-type fixed contacts. For simplicity, however, the switch contacts have been omitted from the drawings.

THE INTERLOCKING MECHANISM FOR THE COVER AND SWITCH

Briefly, the mechanism as described in said prior Pat. 3,274,353 included a cover **49** hinged at one edge over the box body, with a catch bar **60** extending inwardly from a flange on the box cover in position to enter a slot **67** in the edge of the box body when the cover closes.

When the switch contacts are disengaged or open, the box cover may be closed. In so doing, the catch **60** engages an inclined surface on the back of a finger **58** on the latch **50** which is mounted pivotally on a pin in the side of the box. This engagement causes pivoting of the latch **50** counter clockwise to the position of FIG. 5. In such condition the nose **55** on latch **50** has moved out

of a notch **47** in a disc-shaped locking-and-actuating member **46** which is secured by screws to the switch handle **40** so as to move as a unit therewith.

Thus, when the cover is closed, the handle is freed or unlocked for movement from open to closed-switch position.

When the switch is closed (or when it is in a transient position between open and closed as shown in FIG. 5), the nose **55** of the latch **50** abuts the periphery of the locking-actuating member **46** and is thus held in the FIG. 5 position. In such condition its hook portion **59** overlies the catch bar **60** of the cover and prevents the cover from being opened. The cover can thus only be opened when the switch is open, at which time the handle has moved the locking member to a position (not shown in these drawings) where notch **47** will receive the nose **55**. This unlocks the cover by moving the hook **59** out of the path of the cover's catch bar **60** and simultaneously locks the handle from movement to close the switch contacts.

Movement of the switch contacts is accomplished (as described fully in Pat. 3,274,353 by the oscillation of a U-shaped bail **12** pivotally mounted at one end which is out-turned and extends through one wall of the box, while its other end is maintained in engagement with the handle-operated actuating mechanism on the opposite wall of the box. The bail is pivoted at this end on the end of a stud shaft **14** which in turn is supported in a bearing bracket **20** affixed to the wall of the box.

The movement of the bail is initiated by a peripheral transversely-bent lug **48** on the actuating member **46**. This lug is engagable with one or the other of radial surfaces **27, 28** on wings **25** and **26** respectively of a drive plate **24** so as to turn that drive plate until the opposite radial surface engages an inturned peripheral lug **16** on an actuating arm **18** riveted or otherwise secured to one end of the bail **12**. The engagement of the drive plate **24** with the actuating arm **18** causes the bail to turn so as to positively start movement of the switch contacts toward the opposite position.

This movement is continued with a snap action by over center spring **30** on a holder **29**, as described in said 3,274,353.

INTERLOCKING MECHANISM FOR CONNECTOR AND SWITCH

(a) In order to tap off at the box **10** current from the circuit controlled by the herein described switch, an electric attachment plug, designated generally by numeral **110**, is affixed within the box preferably in a corner at one end. This plug may be of any well known type which is adapted to connect with attachment plug receptacle, designated generally by numeral **120**, which is turnable relative to the plug to lock and hold the plug and receptable together until the receptacle is purposely turned and pulled to disconnect them. For the purpose of illustration, the invention is shown in connection with a plug and receptacle, as shown in the expired U.S. Pat. No. 2,102,625.

The plug comprises a cylindrical insulating body **112** encased in a metal protective cylindrical shell **113**. Extending axially from the end of the insulating body and integral therewith is a cylindrical insulating post **114** of lesser diameter than the body **112**. The plug is supported by a U-shaped stamped sheet metal strap or bracket **119** secured by screwbolts to the box wall with the post **114** of the plug body extending through an aperture in the box wall and flush therewith.

Circumferentially spaced around the periphery of the post **114** and extending radially outward are four electrical contacts, of which **115** and **118** are visible. To compel observance of polarity, one contact (**118**) is made larger than the rest. The contacts may be connected in any known fashion to conductor wires entering the opposite end of the plug body, for example as described in said Pat. No. 2,102,625.

The receptacle **120** likewise comprises a cylindrical insulating body **122** encased in a metal protective shell **121**. The receptacle body has a cylindrical cavity **123** in one end adapted to receive a plug post **114**.

Extending lengthwise of the body **122** and radially outward from cavity **123** are channels **124, 125, 126** and **127**. One channel (**127**) is larger than the others and is designed to receive the larger plug contact **118**. This arrangement of contacts and channels makes it possible for the plug post **114** to be inserted in the receptacle when oriented only one way; namely, with the larger contact aligned with the larger channel.

After plug post **114** is inserted fully into the receptacle **120**, the receptacle may be rotated in order to lock the plug and receptacle together to prevent the receptacle from withdrawing without first being reversely rotated. The structural details of the inside of the receptacle **120** which prevent separation from the plug **110** before reverse rotation are well known and may be, for example, as described in said U.S. Pat. No. 2,102,625

In order to prevent connection of the plug **110** with receptacle **120** when the switch is closed or withdrawal of the receptacle from the plug when the switch is closed, a locking link **100** is provided which extends from the switch operating mechanism longitudinally near one side wall of the box to and through the end wall of the box adjacent the receptacle. By the means and structure about to be described this locking link is movable into two positions by the switch operating mechanism so that in one position it will interfere with or prevent the rotation of the receptacle **120** which is necessary on the one hand for withdrawal of the receptacle (if the receptacle is already inserted) or, on the other hand, for connection of the receptacle and plug (if the plug and receptacle were not connected). In the other position, both connection and withdrawal are permitted.

The link **100** is movable in response to movements of the contact-moving bail **12** by a loose connection at one end to a pivot pin **101** projecting inwardly of the box from a crank arm **102**. This crank arm may be integral with or a separate part secured to and rotating with the bail, but the axis of the pin is offset from the axis of rotation of the bail and so located as to cause substantially rectilinear longitudinal movement of the link **100** as the bail operates. Such movement of the link **100** causes its opposite end to project to a greater or lesser extent from the end of the box.

In switch-closed position the end will be projected furthest. To prevent, under such condition, connection of the receptacle to the plug, a locking finger **131** extends radially from the receptacle. The lug may be affixed to the receptacle body **122**, but preferably is permanently attached as by rivets or welding to the metal shell **121**.

The finger may be secured to the shell or body in such position that it will abut the outer end of the locking link **100** if an effort is made to connect the receptacle **120** (when properly oriented) with the plug **110** while the switch is closed and the locking link is fully projected outwardly. Such abutment of the locking finger **131** with the extended end of locking link **100** prevents interconnection of the plug and receptacle.

When the link **100** is retracted by movement of the switch into open-circuit position, the end of the link **100** will no longer interfere with connection of the receptacle to the plug **110**. When the receptacle is connected to the plug and rotated to lock it in the plug, and when the switch is operated to closed-circuit position, the locking finger **131** will lie along side the then-projecting end of the locking link **100**. In such condition, the receptacle cannot be reversely rotated preparatory to separation from the plug because the finger strikes against the link and interferes with this essential preparatory rotation.

It should also be noted that the movement of locking link **100** is independent of intermediate movements of the handle **40**. The locking link **100** does not move until

one of the drive plate wings **25**, **26** engage and move the lug **16**. As the lug **16** moves, however, the over center spring **30** snaps the bail **12** and locking link **100** into its proper position independently of any further movement of the handle **40**. Thus, locking link **100** remains stationary and maintains a position independent of the movement of the handle **40** under normal conditions until the over center spring action becomes effective. This also ensures that the receptacle **120** cannot be separated from or connected to the plug **110** when the switch contacts are being moved between their fully open and closed positions under abnormal conditions, as when the over center spring should break and the wings **25** or **26** have to move the lug **16** and bail.

From the foregoing it will be observed that the receptacle cannot be interconnected with the plug while the switch is closed, nor can the receptacle be separated from the plug while the switch is closed, nor can the cover of the box be opened to gain access to the plug part of the connector or to switch connections or parts while the switch is closed.

(b) In addition to the indirect interlocking of the connector with the box cover, a direct interlock is provided by metallic Z-shape bracket **132** which is riveted or welded or otherwise permanently secured to the receptacle, preferably to its metal shell **121**. The bracket has two parallel oppositely extending arms **134**, **136** connected by the mid-portion **132**, the arm **134** being attached to the shell **121** in such position that when the receptacle **120** and plug **110** are connected, the arm **136** will overlie and engage the surface of the box cover **49** at the end thereof which is adjacent the plug **110** upon attempting to open the cover.

When the receptacle **120** and plug **110** are connected, as in FIGS. 1, 2, 8, 3, the arm **136** of the Z-lock bracket overlies the cover preventing the cover from being opened. As has been described above, the receptacle part of the connector cannot be disconnected from the plug part while the switch is in closed-circuit position because the end of the lock bar **100** will project out of the casing into the path of the locking finger **131** thereby preventing the receptacle from being turned as is necessary before it can separate from the plug part **110**.

Conversely, if the cover is open at the time when the receptacle and plug are connected, the cover cannot be closed because the arm **136** extends into the path through which the cover moves when closing.

Hence, the sequence which must be followed when the connector parts are disconnected and the switch and box cover are both open, is as follows:

(1) Close the cover.
(2) Connect the connector parts **110** and **120**.
(3) Close the switch.

This sequence must be followed reversely when it is desired to gain access to the interior of the box.

(c) To prevent access to the plug contacts whilst the receptacle and plug are disconnected, a spring-based hinged cover **140** is mounted by a hinge pin **142** on an escutcheon plate **144** which is secured to the end of the switch box **10**. An opening in the escutcheon plate registers with the plug part **110** of the connector.

To prevent opening of the connector cover **140** when the switch is closed (at which time the plug contacts will be "live"), a rectangular lock plate **146** is secured to the cover **140** in position to extend laterally beyond the edge of the cover into the path of movement of the end of the lock bar **100**. A rectangular slot or aperture **148** is formed in the plate **146** through which the end of the lock bar may extend, endwise. The slot is just large enough to receive the lock bar so that when the cover **140** is closed and the switch is closed the presence of the lock bar **100** within the slot **148** prevents the cover **140** from pivoting open. Thus the connector part **120** can not be connected to the connector part **110**.

Movement of the switch to open position withdraws the lock bar **100** and thus allows the cover **140** to be opened and the receptacle part **110** to be connected to plug part **120**.

The interlock between the connector and the switch mechanism is not dependent on the mounting of the handle in the sidewall of the box, nor on the particular interlocking means of the prior Daly and O'Malley Pat. 3,274,353. In some instances it is desired to have the handle mounted on the front of the box and to employ interlocking mechanism between the switch-operating mechanism and an openable front door or cover. FIGS. 9 to 15 illustrate one form of such an arrangement. In this form, the snapping overcenter mechanism and the contact mechanism may be the same as in the form previously described. In this form, the box **210** has a front wall **212** with a rectangular opening surrounded by a peripheral outwardly extending flange. The front door or cover **249**, which likewise is flanged, but inwardly, around the front wall flange, is hingedly mounted on the front wall along the longer side.

For actuating the switch, a segmentally shaped lever **270** is pivotally mounted within the box on a fixed pin **272** located midway along the length of the lever. The lever is flat and lies parallel to the side of the switch box. The lower end of the segmental lever is pivotally connected by an elongated slot **275** at its lower end to a pin **274** extending laterally from the actuating member **46'** (like **46** in Pat. 3,274,353) of the switch-operating mechanism. (In the previously described form and in Pat. 3,274,353, the switch-operating handle was secured by screws directly to member **46**.) At its other or upper end, the segmental lever **270** is pivotally connected to an operating handle **240** which pivots in a supporting housing **242** that is mounted on the front wall of the box.

As may be seen best in FIG. 15, if the switch handle **240** is turned anti-clockwise, it will cause lever **270** to pivot clockwise about pivot **272**. This causes the actuating disc member **46'** to turn anti-clockwise and will operate, as in the first described form, to actuate the switch mechanism and contacts.

Latching mechanism is provided to lock the door closed when the switch is closed. For that purpose, a pair of oppositely extending longitudinally movable lock bars **280**, **281** extend longitudinally inside the door, their longitudinal movement being guided in rectangular slots in right-angle brackets **282** affixed to the inside of the door near their ends. Their opposite ends are pivotally connected at diametrically opposite points to a turnable disc member **284** by pins **285**. The disc **284** is stamped from sheet metal and fixedly mounted on a short shaft **284*s*** which, in turn, is mounted on and extends through the door. On the outer end of shaft **284*s*** a hand-operable door-lock handle **287** is fixedly mounted. When this door handle is turned anticlockwise (referring to FIG. 9) the disc **284** is rotated. This moves the lock bars **280**, **281** lengthwise from locking position of FIG. 11 to unlocking position of FIG. 10. In the locking position of the bars **280**, **281**, their ends extend under the front wall of the box preventing the door from being opened. In the unlocked position, the ends of the bars have been moved longitudinally and retracted within the margin of the door, as shown in FIG. 10, so that they no longer prevent door opening.

To lock the door-latching mechanism in position to prevent door opening, a latch-keeper **286** is pivotally mounted on the inside of the door on a pivot pin **289** near the disc **284**. The keeper is a stamped sheet metal part having a nose **286*n*** which is adapted to enter a notch **284*n*** in the disc **284**. A spring **288** coiled about the shaft **284*s*** has one end hooked into the disc **284** and the other end fixedly anchored, thus providing bias of the lock bars **280** and **281** into retracted position (FIG. 10). In like manner another spring (not shown) is coiled about the shaft **289** having one end hooked onto the keeper

286 and the other end fixedly anchored, thus biasing the keeper toward the disc 284.

When the door is closed and the door-handle is turned to move the lock bars into locking position, the bias of the keeper 286 urges its nose into the notch 284*n* thus holding the door locked. In order to release the door-lock bars 280–281, the keeper is fixedly mounted on a short shaft 289 extending through the door, with a slot 289*s* cut in its outer end to receive a screw driver. (See FIG. 9.) When a screw driver is inserted in the slot and the shaft and keeper are turned clockwise (as viewed in FIGS. 10 and 11), the door-locking bar mechanism is released and is moved from the position of FIG. 11 to the position of FIG. 10 by the spring bias exerted thereon.

The door-locking arrangement, as thus far described, is independent of the switch-operating mechanism. To keep the door locked while the switch mechanism is in closed-circuit position, a catch plate 290 of sheet metal stamped into the form illustrated in FIGS. 12 and 13 is bolted adjustably to a portion 286′ of the keeper 286 which is bent up at a right angle to the main body of the keeper. The catch plate thus is mounted perpendicularly to the main body of the keeper. The catch plate has two fingers 291, 292 extending from one side toward the adjacent sidewall of the box. The finger 291 is of such length that when the keeper is in the position of FIG. 11 the finger 291 underlies the front wall 212 of the box (see FIG. 12) and prevents attempts to open or to pry open the door along its edge while the lock bars 280, 281 do the same at the ends of the door, so long as the keeper 286 is engaged with the disc 284.

When the keeper is turned by screw driver manipulation, as above described, so as to release the disc 284, the catch fingers will have rotated sufficiently to be within the margin of the door, as shown in FIG. 10. In that position the fingers no longer underlie the front wall of the box and they would not prevent door opening. At the same time, release of disc 284 allows the lock bars 280, 281 to be automatically withdrawn under the influence of the bias of spring 288, to the FIG. 10 position wherein the bars do not lock the door.

In order to prevent door opening by exterior manipulation of the keeper 286 when the switch is closed, an interlocking lever 294, of the form illustrated in FIG. 14 is pivotally mounted on a pin 295 on the inside surface of the front wall 212 of the box, adjacent the switch handle and in position to engage the keeper 286. A coiled tension spring 296 anchored at one end to a lug on the inside of the front wall of the box and at its other end connected to the interlocking lever biases the lever 290 so that one end engages the side face of the segmental lever 270.

The interlocking lever has a tooth 297 extending toward the segmental lever. When the parts are in the switch-open position of FIGS. 14 and 15, the tooth 297 enters an aperture 278 while the end of the lever 294 engages with a web 277 between two arcuate apertures 276 and 278 in the segmental lever, the aperture 276 being longer than aperture 278. This engagement prevents clockwise movement of the segmental lever toward switch-closed position. In the switch-open position of FIG. 15, the other end 294′ of the lever overlies the lower flange finger 292 of the catch 290, as shown in FIG. 12. This prevents opening of the cover until the keeper is turned by the screw driver action still further, past its position in FIG. 10 sufficiently to remove the end 294′ from a position overlying the catch finger 292.

From the foregoing, it will be understood that the door has a double lock, firstly by the catch finger 292 engaging the underside of the front wall of the box, and secondly by the interlocking lever overlying the catch finger 292.

Conditions change when the switch is moved into closed-circuit position. To permit such movement, the door must first be closed and locked by turning the door handle 287. Turning of the handle 287 rotates the disc 284 until the nose of the keeper 286 can enter the notch in disc 284. Such action allows the keeper to turn to the position of FIG. 11 in which the bottom of the notch between fingers 291, 292 engages the end 294′ of the interlocking lever rocking the interlocking lever sufficiently for its tooth 297 to leave the opening 276 in the segmental lever 270. That releases the segmental lever 270.

Now the switch handle 240 can rock the segmental lever 270 to close the switch. Rocking of segmental lever 270 moves its larger aperture 276 to the right in FIG. 15 making room for the left end of the interlocking lever 294 (FIG. 14) to enter that opening. However, since the right end 294′ is already engaged with the catch 290, the left end does not enter opening 276. But if anyone should attempt to open the box door (by screw driver manipulation of the keeper 286 and then turning the box handle 287) the bias of interlocking lever spring 296 will cause that lever to follow the movement of the keeper into the dotted position of FIG. 14. Thus, the interlocking lever 294 continues to remain over the catch finger 292 preventing the door from being opened so long as the switch is closed.

When the switch handle is moved to open position, the right edge (in FIG. 14) of the larger aperture 276 exerts a camming action against the right side of tooth 297 causing the interlocking lever to rotate counterclockwise to the full line position of FIG. 14, after which the door can be opened by screw driver manipulation of the keeper shaft 289, as previously described.

Thus, in the front-operated form of FIGS. 9–15, the door can not be opened with the switch closed, and the switch can not be closed with the door open. Also, a sequence must be followed to operate the switch. Assuming the plug interlock is as described in FIGS. 1–8, and the switch is closed,

1st. Move the switch handle to open-circuit position. The plug can not be removed until the switch is open for the same reasons as in FIGS. 1–8.
2nd. Remove the plug by rotation and pulling.
3rd. Manipulate the shaft 289 by inserting a screw driver in slot 289*s* and turning. This release the lock bars 280, 281 automatically. It also disengages the latch plate 290 from the interlocking lever 294.
4th. Lift the door.

To close the switch, the procedure that must be followed is:

1st. Close the door. In so doing, the keeper pivots against its sprin gbias as catch 290 hits the flange around the door opening and eventually engages the interlocking lever 294 over the finger 292.
2nd or 3rd. Insert the plug by pushing and turning. Lock the door by turning door handle 287 until keeper nose 286*n* enters disc notch 284*n*, and lock bars 280–281 underlie the front wall of the box. In this position, the finger 291 also underlies the front wall of the box.
4th. Operate the switch handle 240 into switch closed position.

In describing the two forms of the invention, the closure member is called a cover and a door. These terms are used herein as equivalents and the use of one in the claims should be understood to include the other.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, the invention is not limited to the precise form and the configuration of parts as illustrated and described.

What is claimed is:

1. An interlocking switch, connector, and cover combination of the type wherein there is a switch housed within a box and a switch handle extending outside the box for operating the switch between two positions, and the connector has one part mounted on the box and

another part which is outside the box and is connectable to and disconnectable from said one part, there being means to prevent opening the box cover while the switch is in one position, and means to prevent connection and disconnection of the connector parts while the switch is in said one position, with the improvement comprising means on one of said connector parts to prevent opening of the cover while the connector parts are engaged regardless which position the switch occupies, whereby the connector parts cannot be disconnected while the switch is in said one position, and the cover cannot be opened while the connector parts are engaged.

2. The arrangement as claimed in claim 1, wherein the connector parts are turnable relative to one another after the plug part is inserted into the receptacle part, and they have means to prevent their disconnection until reversely turned, and means on said other part preventing turning of it while the switch is in said one position whereby said connector parts may not be connected or disconnected while said switch is in said one position.

3. The arrangement as claimed in claim 2, having means movable by said switch engagable by said means on said other part when said switch is in said one position thereby preventing turning of said other part.

4. The arrangement as claimed in claim 1, wherein said means on said other part comprises an element extending over at least one edge of and engagable by said cover to prevent opening of the cover.

5. In combination, a box having an openable cover, an electric switch in said box having an operating handle extending outside, interlocking means between said switch and cover preventing opening of said cover while said switch is in one position and operation of said switch into said one position while said cover is open, connector means having one part mounted on the box and another part outside the box connectable to and disconnectable from each other, and second interlocking means between said switch and said connector means preventing connection and disconnection of the connector parts while the switch is in said one position, and interengaging means between the cover and said other connector part preventing opening of the cover when the connector parts are connected.

6. In combination, a box having an openable cover, an electric switch in said box having an operating handle extending outside, interlocking means between said switch and cover preventing opening of said cover while said switch is in one position and operation of said switch into said one position while said cover is open, connector means having one connector part mounted on the box, an openable cover for said one connector part preventing access to it while it is covered, and additional interlocking means between said switch and said connector-part cover extending outside the box and engaging said connector-part cover and preventing opening of the latter while said switch is in said one position.

7. In a device as claimed in claim 5, an openable cover for said one part preventing access to it while it is covered, and additional interlocking means between said switch and connector-part cover preventing opening of the latter while said switch is in said one position.

8. In a device as claimed in claim 5, an openable cover for said one part preventing access to said one part while it is covered, said second interlocking means cooperating with said connector-part cover preventing opening of the latter while said switch is in said one position.

References Cited

UNITED STATES PATENTS

2,439,708	4/1948	Abraham	200—50.1
3,277,253	10/1966	Bacon	200—50.2
3,286,051	11/1966	Mackiewicz	200—50.2

ROBERT K. SCHAEFER, Primary Examiner

M. GINSBURG, Assistant Examiner