Feb. 2, 1965 J. F. HEALY 3,168,624

EXPLOSION PROOF DEAD FRONT ELECTRICAL RECEPTACLE HAVING MICROSWITCH MEANS

Filed Feb. 13, 1961 2 Sheets-Sheet 1

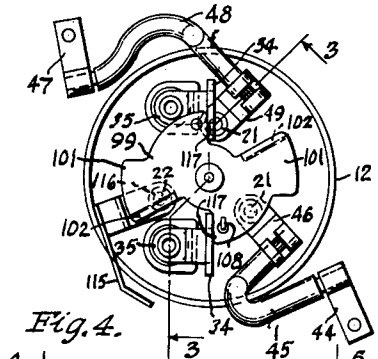


Fig. 4.

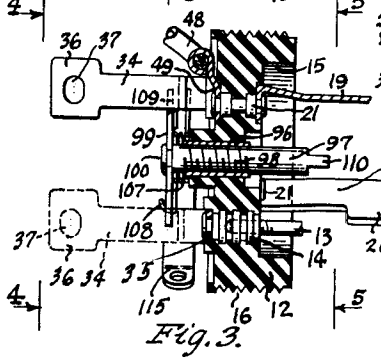


Fig. 3.

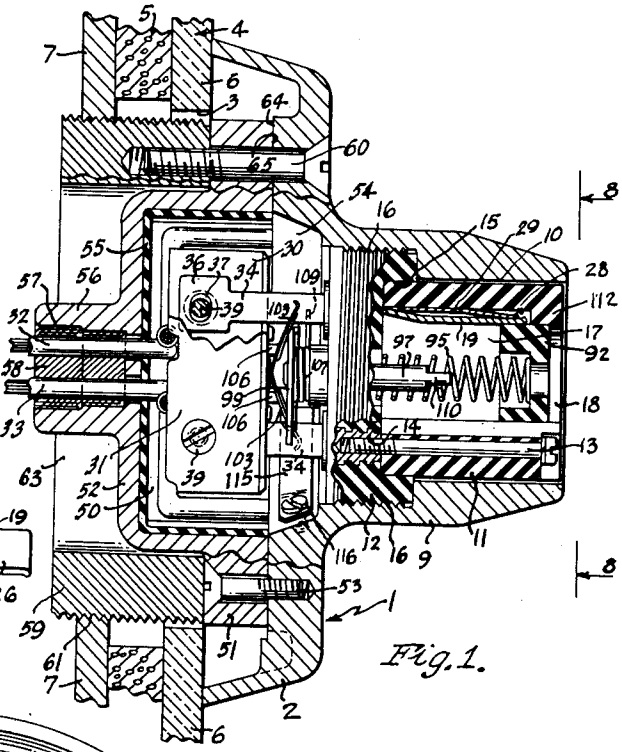


Fig. 1.

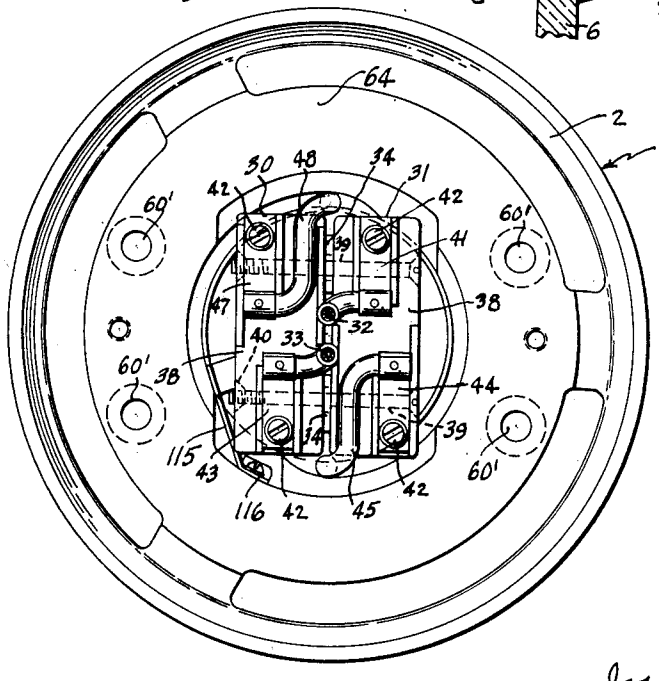


Fig. 2.

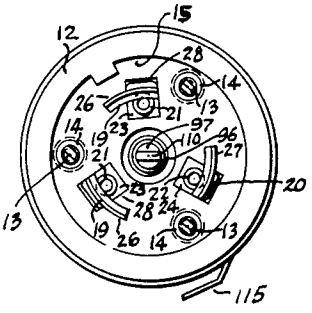


Fig. 5.

INVENTOR
Joseph F. Healy
BY
Wooster, Davis & Cifelli
ATTORNEYS.

Feb. 2, 1965 J. F. HEALY 3,168,624

EXPLOSION PROOF DEAD FRONT ELECTRICAL RECEPTACLE HAVING MICROSWITCH MEANS

Filed Feb. 13, 1961 2 Sheets-Sheet 2

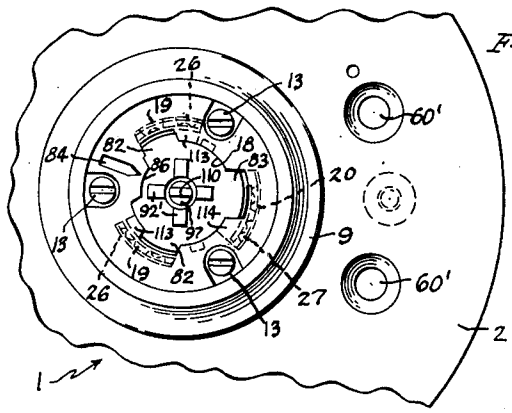


Fig. 8.

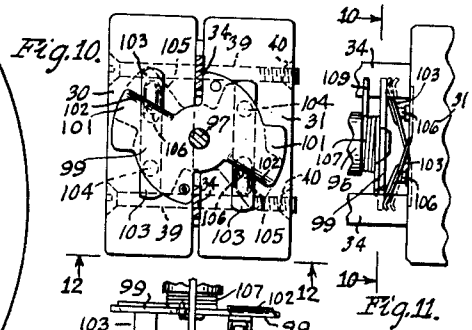


Fig. 10.

Fig. 11.

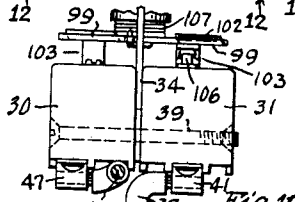


Fig. 12.

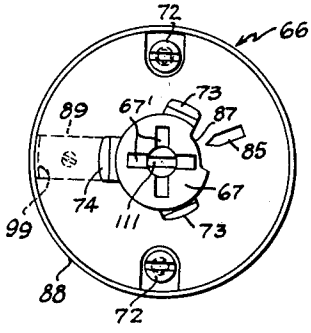


Fig. 9.

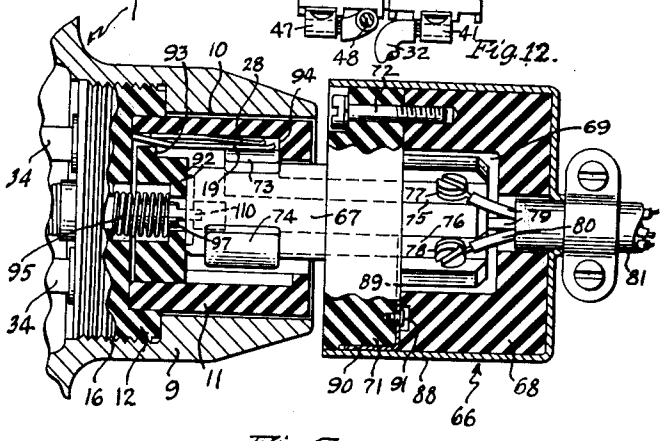


Fig. 7.

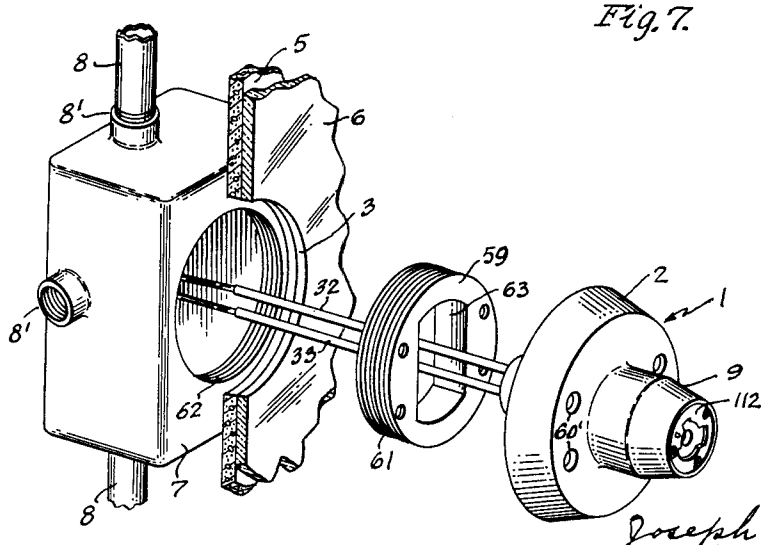


Fig. 6.

INVENTOR
Joseph F. Healy
BY
Mooster, Davis & Cifelli
ATTORNEYS.

United States Patent Office

3,168,624

Patented Feb. 2, 1965

3,168,624

EXPLOSION PROOF DEAD FRONT ELECTRICAL RECEPTACLE HAVING MICROSWITCH MEANS

Joseph F. Healy, Westport, Conn., assignor to Harvey Hubbell, Incorporated, Bridgeport, Conn., a corporation of Connecticut

Filed Feb. 13, 1961, Ser. No. 88,872
4 Claims. (Cl. 200—51.09)

This invention relates to an electric outlet receptacle, particularly to a so-called explosion proof dead front electrical receptacle for use in locations where there might be danger of explosion from gases or vapors, such, for example, as operating rooms of hospitals. It has for an object to provide a receptacle of this character of a construction which will reduce to a minimum danger of explosion in such locations, and also in which there is no danger of operators being injured by coming in contact with the receptacle.

Another object is to provide a receptacle of this type in which the attachment plug-in cap may be locked in the receptacle after insertion therein by limited relative turning movement of the cap, and in which the electrical supply circuit to the receptacle contacts and the cap is normally open and is closed by this turning movement and opened by reverse movement of the cap in the opposite direction to unlock this cap and permit its removal from the receptacle.

It is also an object to provide an electrical receptacle in which the advantages and favorable characteristics of microswitches may be utilized to control the electrical supply current to the receptacle.

It is a further object to provide a simplified construction and one which will require a relatively small space for its installation.

With the foregoing and other objects in view, I have devised the construction illustrated in the accompanying drawings forming a part of this specification. It is, however, to be understood the invention is not limited to the specific details of construction and arrangement shown, but may embody various changes and modifications within the scope of the invention.

In these drawings:

FIG. 1 is a longitudinal vertical section showing the receptacle applied to a wall structure;

FIG. 2 is a rear view of the receptacle with the backing member removed;

FIG. 3 is a section of the base portion of the insulating insert structure taken substantially on line 3—3 of FIG. 4;

FIG. 4 is a rear view thereof taken substantially on line 4—4 of FIG. 3;

FIG. 5 is a partial section and front view of the device of FIG. 3 taken substantially on the plane of line 5—5 of FIG. 3;

FIG. 6 is an exploded view of the receptacle and wall mounting with the outlet box of the house wiring system;

FIG. 7 is a transverse section showing a portion of the receptacle containing the receptacle contacts and the attachment plug cap inserted in the receptacle;

FIG. 8 is a partial front view of the receptacle taken substantially on line 8—8 of FIG. 1;

FIG. 9 is an inner end view of the attachment plug cap;

FIG. 10 is an end view and partial section of the microswitches and means for operating them taken substantially on the plane of line 10—10 of FIG. 11;

FIG. 11 is a partial detail view looking from the right of FIG. 10, and

FIG. 12 is an elevational view looking toward the bottom of FIG. 10, as indicated by line 12—12.

A dangerous hazard in the use of outlet receptacles with attachment plug caps which may be plugged into and removed from the receptacle in providing electrical connection for supplying current to various electrically operated devices or attachments, particularly in such locations, for example, as operating rooms of hospitals where there may be anaesthetic fumes, or other locations where explosive or combustable gases may be involved, is danger of sparks or arcing produced in operation of insertion or removing the plug-in cap causing a fire or an explosion, and it is the principal object of this invention to provide a construction in which such danger is entirely removed, or at least reduced to a minimum.

A particular object is to provide a construction which will utilize the advantages of a microswitch control for the receptacle in which the microswitch means is in a sealed compartment so that any arcing in the operation of the switch means will not ignite any combustible gases in the surrounding atmosphere.

It is also an object to provide a structure in which the switch is always in the "off" or circuit open position when the attachment plug cap is inserted in the receptacle to establish electrical contact between the contacts of the cap and receptacle, or withdrawn from the receptacle to separate the contacts of the plug and receptacle, so that there will be no sparks formed by these operations, and as a further safety means the cap is always locked against withdrawal from the receptacle when the switch means is closed to close the circuit to the receptacle contacts, and is unlocked so as to be withdrawable from the receptacle only when the switch means is in the open position and the circuit to the receptacle contacts is broken.

This improved receptacle comprises a body member **1** including a flange **2** of a size and adapted to cover an opening **3** in a wall structure **4** leading to the wiring system for supplying electrical current. The wall may be of any suitable structure, such as plaster **5** covered with a suitable tile **6**, and provided with an opening **3** leading to a wall outlet box **7** of the electrical wiring system to which the conductor wires of the system may be led through suitable protective conduits **8** connected at **8'** to the box. The body member **1** may be of any suitable material, preferably a suitable metal, such, for example, as bronze, and includes a hollow or tubular forward extension **9** enclosing a chamber **10** open at both its outer and inner ends. Mounted in this chamber is an insulating insert structure comprising a body portion **11** and a base portion **12**. These may be molded in one piece, but preferably comprise two members secured together by lonigtudinal screws **13** in the body portion **11** and threaded at their inner ends into inserts **14** molded in the base portion **12**, the inner end of the portion **11** being seated in a recess **15** in the front wall of the base portion **12**. This portion is secured to the body member **1** by suitable means, such, for example, as a screw threaded engagement **16**.

The body portion **11** is a tubular portion enclosing a chamber **17** having an entrance opening **18** at its outer end, and in which chamber are mounted the receptacle contacts **19** and **20**, one of which, in this case the contact **20**, may be a grounding contact, while the others may be connected with the wiring supply system through the switch means to receive current from this system. These contacts **19** and **20** are in the form of substantially flat, longitudinally extending blades mounted on the front side of the base portion **12** by suitable rivet-type inserts **21** and **22** (FIGS. 3, 4 and 5), by means of laterally extending feet **23** and **24**, one on each contact, provided with an opening to receive the end of the rivet which is then riveted over to secure the contacts, these rivets extending through the base portion **12**, as shown in FIG. 3, forming electrical connection with the receptacle contacts **19** and **20**. These feet are also preferably seated in recesses **25** in the front surface of the base mem-

ber 12 so as to properly locate them and retain them in proper angular position. At their outer ends they are each provided with a curved, wider portion 26 and 27 for a purpose presently to be described. They are also preferably mounted in longitudinally extending recesses 28 in the inner walls of the chamber 17 with a longitudinally extending, substantially flat spring 29 at the rear side of each one to assist in keeping the contacts in proper position.

To connect the receptacle contacts 19 with the supply of a house wiring system, there is mounted on the inner or rear side of the base portion 12 a microswitch means, in the present case comprising two microswitches 30 and 31 connected with the house system through the wall outlet box 7 by means of the supply conductors 32 and 33, one switch controlling one side of the circuit from the conductor 32 to one of the receptacle contacts 19, and the other controlling the other side of the circuit from the conductor 33 to the other receptacle contact 19. A single microswich of the proper capacity could be used, but it is preferred to use two microswitches, one controlling each side of the circuit, as shown. These switches are mounted on the rear side of the base portion 12. For this purpose there are provided two brackets 34 each comprising a flat metal strip provided with lateral feet 35 (FIGS. 3 and 4) provided with openings to receive the inner ends of two of the inserts 14, and then rolled over to secure these feet to the insert and to the member 12. These inserts are so located that the two brackets 34 are in alignment and in the same plane, as indicated in FIGS. 2, 4 and 10, and they are provided with wider end portions 36 provided with elongated openings 37. The two microswitches may be purchased complete and assembled on the market, and include insulating body portions 38 which may be positioned on opposite sides of the free end portions 36 of the brackets 34 and secured thereto by transverse screws 39 passing through these insulating bodies and through the openings 37 in the brackets. The screws may be provided with countersunk nuts 40 in recesses in the sides of the bodies 38, and threaded onto screws 39 to securely clamp the two switches to the opposite sides of the brackets 34. The conductor wire 32 is connected to one contact of the switch 31 by the connecting member 41 and screw 42 (FIGS. 2 and 4), while the other conductor 33 is connected to similar contact 30 by the connector 43. The other contact of the switch 31 is connected by a clip or conductor 44 and conductor wire 45 by one of the inserts 21 to one of the receptacle contacts 19 through the clip 46, which is perforated to seat over the inner end of this insert, and which is rolled or riveted over the clip to secure it to the insert. The insert therefore provides electric connection between the microswitch 31 and the receptacle contact. Similarly, the other microswitch 30 is electrically connected to the other receptacle contact 19 by the clip 47, conductor wire 48 and clip 49 connected to the end of the other insert 21 connected with the other receptacle contact 19.

The microswitch means is enclosed in a sealed chamber 50 formed by the body member 1, base member 12 and a backing member 51. This backing member is a flanged member with a rearwardly extending hollow portion 52 in which is provided a portion of chamber 50, and it is closed at its rear side but is open at the front side facing body member 1. It is secured to the rear or inner side of the body member 1 by suitable screws 53 extending through the flange portion of the member 51 and threaded into the body member 1. Thus the microswitch means is enclosed in a sealed chamber 50 provided by this backing member, the base member 12 and the body member 1. The forward portion of this chamber may be in the rear side of the member 1, as shown at 54. The portion of this chamber within the backing member 51 may be lined with a fiber insulating lining 55. Its rear wall is provided with a tubular extension 56 having an opening 57 for passage of the two conductor wires 32 and 33, and this opening or passage may be sealed by a suitable sealing wax 58, so that the microswitch means and its operating means are entirely enclosed in a sealed chamber. To insure a sealed connection between the backing member 51 and the body member 1, a portion 64 of the rear surface of the body member 1 is finished to an accurate flat surface to form a seat for the similarly finished front surface 65 of the backing member 51.

The receptacle including the body portion 1, the backing member 51 and the elements mounted therein may be connected to the outlet wall box 7 of the current supply system by means of a mounting block 59 secured to the body member 1 and the backing member 51 by suitable screws 60 passing through openings 60' in the flange portions of the body member and backing member, and threaded into the block 59. This block is screw threaded on its outer surface, as indicated at 61, by which it may be threaded into similarly threaded opening 62 in the front wall of the box 7, as indicated in FIGS. 1 and 6. The block 59 is provided with an oblong or substantially rectangular shaped opening 63 to receive the rearwardly extending portion 52 of the backing member 51, which has a somewhat similar oblong or rectangular shape.

The front portion of the receptacle mounted in the forward extension 9 of the body member 1 is constructed to receive an attachment plug cap, indicated at 66 in FIG. 7, inserted in the receptacle. The insulating insert structure 11 is open at its forward end 18 for insertion of an insulating extension 67 of the plug. This plug comprises an insulating body member 68 provided with a recess 69 which may receive the inner end portion 70 of the insulating extension 67. This portion 67 includes an enlarged intermediate portion 71 by which the extension 67 is secured to the insert 68 by suitable screws 72. Mounted on this insulating extension 67 are attachment plug contacts 73 and 74, which are enlarged end portions of longitudinally extending conductor strips 75 and 76 mounted in longitudinal channels in the wall of the insulating extension 67, and provided with binding post screws 77 and 78 to which may be connected the conductor wires 79 and 80 of an insulating cable 81 leading to the attachment or other apparatus to be operated and supplied with current from the wiring system. The contacts 73 are positioned and mounted to engage the receptacle contacts 19 connected through the microswitch means to the house wiring system, while the contact 74 is a grounding contact for connecting to the grounding wire 80 of the cable leading to the attachment. This is preferably made of different size or wider than the contacts 73, and the opening 18 in the insert member 11 is shaped as shown in FIG. 8 so that the plug can be inserted in the receptacle in one position only; thus, the opening 18 as shown in FIG. 8 is provided with two narrower and properly located recesses 82 for insertion of the narrower contacts 73, and a wider recess 83 to receive the wider grounding contact 74. Also, arrow means 84 and 85 may be provided on the receptacle and the end of the plug associated with a rib 86 and recess 87 to further insure that the plug may be inserted in the receptacle in one position only, to insure that the contacts 73 engage only the contacts 19 and the grounding contact 74 engages only the grounding contact 20.

The contact 74 may be grounded on a metal shell 88 enclosing the members 68 and 71 by means of a conductor strip 89 connected to the strip 87 with a laterally extending free end 90 engaging the inside of the shell 88 and secured to the member 71 by a suitable screw 91. The outer end of the chamber 17 in the receptacle is normally closed by a sliding insulating closure 92. This slides within the chamber 17 and has a lateral extension forming a shoulder 93 (FIG. 7) which may engage an overhanging portion 94 adjacent the outer end of the chamber 17 to limit outward movement of the closure

92. This member is normally held in its outer or closed position by a suitable coiled spring 95.

Means is provided to control operation of the microswitch means 30, 31 by the inserted attachment plug 66. For this purpose there is mounted in and extending through the base member 12 in a suitable bearing sleeve 96, an operating shaft 97, and to secure it in the sleeve and also provide a sealed passage the shaft may be threaded in the sleeve, as indicated at 98. Mounted on the inner end of this shaft is a cam 99 secured to the shaft by riveting over the end of the shaft after passing it through an opening in the cam, as indicated at 100. This cam is in the form of a plate provided with oppositely extending lugs 101 provided with inclined cam surfaces 102 on one edge adapted to slide over inclined spring members 103 secured at one end by suitable rivets 104 to the insulating bodies of the microswitches 30 and 31, as shown in FIGS. 10, 11 and 12. These springs are inclined upwardly and outwardly from their anchored ends and extend in opposite directions on the two microswitches, as indicated in these figures. The free ends are provided with V-shaped channels 105 on their under sides receiving the free ends of operating buttons or plungers 106 of the switches. The cam 99 is normally held in the retracted position by a coil spring 107 one end 108 of which is secured to the cam, while the other end 109 is held behind one of the switch supporting brackets 34. This spring is so tensioned as to normally hold the cam in its retracted position with the switches in their open position, and also tends to return the cam to this position when released. At its outer end the shaft 97 is provided with a noncircular end 110, in the present case a flattened end portion, to detachably interlock with a similarly shaped recess 111 in the end of the extension 67 of the attachment plug cap 66. This flattened end of the shaft and the channel or recess 111 of the plug are so located that normally they are at right angles to the line joining the rivets or inserts 14 mounting microswitch supporting brackets 34, so that the flattened end 110 will seat in the recess 111 as the plug is inserted in the receptacle.

It will be noted that the contacts 73 and 74 of the attachment plug cap project outwardly from the surface of the insulating extension 67 of the plug, so that they pass through the respective recesses 82 and 83, and by the longitudinal movement of inserting them with the extension 67 of the plug cap into the receptacle they engage the respective receptacle contacts 19 and 20. It will be noted that in this action the closure plug or slider 92 is forced inwardly to the position of FIG. 7 to permit insertion of the plug. This longitudinal inserting motion of the plug, however, has no action on the microswitch means, but the receptacle, including the chamber 17, is so constructed that after the plug is inserted in the receptacle, as shown in FIG. 7, it may be turned by a limited turning movement to a locked position in the receptacle. This is a limited turning movement clockwise after insertion of the extension 67 into the receptacle. To secure the locking effect the end wall 112 of the member 11 is extended to one side of the notches 82 and 93, as indicated at 113 and 114, and as shown in FIG. 8, and the widened free end portions 26 and 27 of the contacts 19 and 20 extend in behind these overhanging portions of the end wall, so that as the inserted plug is given a limited turning movement the contacts 73 and 74 of this plug move behind the shoulders or overhanging walls 113 and 114 and lock the plug against removal from the receptacle. The contacts 73 and 74 of the plug engage the contacts 19 and 20 of the receptacle by the longitudinal movement of inserting the plug in the receptacle to form electrical contact between the plug contacts and the receptacle contacts, and the widened portions 26 and 27 of the receptacle contacts maintain this electrical contact between the plug and receptacle contacts during the turning movements of the plug to and from the locking position. It will be seen that this turning movement of the inserted plug also

turns the shaft 97 by the interlocked action between the end 110 of the shaft and the elongated recess 111 in the plug. This turning of the shaft operates the cam 99, and its cam surfaces 102 by sliding over and depressing the inclined springs 103 depress the operating plungers 106 of the microswitches to shift the switches to their on or closed position, it being a structure of these switches that they are normally in the off or open position and when the pressure on the plungers 106 is released automatically return to the open position. This operation of the cam on the switches closes the supply circuit to the receptacle contacts 19 to supply current to the inserted plug and the cable 81 leading to the attachment or other device to be supplied with curernt from the wiring system. To assist in retaining the cap in the locked position in the receptacle the outer surface of the sliding closure 92 may be provided with radial ribs 92′ adapted to seat in similarly arranged grooves or channels 67′ in the end of the extension 67 of the plug cap.

The other contact 20 of the receptacle may be grounded on the body member 1 by a grounding strip 115 mounted on the base portion 12 by an insert rivet 22 fastening the contact 20 to the member 12, and the strip 115 connected to the body member 1 by a suitable screw 116, as shown in FIG. 2.

It will be seen that the inserted plug may be returned to the unlocked position so that it may be withdrawn from the receptacle by a relative turning movement counterclockwise or backward to its first position after it is inserted in the receptacle. This movement removes the plug contacts 73 and 74 from their locked position under the overhanging walls 113 and 114 and permits withdrawal of the plug from the receptacle. This movement, together with the action of the spring 107, returns the cam 99 to its original or off position, this movement being limited and the position determined by stop shoulders 117 on the lugs 101 of the cam engaging the mounting brackets 34 for the switches, as shown in FIG. 4. This movement of the cam permits the microswitches to move automatically to their open circuit position, cutting off the supply of current from the house wiring system to the receptacle contacts 19. The attachment plug cap 66 now being in the unlocked position may be withdrawn from the receptacle.

It will be seen from the above that the making of the contact or engagement between the cap contacts and the receptacle contacts is effected by the longitudinal movement of the plug as it is inserted in the receptacle, and that this electrical contact between the cap contacts and the receptacle contacts is maintained during turning movements of the cap to and from the locked position. It is also seen that the electrical contact of the cap contacts to the receptacle contacts is made and broken only when the microswitches are in their open position, so that this contact and separation of the cap and receptacle contacts is effected only when the receptacle contacts are dead or are not connected to the house wiring system. There is, therefore, no chance of sparking in the operation of making or breaking contact between the cap contacts and the receptacle contacts. Also, the circuit and current supply to the receptacle contacts is on or closed only when the inserted attachment plug cap is in the locked position, and the cap therefore cannot be removed or withdrawn from the receptacle when the receptacle contacts are alive or connected to the current supply system. There is thus no chance of sparks or electric arcs being provided at any time to ignite the surrounding atmosphere, and the switch contacts to make or break the electrical circuit are enclosed in a sealed chamber.

Having thus set forth the nature of my invention, I claim:

1. In combination, a wall having an opening; a closed outlet box of an electrical supply wiring system mounted in said wall provided with a front wall having a threaded opening in alignment with the wall opening; a receptacle

including a body member secured to the wall to cover the first opening and provided with a chamber; an insulating structure mounted in said chamber; stationary receptacle contacts mounted in said insulating structure adapted for engagement with the contacts of an attachment plug cap inserted in said insulating structure; microswitch means mounted at the rear side of said insulating structure and electrically connected with the receptacle contacts to control current supply thereto; operating means for said microswitch means operable by turning movements of a plug cap inserted into the receptacle; a backing member provided with a chamber enclosing the microswitch means; means securing said backing member to said body member with the backing member and body member providing a sealed chamber enclosing the microswitch means and its operating means; a mounting block in the form of an adjusting ring rigidly secured to the back of said body member and backing member and having a threaded portion arranged to be threadedly secured in said threaded opening in the outlet box.

2. An electrical receptacle comprising: a body member including a hollow forward portion open at its opposite ends and a flange portion at the inner end thereof arranged to cover a wall opening leading to a house wiring system; an insert structure of insulating material mounted in said hollow portion; stationary receptacle contacts mounted in said insert structure; said insert structure being open at its outer end for insertion of an attachment plug cap having contacts to engage the receptacle contacts; means in the insert structure adapted to cooperate with the cap to lock the cap in the receptacle on relative turning movement of the insert cap; microswitch means electrically connected with the receptacle contacts; means mounting said microswitch means on the insert structure; said microswitch means including a housing and an operating button; an associated spring member secured to said microswitch means housing and arranged to normally incline relative thereto in position to be moved toward and actuate said operating button; operating means to control said microswitch means comprising a shaft and a cam on the inner end of the shaft arranged to actuate said spring member to, in turn, cause it to actuate said operating button in response to turning movement of the shaft and cam; the outer end of the shaft provided with means to detachably interlock with an inserted attachment plug cap to operate the shaft and cam by turning movement of the cap; means for making electrical connection from a house wiring system to the microswitch means; a backing member provided with a chamber enclosing the microswitch means; and means securing the backing member to the rear of the body member, whereby the insert structure and backing member form a sealed chamber enclosing the microswitch means and the operating means for controlling it.

3. An electrical receptacle as defined in claim 2 wherein said microswitch means comprises a pair of microswitches which are secured to the rear of said insert structure by bracket means disposed between said pair of microswitches.

4. An electrical receptacle of claim 2 wherein said insert structure is provided with holding means arranged to cooperate with holding means on the contacts of an associated attachment plug cap to lock the cap in the receptacle by turning movement of the inserted cap; said receptacle contacts are located to be engaged by the cap contacts as they are inserted into the receptacle are of a width to maintain contact as the cap is turned to and from the locking position; and wherein said microswitch operating means is operative to move said spring member to operate the said operating button to close a circuit to the receptacle contacts only when the cap is in the locked position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,181,829	Jeffrey	Nov. 28, 1939
2,441,465	Bauroth	May 11, 1948
2,646,475	Goodrich et al.	July 21, 1953
2,752,465	MacDonald	June 26, 1956
2,857,486	Hubbell et al.	Oct. 21, 1958