

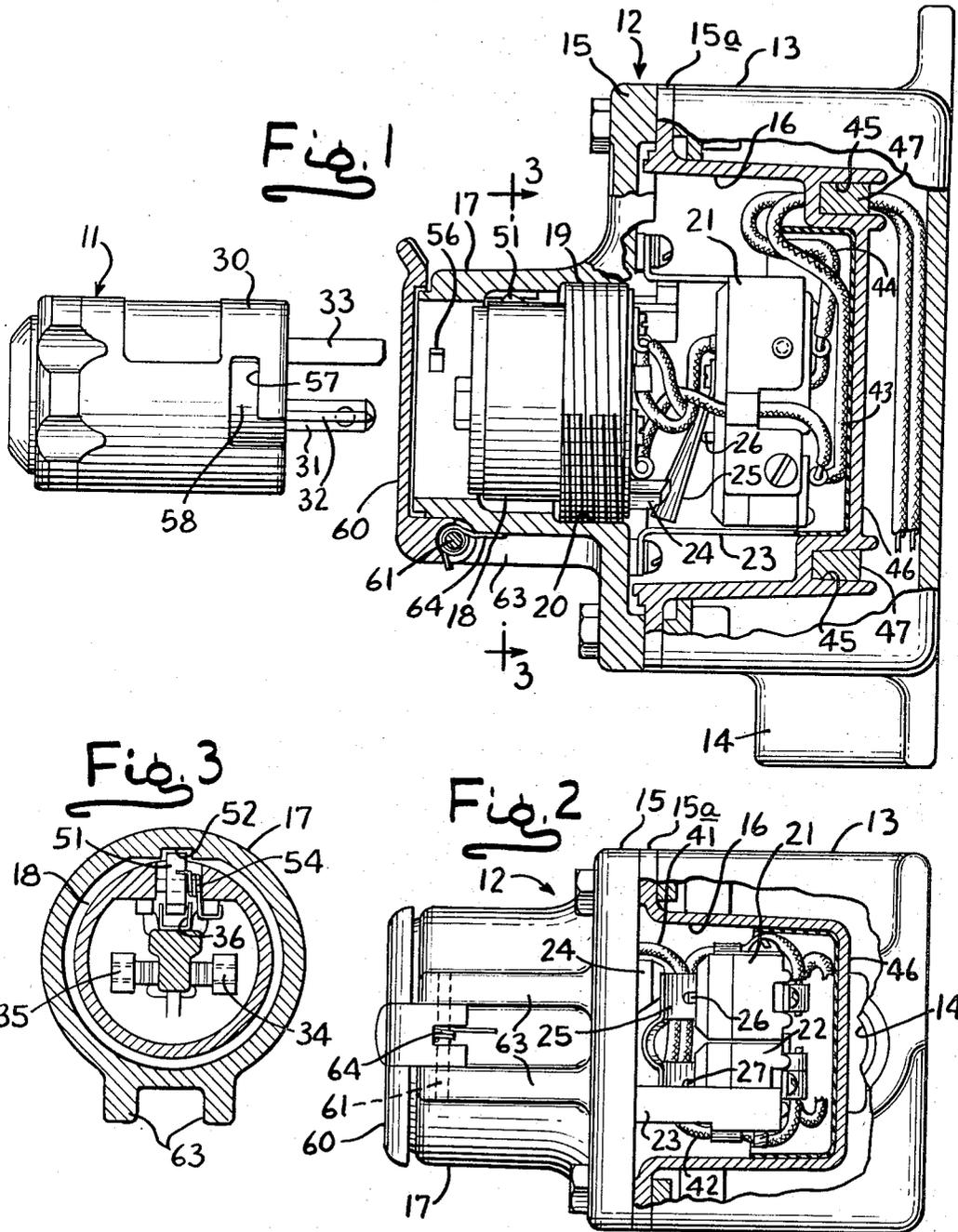
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A. I. APPLETON
EXPLOSION-PROOF PLUG AND RECEPTACLE WITH
RELEASABLE SOCKET ENGAGING MEANS

3,346,709

Filed April 21, 1965

2 Sheets-Sheet 1



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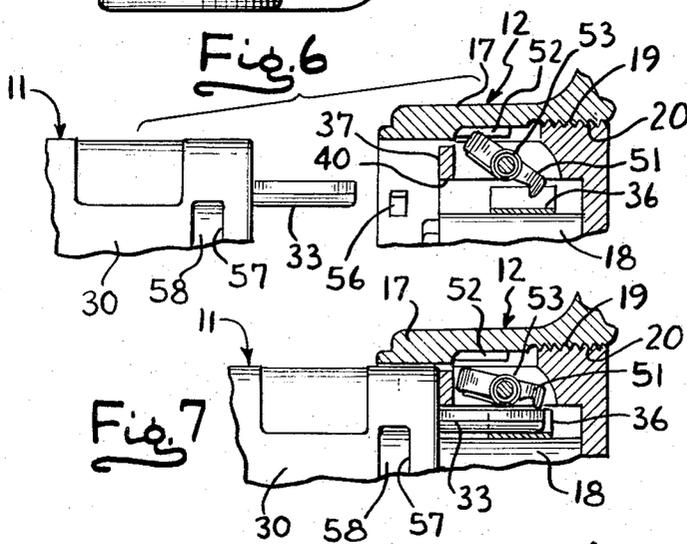
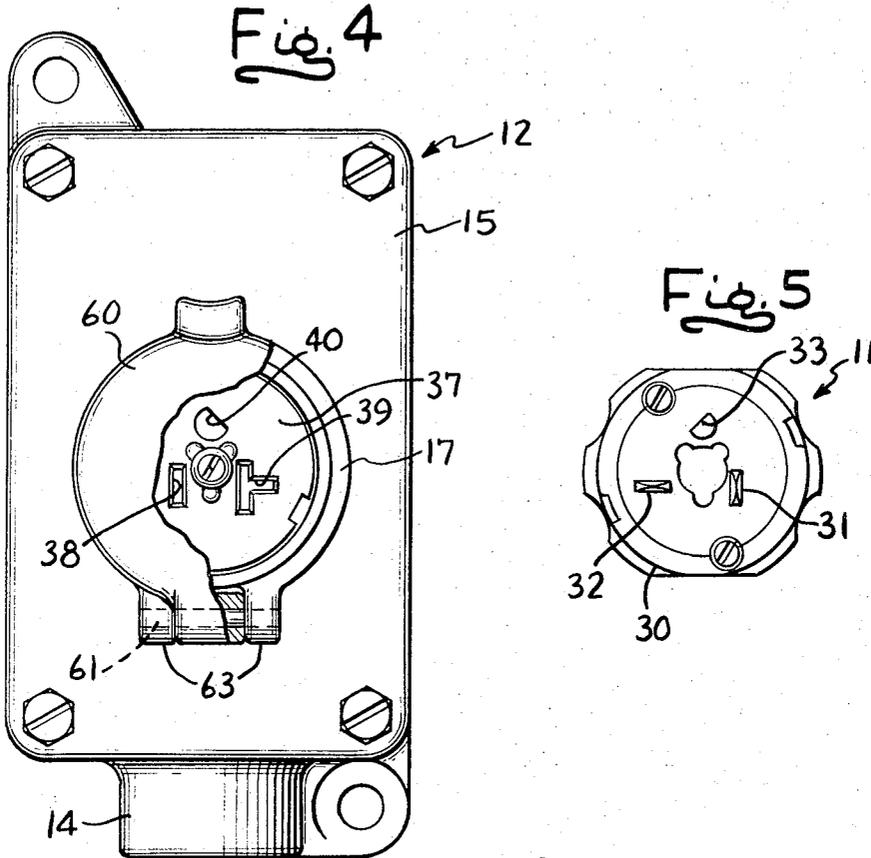
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EXPLOSION-PROOF PLUG AND RECEPTACLE WITH RELEASABLE SOCKET ENGAGING MEANS

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 7 Claims. (Cl. 200—51.09)

The present invention relates generally to electrical outlet receptacles and more particularly concerns an electrical outlet assembly of the explosion-proof type.

There are many instances in which it is desirable to provide an electrical outlet receptacle of the explosion-proof type which permits the plug of a movable electrical appliance to be quickly and easily inserted into or removed from the receptacle without danger of arcing or generating an explosion. One illustrative example in which explosion-proof receptacles have found increasing utility is in hospital rooms where there is an increasing use of portable equipment of the type that might generate an explosive atmosphere and yet where safety requires that satisfactory protective measures be employed. In such cases, it is also desirable that the explosion-proof outlet receptacle be attractive in appearance with an exterior that can be easily cleaned for sanitary and health reasons.

Accordingly, the primary aim of the present invention is to provide a self-contained explosion-proof outlet assembly in which the plug of an appliance may be inserted without any danger of arcing or generating an explosion. It is a more particular object of the invention to provide such an explosion-proof outlet assembly in which positive engagement of the contact prongs of a plug and the contact elements of the socket is insured before electrical current is supplied to the socket.

It is another object of the present invention to provide an explosion-proof outlet assembly which includes a sealed switch chamber and incorporates means for actuating the switches in the sealed chamber only after an appliance plug has been inserted into the cooperating outlet receptacle.

It is also an object of the present invention to insure that the plug cannot be removed from the outlet receptacle until the supply of electrical current to the contact elements in the socket has been terminated.

Yet another object of the invention is to provide an explosion-proof outlet assembly of the above type in which the plug must be inserted into the cooperating socket and the plug and socket rotated before any current is supplied to the contact elements of the socket. A related object of the invention is to prevent energization of the outlet socket except by the insertion of specially designed plugs.

Finally, it is an object of the present invention to provide such an explosion-proof outlet assembly that is attractive in appearance, simple in function and operation and which may be quickly and conveniently cleaned and serviced.

Other objects and advantages of the invention will become more readily apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIGURE 1 is a side elevational view of an explosion-proof outlet receptacle assembly and plug with certain portions broken away to better illustrate the features of the present invention.

FIG. 2 is an end view of the receptacle assembly shown in FIG. 1 with portions broken away.

FIG. 3 is a section taken substantially along the line 3—3 in FIG. 1.

FIG. 4 is a plan view of the receptacle shown in FIG. 1 with a portion of the lid broken away to illustrate the enclosed socket.

FIG. 5 is an end view of the plug illustrated in FIG. 1.

FIG. 6 is a fragmentary view, partly in section, of the plug removed from the socket; and

FIG. 7 is a view similar to FIG. 6 with the plug inserted into the socket.

While the invention will be described in connection with a preferred embodiment, it will be understood that I do not intend to limit the invention to that embodiment. On the contrary, I intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning now to the drawings, there is shown in FIGURE 1 an illustrative explosion-proof outlet assembly including a plug 11 and receptacle 12 which embody the features of the present invention. In the illustrated embodiment, the receptacle 12 is mounted in an explosion-proof connection box 13 which may be generally rectangular in shape and provided with an internally threaded conduit coupling 14. It will be understood that the connection box 13 affords sufficient space for enclosing a substantial portion of the outlet receptacle 12 as well as for providing space within which connections to electrical service wires can be made.

To close the explosion-proof connection box 13 the receptacle assembly 12 of the present invention includes a two-part cover 15, 15a with the outer part 15 adapted to overlie and sandwich the inner part 15a against the connection box 13. As shown in FIG. 1, the two-part cover 15, 15a is formed to define a sealed switch chamber 16 between the two parts. The outer part 15 of the cover is also formed with an outwardly projecting hollow neck portion 17 which is adapted to receive an outlet socket 18.

For sealing the hollow neck portion 17 of the cover 15, the socket 18 is provided with a plurality of external threads 19 engageable with threads 20 formed internally of the neck 17. Thus, the threads 19 and 20 serve a three-fold purpose, namely, to hold the socket 18 in the neck; to seal the switch chamber 16; and to allow the socket 18 to be rotated in the neck 17.

Within the switch chamber 16 there are located a pair of electrical switches 21 and 22. In the illustrated embodiment, the switches 21, 22 are held within the switch chamber 16 by means of brackets 23 secured to the outer cover 15, although it will be appreciated that other supporting means might be used. A cam element 24 secured to the socket 18 is also disposed to project into the chamber 16 and is engageable with a cam follower 25 which is arranged to depress the switch operators 26 and 27 upon rotation of the socket 18.

Referring now to the plug 11 shown in FIGS. 1 and 5, it will be seen that the plug includes a body 30 from which a pair of electrical contact prongs 31 and 32 and a guide prong 33 project. As shown here, one of the contact prongs 32 is disposed at right angles to the other contact prong 31 as is typical for plugs having a capacity of 20 amps or more. It will also be noted that the guide prong 33 is slightly longer than the contact prongs 31, 32 and the guide prong is formed with a substantially D-shaped cross section.

Turning now to FIGURE 3, it will be seen that the socket 18 is provided with a pair of electrical contact elements 34 and 35 and a recess 36 for receiving the prongs 31, 32 and 33 of the plug 11. As seen in FIG. 4, the socket 18 is further provided with a face plate 37 which defines an I-shaped slot 38, a T-shaped slot

39 and a D-shaped opening 40 for respectively receiving the prongs 31, 32 and 33 of the plug 11.

Each of the electrical contact elements 34, 35 is coupled to one of the switches 21, 22 by means of short lead wires 41 and 42, respectively. The switches 21, 22 are also connected to lead-in wires 43 and 44 which pass through apertures 45 defined in the lower wall 46 of the inner cover member 15a. The spaces surrounding the lead-in wires 43, 44 in the apertures 45, as well as any unused apertures, are closed by a suitable sealant indicated at 47. The free ends of the lead-in wires 43, 44 are thus disposed within the connection box 13 where they may be connected to electrical supply lines inserted into the connection box 13 through the threaded conduit coupling 14. From the above it will be appreciated that the contact element 34 in the socket 18 is connected in a circuit which includes switch 21 and lead-in wire 44. Similarly, electrical contact element 35 is connected in a circuit which includes switch 22 and lead-in wire 43.

In accordance with the present invention, no electrical current is supplied to the contact elements 34, 35 of the socket 18 until after the plug 11 is inserted into the socket and the socket and plug are rotated to actuate the switches 21, 22. Therefore, this arrangement effectively precludes the chance of a spark being generated as the prongs 31, 32 engage the contacts 34, 35. Moreover, since the switches 21, 22 are enclosed in the sealed switch chamber 16, any spark that may be generated within the chamber 16 is precluded from initiating an explosion in the surrounding atmosphere.

Pursuant to one aspect of the present invention, means are provided for precluding rotation of the socket 18 in the hollow neck 17 until the plug 11 has been inserted into the socket. To this end, the socket 18 carries a catch lever 51 which is engageable with a groove 52 formed internally of the neck 17. As shown in the drawings, the outer end of the catch lever 51 is normally urged into the groove 52 and the inner end of the catch lever 51 is normally disposed in the recess 36 by means of a biasing spring 54.

Upon the insertion of the plug 11 into the socket 18 the guide prong 33 engages the inner end of the catch lever 51 thereby pushing the other end of the catch 51 out of the groove 52. With the catch 51 released from the groove 52, the socket 18 is then freed for rotation in the hollow neck 17 of the cover. As previously mentioned, the guide prong 33 is somewhat longer than the contact prongs 31 and 32 and preferably the operating end of the catch lever 51 is disposed adjacent the remote end of the recess 36. Thus, the socket 18 is not freed for rotation in the neck 17 until the plug 11 is inserted substantially into the socket insuring that the contact prongs 31, 32 have made good electrical contact with the socket elements 34, 35. Moreover, this arrangement precludes the catch 51 from being released to free the socket 18 for rotation in the neck 17 by the insertion of any plug other than one specifically designed for use in the novel explosion-proof outlet receptacle 12.

It is a further feature of the present invention that means are provided for preventing the removal of the plug 11 from the socket 18 unless the socket has been rotated to its initial position and the switches 21, 22 are deactivated so that no current flows to the socket contacts 34 and 35. For this purpose the hollow neck 17 is provided with a pair of lugs 56 which project inwardly so as to engage a pair of shoulders 57 defining the forward edge of grooves 58 formed on the body 30 of the plug 11. Those skilled in this art will, of course, recognize this arrangement as being similar to a conventional bayonet-type connection.

In further keeping with the present invention, the outwardly projecting hollow neck 17 is provided with a lid 60 so as to cover the socket 18 when the plug 11 is removed therefrom. Preferably, the lid 60 is pivotally

mounted by means of a pin 61 projecting through a pair of ribs 63 which merge into the neck 17. A small helical spring 64 is provided to bias the lid 60 toward its closed position. In this way, dirt and other foreign material is precluded from entering the socket 18.

From the foregoing it will be appreciated that the novel explosion-proof receptacle outlet assembly of the present invention is constructed so as to virtually preclude any possibility of generating a spark that would be communicated to the surrounding atmosphere. Through the use of the novel catch lever 51, the plug 11 must be inserted substantially into the socket 18 with the contact prongs 31, 32 engaging the contact elements 34, 35 before current can be supplied to the contacts 34, 35 by rotating the plug 11 and socket 18 to actuate the switches 21, 22. Furthermore, the bayonet-like construction of the lugs 56 and shoulders 57 precludes the removal of the plug 11 from the socket 18 until the socket has been rotated again to deactivate the switches 21, 22. It will also be appreciated that the illustrative explosion-proof outlet assembly is inherently simple and the generally smooth exterior lends itself to an attractive appearance and easy cleaning.

I claim as my invention:

1. An electrical outlet assembly of the explosion-proof type for use with an explosion-proof connection box comprising, in combination, a two-part cover for said connection box formed to define a sealed switch chamber between the two parts thereof, said cover having a hollow neck portion with internal threads therein, an outlet socket dimensioned for insertion into said neck and having external threads thereon, said internal and external threads sealingly engaging said socket in said hollow neck while permitting rotation of said socket between first and second positions, an electrical plug having a pair of contact prongs and a guide prong thereon, said socket having a pair of complementary contact elements and a locating recess formed respectively to receive said contact prongs and guide prong, a pair of switches located in said chamber, lead-in wires passing through and sealed in a wall of said chamber from said connection box, circuit means including said switches for connecting said lead-in wires to said contact elements, means for actuating said switches to close said circuit means incident to rotation of said socket from said first position to said second position, means releasably engaging said socket and neck for retaining said socket in said first position, said guide prong when inserted substantially completely into said locating recess releasing said engaging means thereby conditioning said socket for rotation to said second position, and means in said neck engageable with said plug for preventing insertion or removal of said plug except when said socket is in said first position.

2. An electrical outlet assembly of the explosion-proof type for use with an explosion-proof connection box comprising, in combination, a two-part cover for said connection box formed to define a sealed switch chamber between the two parts thereof, said cover having an outwardly extending hollow neck portion with internal threads therein, an outlet socket dimensioned for insertion into said neck and having external threads thereon, said internal and external threads sealingly engaging said socket in said hollow neck while permitting rotation of said socket between first and second positions, an electrical plug having a pair of contact prongs and a guide prong thereon, said guide prong being longer than said contact elements and having a generally D-shaped cross section, said socket having a pair of complementary contact elements and an elongated, generally D-shaped locating recess formed respectively to receive said contact prongs and guide prong, a pair of switches located in said chamber, lead-in wires passing through and sealed in a wall of said chamber from said connection box, circuit means including said switches for connecting said lead-in wires to said contact elements, means for actuating

said switches to close said circuit means incident to rotation of said socket from said first position to said second position, means including a spring biased catch releasably engaging said socket and neck for retaining said socket in said first position, said guide prong adapted to engage said catch when said prong is inserted substantially completely into said locating recess thereby releasing said socket for rotation to said second position, and means in said neck engageable with said plug for preventing insertion or removal of said plug except when said socket is in said first position.

3. An electrical outlet assembly of the explosion-proof type for use with an explosion-proof connection box comprising, in combination, a two-part cover for said connection box formed to define a sealed switch chamber between the two parts thereof, said cover having an outwardly extending hollow neck portion with internal threads therein, an outlet socket dimensioned for insertion into said neck and having external threads thereon, said internal and external threads adapted to sealingly engage said socket in said hollow neck while permitting rotation of said socket between first and second positions, an electrical plug having a pair of contact prongs and a guide prong thereon, said socket having a pair of complementary contact elements and a locating recess formed respectively to receive said contact prongs and guide prong, a pair of switches located in said chamber, lead-in wires passing through and sealed in a wall of said chamber from said connection box, circuit means including said switches for connecting said lead-in wires to said contact elements, means for actuating said switches to close said circuit means incident to rotation of said socket from said first position to said second position, means including a spring biased catch secured to said socket and having one portion normally engageable with a groove in said neck for retaining said socket in said first position, said catch having another portion thereof normally disposed in said locating recess and engageable by said guide prong when said prong is inserted substantially into said locating recess thereby releasing said one portion of said catch from said groove, and means in said neck engageable with said plug for preventing insertion or removal of said plug except when said socket is in said first position.

4. An electrical outlet assembly of the explosion-proof type for use with an explosion-proof connection box comprising, in combination, a two-part cover for said connection box formed to define a sealed switch chamber between the two parts thereof, said cover having an outwardly extending hollow neck portion with internal threads therein, an outlet socket dimensioned for insertion into said neck and having external threads thereon, said internal and external threads sealingly engaging said socket in said hollow neck while permitting rotation of said socket between first and second positions, an electrical plug having a pair of contact prongs and a guide prong thereon, said socket having a pair of complementary contact elements and a locating recess formed respectively to receive said contact prongs and guide prong, a pair of switches located in said chamber, lead-in wires passing through and sealed in a wall of said chamber from said connection box, circuit means including said switches for connecting said lead-in wires to said contact elements, a cam element secured to said socket and projecting into said chamber, a cam follower disposed in said chamber for actuating said switches to close said circuit means incident to rotation of said socket from said first position to said second position, means releasably engaging said socket and neck for retaining said socket in said first position, said guide prong when inserted substantially completely into said locating recess releasing said engaging means thereby conditioning said socket for rotation to said second position, and means including a lug in said neck engageable with a shoulder on said plug for prevent-

ing insertion or removal of said plug except when said socket is in said first position.

5. An electrical outlet assembly of the explosion-proof type for use with an explosion-proof connection box comprising, in combination, a two-part cover for said connection box formed to define a sealed switch chamber between the two parts thereof, said cover having an outwardly extending hollow neck portion with internal threads therein, an outlet socket dimensioned for insertion into said neck and having external threads thereon, said internal and external threads adapted to sealingly engage said socket in said hollow neck while permitting rotation of said socket between first and second positions, an electrical plug having a pair of contact prongs and a guide prong thereon, said socket having a pair of complementary contact elements and a locating recess formed respectively to receive said contact prongs and guide prong, a pair of switches located in said chamber, lead-in wires passing through and sealed in a wall of said chamber from said connection box, circuit means including said switches for connecting said lead-in wires to said contact elements, a cam element secured to said socket and projecting into said chamber, a cam follower disposed in said chamber for actuating said switches to close said circuit means incident to rotation of said socket from said first position to said second position, means including a spring biased catch secured to said socket and having one portion normally engageable with a groove in said neck for retaining said socket in said first position, said catch having another portion thereof normally disposed in said locating recess and engageable by said guide prong when said prong is inserted substantially into said locating recess thereby releasing said one portion of said catch from said groove, and means including a lug in said neck engageable with a shoulder on said plug for preventing insertion or removal of said plug except when said socket is in said first position.

6. An electrical outlet assembly of the explosion-proof type for use with an explosion-proof connection box comprising, in combination, a cover including an inner and an outer member lying one upon the other and shaped to form between them a sealed switch chamber extending into said connection box when said cover is applied thereto, said outer member formed with an outwardly extending hollow neck portion with internal threads therein, an outlet socket dimensioned for insertion into said neck and having external threads thereon, said internal and external threads adapted to sealingly engage said socket in said hollow neck while permitting rotation of said socket between first and second positions, an electrical plug having a pair of contact prongs and a guide prong thereon, said socket having a pair of complementary contact elements and a locating recess formed respectively to receive said contact prongs and guide prong, a pair of switches located in said chamber, lead-in wires passing through and sealed in a wall of said chamber from said connection box, circuit means including said switches for connecting said lead-in wires to said contact elements, a cam element secured to said socket and projecting into said chamber, a cam follower disposed in said chamber for actuating said switches to close said circuit means incident to rotation of said socket from said first position to said second position, means including a spring biased catch secured to said socket and having one portion normally engageable with a groove in said neck for retaining said socket in said first position, said catch having another portion thereof normally disposed in said locating recess and engageable by said guide prong when said prong is inserted substantially into said locating recess thereby releasing said one portion of said catch from said groove, and means including a lug in said neck engageable with a shoulder on said plug for preventing insertion or removal of said plug except when said socket is in said first position.

7. An electrical outlet assembly of the explosion-proof

type for use with an explosion-proof connection box having electric lead wires therein comprising, in combination, a cover for said connection box formed with a hollow neck portion having internal threads therein, an outlet socket dimensioned for insertion into said neck and having external threads thereon, said internal and external threads sealingly engaging said socket in said hollow neck while permitting rotation of said socket between first and second positions, an electrical plug having a plurality of contact prongs including at least one guide prong, said socket having a plurality of complementary contact elements and including a locating recess formed respectively to receive said contact and guide prongs, means for sealingly enclosing a plurality of electrical switches, circuit means including said switches for connecting said lead wires to said contact elements, means for actuating said switches to close said circuit means incident to rotation of said socket from said first position to said second position, means releasably engaging said socket and neck

for retaining said socket in said first position, said guide prong when inserted substantially completely into said locating recess releasing said engaging means thereby conditioning said socket for rotation to said second position, and means in said neck engageable with said plug for preventing insertion or removal of said plug except when said socket is in said first position.

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