Sept. 9, 1952 O. S. GREESON 2,610,266

PLUG AND RECEPTACLE

Filed Feb. 2, 1951 4 Sheets-Sheet 1

Fig. 1

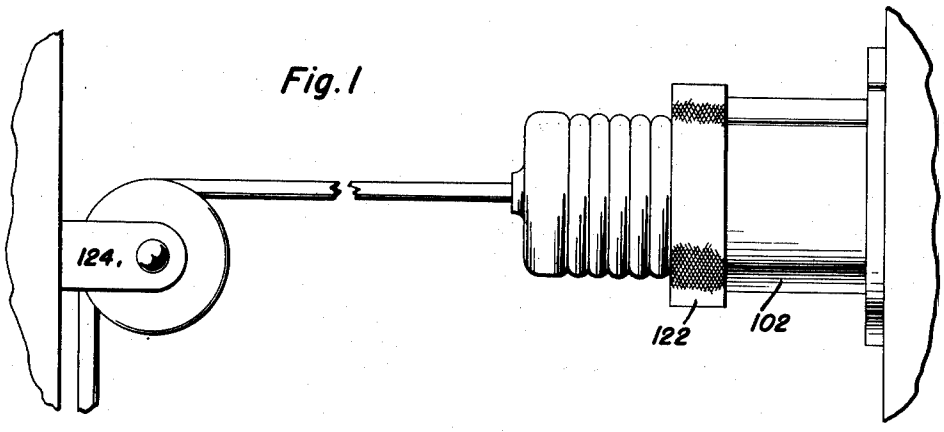


Fig. 4

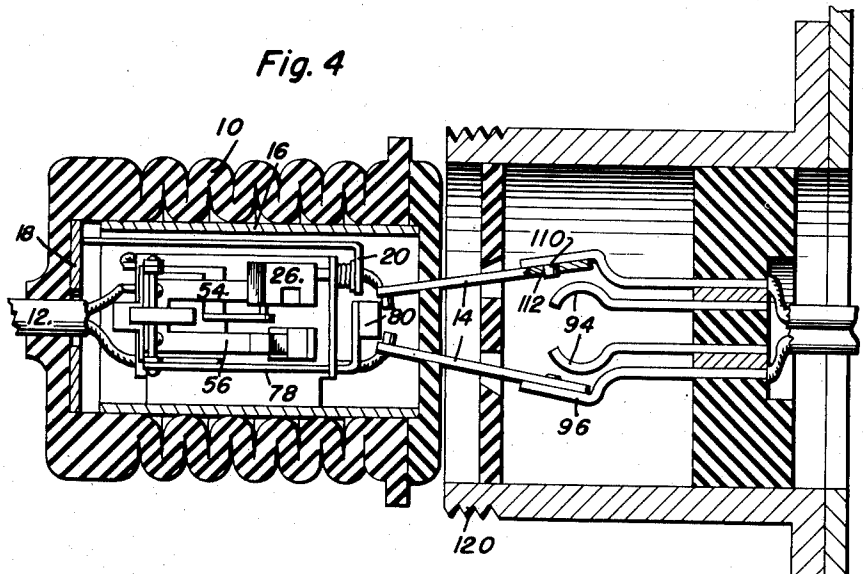
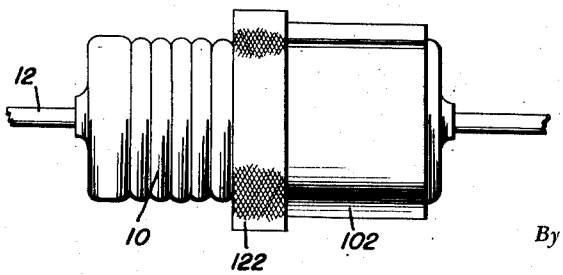


Fig. 13



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Sept. 9, 1952 O. S. GREESON 2,610,266

PLUG AND RECEPTACLE

Filed Feb. 2, 1951 4 Sheets-Sheet 2

Fig. 2

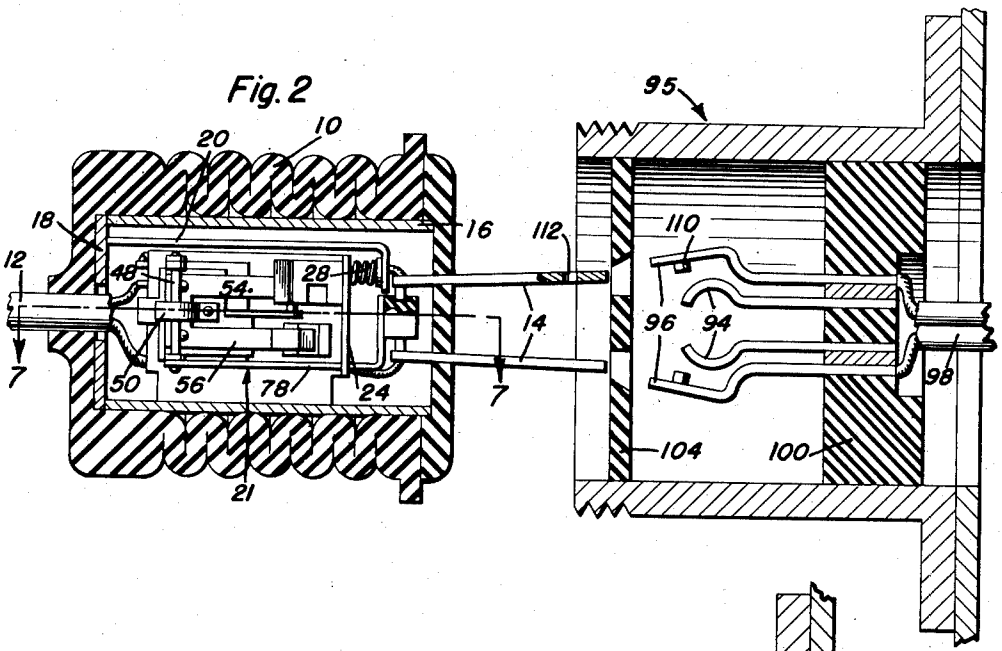


Fig. 3

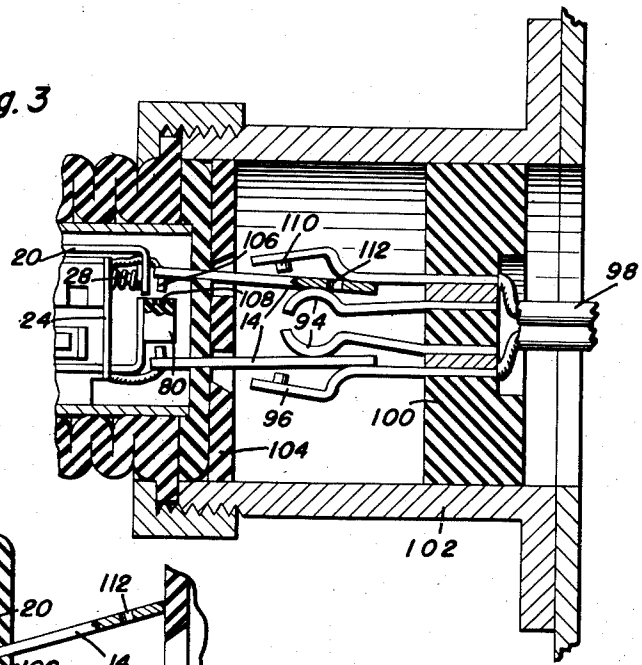
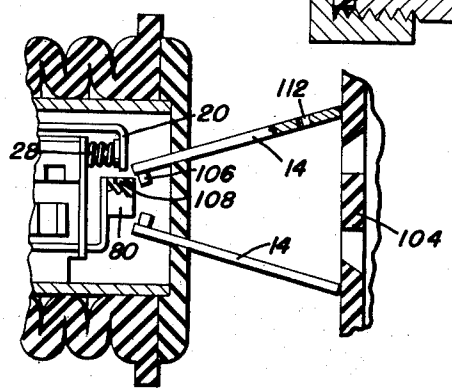


Fig. 5



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Sept. 9, 1952 O. S. GREESON 2,610,266

PLUG AND RECEPTACLE

Filed Feb. 2, 1951 4 Sheets-Sheet 3

Fig. 6

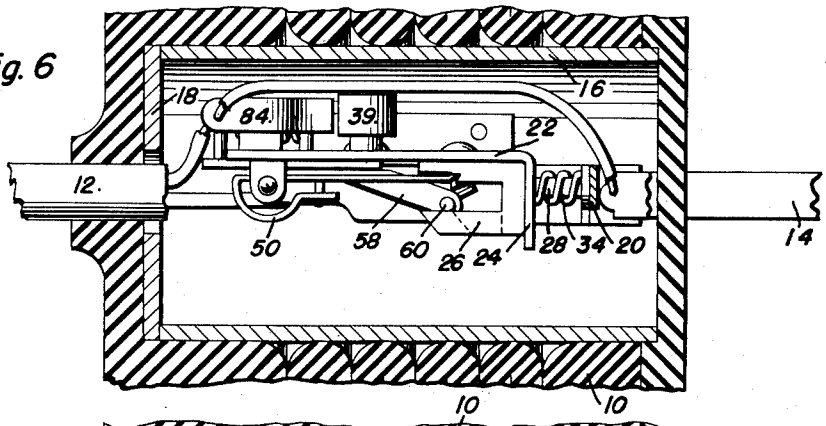


Fig. 7

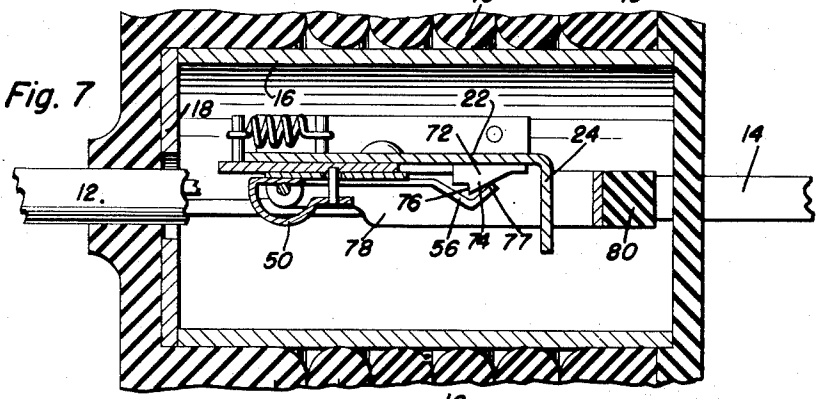
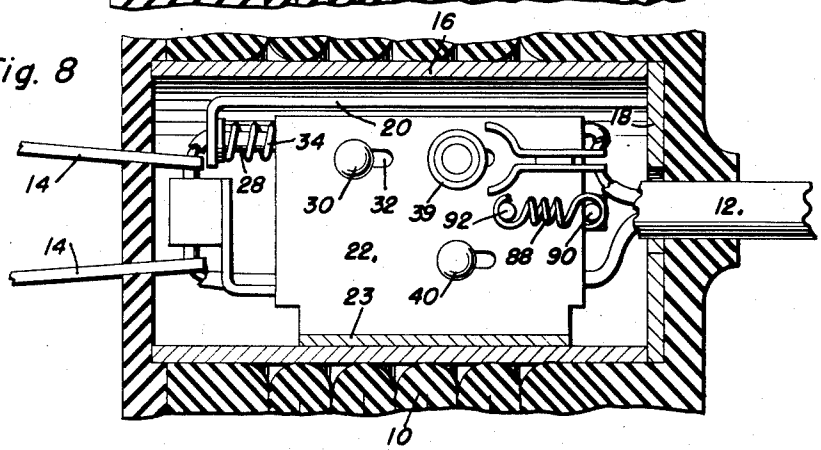


Fig. 8



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Sept. 9, 1952 O. S. GREESON 2,610,266

PLUG AND RECEPTACLE

Filed Feb. 2, 1951 4 Sheets-Sheet 4

Fig. 12

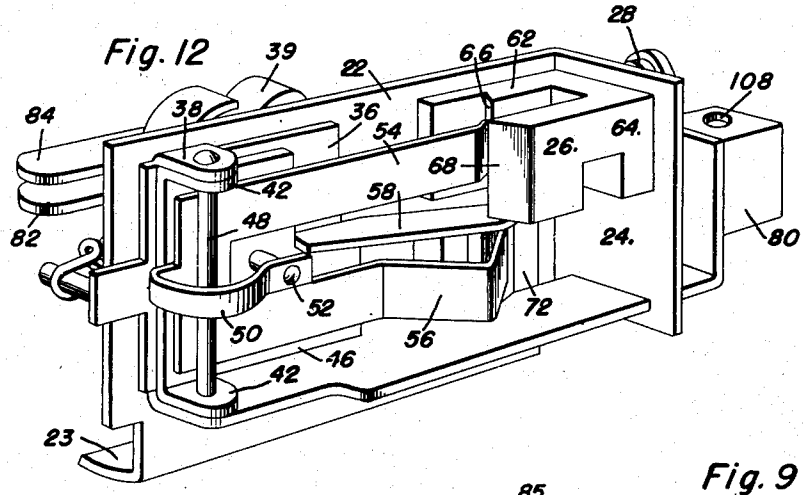


Fig. 9

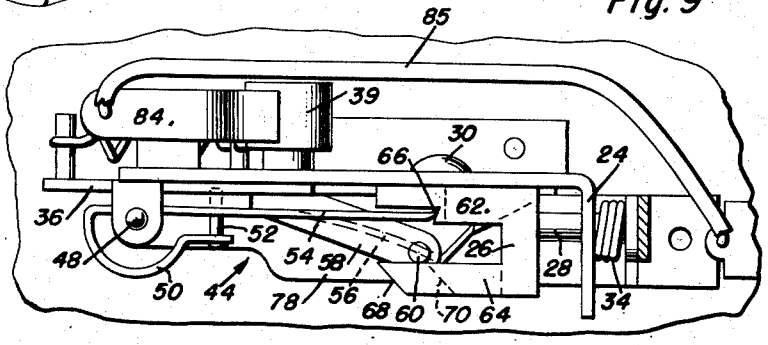


Fig. 10

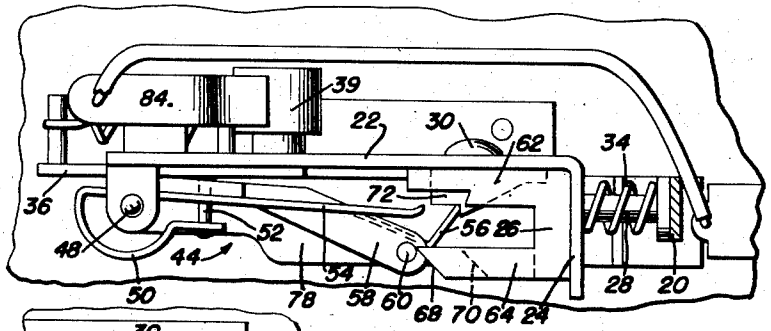
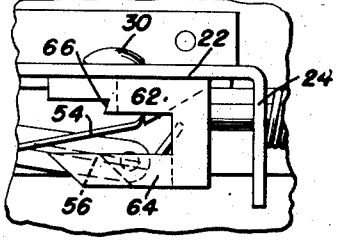


Fig. 11



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2,610,266

UNITED STATES PATENT OFFICE

2,610,266

PLUG AND RECEPTACLE

Orion S. Greeson, Elizabeth, N. J.

Application February 2, 1951, Serial No. 209,073

10 Claims. (Cl. 200—51.09)

1

This invention relates to control means for closing electrical circuits and more particularly to a plug and receptacle that is substantially explosion-proof.

The switch incorporated in the plug comprising one element of the present invention is of the type disclosed in the copending applications, Serial No. 107,598, filed July 29, 1949, now Patent No. 2,587,143, February 26, 1952, and Serial No. Serial No. 144,079, filed February 14, 1950, now Patent No. 2,587,144, February 26, 1952, of which this application is a continuation in part.

The primary object of this invention is to provide a substantially explosion-proof plug and receptacle which is designed so that the male terminals of the plug cannot either make or break contact with the terminals of the receptacle while the circuit to the connected appliance is closed.

As can be readily understood, if the contact between the male terminals and the terminals of the the receptacle were to be made while the circuit was closed, a spark might result, which in an explosive laden atmosphere, would set off an explosion.

A further object of this invention is to provide a device in which the circuit is automatically opened when pull is exerted on an extension cord to the appliance being used.

A further object of this invention is to provide a plug and receptacle which is sealed in such manner that when the plug is inserted the device is water-proof, dust-proof, vapor-proof and proof against corrosive fumes and even submerged conditions will not affect it in any way.

Another object of this invention is the provision of means for running an extension cord through one or more pulleys and controlling the power to an appliance by pulling on the cord so as to eliminate a switch on the appliance to be used and to insure the proper expiration of the plug in case of an accidental rupture of the cord.

Still further objects of the invention reside in the provision of a plug and receptacle embodying a switch unit with interdependent switching mechanisms, which is strong, durable, highly efficient in operation, simple in construction and manufacture, and capable of being used for various and numerous purposes.

These, together with the various ancillary objects of the invention which will become apparent as the following description proceeds, are obtained by this invention, preferred embodiments of which have been illustrated in the accompanying drawings, by way of example only, wherein:

2

Figure 1 is an elevational view of the device comprising the present invention shown in use in conjunction with a pulley system;

Figure 2 is a longitudinal sectional view of the device shown in its initial position;

Figure 3 is a longitudinal sectional view of the device after the plug has been inserted in the receptacle;

Figure 4 is a longitudinal sectional view of the invention shown after it has been attempted to remove the plug from the receptacle with the circuit closed in the switch mechanism in the plug;

Figure 5 is a sectional detail showing why it is impossible to insert the plug in the receptacle with the switch in the plug in a closed position;

Figure 6 is an enlarged sectional detail showing the switch in its initial position;

Figure 7 is an enlarged sectional detail of the plug as taken along the line 7—7 in Figure 2;

Figure 8 is an enlarged sectional detail as taken along a plane at right angles to the plane of Figure 7;

Figure 9 is an enlarged detail view showing the switch in its second phase of operation;

Figure 10 is an elevational detail showing the switch in another operative position;

Figure 11 is a detail view showing the position of the various elements of the invention in yet another position;

Figure 12 is a perspective view of the switch comprising an important element of the present invention;

Figure 13 is an elevational view of a modified form of the invention showing the receptacle for use in conjunction with an extension cord.

With continuing reference to the accompanying drawings wherein like reference numerals designate similar parts throughout the various views, reference numeral 10 is used to designate a resilient cylinder formed of rubber or the like having an extension cord 12 entering at one end and male terminals 14 set in the other end.

Inside the cylinder 10 is a rigid sleeve 16 with a portion bonded to the cylinder at the terminal end. A disk or plate 18 is bonded to the cord end of the cylinder 10. The switch mechanism is fastened to the sleeve 16. An actuation arm 20 is fastened to the plate 18 in such manner that when the cord 12 is pulled and the cylinder 10 elongated, the switch mechanism will be actuated. The switch mechanism 21 includes a base 22 formed with a flange 23 attached by screws to the sleeve 16 and which is formed with an upturned leg 24 forming a guide post. A driving head 26 is equipped with a rod 28 which slides in a hole in

the guide post 24. The path of travel of the driving head 26 is maintained in a straight line by means of a rivet 30 which is attached to the driving head 26 and which slides in a slot 32. A compression spring 34 is provided for urging the driving head to its back position and is positioned about rod 28. The drive head is adapted to control the position of a secondary plate 36 through a motion-transmitting mechanism to be further defined.

The secondary plate 36 is held to the base 22 by contact 39 and rivet 40 which slide in slots in the base 22. A portion of the opposed sides of the plate 36 are upturned as at 38 to provide a cradle for the latch device 44.

The latch device 44 includes a latch plate 46 which is provided with ears 42 which are positioned on pintle 48 which is terminally secured to the ears 38 of the secondary plate 36. Means are provided for drawing the latch plate 46 inwardly and consist of a flat spring 50 attached to the latch plate which is curved around the pintle 48 and which is attached at its free end to a pin 52. The pin 52 passes through an opening in the latch plate 46 and is attached to the secondary plate 36. The spring 50 draws the latch plate 46 toward the secondary plate 36 or inwardly. The latch plate 46 carries two elastic pawls 54 and 56 which are preferably made of spring steel or of other highly elastic material and which are riveted, welded, or otherwise secured to the outer side of the latch plate 46. Each spring pawl consists of a leaf spring with a bent end, the ends being bent at an angle to the remainder of the leaf spring forming the working ends of the pawls. The plate 46 further carries an arm 58 which is fixedly attached to it. The arm 58 supports at its free end a guide pin 60.

The driving head 26 consists of a block which is substantially U-shaped and which is provided with a yoke to which the rod 28 is attached. The driving head has two legs 62 and 64 which are substantially parallel. The leg 62 is provided with a step 66. The bent end of the pawl 54 may be applied against the step 66 if the latch plate 46 is in a given position. The leg 64 of the driving head 26 is provided with a slanting end surface 68. The leg 64 is of a shorter height than the yoke but at its end is provided with a projection 70 of rhomboidal cross section. The rhomboidal projection 70 and the adjacent and contiguous surfaces of the leg 64 cooperate with the guide pin 60 on the arm 58 of the latch plate 46.

The spring pawl 56 engages a locking segment 72 which is carried by the base plate 22. The locking segment is formed with a track 74 having a stepped surface 76 and a slanting surface 77 forming an incline. The latch plate may be locked in position when pawl 56 is engaged behind the step 76 of the tooth 74 of the locking segment.

An arm 78 extends from the secondary plate 36 and slides in an opening in the guide post 24. The arm 78 performs a dual function; it cooperates with the contact 39 and the rivet 40 in guiding the secondary plate 36 and also carries the block 80. Insulatively mounted on the base 22 are secondary contact springs 82 and 84. One conductor of the extension cord 12 is operatively connected to spring 82 and the other conductor of the cord 12 is operatively connected to one of the terminals 14. Conductor 85 is provided to connect the contact spring 84 with the other terminal 14. These contact springs 82 and 84 are only semi-elastic and so an operative circuit through them is closed by bringing contact 39 in contact with them. This is accomplished by pushing the secondary plate 36 to which contact 39 is secured forward. The outer sleeve of contact 39 which is insulated from its supporting post is thus directed between the semi-circular ends of the contact springs 82 and 84, thereby establishing a good connection.

The pushing of the secondary plate 36 forward also tensions a retractile spring 88 which is stretched between pin 90 which projects from the secondary plate 36 and the pin 92 which projects from the base 22. When the secondary plate is released, it is pulled back by spring 88 and since contact 39 is attached to the secondary plate, it is also pulled back from contact with the spring contacts 82 and 84, thus opening the circuit. The backward movement of the secondary plate is limited by pin 90 striking the edge of the base 22.

When the switch is in its initial position, the terminals 14 are inserted in the receptacle 95. The receptacle includes a pair of inner springs 94 and a pair of outer spring 96. A lug 110 is attached to each outer spring. One outer spring 96 is connected to one inner spring 94 and lead wires 98 are connected to the outer springs 96. The springs 94 and 96 are attached to an insulator 100 which, in turn, is attached to a base 102. A face plate 104 is attached to the base 102.

The terminals 14 are molded in the end wall of the cylinder 10 in such a manner that the elasticity of the rubber or similar material that constitutes the end wall tends to spread the outer end of the terminals apart and to press the inner end of the terminals together. Therefore, when unrestrained, the terminals will assume an angulated position as shown in Figure 5. When the switch is in its initial position, the block 80 is positioned between the inner end of the terminals, thus limiting the spread of the outer end of the terminals so that they assume a slightly angulated position as shown in Figure 2. In this position, the lugs 106 are positioned in the recesses 108 in the block 80, thus preventing the operation of the switch. When the plug is inserted in the receptacle, the curvature of the outer springs 96 presses the outer end of terminals 14 together slightly, thus spreading the inner end of the terminals apart. This action lifts the lugs 106 out of the recesses 108 in the block 80, freeing the switch so that it may be operated. Then the plug is given a slight pull by pulling on the extension cord which operates the switch and closes the circuit. The closure of the switch may cause a spark at contacts 82 and 84 but no explosion will result because the switch is hermetically sealed within the cylinder 10.

When it is desired to remove the plug from the receptacle, the plug is given a slight pull which operates the switch and opens the circuit. The resultant spark will cause no explosion because it is confined within the cylinder 10. The opening of the switch positions the block 80 between the inner end of the terminals 14, thus limiting the spread of the outer end of the terminals so that the plug may be withdrawn.

If an attempt is made to withdraw the plug when the switch is closed, the terminals will be held in a normal position by the outer springs of the receptacle until they pass the curved portion of the outer springs, at which time they will spread. With the switch closed, the block which limits the spread of the terminals is withdrawn and so the lugs 110 on the outer springs will en-

gage the holes 112 in the terminals and prevent withdrawal.

In case the switch is inadvertently closed when the plug is out of the receptacle, the terminals will spread as shown in Figure 5 and, since they will then be out of line with the holes in insulating face plate 104, the plug cannot be inserted until the terminals are returned to a normal position and the switch re-operated to open the circuit. This positions the block between the inner end of the terminals, thus limiting the spread as shown in Figure 2.

The switch is operated as follows: In the initial position, the pawl 54 rests on the step 66 of the driving head 26 and is somewhat under tension. The pawl 54 rests on or is held above the incline 77 of the locking segment 72 and this spring pawl is without tension. The guiding pin on the arm 58 rests on the inner face of the rhomboidal projection 70 near the inner edge of the projection. The spring 50 is only slightly tensioned. Upon pulling on the extension cord, the actuation arm 20 pushes the driving head 26 and causes the contact 39 to close the contact between spring contacts 82 and 84. This will cause the latch plate 46 to move. During this movement, the pawl 56 is riding on the incline of locking member 72. At the end of the forward stroke, the pawl 56 rides over the locking tooth and is caught behind the step of the locking tooth. The movement of the pawl 56 along the incline imparts to the latch plate 46 a tendency to move angularly and outwardly. This movement is, however, counteracted by the guide pin 60 riding on the inner face of the projection 70. Therefore, the pawl spring 56 is tensioned. The position of the parts at this stage of the operation will be as shown in Figure 9. When the drive head is moved back, due to the action of the spring 34 as is shown in Figure 10, the guide pin 60 loses contact with the inner wall of the driving head and moves outwardly along the wall and finally passes the outermost edge. The tension and bent pawl 56 can now unbend and the latch plate 46 is now moved angularly and outwardly, tensioning somewhat the spring 50. The guide pin 60 is now in front of the inclined wall 68 of the projection 70 without touching it. Pawl 54 has been lifted into the air and is no longer touching the leg 62.

If a further impulse is imparted by pulling on the extension cord, this will merely open the circuit in the switch. This is because the actuation arm 20 is once more actuated, which moves the driving head toward the latch plate, its pawls and the guiding pin. The latter now ride on the projection 70 and upon movement of the driving head toward it, it is moved outwardly by the inclined outer face 68 on the rhomboidal projection 70. A further angular movement of the latch plate 46 is thus produced, lifting pawl 56 out of the step 66. The second impulse, therefore, releases the secondary plate which is no longer held by the locking member 72 and which therefore returns to its initial position. This phase of the operation is shown in Figure 11 and returns the elements to their initial position.

Thus, it may be observed that the plug and receptacle constitute an explosion-proof arrangement that is practially foolproof. As is indicated in Figures 1, 3 and 13, the base 102 of the receptacle is threaded at its outer end, as at 120, for reception of a threaded collar 122. This threaded collar seals the receptacle in an absolutely effective manner. It is to be understood that the receptacle 102 may be attached to a wall or may be attached to an extension cord. Further, as is indicated in Figure 1, it is quite possible to use this device in connection with a pulley system, as is indicated at 124, which will insure the proper operation of the switch in the plug in case of accidental severe stress on the extension cord. Further, it is to be understood that the use of this pulley system is optional with the invention and other and various modifications will be readily and easily understood from the foregoing description. Therefore, it not intended to limit the invention to the precise embodiment shown and described, but all necessary modifications and numerous equivalents may be readily resorted to which fall within the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. A plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, a switch secured to said sleeve, prongs secured to said casing and extending therefrom, conductors completing an operative electrical circuit between said prongs and said extension cord, and an actuation arm secured to said disk for actuating said switch upon displacement of said disk from engagement with said sleeve.

2. A plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, a switch secured to said sleeve, said switch including a base plate secured to said sleeve and having a portion forming a guide post, a driving head movably secured on said base plate, a secondary plate slidably secured to said base plate, a latch plate pivotally secured to said secondary plate, a stationary locking member secured to said base plate, two resilient pawls carried by said latch plate, one of said pawls being a locking pawl adapted to engage the stationary locking member, the other pawl being a driving pawl engaged by the driving head, an arm fixedly connected to said latch plate adapted to engage said driving head, a pair of spaced spring contacts carried by said base plate, a movable contact member carried by said secondary plate adapted to engage said spring contacts to close a circuit therebetween upon movement of said secondary plate, said arm engaging one portion of the driving head to hold the other pawl under tension and being adapted to engage said driving head to impart an angular movement to the latch plate, thereby lifting the locking pawl out of engagement with the stationary locking member so as to permit the return of the secondary plate to its initial circuit-open position, a rod secured to said driving head extending through and beyond said guide post, resilient means urging said rod and said driving head towards its initial position, an actuation arm secured to said disk engaging said rod upon displacement of said disk from engagement with said sleeve, prongs secured to said casing and extending therefrom, and conductors completing an operative electrical circuit between said terminals and said extension cord.

3. A plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, a switch secured to said sleeve, prongs secured to said casing and extend-

ing therefrom, conductors completing an operative electrical circuit between said prongs and said extension cord, an actuation arm secured to said disk for actuating said switch upon displacement of said disk from engagement with said sleeve, said prongs being molded in said casing at an outwardly diverging angle.

4. A plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, a switch secured to said sleeve, said switch including a base plate secured to said sleeve and having a portion forming a guide post, a driving head movably secured on said base plate, a secondary plate slidably secured to said base plate, a latch plate pivotally secured to said secondary plate, a stationary locking member secured to said base plate, two resilient pawls carried by said latch plate, one of said pawls being a locking pawl adapted to engage the stationary locking member, the other pawl being a driving pawl engaged by the driving head, an arm fixedly connected to said latch plate adapted to engage said driving head, a pair of spaced spring contacts carried by said base plate, a movable contact member carried by said secondary plate adapted to engage said spring contacts to close a circuit therebetween upon movement of said secondary plate, said arm engaging one portion of the driving head to hold the other pawl under tension and being adapted to engage said driving head to impart an angular movement to the latch plate, thereby lifting the locking pawl out of engagement with the stationary locking member so as to permit the return of the secondary plate to its initial circuit-open position, a rod secured to said driving head extending through and beyond said guide post, resilient means urging said rod and said driving head towards its initial position, an actuation arm secured to said disk engaging said rod upon displacement of said disk from engagement with said sleeve, prongs secured to said casing and extending therefrom, said prongs being molded in said casing at an outwardly diverging angle, and conductors completing an operative electrical circuit between said terminals and said extension cord.

5. A plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, a switch secured to said sleeve, prongs secured to said casing and extending therefrom, conductors completing an operative electrical circuit between said terminals and said extension cord, an actuation arm secured to said disk for actuating said switch upon displacement of said disk from engagement with said sleeve, said prongs being molded in said casing at an outwardly diverging angle, and insulative means carried by said switch receivable between the inner ends of said prongs to urge the outer ends of said prongs together.

6. A plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, a switch secured to said sleeve, said switch including a base plate secured to said sleeve and having a portion forming a guide post, a driving head movably secured on said base plate, a secondary plate slidably secured to said base plate, a latch plate pivotally secured to said secondary plate, a stationary locking member secured to said base plate, two resilient pawls carried by said latch plate, one of said pawls being a locking pawl adapted to engage the stationary locking member, the other pawl being a driving pawl engaged by the driving head, an arm fixedly connected to said latch plate adapted to engage said driving head, a pair of spaced spring contacts carried by said base plate, a movable contact member carried by said secondary plate adapted to engage said spring contacts to close a circuit therebetween upon movement of said secondary plate, said arm engaging one portion of the driving head to hold the other pawl under tension and being adapted to engage said driving head to impart an angular movement to the latch plate, thereby lifting the locking pawl out of engagement with the stationary locking member so as to permit the return of the secondary plate to its initial circuit-open position, a rod secured to said driving head extending through and beyond said guide post, resilient means urging said rod and said driving head towards its initial position, an actuation arm secured to said disk engaging said rod upon displacement of said disk from engagement with said sleeve, prongs secured to said casing and extending therefrom, said prongs being molded in said casing at an outwardly diverging angle, an arm secured to said secondary plate extending through said guide post, insulative means carried by said arm receivable between the inner ends of said prongs to urge the outer ends of said prongs together, and conductors completing an operative electrical circuit between said terminals and said extension cord.

7. A switch comprising a base plate having a portion forming a guide post, a driving head movably secured on said base plate, a secondary plate slidably secured to said base plate, a latch plate pivotally secured to said secondary plate, a stationary locking member secured to said base plate, two resilient pawls carried by said latch plate, one of said pawls being a locking pawl adapted to engage the stationary locking member, the other pawl being a driving pawl engaged by the driving head, an arm fixedly connected to said latch plate adapted to engage said driving head, a pair of spaced spring contacts carried by said base plate, a movable contact member carried by said secondary plate adapted to engage said spring contacts to close a circuit therebetween upon movement of said secondary plate, said arm engaging one portion of the driving head to hold the other pawl under tension and being adapted to engage said driving head to impart an angular movement to the latch plate, thereby lifting the locking pawl out of engagement with the stationary locking member so as to permit the return of the secondary plate to its initial circuit open position, a rod secured to said driving head extending through and beyond said guide post, and resilient means urging said rod and said driving head towards its initial position.

8. An explosive-proof plug and receptacle, said plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, prongs secured to said casing and extending therefrom, conductors completing an operative electrical circuit between said terminals and said extension cord, and an actuation arm secured to said disk for actuating said switch upon displacement of said disk from engagement with said sleeve, said receptacle including a housing, an insulative plate in said housing, a pair of outer contact springs secured to said insulative plate, a pair of inner contact springs secured to

said insulative plate, each of said inner contact springs being electrically connected to one of said outer contact springs, a face plate having apertures therethrough secured to said housing, said prongs being receivable through the apertures in the face plate between said inner contact springs and said outer contact springs.

9. An explosive-proof plug and receptacle, said plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, prongs secured to said casing and extending therefrom, conductors completing an operative electrical circuit between said terminals and said extension cord, and an actuation arm secured to said disk for actuating said switch upon displacement of said disk from engagement with said sleeve, said receptacle including a housing, an insulative plate in said housing, a pair of outer contact springs secured to said insulative plate, a pair of inner contact springs secured to said insulative plate, each of said inner contact springs being electrically connected to one of said outer contact springs, a face plate having apertures therethrough secured to said housing, said prongs being receivable through the apertures in the face plate between said inner contact springs and said outer contact springs, said prongs being molded in said casing at an outwardly diverging angle.

10. An explosive-proof plug and receptacle, said plug comprising a resilient casing, a sleeve in said casing, a disk secured to said casing adapted to engage said sleeve, an extension cord secured to said disk, prongs secured to said casing and extending therefrom, conductors completing an operative electrical circuit between said terminals and said extension cord, and an actuation arm secured to said disk for actuating said switch upon displacement of said disk from engagement with said sleeve, said receptacle including a housing, an insulative plate in said housing, a pair of outer contact springs secured to said insulative plate, a pair of inner contact springs secured to said insulative plate, each of said inner contact springs being electrically connected to one of said outer contact springs, a face plate having apertures therethrough secured to said housing, said prongs being receivable through the apertures in the face plate between said inner contact springs and said outer contact springs, said prongs being molded in said casing at an outwardly diverging angle, and insulative means carried by said switch receivable between the inner ends of said prongs to urge the outer ends of said prongs together.

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