

[54] ELECTRICAL DISCONNECT MEANS

[75] Inventors: Albert C. Ackerman, Troy; Walter J. Bowman, Detroit, both of Mich.

[73] Assignee: Mac Valves, Inc., Oak Park, Mich.

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[51] Int. Cl. H01r 3/06

[58] Field of Search... 339/14 R, 14 P, 14 RP, 14 LR, 339/14 L, 14 A, 4, 8 R, 8 A, 63, 6 R, 6 A, 62, 256 S, 258 S, 211, 32 R, 32 M, 33, 198 R, 198 H, 47 R, 47 C, 49 R, 49 B

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Primary Examiner—Marvin A. Champion

Assistant Examiner—Robert A. Hafer

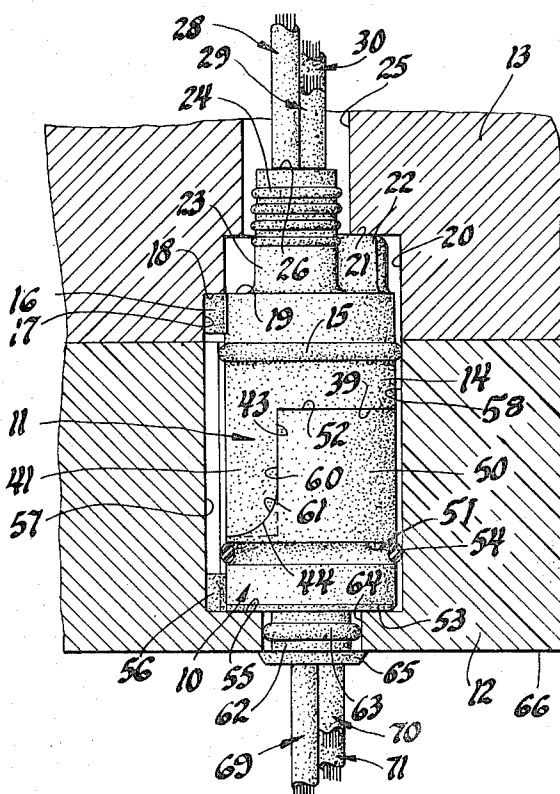
Attorney, Agent, or Firm—Robert C. Mentag

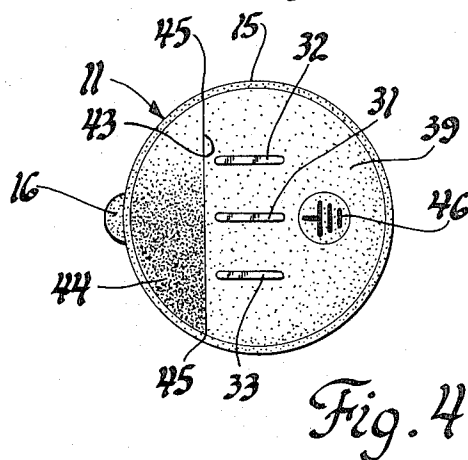
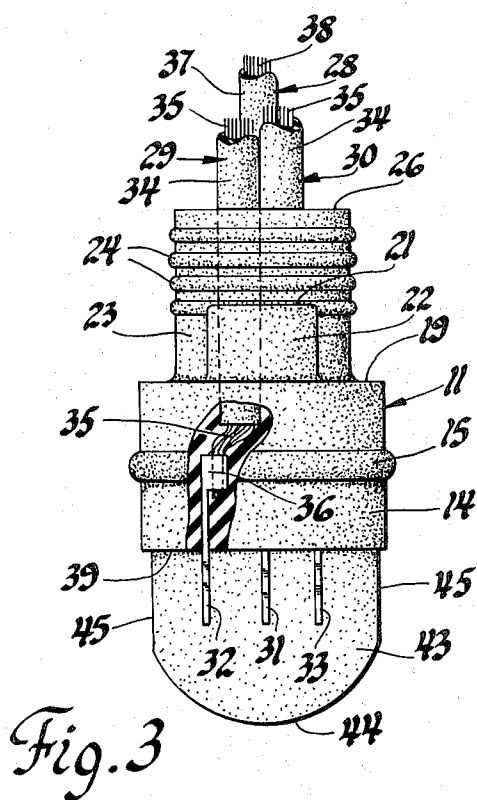
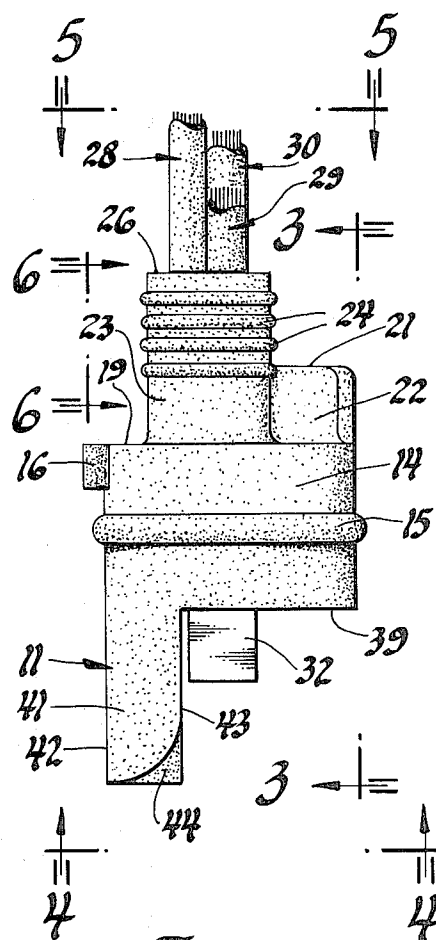
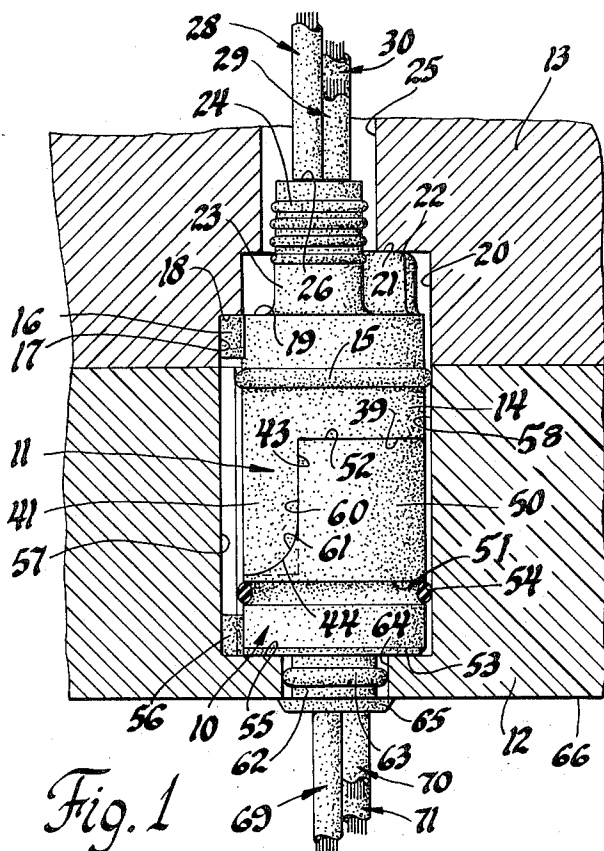
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ABSTRACT

A two-piece electrical disconnect means which can be assembled or disconnected in an in-line connection or from two directions 90° apart, or from any angle in between. A female plug has a molded insulating body which carries a plurality of receptacle type female terminals which are each open on the outer end and on one side thereof for the reception of a spade type male terminal, at any angular position between and including an in-line position and a right-angle position. A male plug has a molded insulating body which carries a plurality of spade type male terminals which are adapted to be received in the female receptacle terminals.

5 Claims, 13 Drawing Figures





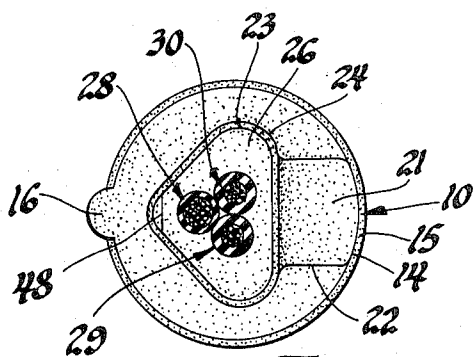


Fig. 5

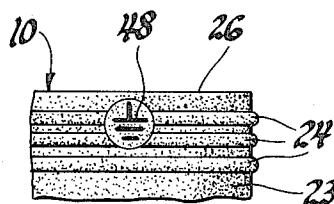


Fig. 6

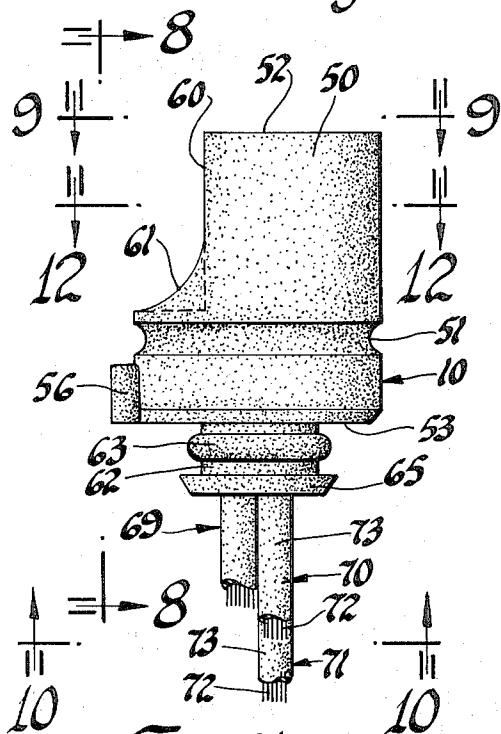


Fig. 7

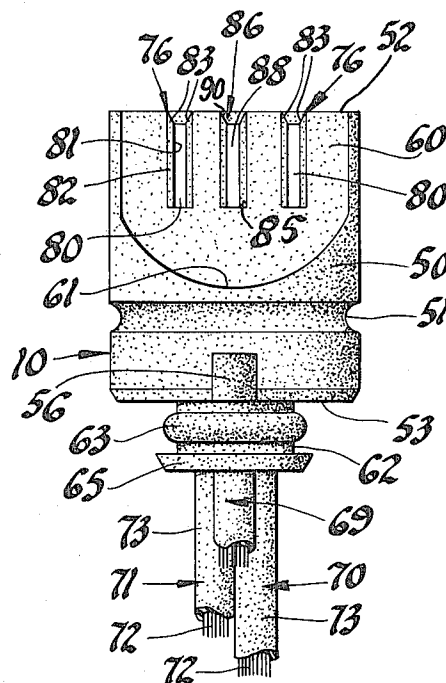


Fig. 8

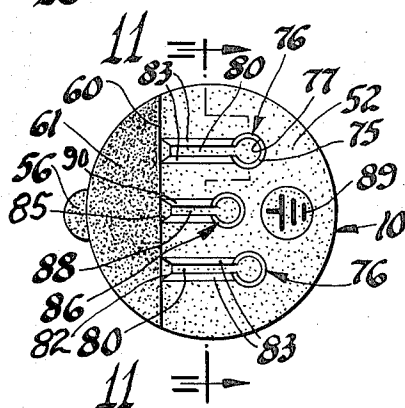


Fig. 9

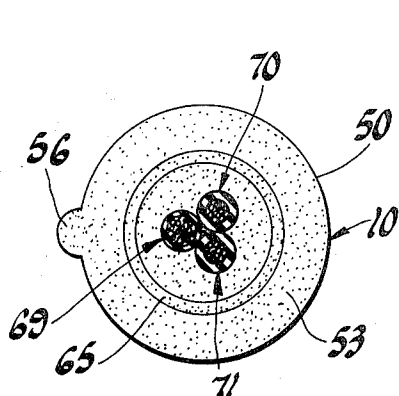


Fig. 10

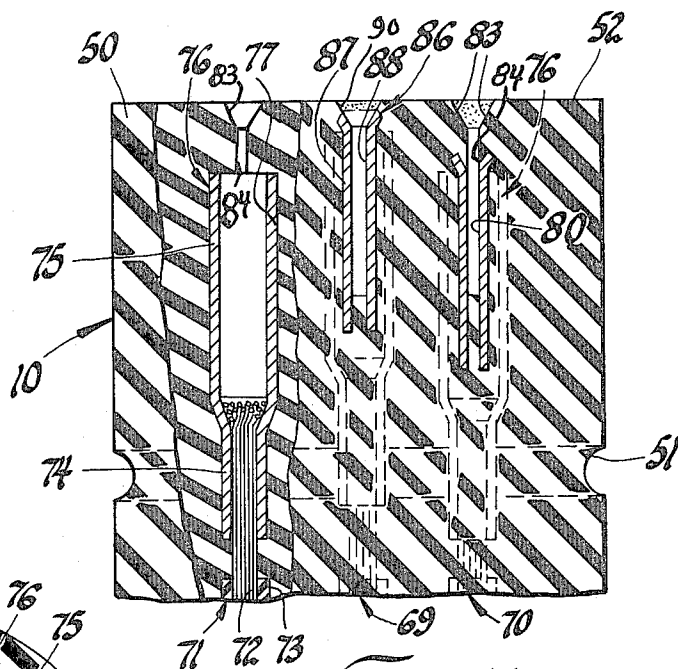


Fig. 11

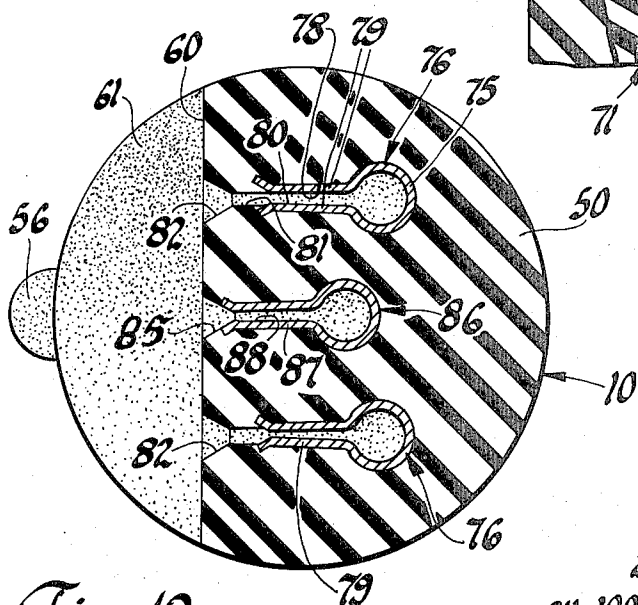


Fig. 12

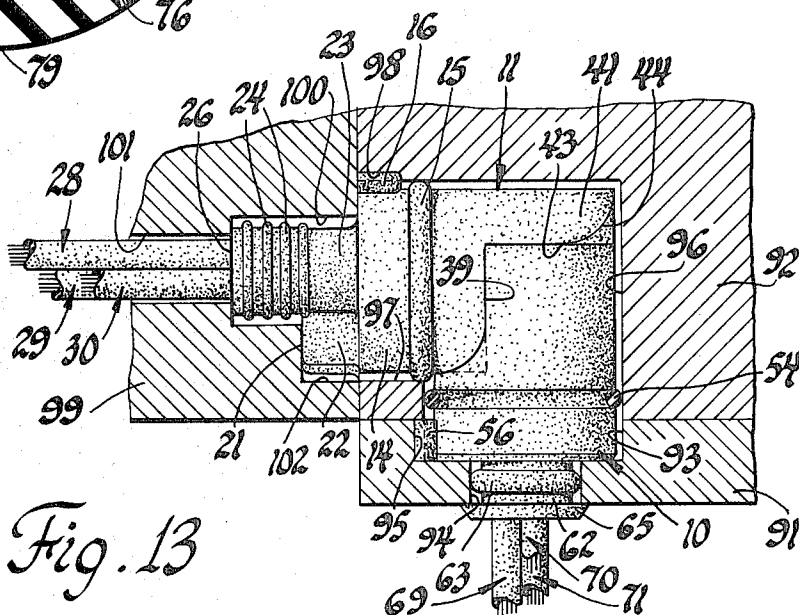


Fig. 13

ELECTRICAL DISCONNECT MEANS

SUMMARY OF THE INVENTION

This invention relates generally to the electrical disconnect means art, and more particularly to a two-piece electrical disconnect means which includes a female plug and a male plug that can be assembled in a plurality of angular positions.

It is the primary object of the present invention to provide a novel and improved two-piece electrical disconnect means which can be used for many purposes where it is necessary to provide an electrical disconnect means that may be separated by merely moving two members apart, as for example, two members or portions of a solenoid operated valve.

It is another object of the present invention to provide a novel and improved electrical disconnect means which includes a female plug adapted to be mounted in a first member and a male plug adapted to be mounted in a second member, and wherein the male and female plugs may be connected together when said two members are moved into engagement with each other. The female and male plugs may be mounted in said members in one manner whereby an in-line connection is made, or they may be mounted in said members in another manner whereby a 90° connection is made, or they may be mounted in said members at any angle in between said in-line connection, and said 90° connection. In both the in-line connection and the 90° connection, the contact areas between the terminals in said plugs, and the amount of insulation, remains essentially the same. The male and female plugs may carry any number of conductors or lead wires and mating terminal members. The male and female plugs are provided with suitable seal means for sealing the contoured holes in which they are mounted in said members against dirt and moisture.

It is still another object of the present invention to provide a novel and improved electrical disconnect means which is simple and compact in structure, economical to manufacture and efficient in operation.

Other features and advantages of this invention will be apparent from the following detailed description, appended claims, and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of an electrical disconnect means made in accordance with the principles of the present invention, and showing the male and female plugs in an in-line connection.

FIG. 2 is an enlarged elevational view of the male connector plug illustrated in FIG. 1, and shown detached from the female connector plug.

FIG. 3 is a right side elevational view of the structure illustrated in FIG. 2, taken along the line 3—3 thereof, looking in the direction of the arrows and showing part of the structure in section.

FIG. 4 is a bottom plan view of the structure illustrated in FIG. 2, taken along the line 4—4 thereof, and looking in the direction of the arrows.

FIG. 5 is a top plan view of the structure illustrated in FIG. 2, taken along the line 5—5 thereof, and looking in the direction of the arrows.

FIG. 6 is a fragmentary, elevational view of the structure illustrated in FIG. 2, taken along the line 6—6 thereof, and looking in the direction of the arrows.

FIG. 7 is an enlarged elevational view of the female connector plug illustrated in FIG. 1, and showing the same disconnected from the male connector plug.

FIG. 8 is a left side elevational view of the structure illustrated in FIG. 7, taken along the line 8—8 thereof, and looking in the direction of the arrows.

FIG. 9 is a top plan view of the structure illustrated in FIG. 7, taken along the line 9—9 thereof, and looking in the direction of the arrows.

FIG. 10 is a bottom plan view of the structure illustrated in FIG. 7, taken along the line 10—10 thereof, and looking in the direction of the arrows.

FIG. 11 is an elevational section view of the structure illustrated in FIG. 9, taken along the line 11—11 thereof, and looking in the direction of the arrows.

FIG. 12 is a horizontal section view of the structure illustrated in FIG. 7, taken along the line 12—12 thereof, and looking in the direction of the arrows.

FIG. 13 is an elevational view of the electrical disconnect means of the present invention and showing the male and female connector plugs attached in a right angle position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and in particular to FIG. 1, wherein is shown an illustrative embodiment of the invention, the numeral 10 generally designates a molded female connector plug employed in the invention, and the numeral 11 generally designates a molded male connector plug employed in the invention. The female and male connector plugs 10 and 11 are connected together in an in-line combination, and they are shown mounted in a pair of abutting support members 12 and 13, as for example, a pair of abutting solenoid valve housing members. The male connector plug 11 is operatively mounted in the valve member 13 and the female connector plug 10 is operatively mounted in the valve member 12, as more fully described hereinafter. The connector plugs 10 and 11 are adapted to be mounted in separate abutting support elements as 12 and 13, whereby when the two elements 12 and 13 are moved apart the connector plugs 10 and 11 will be automatically disconnected.

As shown in FIGS. 1, 2 and 3, the male connector plug 11 includes a cylindrical molded body or post 14 which is provided with an integral, half-round body dirt and moisture seal that extends around the outer periphery of the cylindrical body 14. Integrally formed on the inner end of the plug body 14, on the periphery thereof, is a radially outward extended orientation lug 16. The orientation lug 16 is adapted to be slidably mounted into a mating slot 17 formed in the valve member 13, and it is used to align the plug 11 and prevent rotation. The numeral 18 designates the inner end wall of the slot 17.

As shown in FIGS. 1, 2 and 3 the inner end of the male plug body 14 is designated by the numeral 19. The inner end of the integral orientation lug 16 is co-planar with the inner end 19 of the male plug body 14. As shown in FIG. 1, the inner portion of the male plug body 14 is adapted to be seated within a suitable cylindrical bore or seat hole 20 formed in the valve member 13. The slot 17 communicates with the hole 20.

As best seen in FIGS. 5 and 6, the numeral 23 designates a molded grip or extension which is triangular in cross section and which is integrally formed with the

body 14. The grip 23 is provided with integral half-round hand grip peripheral extensions 24 on the outer face thereof which are longitudinally spaced apart. The number 26 designates the inner end of the grip 23. The hand grip 23 extends into the reduced diameter bore 25 which is an extension of the bore 20. The hand grip 23 is provided with a laterally outward extended integral extension 22 which comprises a locating member that has a shoulder 21 which abuts the transverse shoulder formed at the intersection of the bores 20 and 25.

As shown in FIGS. 1 and 3 the male plug 11 is provided with a ground lead wire, generally indicated by the numeral 28, and a pair of lead wires, generally indicated by the numerals 29 and 30. As illustrated in FIG. 3, each of the lead wires 29 and 30 includes a wire 35 which is coated with a suitable plastic coating 34. As shown in FIG. 3, the wire 35 for the lead wire 29 is operatively connected by crimping or soldering to a connector member 36 on the inner end of a male spade terminal 32. The other lead wire 35 is connected in the same manner to another male spade terminal 33 which is laterally spaced apart from the terminal 32, as shown in FIGS. 3 and 4. The ground wire 28 also includes a wire 38 enclosed in a suitable plastic coating 37 and operatively connected in the same manner as the other wires to a male spade terminal 31.

As best seen in FIGS. 2, 3 and 4, the outer end 39 of the male plug body 14 is flat or perpendicular to the longitudinal axis of the plug. As best seen in FIGS. 2 and 4, the male plug 11 is provided with an integral, outwardly and longitudinally extended half-round extension 41. The numeral 42 in FIG. 2 indicates the rounded outer surface of the plug extension 41, and the numeral 43 indicates its flat, longitudinally extended inner face 43. The outer end of the extension 41 is rounded, as indicated by the numeral 44 in FIGS. 2 and 3. As shown in FIG. 3 the extension 41 is provided with straight and parallel side edges 45, along the outer sides thereof. The straight side edges 45 extend to a point where they connect with the rounded outer surface 44. As shown in FIG. 4, a ground symbol 46 is provided on the outer face 39 of the male plug 11, at a point adjacent the male spade terminal 31, for identification purposes. As shown in FIG. 6, a second ground symbol 48 is provided on the side of the triangular male grip portion 23.

As shown in FIG. 1, the female connector plug 10 includes a cylindrical molded body or post 50 which is provided with a peripheral groove 51 in which is operatively mounted an O-ring seal 54. The female plug body 50 is provided with a flat outer end 52 and a flat inner end 53. In the arrangement of FIG. 1, the female plug body 50 is slidably mounted in the bore 58 in the valve member 12 and the seal 54 seals the bore 58 from dirt and moisture entry. The inner flat end 53 of the plug body 50 is adapted to be seated on the inner end wall 55 of the bore 58. The female plug body 50 is retained in a predetermined position in the bore 58 by an orientation lug 56 which is integrally formed on the plug body 50 and which is slidably mounted in a slot 57 which communicates with the bore 58.

As shown in FIGS. 1, 7 and 8, the female plug body 50 has an elongated portion removed along one side thereof so as to provide an elongated flat or straight face 60 which is offset inwardly from the outer periphery of the plug body 50 and which is adapted to be seated against the flat face 43 on the extension 41 of

the male plug 11. The female plug flat face 60 terminates at the inner end thereof at a curved wall portion 44 that extends outwardly to the outer periphery of the female plug body 50 and which is adapted to receive the curved lower end 44 of the male plug extension 41.

As shown in FIG. 1, the female plug body 50 is provided with an integral molded hand grip 62 on the inner end thereof. The grip 62 is provided with an integral half-round peripheral extension or bead 63 that is adapted to engage the surface of the bore 64 in which the hand grip 62 is located, for sealing against dust and moisture. Integrally formed on the outer end of the hand grip 62 is a retaining lip 65 which is adapted to engage the outer face 66 of the valve member 12 in which the female plug 10 is seated.

As shown in FIGS. 7 and 8, the female plug 10 is provided with a lead wire 69, which functions as a ground wire, and a pair of power conducting lead wires 70 and 71. The lead wires 69, 70 and 71 are molded into the female plug 10 in the same manner as the lead wires for the male plug 11.

As illustrated in FIGS. 7 and 8, each of the lead wires 70 and 71 includes a wire 72 which is coated with a suitable plastic coating 73. As best seen in FIGS. 9, 11 and 12, the female plug 10 is provided with three receptacle type terminals of envelope design which are open at the end opposite the lead wire connection and on one side. This receptacle type terminal structure allows a male spade terminal to enter from two directions 90 degrees apart or any angle in between. The lead wires 70 and 71 are operatively connected to a pair of the receptacle type terminals generally indicated by the numeral 76. The ground lead wire 69 is operatively connected to a receptacle type terminal generally indicated by the numeral 86.

As best seen in FIG. 11, each of the receptacles 76 is provided with a reduced diameter inner end 74 in which is fixedly connected one end of a wire 72 by any suitable means, as by crimping or soldering. The outer end 75 of each of the receptacles 76 is enlarged in diameter and seated in a bore 77. The terminals 76 and 86 are recessed in the molded insulating material of the female plug body 50 to protect against shock or shorting. It will be understood that each of the lead wires 70 and 71 is connected in the same manner to its respective receptacle 76, and that the ground lead wire 69 is also connected in the same manner to its receptacle 86. As shown in FIG. 11, the ground receptacle 86 is positioned closer to the outer surface 52 of the plug body 50 so that the ground circuit will be the first circuit to be made and the last circuit to be broken.

As shown in FIGS. 7 and 8, the female plug 10 is provided with a ground lead wire 69 and a pair of power conducting lead wires 70 and 71 which are molded into the plug body 50.

As shown in FIG. 12, each of the female terminal receptacles 76 includes a pair of integral, spaced apart locator blades 79 which are positioned in longitudinally extended slot 78 in the plug body 50. The locator blades 79 are spaced apart to provide a slot 80 for the sliding engagement and reception of a male spade terminal on the male plug 11. As shown in FIG. 12, the blades 79 converge outwardly from their respective receptacle portions 75 and they are adapted to be flexed outwardly to make a good sliding contact with a spade male terminal when it is inserted therebetween.

As shown in FIG. 12, the opening 80 between the female receptacle terminal blades 79 is aligned with a passage 81 in the insulating plug body 50 which is in turn connected to a tapered inlet slot 82. The slot 82 is formed along the longitudinal face 60 of the female plug body 50. As shown in FIG. 11, the opening 80 between the terminal blades 79 also communicates with a longitudinally extended slot 84 in the insulating plug body 50 which terminates in a tapered slot 83 formed on the outer end 52 of the female plug body 50. As shown in FIG. 9, the tapered slots 82 and 83 communicate with each other. The slots 81 and 84 also communicate with each other.

As shown in FIG. 12, the ground receptacle 86 is also provided with a pair of spaced apart locator blades 87 which have an opening 88 therebetween for the reception of the ground male spade terminal 31 on the male plug 11. It will be seen that the locator blades 87 are only spaced from the plug side face 60 by a tapered slot 85 which extends longitudinally along the side face 60 (FIG. 8). As shown in FIG. 11, the female ground terminal locator blades 87 are also disposed adjacent the plug end face 52, and they are spaced from the plug end face 52 by a tapered slot 90. As shown in FIG. 9, the female plug 11 is provided with a ground symbol 89 on the outer end face 52. The location of the female ground terminal blades 87 nearer the plug side face 60 and the plug end 52 than the other female terminal blades provides a making first of the ground circuit and a breaking last of this circuit.

FIG. 1 illustrates the two plugs of the present invention being assembled in an in-line connection, and FIG. 13 illustrates these plugs mounted in a right-angle connection. In FIG. 13, the plugs 10 and 11 are shown as being mounted in a three-element supporting structure, as for example, three portions of a valve structure, as indicated by the numerals 91, 92 and 99. In the structure illustrated in FIG. 13, the valve structure portions 92 and 99 would be lifted upwardly to separate the two plug members 10 and 11. The two plug members 10 and 11 may also be reconnected by merely reversing the last mentioned movement of the valve structure portions 92 and 99 relative to the valve structure portion 91.

In the structure of FIG. 13, the female plug 10 is shown having its hand grip portion 62 slidably mounted in a bore 94 in the valve structure portion 91, and with the inner end of the plug body being mounted in a larger bore 93 in the valve structure portion 91. The orientation lug 56 is slidably mounted in a slot 95 formed in the valve structure portion 91. The outer end of the male plug 11 is mounted in the bore 96 in the valve structure portion 92. A second bore 97 is formed at right angles to the bore 96 in the valve structure portion 92, and the male plug 11 is slidably mounted into the bores 97 and 98 and positioned at right angles to the female plug 10. The orientation lug 16 on the male plug 11 is slidably mounted in a suitable slot 98 formed in the valve structure portion 92. The hand grip portion 23 of the male plug 11 is mounted in a bore 100 in the third valve structure portion 99. The shoulder 22 of the male plug 11 is slidably mounted in a slot 102 in the valve structure portion 99 which communicates with the bore 100. The lead wires 28, 29 and 30 extend outwardly through a bore 101 formed through the valve structure portion 99.

It will be seen that the female plug 10 and the male plug 11 of the present invention provide a two-piece electrical disconnect means which can be assembled for use as an in-line connection or for use in two directions 90° apart, or at any angle therebetween. The plugs 10 and 11 are molded to their respective lead wires, and the electrical metal terminals employed in the plugs are positioned and insulated by the molded plugs. Regardless of which position the plugs are disposed in, the amount of contact areas between the male spade terminals and the female receptacle terminals is essentially the same, and the amount of insulation remains essentially the same. The plugs 10 and 11 may be separated or disconnected by an axial force when they are connected in an in-line connection, and by a perpendicular force when they are connected in a 90° connection, and at a force at any angle in between the first two mentioned positions when they are so connected. It will be understood that any number of lead wires and terminals may be employed.

While it will be apparent that the preferred embodiment of the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change.

We claim:

1. An electrical disconnect means comprising:

- a. a male plug having an insulating body which carries a plurality of spade type male terminals and with each male terminal electrically connected to a lead wire;
- b. a female plug having an insulating body which carries a plurality of receptacle type female terminals which are each open on the outer end and one side thereof for the reception of a spade type male terminal at any angular position between an in-line connection with the male terminal inserted into the open outer end of the female terminal and a right-angle connection with the male terminal inserted into the open side of the female terminal, and with each female terminal electrically connected to a lead wire;
- c. said female plug body having a flat outer end perpendicular to the longitudinal axis thereof through which is accessible the open end of each of the receptacle type female terminals;
- d. said female plug body having a flat longitudinally extended surface on said one side thereof through which is accessible the open side of each of the receptacle type female terminals;
- e. said male plug body having a flat outer end perpendicular to the longitudinal axis thereof with the spade type male terminals extended outward therefrom; and,
- f. said male plug body having a longitudinal extension on one side of said outer end and which is provided with a flat inner face perpendicular to said flat outer end, whereby when the male plug is connected to the female plug in an in-line connection the flat outer end on the female plug body is seated against the flat outer end on the male plug body and the flat longitudinally extended surface on one side of the female plug body is seated against the flat inner face on the longitudinal extension on the male plug body, and when the female plug is attached to the male plug in a right angle connection, the flat outer end on the female plug body seats on

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the flat inner face on the longitudinal extension on the male plug body and the flat outer end on the male plug body seats against the longitudinally extended flat surface on one side of the female plug body.

2. An electrical disconnect means as defined in claim 1, wherein:

a. each of said male and female plug bodies is molded to the lead wires electrically attached to the terminals carried therein.

3. An electrical disconnect means as defined in claim 2, wherein:

a. one of said plurality of female terminals is a ground terminal; and,

b. one of said plurality of male terminals is a ground terminal.

4. An electrical disconnect means as defined in claim 3, wherein:

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a. the ground female terminal is located closer to the flat outer end and the flat longitudinally extended surface than are the other female terminals so that the male ground terminal will contact the female ground terminal before the other male and female terminals contact during a connection operation, and the male ground terminal will break last from the female terminal when the other male and female terminals break from each other during a disconnection operation.

5. An electrical disconnect means as defined in claim 3, wherein:

a. the contact area between a female terminal and a male terminal is essentially the same when they are connected in an in-line connection and in a right-angle connection.

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