Aug. 10, 1965 J. S. CARPINONE 3,200,365

SAFETY BALL SOCKET CONNECTOR FOR ELECTRIC PLUGS

Filed Oct. 28, 1963

2 Sheets-Sheet 1

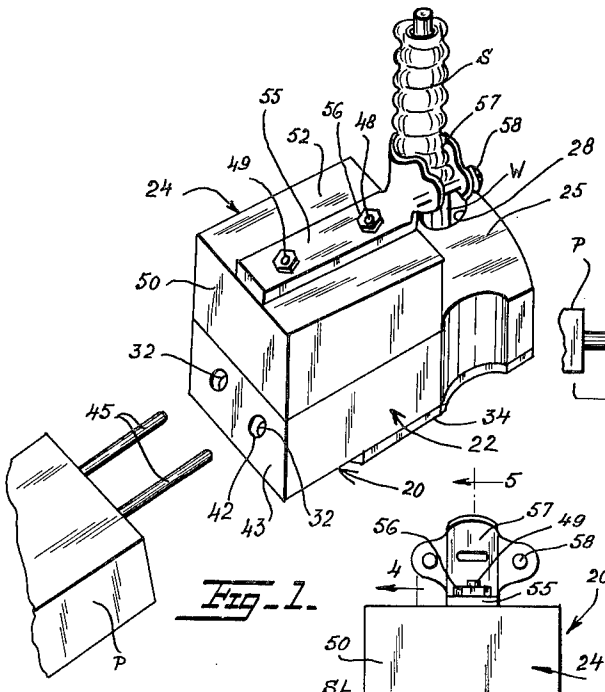


Fig. 1.

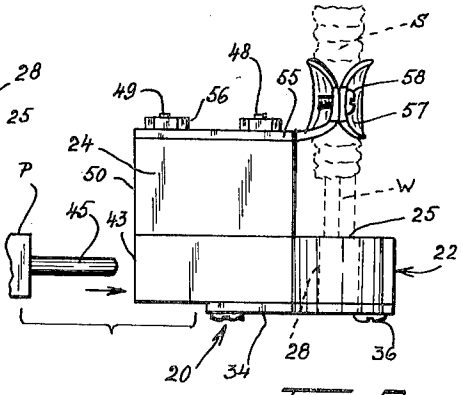


Fig. 2.

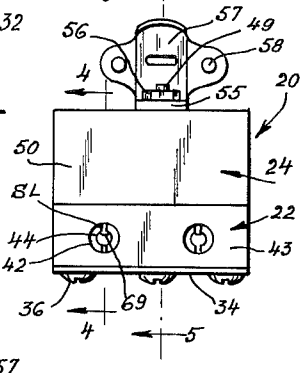


Fig. 3.

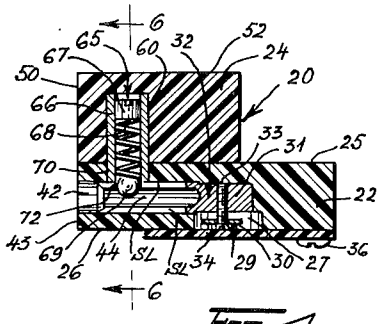


Fig. 4.

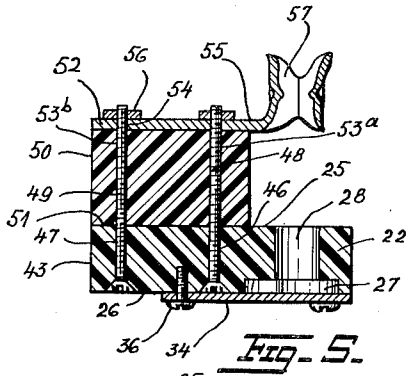


Fig. 5.

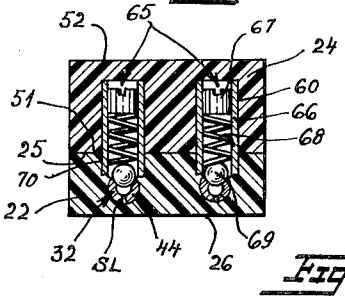


Fig. 6.

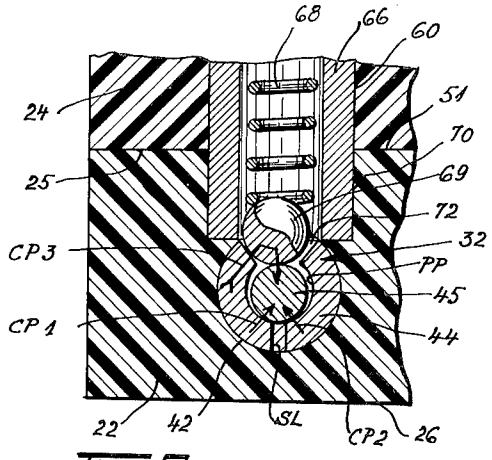


Fig. 7.

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Aug. 10, 1965 J. S. CARPINONE 3,200,365

SAFETY BALL SOCKET CONNECTOR FOR ELECTRIC PLUGS

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2 Sheets-Sheet 2

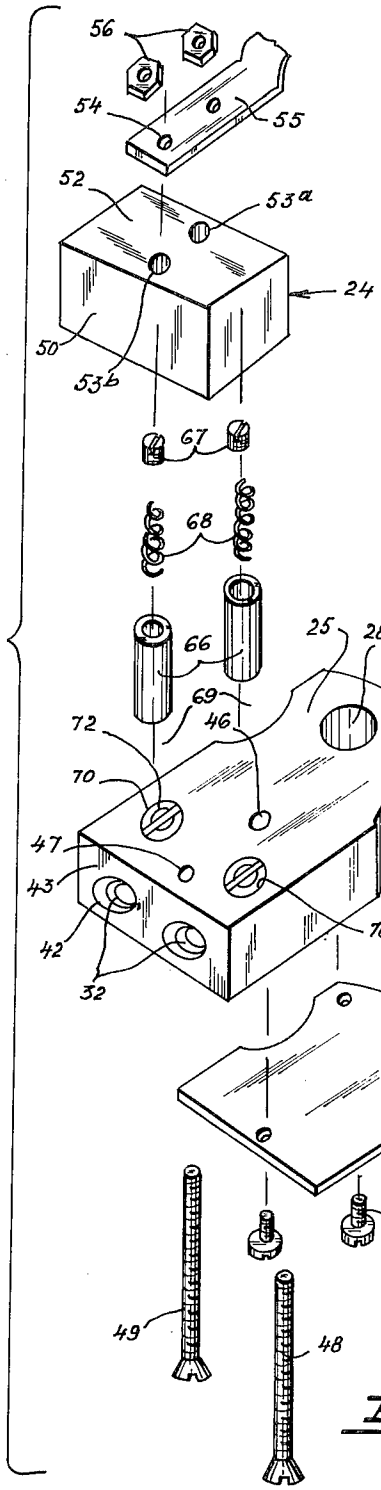


Fig. 11.

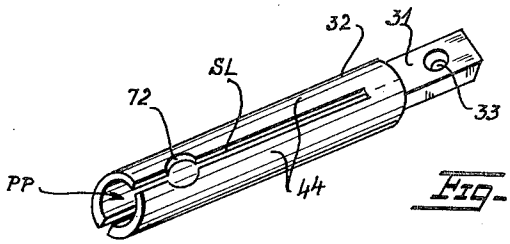


Fig. 8.

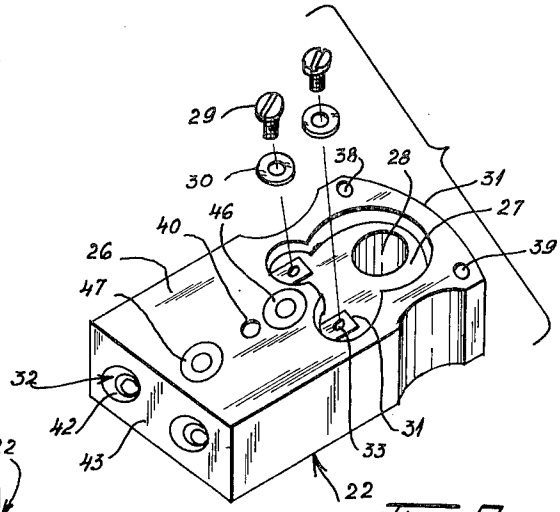


Fig. 9.

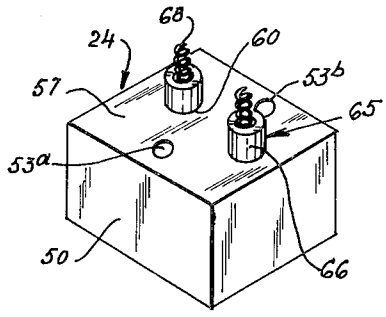


Fig. 10.

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3,200,365

SAFETY BALL SOCKET CONNECTOR FOR ELECTRIC PLUGS

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Filed Oct. 28, 1963, Ser. No. 319,363
8 Claims. (Cl. 339—103)

This invention concerns an improved electrical connector or receptacle with spring loaded ball grip and contact means.

According to the invention there is provided an electrical connector or receptacle especially adapted for attachment to wires at the end of a cable enclosed in a metal shield. The electrical connector has socket contact members for receiving prongs of a terminal plug. In order to effect a positive frictional grip on the prongs when inserted in the contact members of the receptacle, to insure electrical continuity between the prongs and contact members at all times, and to prevent sparking between the prongs and contact members, there is provided a spring and ball assembly in the electrical connector.

In accordance with the invention, the connector or receptacle is provided with an auxiliary lateral block in which spring and ball assemblies are mounted. Each of the contact members in the receptacle has a concave seat formed therein through which a ball loaded by a spring can extend for engaging one of the prongs of the plug. The ball exerts lateral pressure on the prong to insure complete and continuous electrical continuity between the prong and contact member. In addition, the ball serves as an electrical circuit element to bridge points of the prong and contact member. The net results are lowered contact resistance, and prevention of sparking and of erratic discontinuous contacts between the prongs of the plug and the socket members of the receptacle.

It is therefore one object of the invention to provide an electrical receptacle for a plug, in which the receptacle has spring loaded ball grip and contact assemblies associated with contact members in the receptacle to engage prongs of the plug.

A further object is to provide an electrical receptacle as described, wherein the spring and ball assemblies are housed in a block laterally mounted on the receptacle.

Another object is to provide an electrical receptacle as described wherein the assemblies are provided with adjustable means for varying tension in the springs and pressure on the balls of the assemblies.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIG. 1 is a perspective view of an electrical receptacle embodying the invention, shown with part of an associated plug, and with part of an attached shielded cable.

FIG. 2 is a side view of the receptacle with part of the plug.

FIG. 3 is a front end view of the receptacle.

FIG. 4 and FIG. 5 are sectional views taken on lines 4—4 and 5—5, respectively, of FIG. 3.

FIG. 6 is a sectional view taken on line 6—6 of FIG. 4.

FIG. 7 is an enlarged fragmentary sectional view similar to a portion of FIG. 6, with a prong of a plug shown inserted in the receptacle.

FIG. 8 is an enlarged perspective view of a contact member of the receptacle.

FIG. 9 is an exploded perspective view of a body portion of the receptacle shown in an inverted position, with associated parts.

FIG. 10 is a perspective view of a block employed in the receptacle shown with parts of the spring and ball assemblies.

FIG. 11 is an exploded perspective view of parts of the receptacle.

Referring to the drawings, there is shown in FIGS. 1–7 the receptacle 20 including an elongated generally rectangular body portion 22 with an auxiliary rectangular block 24. The block is equal in width to that of body portion 22 but is shorter than the body portion.

The body portion 22 has flat opposite sides 25, 26. In the underside 26 shown to best advantage in FIGS. 4, 5 and 9 is a rather large recess 27 communicating with a large hole 28 which extends through the body portion to open at upper side 25. Wires W extending out of one end of a metal shield S can be passed through hole 28 and recess 27 to be engaged by screws 29 and washers 30 at rear ends 31 of contact members 32. The ends 31 of the contact members have threaded holes 33 to receive the screws 29; see FIGS. 4 and 8. The recess 27 is covered by a removable flat plastic plate 34 having holes 35 through which extend screws 36. The screws are seated in threaded holes 38, 39 and 40 formed at the end corners and near the center of the body portion 22 at side 26.

The body portion 22 has two cylindrical bores 42 extending inwardly from front end 43. In these bores are embedded two generally cylindrical hollow contact members 32. The contact members are formed with diametrally slit arcuate forward sections 44 serving as spring fingers 44 and defining cylindrical passages PP into which the prongs 45 of a plug P can be axially inserted. The rear ends 31 of the contact members are generally rectangular and extend rearwardly to be exposed at the recess 27 for attachment of wires W to the contact members.

The body portion 22 has two holes 46, 47 extending through the body portion. Screws 48 and 49 can be inserted through these holes. The holes are countersunk at side 26 to receive the conical heads of the screws. The head of screw 48 will be concealed by plate 34 when it is attached by screws 36 to body portion 22. The head of screw 49 will be exposed at side 26; see FIG. 5.

Auxiliary block 24 is juxtaposed to side 25 of body portion 22 when the receptacle is assembled. The front end 50 of the block is flush with and in registration with the front end 43 of the body portion 22. The block has opposite flat sides 51, 52. Two spaced holes 53^a, 53^b extend through the block and are located in registration with holes 46, 47 of body portion 22. The screws 48, 49 extend through holes 53^a, 53^b. The free ends of the screws engage in holes 54 of a shield clamp 55. These holes can be threaded to engage the screws and locknuts 56 can be screwed on the ends of the screws projecting through holes 53. The clamp has arcuate fingers 57 engaged by screws 58 for embracing and holding shield S in axial alignment with hole 28 in body portion 22.

The block 24 is formed with two blind end cylindrical bores 60 extending inwardly of the block from side 51. Seated in these bores are spring and ball assemblies 65 each including a cylindrical internally threaded sleeve 66; see FIGS. 4, 7, 10 and 11. A set screw 67 is adjustably screwed into one end of sleeve 66. The screw bears axially on a coil spring 68 which in turn bears on a metal ball 69.

Body portion 22 is formed with two lateral holes or bores 70 registering with bores 60. Sleeves 66 seat in bores 70. Bores 70 are axially perpendicular to the axes of contact members 32 and are aligned with the diametral slits or spaces SL between sections 44 of the contact mem-

bers 32. The bores 70 extend inwardly from side 25 and terminate in a plane substantially tangential to the upper sides of the contact members. Lateral holes 72 with conical edges are formed in axial alignment with bores 60 and 70 at facing edges of slits SL and serve as conical seats for the lower portions of the balls 69 when the prongs 45 of the plug are removed from the receptacle. The balls then project into passages PP between spring fingers 44.

When the prongs 45 are inserted in the passages PP of the socket members of the receptacle as shown on an enlarged scale in FIG. 7, the springs are compressed and the balls are slightly retracted or pushed outwardly. It will be noted in FIG. 7 that the pressure of the springs on the balls is transmitted to the prongs 45 forcing and holding them in firm and continuous contact with the sections 44 of the contact members at contact points CP1 and CP2. In addition, each ball 69 provides another circuit path CP3 between one of the contact sections 44 and the inserted prong 45. This occurs because the ball will tend to roll slightly laterally off the top dead center of the prong under pressure of the spring to become securely seated in conical hole 72 and bridge section 44 and prong 45. The two balls 69, which are continuously spring pressed against the prongs, prevent the prongs from shaking laterally in or slipping axially out of the receptacle. The continuous contact between the prongs and socket members maintained by the spring loaded balls prevents sparking. In addition, the circuit paths CP3 provided by the balls 69 reduce the inherent electrical contact resistance between the prongs and socket members. The spring fingers may also grip the sides of the prongs if the prongs are not too narrow.

The block 24 is held with the spring and ball assemblies securely on the body portion 22 by the screws 48, 49 locked by nuts 56. The entire receptacle can be very quickly assembled, or disassembled, when required. Since the recess 27 is uncovered by removing plate 34, it is not necessary to disturb the block 24 and its contents to attach and detach wires W from the receptacle.

The block 24 and body portion 22 may be made of rigid plastic insulation material. The several bores may be formed at the time these plastic parts are molded or subsequently. The holes 72 in the contact members can be made prior or subsequent to assembly or embedding of the contact members in the body portion 22 of the receptacle.

While I have illustrated and described the preferred embodiment of my invention, it is to be understood that I do not limit myself to the precise construction herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. An electrical connector for a plug having a pair of prongs, comprising a rectangular body portion having a pair of parallel first bores extending inwardly from one end of said body portion, a pair of cylindrical hollow contact members axially disposed in said bores and having axial passages for receiving said prongs respectively, said body portion having a recess at the other end thereof, said contact members having ends thereof disposed in and exposed at said recess, said body portion having a first lateral hole communicating with said recess for passing wires into the recess to connect with said ends of the contact members, each of said contact members having a lateral hole therein between its opposite ends, said body portion having a pair of other lateral holes respectively aligned axially with the lateral holes in the contact members and communicating therewith, a rectanguar block, screws extending through said body portion and block to hold the block against one side of said body portion, a clamp for a cable shield engaged by said screws at one

side of said block, said clamp having clamp fingers for engaging said cable shield aligned with the first lateral hole for passing wires from said shield into said recess, said block having a pair of blind bores respectively axially aligned and registering with said other lateral holes, a compressed coil spring in each of said blind bores extending into one of said other lateral holes, a ball at one end of each spring engaged by the spring and pressed into one lateral hole in a contact member, said balls projecting into the passages in said contact members, whereby the springs contract and the balls are retracted when the prongs of the plug are inserted into said contact members while the spring hold the balls under pressure to keep the prongs pressed laterally into contact with the contact members.

2. An electrical connector for a plug having a pair of prongs, comprising a rectangular body portion having a pair of parallel first bores extending inwardly from one end of said body portion, a pair of cylindrical hollow contact members axially disposed in said bores and having axial passages for receiving said prongs respectively, said body portion having a recess at the other end thereof, said contact members having ends thereof disposed in and exposed at said recess, said body portion having a first lateral hole communicating with said recess for passing wires into the recess to connect with said ends of the contact members, each of said contact members having a lateral hole therein between its opposite ends, said body portion having a pair of other lateral holes respectively aligned axially with the lateral holes in the contact members and communicating therewith, a rectangular block, screws extending through said body portion and block to hold the block against one side of said body portion, a clamp for a cable shield engaged by said screws at one side of said block, said clamp having clamp fingers for engaging said cable shield aligned with the first lateral hole for passing wires from said shield into said recess, said block having a pair of blind bores respectively axially aligned and registering with said other lateral holes, an internally threaded sleeve in each of the blind bores extending into one of said other lateral holes, a coil spring in each of the sleeves, a screw in each of the sleeves at one end thereof bearing on one end of the coil spring for adjusting compression thereof, a ball at the other end of each spring and engaged thereby, said balls being pressed into the lateral holes in the contact members by the compressed springs with the balls extending into the passages in the contact members, whereby the springs contract and the balls are retracted when the prongs of the plug are inserted into the contact members while the springs hold the balls under pressure to keep the prongs pressed laterally into contact with the contact members.

3. An electrical connector for a plug having a prong, comprising a rectangular body portion made of insulation material and having a first bore extending inwardly from one end of said body portion, a cylindrical hollow contact member axially disposed in said bore and having an axial passage for receiving said prong, said body portion having a recess at the other end thereof, said contact member having one end thereof disposed in and exposed at said recess, said body portion having a first lateral hole communicating with said recess for passing a wire into the recess to connect with said end of said contact member, said contact member having a lateral hole therein between its ends, said body portion having another lateral hole aligned axially with the lateral hole in the contact member and communicating therewith, a rectangular block made of insulation material, screws extending through said body portion and block and holding the block against one side of said body portion, a clamp for a cable shield engaged by said screws at one side of said block, said clamp having fingers for engaging said cable shield aligned with the first lateral hole for passing a wire from said cable shield into said recess, said block having a blind bore axially aligned and registering with said other

lateral hole, a compressed coil spring in said blind bore and extending into said other lateral hole, a ball at one end of the spring engaged by the spring and pressed into the lateral hole in the contact member, said ball projecting into said passage in the contact member, whereby the spring contracts and the ball is retracted when the prong of the plug is inserted into the contact member while the spring holds the ball under pressure to keep the prong pressed laterally into contact with the contact member to effect one electrical connection, and whereby the ball serves as a circuit element to complete a second electrical connection between the prong and contact member to lower electrical contact resistance between the prong and contact member, to prevent sparking between the prong and contact member, and to hold the prong frictionally in said contact member.

4. An electrical connector for a plug having a prong, comprising a rectangular body portion made of insulation material and having a first bore extending inwardly from one end of said body portion, a cylindrical hollow contact member axially disposed in said bore and having an axial passage for receiving said prong, said body portion having a recess at the other end thereof, said contact member having one end thereof disposed in and exposed at said recess, said body portion having a first lateral hole communicating with said recess for passing a wire into the recess to connect with said end of said contact member, said contact member having a lateral hole therein between its ends, said body portion having another lateral hole aligned axially with the lateral hole in the contact member and communicating therewith, a rectangular block made of insulation material, screws extending through said body portion and block and holding the block against one side of said body portion, a clamp for a cable shield engaged by said screws at one side of said block, said clamp having fingers for engaging said cable shield aligned with the first lateral hole for passing a wire from said cable shield into said recess, said block having a blind bore axially aligned and registering with said other lateral hole, a threaded sleeve in the blind bore and other hole, a coil spring in said sleeve, a screw adjustably disposed in said sleeve and bearing on one end of said spring to maintain the same in a compressed condition, an electrically conductive ball at the other end of the spring engaged by the spring and pressed into the lateral hole in the contact member, said ball projecting into said passage in the contact member, whereby the spring contracts and the ball is retracted when the prong of the plug is inserted into the contact member while the spring holds the ball under pressure to keep the prong pressed laterally into contact with the contact member to effect one electrical connection, and whereby the ball serves as a circuit element to complete a second electrical connection between the prong and contact member to lower electrical contact resistance between the prong and contact member, to prevent sparking between the prong and contact member, and to hold the prong frictionally in said contact member.

5. An electrical connector for a plug having a prong, comprising a rectangular body portion having a first bore extending inwardly from one end thereof, a cylindrical hollow contact member disposed in said bore in axial alignment therewith, said contact member having an axial passage to receive said prong, said contact member having a lateral hole therein, said body portion having a lateral other hole communicating with and axially aligned with the hole in the contact member, a rectangular block, means securing said block to one side of said body portion, said block having a lateral blind bore therein axially aligned with the holes in the contact member and body portion, a threaded sleeve in the blind bore and other hole, a coil spring in said sleeve, a set screw adjustably disposed in said sleeve and bearing on one end of said spring to maintain the same in a compressed condition, an electrically conductive ball engaged at the other end of said spring

and disposed in said other hole, said ball being pressed by said spring into the hole in the contact member, said ball extending into the passage in the contact member, whereby the spring contracts and the ball is retracted when said prong of said plug is inserted into said contact member while the spring holds the ball under pressure to keep the prong pressed laterally into contact with said contact member to complete one circuit path, and whereby said ball serves as a circuit element to complete an auxiliary circuit path between said prong and said contact member to lower contact resistance between the prong and contact member to prevent sparking between the prong and contact member, and to hold the prong frictionally in said contact member, said contact member being partially split longitudinally to define two spring fingers for frictionally gripping said prong, said lateral hole being formed on adjacent edges of the two spring fingers and having a generally conical shape for retaining said ball therein.

6. An electrical connector for a plug having a pair of prongs, comprising a rectangular body portion having a pair of parallel first bores extending inwardly from one end of said body portion, a pair of cylindrical hollow contact members axially disposed in said bores and having axial passages for receiving said prongs respectively, said body portion having a recess at the other end thereof, said contact members having ends thereof disposed in and exposed at said recess, said body portion having a first lateral hole communicating with said recess for passing wires into the recess to connect with said ends of the contact members, each of said contact members having a lateral hole therein between its opposite ends, said body portion having a pair of other lateral holes respectively aligned axially with the lateral holes in the contact members and communicating therewith, a rectangular block, screws extending through said body portion and block to hold the block against one side of said body portion, a clamp for a cable shield engaged by said screws at one side of said block, said clamp having clamp fingers for engaging said cable shield aligned with the first lateral hole for passing wires from said shield into said recess, said block having a pair of blind bores respectively axially aligned and registering with said other lateral holes, a compressed coil spring in each of said blind bores extending into one of said other lateral holes, a ball at one end of each spring engaged by the spring and pressed into one lateral hole in a contact member, said balls projecting into the passages in said contact members, whereby the springs contract and the balls are retracted when the prongs of the plug are inserted into said contact members while the springs hold the balls under pressure to keep the prongs pressed laterally into contact with the contact members, said contact members each being partially split longitudinally to define two spring fingers for frictionally gripping said prongs, the lateral holes in the contact members being formed on adjacent edges of the spring fingers and having generally conical shapes to define conical seats for retaining the balls therein.

7. An electrical connector for a plug having a pair of prongs, comprising a rectangular body portion having a pair of parallel first bores extending inwardly from one end of said body portion, a pair of cylindrical hollow contact members axially disposed in said bores and having axial passages for receiving said prongs respectively, said body portion having a recess at the other end thereof, said contact members having ends thereof disposed in and exposed at said recess, said body portion having a first lateral hole communicating with said recess for passing wires into the recess to connect with said ends of the contact members, each of said contact members having a lateral hole therein between its opposite ends, said body portion having a pair of other lateral holes respectively aligned axially with the lateral holes in the contact members and communicating therewith, a rectangular block, screws extending through said body portion and block to hold the block against one side of said body portion,

a clamp for a cable shield engaged by said screws at one side of said block, said clamp having clamp fingers for engaging said cable shield aligned with the first lateral hole for passing wires from said shield into said recess, said block having a pair of blind bores respectively axially aligned and registering with said other lateral holes, an internally threaded sleeve in each of the blind bores extending into one of said other lateral holes, a coil spring in each of the sleeves, a screw in each of the sleeves at one end thereof bearing on one end of the coil spring for adjusting compression thereof, a ball at the other end of each spring and engaged thereby, said balls being pressed into the lateral holes in the contact members by the compressed springs with the balls extending into the passages in the contact members, whereby the springs contract and the balls are retracted when the prongs of the plug are inserted into the contact members while the springs hold the balls under pressure to keep the prongs pressed laterally into contact with the contact members, said contact members each being partially split longitudinally to define two spring fingers for frictionally gripping said prongs, the lateral holes in the contact members being formed on adjacent edges of the spring fingers and having generally conical shapes to define conical seats for retaining the balls therein.

8. An electrical connector for a plug having a prong, comprising a rectangular body portion made of insulation material and having a first bore extending inwardly from one end of said body portion, a cylindrical hollow contact member axially disposed in said bore and having an axial passage for receiving said prong, said body portion having a recess at the other end thereof, said contact member having one end thereof disposed in and exposed at said recess, said body portion having a first lateral hole communicating with said recess for passing a wire into the recess to connect with said end of said contact member, said contact member having a lateral hole therein between its ends, said body portion having another lateral hole aligned axially with the lateral hole in the contact member and communicating therewith, a rectangular block made of insulation material, screws extending through said body portion and block and holding the block against one side of said body portion, a clamp for a cable shield engaged by said screws at one side of said block, said clamp having fingers for engaging said cable shield aligned with the first lateral hole for passing a wire from said cable shield into said recess, said block having a blind bore axially aligned and registering with said other lateral hole, a threaded sleeve in the blind bore and other hole, a coil spring in said sleeve, a screw adjustably disposed in said sleeve and bearing on one end of said spring to maintain the same in a compressed condition, an electrically conductive ball at the other end of the spring engaged by the spring and pressed into the lateral hole in the contact member, said ball projecting into said passage in the contact member, whereby the spring contracts and the ball is retracted when the prong of the plug is inserted into the contact member while the spring holds the ball under pressure to keep the prong pressed laterally into contact with the contact member to effect one electrical connection, and whereby the ball serves as a circuit element to complete a second electrical connection between the prong and contact member to lower electrical contact resistance between the prong and contact member, to prevent sparking between the prong the contact member, and to hold the prong frictionally in said contact member, said contact member being partially split longitudinally to define two spring fingers for frictionally gripping said prong, said lateral hole being formed on adjacent edges of the two spring fingers and having a generally conical shape for retaining said ball therein.

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