

Sept. 16, 1969

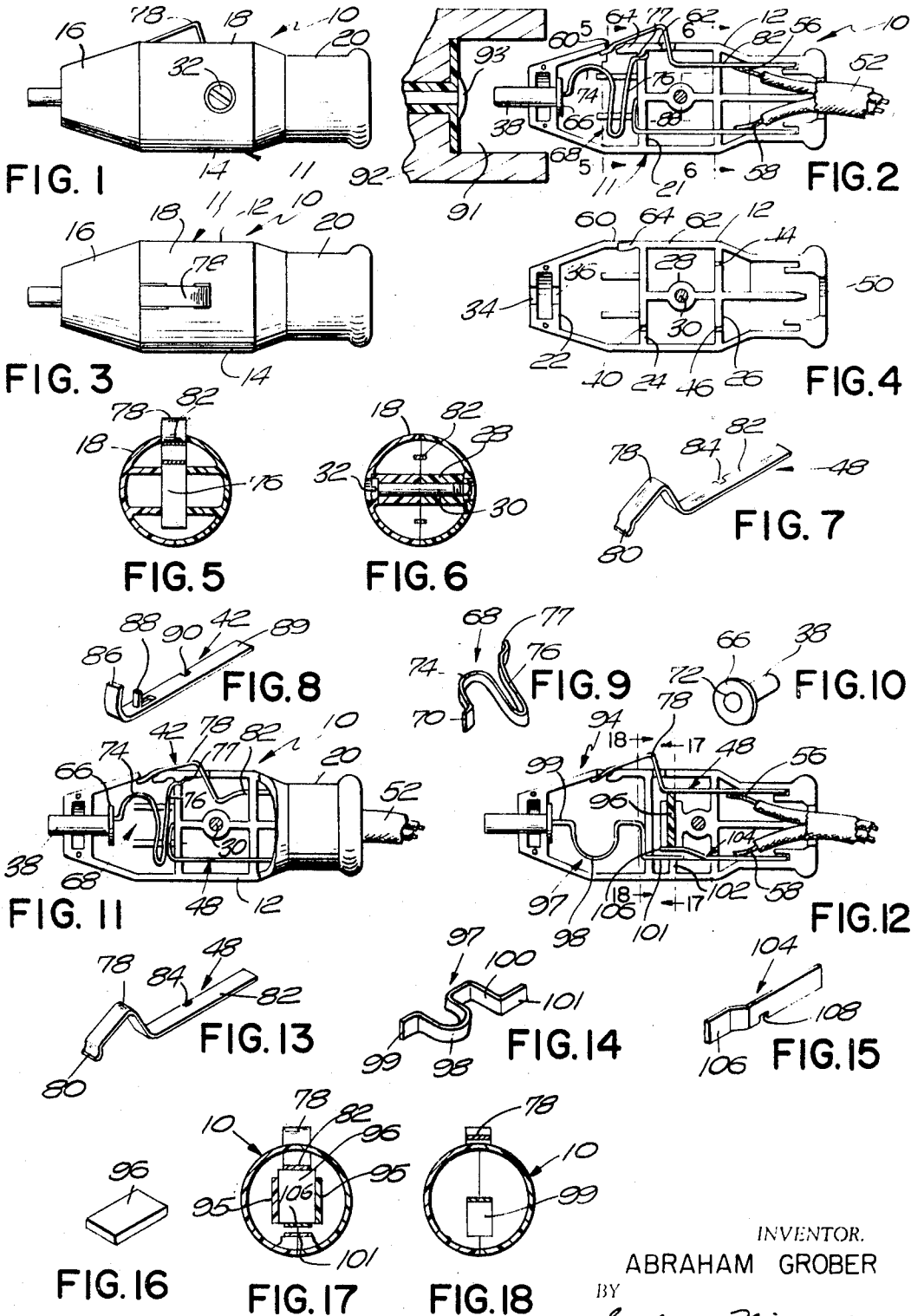
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3,467,796

ELECTRICAL CONNECTOR

Filed Feb. 20, 1967

2 Sheets-Sheet 1



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ELECTRICAL CONNECTOR

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2 Sheets-Sheet 2

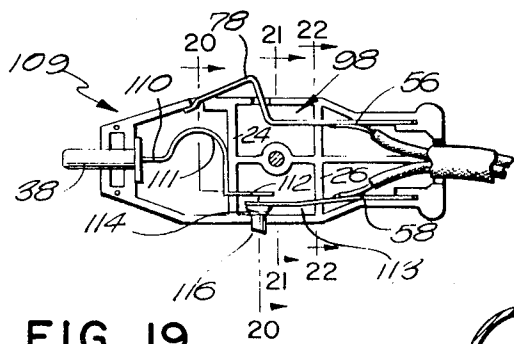


FIG. 19

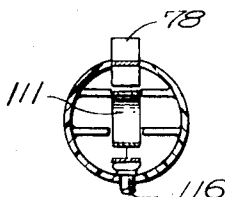


FIG. 20

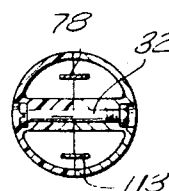


FIG. 21

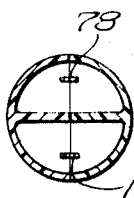


FIG. 22

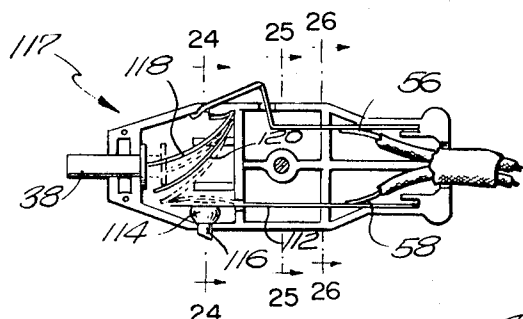


FIG. 23

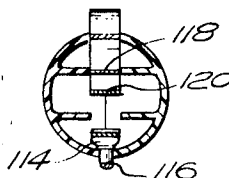


FIG. 24

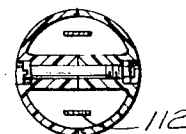


FIG. 25

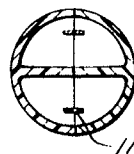


FIG. 26

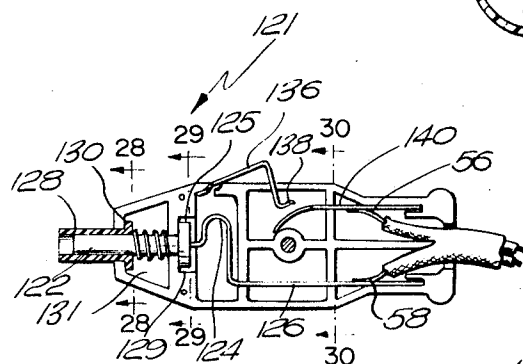


FIG. 27



FIG. 28

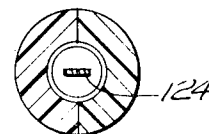


FIG. 29

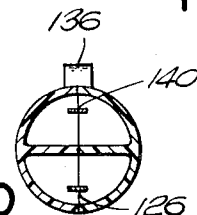


FIG. 30

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3,467,796

ELECTRICAL CONNECTOR

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U.S. Cl. 200—51.09

8 Claims

ABSTRACT OF THE DISCLOSURE

An electrical connector including a housing that is inserted into a socket and having contact members located within the housing, one of the contact members being normally disconnected from its conductor lead and being automatically connectable therewith upon insertion of the connector housing into the socket.

Background of the invention

The connector of the present invention is of the plug-in type and, more specifically, in the type of connector commonly known in the art as a twelve-volt connector. There are many devices which utilize this conventional type of connector, such as automotive devices and appliances which derive their power source when the connector is plugged into a standard automobile cigar lighter socket. This same type of connector is utilized by the radio and television industry to power their twelve-volt transistorized portable television sets.

In addition to deriving power from a battery source such as the conventional cigar lighter socket in an automobile, certain electric appliances and electronic equipment are manufactured to operate on the standard 110-volt household socket while at the same time comprising an attached or built-in rechargeable battery supply. In some of these units, while operating on 110 volts, there are facilities which enable a charging voltage to be simultaneously generated by the unit. In such applications, the battery pack has a socket or receptacle similar to those found in an automobile, and by inserting the 12-volt connector into said receptacle or socket, it is possible to recharge the portable battery pack while at the same time the basic unit is operating on 110 volts. It will be understood that in units of this type two separate connectors will be provided, namely, one connector for plugging into the 110-volt source, and a 12-volt connector for recharging purposes, as just described. The problem which exists here is that when the unit is operating on 110 volts, the contacts on the 12-volt connector are live, which means that if these contacts are accidentally crossed, a short circuit will result, which could prove injurious to the equipment itself, as well as harmful to the user.

Thus, the instant invention is directed to overcoming this problem by providing a 12-volt connector or the like wherein one of the contacts is normally disconnected from its conductor lead so that the exposed contact is not live, thus preventing inadvertent shorting. The connector is so constructed that when it is plugged into its socket, the normally disconnected contact automatically makes good electrical contact with its conductor lead so as to complete the circuit. It will therefore be seen that the instant invention is of value in all situations where a source of power is generated from within the appliance or equipment so as to make the contacts of the connector live, as opposed to the situation where the source of power is completely external, in which event the contacts of the connector are not live until the connector is plugged into the external source.

Summary of the invention

The present invention includes a connector for use with electrical appliances that is provided with a housing for insertion into a socket either for electrically connecting the appliance to a source of current for operating the appliance or for electrically connecting the battery circuit of the appliance to a source of current for recharging the battery. In some instances, the source of the charging current is an integral part of the appliance, in which case the connector of the present invention cannot only be used to receive current from an outside current source but can be used in a battery recharge circuit or as a connector in the operation of another electrical device. In order to avoid the heretofore known problem of including live contacts in the connector prior to insertion thereof into a socket, one of the contacts of the connector is normally located out of electrical communication with its conductor lead. By providing contacts that are compressible when the connector is inserted into a socket, the contacts may be electrically interconnected to the conductor leads for the connector only after insertion of the connector into a socket in which a contact to a source of current is located. Thus, in the present invention, a first contact member is located in the connector housing and extends exteriorly thereof, the first contact member being connectable to a conductor lead that is received in the housing. A second contact member is located in the housing and also extends exteriorly thereof and is connected to another conductor lead that projects into the housing. A spring contact is joined to the second contact member for urging it outwardly of the housing, the spring contact also being interconnectable to one of the conductor leads. Since one of the contact members is normally located out of electrical communication with its associated conductor lead and is movable into electrical communication with its conductor lead upon insertion of the housing of the connector into a socket, the compressible conductors act to complete a circuit when the connector is inserted into the socket.

Accordingly, it is an object of the present invention to provide an electrical connector that is adapted to be inserted into a socket and that includes at least one contact member that is normally located out of electrical communication with an associated conductor lead and that is interconnected to the conductor lead after insertion of the connector into the socket.

Another object of the invention is to provide a plug-in type electrical connector that includes contact members, one of which is normally disconnected until the connector is plugged into a socket so as to prevent inadvertent shorting across the contact members.

Still another object is to provide a plug-in electrical connector that includes a compressible male prong that projects from the nose of the connector and that is adapted to establish electrical communication through the connector upon compression of the male prong when the connector is inserted into a socket.

Other objects, features and advantages of the invention will become apparent as the description thereof proceeds when considered in connection with the accompanying illustrative drawings.

Description of the drawings

FIG. 1 is a side elevational view of the connector embodied in the present invention;

FIG. 2 is a view similar to FIG. 1 with a section of the housing removed so as to expose the interior of the connector;

FIG. 3 is a top plan view of the connector;

FIG. 4 is a view of the section of the connector illustrated in FIG. 2 with the electrical components removed therefrom;

FIG. 5 is a sectional view taken along lines 5—5 in FIG. 2;

FIG. 6 is a sectional view taken along lines 6—6 in FIG. 2;

FIG. 7 is a perspective view of one of the contact members located in the connector shown in FIG. 2;

FIG. 8 is a perspective view of a contact arm located in the connector that is illustrated in FIG. 2;

FIG. 9 is a perspective view of a spring contact that is connected to one of the contact members illustrated in FIG. 2;

FIG. 10 is a perspective view of the prong-type contact member that projects from the nose of the connector illustrated in FIG. 2;

FIG. 11 is a view similar to FIG. 2 and showing the position of the connector after insertion thereof into a socket wherein a circuit is established through the connector;

FIG. 12 is a view similar to FIG. 2 showing a modified form of spring contact incorporated therein;

FIG. 13 is a perspective view of one of the contact members located in FIG. 12;

FIG. 14 is a perspective view of the modified spring contact located in the connector shown in FIG. 12;

FIG. 15 is a perspective view of the contact arm shown in the connector illustrated in FIG. 12;

FIG. 16 is a perspective view of a nonconducting plate that is employed in the connector shown in FIG. 12;

FIG. 17 is a sectional view taken along lines 17—17 in FIG. 12;

FIG. 18 is a sectional view taken along lines 18—18 in FIG. 12;

FIG. 19 is a view similar to FIG. 2 showing another modified form of the connector of the present invention;

FIG. 20 is a sectional view taken along lines 20—20 in FIG. 19;

FIG. 21 is a sectional view taken along lines 21—21 in FIG. 19;

FIG. 22 is a sectional view taken along lines 22—22 in FIG. 19;

FIG. 23 is a view similar to FIG. 2 showing a still further modified form of the connector;

FIG. 24 is a sectional view taken along lines 24—24 in FIG. 23;

FIG. 25 is a sectional view taken along lines 25—25 in FIG. 23;

FIG. 26 is a sectional view taken along lines 26—26 in FIG. 23;

FIG. 27 is a view similar to FIG. 2 showing still another modified form of the connector;

FIG. 28 is a sectional view taken along lines 28—28 in FIG. 27;

FIG. 29 is a sectional view taken along lines 29—29 in FIG. 27; and

FIG. 30 is a sectional view taken along lines 30—30 in FIG. 27.

Description of the invention

Referring now to the drawings and particularly to FIGS. 1 through 11, one form of the connector embodied herein is indicated at 10 and includes a housing generally indicated at 11. The housing 11 is formed in two parts defined by sections 12 and 14 that are preferably molded of a plastic material and are substantially identical in construction except for certain internal rib structure. As shown in FIGS. 1 and 3, the assembled housing 11 is generally cylindrical in shape and includes a forward nose portion 16, an intermediate portion 18, and a rearwardly reduced portion 20. As seen in FIG. 4, the section 12 of the housing 11 is formed with a plurality of internal transversely extending ribs 22, 24 and 26, the ribs being molded integral with a peripheral edge that extends around the

entire margin of the section 12. Although the internal construction of the section 14 is not illustrated, it corresponds generally to that of section 12, except for a variation in the rib detail.

Disposed between the ribs 24 and 26 of the section 12 is a tubular plug 28, through which an opening 30 extends for receiving a screw 32 (FIG. 1) that is adapted to retain the sections 12 and 14 in the locked position thereof. Formed in the forward peripheral edge of each section as represented by the section 12 is a recess 34 that cooperates with a similar recess 36 formed in the transverse rib 22 to receive a cylindrical contact member 38 in bearing relation. Formed in the transverse rib 24 is a notch 40 that receives an edge of a contact arm which is generally indicated at 42 in FIG. 8. As further shown in FIG. 4, the transverse rib 26 is formed with spaced notches 44 and 46 therein, the notch 44 receiving the rear portion of a contact member that is generally indicated at 48 in FIG. 7. As will be further described, the notch 46 receives the rear portion of the contact arm 42 therein. The rear portion of the housing sections 12 and 14 that define the reduced portion 20 are formed with grooves 50 in the marginal edge thereof, the grooves 50 receiving a sheathed conductor 52 in which conductor leads 56 and 58 are located.

As will be further described, the contact member 48 extends outwardly of the housing 11, and, for this purpose, the section 12 is formed with spaced notches 60 and 62 in a marginal edge thereof, a plate-like portion 64 being molded to the transverse rib 24 and being located between the notches 60 and 62 for receiving the exposed portion of the contact member 48 thereover.

Referring to FIG. 10, the contact member 38 is shown being formed in a cylindrical configuration and has a flange 66 joined to the rear end thereof. Fixed to the contact member 38 is a spring contact generally indicated at 68 that is formed of flat stock and that includes a forward edge 70. The forward edge 70 of the spring contact 68 is fixed in an opening 72 formed in the cylindrical contact member 38 so as to be in electrical communication with the contact member. Joined to the forward edge 70 of the contact member 38 is a loop portion 74 that defines a spring portion for the unit, a rearwardly extending leg 76 being joined to the loop portion 74 and having a bent end 77 joined thereto. The contact member 38 is placed within the housing 11 by positioning the cylindrical portion thereof in the recesses 34 and 36 and then locating the leg 76 of the spring contact 68 so that it exerts an outwardly directed force on the contact member 38. Thus, as shown in FIG. 2, the bent end 77 of the leg 76 extends through a slot formed in the transverse rib 24 wherein the contact member 38 is positively held in position and is prevented from inadvertent dislocation. The spring contact 68 thus tends to urge the contact member 38 outwardly of the nose portion 16, the normal position thereof being such that the flange 66 abuts against the transverse rib 22.

As illustrated in FIG. 7, the contact member 48 is formed of flat stock and includes an elbow portion 78, on the outer extreme end of which an offset edge 80 is joined. The elbow portion 78 is further joined to an arm 82 in which a notch 84 is formed, the notch 84 cooperating with the notch 44 formed in the transverse rib 26 to locate the arm 82 in a positive position. The end of the arm 82 is received in slots formed in the reduced portion 20 of the sections 12 and 14 to lock the arm 82 in place, while the conductor 56 is joined to the arm in electrical communication therewith, as illustrated in FIG. 2. As further shown in FIG. 2, the elbow portion 78 projects outwardly of the housing 11, the offset edge 80 being received within the notch 60 and the inclined portion opposite to the edge 80 being received within the notch 62. It is seen that the projecting elbow portion 78 of the conductor member 48 will positively engage the edge of a socket in which the housing 11 is adapted to

be inserted, thereby electrically interconnecting the lead 56 to ground.

As seen in FIG. 8, the contact arm 42 is formed with a bent contact portion 86 that is adapted to abut the forward side of the transverse rib 24. As described, the transverse ribs 24 and 26 are formed with the notches 40 and 46, respectively, the arm 42 being formed with a struck-out projection 88 and a notch 90 that cooperate with the notches 40 and 46 to positively retain the arm 42 in position. The rearmost end of the arm 42 is received within grooves formed in the reduced portion of the sections 12 and 14 and fixes the rear end of the arm 42 in place for attachment to the conductor lead 58. With the contact members 38 and 48 locked in position between the sections 12 and 14 and the screw 32 fastened in place as shown in FIG. 1, the connector may be inserted within a suitable socket in which a stop contact is located. In this connection, one form of a socket 91 is illustrated in FIG. 2 and is shown as a recess that is formed in a metallic base 92. A contact button 93 is fixed in the socket 91 and is insulated from the base 92 for connection to a suitable power source. The diameter of the socket 91 is such as to permit entry of the intermediate portion 18 of the housing 11, the elbow 78 of the contact member 48 being compressed into positive engagement with the peripheral edge of the socket. Since the base 91 is formed of a metallic material, the elbow portion 78 of the contact member 48 that positively engages the edge of the socket establishes ground communication with the conductor lead 56.

As shown in FIG. 2, the leg 76 of the spring contact 68 is normally maintained out of engagement with the bent projection 86 of the contact arm 42. Thus, the contact member 38 is prevented from having electrical communication with the conductor lead 58 in the normal position thereof. When the connector is inserted within the socket 91, the outwardly projecting male prong or contact member 38 is moved into engagement with the stop contact button 93 located within the socket 91. Continued movement of the connector into the socket 91 forces the contact member 38 into the housing 11 and against the action of the spring contact 68. As shown in FIG. 11, the rearward movement of the contact member 38 moves the leg 76 into engagement with the projection 86 to establish electrical communication between the contact member 38 and the conductor lead 58. When the connector is removed from the socket 91, the spring contact 68 forces the contact member 38 outwardly of the housing 11 to remove the leg 76 from engagement with the projection 86 of the contact arm 42, thereby breaking the circuit to conductor lead 58.

Referring now to FIGS. 12 through 18, a modified form of the invention indicated at 94 is illustrated, in which the sections of the housing are generally similar to those described above but which further include spaced ribs 95 between which a plate 96 is slidably received, as will hereinafter be described. In the form of the invention illustrated in FIGS. 12 through 18, a spring contact generally indicated at 97 is interconnected to the contact member 38 and is formed of flat stock to include a loop 98 to which a forward edge 99 is joined, the edge 99 being fixed to the contact member 38. Joined to the other side of the loop 98 is a connecting portion 100 to which a contact portion 101 is joined and is bent at right angles with respect thereto. A shortened transverse rib 102 is formed in the housing sections for accommodating the end of the contact portion 101 as illustrated in FIG. 12, the contact portion 101 being further received in the notch 40 of the transverse rib 24.

Fixed to the conductor lead 58 is a contact arm 104 that is provided with an offset contact portion 106 and that includes a notch 108 that engages the notch 46 formed in the transverse rib 26 for positively locating the contact arm 104 within the housing sections. As further shown in FIG. 12, the contact member 48 as described

above is electrically connected to the conductor lead 56, and includes the elbow portion 78 that extends outwardly of the housing 10. Disposed between the arm 82 of the contact member 48 and the contact portion 106 of the contact arm 104 is the nonconducting plate 96 that is adapted to transfer movement of the contact member 78 to the contact portion 106. Thus, it is seen that when the connector illustrated in FIG. 12 is inserted into a socket, the elbow portion 78 engages the peripheral edge of the socket and is thereby forced inwardly of its housing. The arm 82 and the plate 96 are also moved in a corresponding manner to force the contact portion 106 of the arm 104 into engagement with the contact portion 101 of the spring contact 97. Electrical communication is thereby established between the contact member 38 and the conductor lead 58.

It is also understood that the spring contact 97 resists inward movement of the contact member 38 so that when the contact member 38 is forced against the contact button within the socket in which the connector is inserted, a positive connection is provided between the contact member 38 and the socket contact button.

Referring now to FIGS. 19 through 22, another modified form of the invention indicated at 109 is illustrated and differs from the constructions described hereinabove in the formation of the spring contact that is interconnected to the contact member 38 and in the contact arm that is adapted to be electrically interconnected to the spring contact. As shown in FIG. 19, a spring contact 110 that is formed with a loop portion 111 is interconnected to the contact member 38, a leg portion 112 being joined to the loop portion 111 and extending through a slot in the transverse rib 24. A flat contact arm indicated at 113 is fixed in the appropriate groove formed in the reduced end of the housing sections and in a notch formed in the rib 26 and is also electrically connected to the conductor lead 58. Engaging the forwardmost end of the contact arm 113 is a nonconducting button 114 to which a lug 116 is joined that extends outwardly of the housing 10. The outermost edge of the lug 116 is inclined so that upon insertion of the connector 109 into an appropriate socket, the inclined edge of the lug 116 will strike the edge and force the lug 116 inwardly. As shown in FIG. 19, inward movement of the lug 116 forces the button 114 to move the outermost end of the contact arm 113 upwardly into engaging relation with the leg portion 112 of the spring member 110. Electrical communication is thereby established between the connector member 38 and the conductor lead 58. It is understood, as previously described, that as the connector is inserted within its socket, the elbow 78 of the contact member 48 will engage the edge of the socket so as to establish ground contact with the edge of the socket and the conductor lead 56.

Referring to FIGS. 23 through 26, a still further modified form of the invention indicated at 117 is illustrated and is somewhat similar in construction to the construction 109 illustrated in FIG. 19, including the contact arm 112 and the insulated button 114. In the constructions shown in FIGS. 19 and 23, a spring contact 118 that has a generally V-like configuration is employed and includes a lower arm portion 120, the apex of the V being received at the intersection of the rib 24 and the plate portion 64. Upon insertion of the connector 117 into a socket and as the contact member 38 engages the socket contact button, the spring contact 118 is deformed to the position illustrated in dotted lines in FIG. 23. The lug 116 further forces the end of the contact arm 112 to move upwardly, as shown in dotted lines, the lower arm portion 120 of the spring contact 118 thereby electrically interconnecting the contact member 38 to its conductor lead 58 through the contact arm 112.

Referring to FIGS. 27 through 30, a still further modified form of a connector indicated at 121 is illustrated, and in this form of the invention the contact members as previously described are reversed with respect to the

permanent connection thereof to their conductor leads. As shown in FIG. 27, an elongated cylindrical contact member 122 projects through the nose of the housing and is interconnected to a spring contact 124 through a flange 125. The spring contact 124 includes a rearwardly extending arm 126 that is joined to the conductor lead 58. The housing sections of the connector 121 are somewhat modified to accommodate the elongated contact member 122 on the outer end of which a movable sleeve 128 is mounted. A flange 130 is joined to the movable sleeve and is movable within a cavity 131 inwardly of the housing section. A spring 132 located in the cavity 131 engages the flange 132 for normally urging the sleeve 128 outwardly to envelop the contact member 122. Joined to the innermost end of the cylindrical contact member 122 and disposed within a recess 129 formed in the housing sections is the flange 125 to which the spring contact 124 is joined. The ground contact member indicated at 136 is formed with an elbow as described above and is secured between the housing sections within notches formed therein as also described previously. However, the innermost end of the ground contact member 136 terminates in an end 138 that is spaced from a contact arm 140. The contact arm 140 is fixed within the housing sections and is joined to the conductor lead 56. It is seen that when the connector 121 illustrated in FIG. 27 is inserted into an appropriate socket, the spring 132, which is somewhat weaker than the spring contact 124, will permit the sleeve 128 to be retracted to expose the contact member 122 for engagement with a contact button located in the socket. Further movement of the connector within the socket will cause the contact member 122 to make positive contact with the button contact therein. As the connector 121 is inserted within the socket, the elbow portion of the ground contact member 136 engages the peripheral edge of the socket to cause the inner edge 138 of the ground contact member to engage the contact arm 140, thereby electrically interconnecting the ground contact member 136 to the contact lead 56.

It will be seen that in all forms of the invention as described hereinabove, one of the contact members is normally disconnected from the conductor lead. Thus, inadvertent shorting of the conductor leads is avoided. However, once the connector is inserted within an appropriate socket, positive contact of both contact members with their conductor leads is provided.

While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying inventive concept and that the same is not limited to the particular forms herein shown and described except insofar as indicated by the scope of the appended claims.

What is claimed is:

1. In an electrical connector for use with an electrical appliance to which conductor leads are electrically connected, a housing, a first contact member located in said housing and extending exteriorly thereof, said first contact member being connectable to one of said conductor leads, a longitudinally movable second contact member located in said housing and extending exteriorly thereof, a spring member joined to said second contact member for urging said second contact member outwardly of said housing and being biased upon inward movement of said second contact member when said housing is inserted into an electrical socket, said spring member being connectable to the other of said conductor leads, said spring member being normally located out of electrical communication with its associated conductor lead and having an end that is fixed in said housing, a portion of said spring member that is located adjacent to said fixed end being placed in electrical communication with its associated conductor lead when said second contact member is

moved inwardly upon insertion of said housing into said socket, wherein a circuit is completed to said appliance.

2. In an electrical conductor as set forth in claim 1, said second contact member having a cylindrical configuration and projecting through an opening formed in an end of said housing.

3. In an electrical conductor as set forth in claim 2, said first contact member being formed of flat metal stock and being bent to form an elbow that extends outwardly of said housing, said elbow being adapted to engage an edge of said socket when the housing of said connector is inserted therein for establishing an electrical circuit therewith.

4. In an electrical connector for use with an electrical appliance to which conductor leads are electrically connected, a housing, a first contact member located in said housing and extending exteriorly thereof, said first contact member being connectable to one of said conductor leads, a longitudinally movable second contact member located in said housing and extending exteriorly thereof, a spring member joined to said second contact member for urging said second contact member outwardly of said housing and being biased upon inward movement of said second contact member when said housing is inserted into an electrical socket, said spring member being connectable to the other of said conductor leads, said second contact member being normally located out of electrical communication with its associated conductor lead and being movable into electrical communication with its conductor lead by the biased spring member upon insertion of the housing of said connector into the socket, wherein a circuit is completed to said appliance, said first contact member being formed of flat metal stock and being bent to define an elbow that extends outwardly of said housing, said elbow being adapted to engage an edge of said socket when the housing of said connector is inserted therein for establishing an electrical circuit therewith, said second contact member having a cylindrical configuration and projecting through an opening formed in an end of said housing, said spring member being formed of flat stock and including a loop located adjacent to said cylindrical contact member and being formed so as to resist inward movement of said cylindrical contact member when said housing is inserted into said socket and the cylindrical contact member engages a stop contact in said socket.

5. In an electrical conductor as set forth in claim 4, an inner contact arm located adjacent to said spring member and being connected to said other conductor lead, said spring member being movable into engagement with said contact arm upon compression thereof when said cylindrical contact member engages the stop contact in said socket, wherein a circuit is completed from said cylindrical contact member to said other conductor lead.

6. In an electrical conductor as set forth in claim 1, an inner contact arm located in said housing and being joined to one of said conductor leads, said inner contact arm being connectable to said second contact member when said housing is inserted into said socket to complete the circuit through said conductor leads and to said appliance.

7. In an electrical conductor as set forth in claim 6, said inner contact arm being fixed in position and being engageable by said spring member upon engagement of said cylindrical contact member with a stop contact located in said socket when said housing is inserted in said socket.

8. In an electrical connector for use with an electrical appliance to which conductor leads are electrically connected, a housing, a first contact member located in said housing and extending exteriorly thereof, said first contact member being connectable to one of said conductor leads, a longitudinally movable second contact member located in said housing and extending exteriorly thereof, a spring member joined to said second contact member

for urging said second contact member outwardly of said housing and being biased upon inward movement of said second contact member when said housing is inserted into an electrical socket, said spring member being connect-
5 able to the other of said conductor leads, said second contact member being normally located out of electrical communication with its associated conductor lead and being movable into electrical communication with its conductor lead by the biased spring member upon in-
10 sersion of the housing of said connector into said socket, wherein a circuit is completed to said appliance, said second contact member having a cylindrical configuration and projecting through an opening formed in an end of said housing, a nonconducting plate located in said hous-
15 ing being positioned between said first contact member and said inner contact arm and in engagement therewith, said first contact member extending outwardly of said housing and being inwardly movable upon engagement thereof with an edge of said socket when said housing is inserted therein, said plate and contact arm being re-

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sponsive to inward movement of said first contact mem-
ber to cause said contact arm to be electrically engaged
with said first contact member.

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