

[54] ELECTRICAL ADAPTER PLUG

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 339/206 P  
 [51] Int. Cl. .... H01r 33/30  
 [58] Field of Search ..... 339/28, 29, 31-33,  
 339/182, 183, 176, 95, 206; 240/8.14, 8.18;  
 200/51.09; 219/202

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3,377,610	4/1968	Busch et al. ....	339/182 R X
3,467,796	9/1969	Grober.....	200/51.09
3,099,0505	7/1963	Schwartz.....	339/182 R X

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[57] ABSTRACT

An electrical adapter connector for connecting leads of a low voltage electrical appliance to a power source of a cigarette lighter receptacle. The connector includes an axially elongated housing having an outer wall which is insertable into the cigarette lighter receptacle. A bore is provided at the forward end of the housing and an opening is provided at the rear end of the housing. A positive contact member is slidably carried within the axial bore and projects outwardly beyond the housing. A closure is secured to the housing and over the rear opening. A pair of spaced channels are defined between the housing and the closure. A first electrical conductor is positioned within the housing and the front end thereof is in electrical contact with the positive contact. The rear end of the positive conductor projects outwardly from the housing through one of the spaced channels. A negative electrical conductor has an offset portion which extends beyond the periphery of the housing. The rear of the negative electrical conductor projects through the other of the spaced channels. Leads from an appliance are crimped onto the outer ends of the two electrical conductors. A cap on the rear of the housing electrically isolates the rear of the innerconnected electrical conductors and power leads.

10 Claims, 5 Drawing Figures

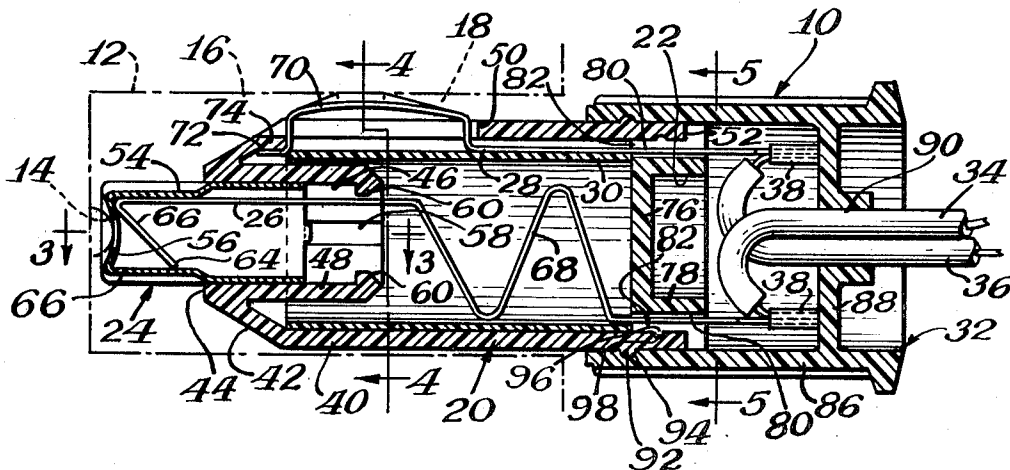


FIG. 1.

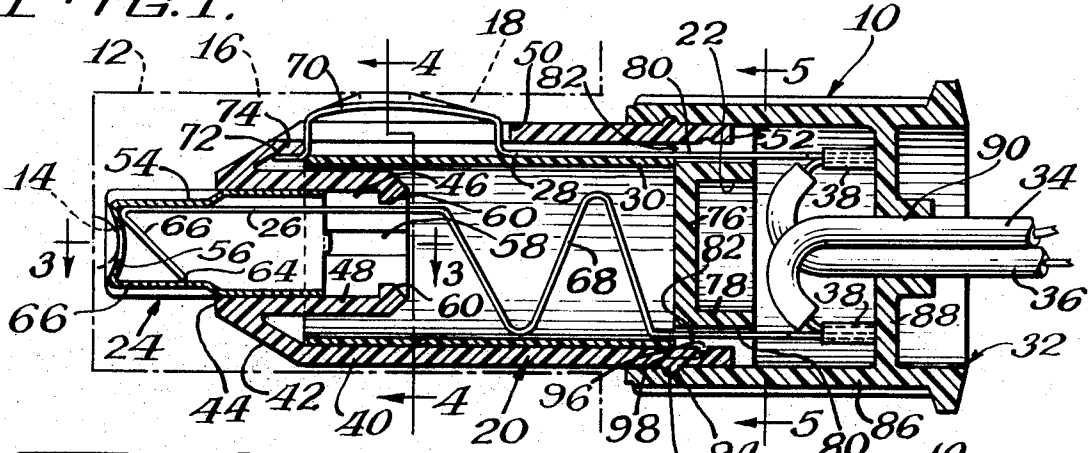


FIG. 2.

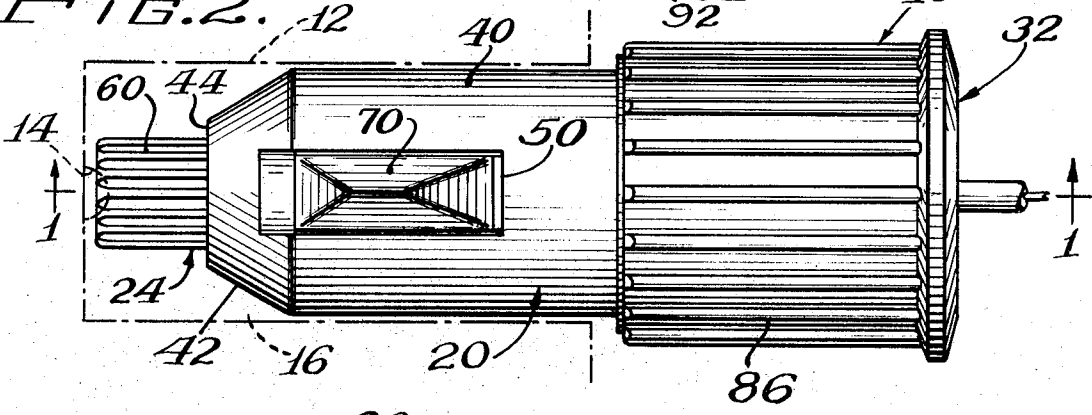


FIG. 3.

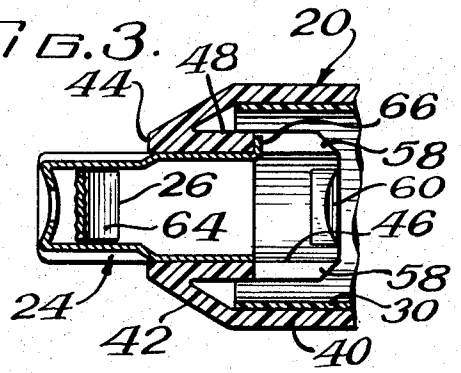


FIG. 5.

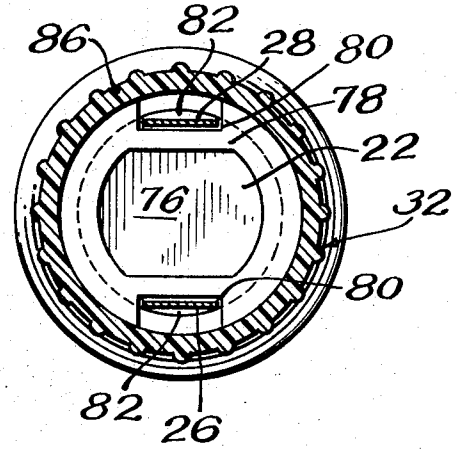
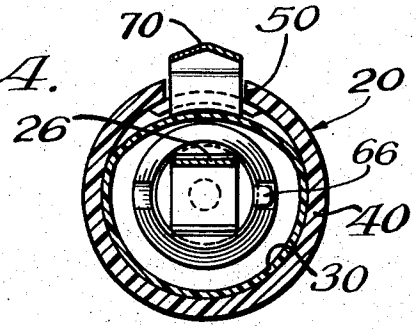


FIG. 4.



**ELECTRICAL ADAPTER PLUG****BACKGROUND OF THE INVENTION FIELD OF THE INVENTION AND DESCRIPTION OF THE PRIOR ART**

This invention relates to electrical connecting devices and particularly to electrical connectors which may be inserted into the sockets or receptacle of automotive cigarette lighter assemblies and the like so that various low voltage appliances may be operated by the electrical system of the vehicle.

In recent years, a great variety of electrical appliances have become available for operation by the low voltage, direct current power of the electrical system of a car, power boat, camper, and the like. The appliance is generally interconnected to the electrical system of the vehicle by use of an adapter plug or connector which is inserted into the cigarette lighter socket or receptacle of an automobile or other vehicle. Electrical appliances and accessories which can be operated from a vehicle electrical system vary widely and include portable television sets, tape recorders, trouble lights, window defrosters, electric shavers, electric toothbrushes, can openers, food mixers, and the like. As stated previously, these accessories are normally interconnected to the electrical system of the automobile, boat or camper, through the cigarette lighter receptacle by means of an electrical connector which is inserted into the receptacle which includes positive and negative contacts for thereby interconnecting the electric power to the accessory to be operated. In this way, the accessory can be connected to the battery or electrical system of the automobile or the like.

Such prior art devices useful for electrical connection within cigarette lighters include Focosi U.S. Pat. No. 2,954,544, Schwartz U.S. Pat. No. 3,099,505, and Busch et al. U.S. Pat. No. 3,377,610.

Although the connectors of the type shown and described in the above identified patents have been and are being used successfully and to advantage, because of the wider use of these adapter plugs in view of the increasing number of appliances being used therewith, there is a greater demand for providing adapter plugs to the O.E.M. manufacturer of the low voltage accessories which can be attached easily by them to the electrical leads of the appliance. Since the O.E.M. manufacturers using the plugs vary from small manufacturers to large manufacturers, depending on the appliance and depending on the manufacturer's own specifications and requirements, electrical leads of varying specifications are interconnected to the adapter plug by the appliance manufacturer. For this reason, many manufacturers prefer or require that the adapter plug be installed by them to their own appliance or accessory at their own plant by their own employees. It is considered highly desirable to provide an adapter plug for insertion into cigarette lighters of vehicles wherein lead cords of different specifications may be easily and conveniently assembled to the adapter plug by the manufacturer itself.

Additional important design considerations for these adapter plugs are that they should be sturdy, reliable in use, and easily inserted and withdrawn from the cigarette lighter receptacle.

**SUMMARY OF THE INVENTION**

It is therefore an important object of this invention to

provide an improved electrical adapter plug or connector useful for insertion into a cigarette lighter socket or receptacle of various vehicles, wherein the adapter plug is characterized by the ease in which an accessory manufacturer using the plug may attach wire leads of different sizes to the electrical terminals of the adapter plug.

It is also an object of this invention to provide an improved adapter plug particularly useful for interconnection to cigarette lighter sockets or receptacles of vehicles for low voltage operation of various appliances and accessories, wherein the adapter plug is characterized by having two enclosed chambers, one of the chambers enclosing the interconnections between the two wire leads of the appliance and the ends of electrical conducting members of the adapter plug.

It is a further object of this invention to provide a unique adapter plug for insertion into cigarette lighter receptacles of vehicles wherein the adapter plug includes a closure member for one end of the housing and which defines an alignment element for aligning spring type electrical connectors in the body of the housing, and also functioning to provide channel means between the housing means and the closure member for passage therethrough of the outer ends of the spring connectors for securement of the appliance power leads thereto.

It is yet another object of this invention to provide an improved adapter plug for interconnection to low voltage appliances or accessories which may be operated by insertion of the adapter plug or connector into the socket or receptacle of an automobile, truck, camper, boat, or the like, wherein the adapter plug is characterized by its versatility for use with a variety of accessories, its reliability in use, its simplicity in construction, and its economy of manufacture and assembly, the entire assembly being held together without the use of extra fasteners as all interconnected parts are secured together by a snapfit.

Further purposes and objects of this invention will appear as the specification proceeds.

The foregoing objects are accomplished by providing an electrical connector or adapter plug for connection of the power leads of an electrical appliance to the electrical power source of an automotive cigarette lighter receptacle or the like, wherein the connector includes a housing having an outer peripheral wall which is sized and shaped for insertion into the receptacle with an axial bore at the front end thereof, and an aperture at the rear end thereof. A peripheral opening is provided in a side wall of the housing intermediate the opposite ends thereof. A positive contact member is slidably carried within the axial bore, and projects outwardly beyond the housing for making electrical contact with the positive source of electrical power within the receptacle. A closure member is interconnected to the housing and closes the opening in the rear end of the housing and defines an enclosed chamber for the housing. A positive electrical conducting member is positioned within the chamber and at its front end is an electrical conductive and biasing relationship with the first contact member. The rear end of the positive electrical conducting member projects outwardly from the chamber through one of the channel means defined between the closure member and the housing. The negative electrical conducting member is positioned in the first chamber and has a portion which extends laterally

outwardly beyond the periphery of the housing, is biased therefrom and defines the negative electrical contact for interconnection to the negative source of power in the receptacle. The rear portion of the negative electrical conductor projects outwardly from the chamber and through the other of the spaced channel means. A cap member is interconnected to the housing and defines a second chamber which encloses the outer ends of the two electrical connectors, which are interconnected in the second chamber to the lead wires from the appliance or accessory to be operated from the electrical power in the cigarette lighter receptacle.

#### BRIEF DESCRIPTION OF THE DRAWINGS

A particular embodiment of the present invention is illustrated in the accompanying drawings wherein:

FIG. 1 is a longitudinal cross-sectional view, taken along the line 1—1 of FIG. 2, through an adapter plug embodying my invention;

FIG. 2 is an exterior view of the embodiment of FIG. 1 rotated 90°;

FIG. 3 is a fragmentary, cross-sectional view taken along the lines 3—3 of FIG. 1 illustrating the structure of the adapter plug at the forward end thereof;

FIG. 4 is a transverse cross-sectional view taken along the line 4—4 showing structure at the forward end of the adapter plug; and

FIG. 5 is a transverse cross-sectional view taken along the line 5—5 of FIG. 1 illustrating the rear portion of the adapter plug.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

My improved adapter plug, generally 10, as seen in FIGS. 1 and 2 is seen as it is being inserted into a receptacle or socket 12 of a cigarette lighter assembly of the type generally found in automobiles, boats, campers, and the like. The electrical power of the automobile electrical system is generally a 12 volt system and is available in the receptacle 12. When the automobile or other vehicle is not operating, the electrical power source is generally the battery of the vehicle. When the engine is running, the power source is the electrical generating system of the automobile. The receptacle 12 has an electrical contact 14, usually positive, at the central portion of the base of the receptacle. The side wall 16 of the receptacle 12 usually has a negative contact 18 defined along its inner periphery. When contact portions of the plug 10, to be hereinafter described, electrically contact the positive contact 14 and negative contact 18, electrical power, generally direct current from the automotive electrical system, passes through the plug or connector 10 to the appliance or accessory (not shown) which is to be operated. It is to be understood that the plug 10 may be used with a wide variety of receptacles 12 of the type commonly used in automobiles, trucks, campers and power boats.

The plug 10 includes a housing, generally 20, an enclosure member, generally 22, a positive contact, generally 24, a positive electrical conductor, generally 26, a negative electrical conductor, generally 28, an insulating sleeve, generally 30, a cap, generally 32, which is interconnected to the rear portion of the outer periphery of the housing 20, positive and negative electrical leads 34 and 36, respectively, passing through the cap 32, and a pair of metallic crimping members 38 for

securely attaching the leads 34 and 36 to the contacts 26 and 28 respectively.

The housing 20 comprises a generally cylindrical outer wall 40 which includes a downwardly and inwardly inclined, forward frusto-conical surface 42. The outer periphery of the wall 40 has a diameter which is designed to be snugly received within the receptacle 12 with sufficient diametrical spacing for proper electrical contact to be accomplished between the negative contact 18, defined in the side wall 16, and the negative conductor 28, as will be hereinafter described in greater detail. The frusto-conical surface 42 of the housing 20 terminates with an annular outer front surface 44 surrounding an opening defined by an axial bore 46 in the front end of the housing 20. The axial bore 46 is defined by a generally cylindrical wall 48 which extends rearwardly from the surface 44 for a short distance, as approximately 25 percent of the overall length of the housing 20, as seen in FIG. 1. As seen best in FIGS. 1 and 2, the side wall 40 of the housing 20 includes a longitudinally elongated, rectangular opening 50. The rear end of the housing 20 includes a substantially circular opening 52.

The positive contact member 24 is slidably carried within the axial bore 46 of the housing 20 and projects frontwardly beyond the annular surface 44 for movement into contact with the positive contact 14 in the receptacle 12. As seen in FIGS. 1 and 3, the contact 24 includes a substantially cylindrical side wall 54, the front portion being corrugated and reduced in diameter relative to the rear portion thereof, and a concave end wall 56 which is movable into contact with the positive contact 14 within the receptacle 12. The rear end of the positive contact member 24 is open and the positive conductor 26 is lockably positioned therein, as will be described.

As seen best in FIGS. 1, 3 and 4, the wall 48 defining the axial bore 46 includes a pair of diametrically opposed longitudinal slots 58 therein. A pair of inwardly facing flanges 60 also project inwardly from the rear end of the wall 48. A transverse tongue 62 on the connector 24 is slidably received within one of the slots 58 so as to guide the forward and rearward sliding movement of the connector 24 in a non-rotatable path of travel. The flanges 60 act to bear against the rear edge of the cylindrical side wall 54 of the positive contact 24 to define a stop for preventing excessive rearward movement thereof during insertion of the plug 10 into the receptacle 12. In assembling the plug 10, the positive contact 24, is snapped over the flanges 60 so as to define the positive, fastener-free connection.

The positive conductor 26 is constructed from a flat spring member of an electrical conducting material, such as copper or bronze. The forward end of the positive conductor 26 includes an offset front portion 64 which is lockably received within the interior of the cylindrical side wall 54 of the positive contact 24, as best seen in FIG. 1, the corrugated front portion and springable offset portion cooperating to provide a locking relationship therebetween. The central portion 68 of the conductor 26 is bent into a biasing section for providing springability or biasing action for normally biasing the positive conductor 26 outwardly or frontwardly from the housing 20. The biasing pressure from the positive conductor 26 assures firm, positive, electrical contact with the positive contact 14 of the receptacle 12. The rear portion of the conductor 26 extends rear-

wardly from the housing 20 and beyond the end closure 22. The rear edge of the central portion 68 defines a stop position so that the springable conductor cannot move so far rearwardly as to adversely affect the biasing action of the springable conductor.

The negative conductor 28 is, like the conductor 26, made from brass or bronze. The negative conductor 28 includes a laterally offset portion 70 which passes through the opening 50 in the side wall 50 of the housing 20 to define a negative contact. As seen in FIG. 2, the offset portion 70 substantially fills the entire opening 50 and is in close proximity with the edges of the wall 40 defining the opening 50. The offset portion 70 is radially springable or movable relative to the outer periphery of the wall 40 of the housing 20.

The forward end of the negative conductor 28 includes a lip 72 which is locked in place between a flange 74, defining the front edge of the opening 50, and a portion of the outer periphery of the wall 48 defining the axial bore 46 in the housing 20. The lip 72 cooperates with the flange 74 and wall 48 to limit the amount of radial movement that can be imparted to the negative conductor 28 as the plug 10 is inserted into the receptacle 12. Since the negative conductor 28 is constructed of a springable material, positive contact is assured between the negative contact 18 defined on the side wall 16 of the receptacle 12 and the offset contact portion 70 of the negative conductor 28 after insertion into the receptacle. The rear portion of the negative conductor 28 is substantially flat and extends rearwardly from the offset portion 70 out of the housing 20 and beyond the end closure 22.

The end closure member 22 comprises an important feature of the invention. The closure member 22 is generally cup-shaped, and includes a substantially circular wall 76 and a cylindrical side wall 78. Diametrically opposed channels 80, as seen best in FIGS. 1 and 5, are defined by the side wall 78 and the wall 40 of the housing 20. The rear ends of the positive conductor 26 and negative conductor 28 pass outwardly through the channels 80, as seen in FIGS. 1 and 5. The inner surface of the rear portion of the wall 40 of the housing 20 includes elongated bosses 82 which generally engage in the channels 80 of the closure member 22. The bosses 82 and channels 80 thereby cooperate to act as alignment or guide means between the housing 20 and closure member 22. In this way, the channels 80 are aligned relative to the rectangular opening 50 in the wall 40 so as to properly hold and align the outer end of the negative conductor 28 relative to the opening 50. Additionally, the closure member acts to hold the rear end of the positive conductor 26 in a fixed position so that rotatable movement between the positive contact 24 and the housing 20 is substantially avoided.

At this point in time of the assembly of the plug 10, the plug 10 may be shipped to the manufacturer for attachment of the positive and negative leads 34 and 36 to the positive and negative conductors 26 and 28. The closure member 22 defines an enclosed chamber within the housing 20 in which the conductors 26 and 28 are located. Preferably, in order to avoid any possible electrical contact between the conductors 26 and 28 within the closed housing chamber, the flexible insulating sleeve 30 is positioned in the chamber exterior of the wall 48 of the axial bore 46 and acts to electrically isolate the conductors 26 and 28 from each other to pre-

vent electrical contact, arcing or a short circuit therebetween.

A manufacturer who wishes to assemble the leads 34 and 36 of a particular accessory to the plug 10 is able to select wires 34 and 36 of a particular specification, as size, that is desired. The leads 34 and 36 are first passed through the cap 32. The cap 32 includes a substantially cylindrical outer wall 86 and a unitary circular end wall 88. The central portion of the end wall 88 includes an aperture 90 through which the appliance or accessory leads 34 and 36 are passed. The stripped ends of the leads 34 and 36 are then electrically interconnected to the projecting outer ends of the conductors 26 and 28. The crimping members 38 are preferably used. The crimping members 38 comprise metallic, formable members which can firmly be crimped around the wire ends of the leads 34 and 36 and into firm electrical contacting relationship with the projecting outer ends of the conductors 26 and 28. The crimping members 38 may be secured by any suitable hand tool or by simply crimping devices, commonly available. The simple attachment is important as it enables the O.E.M. manufacturer, both small and large, to easily complete the assembly of the plugs 10.

When the cap 32 is connected to the housing 20, a second enclosed chamber is defined between the closure member 22 and the cap 32 wherein basically only the electrical connections between the leads 34 and 36 and the conductors 26 and 28 are located. A plurality of peripheral ridges 92 are located on the exterior, end portion of the housing 20 and a plurality of peripheral grooves 94 are located on the inner periphery of the outer wall 86 of the cap 32 for providing a locking, non-rotating relationship therebetween. Similarly, the end closure 22 includes a plurality of peripheral ridges 96 which are in locking relationship with peripheral grooves 98 in the internal wall 40 of the housing 20.

From the foregoing, it is seen that I have provided a simple, and highly useful adapter plug for insertion into the receptacle of automobile cigarette lighters and the like, wherein the device has two separate chambers formed therein. The first chamber contains the major operating portion of the plug 10 and requires no assembly by the user, while the second chamber encloses the electrical connections of the leads with the conductors located within the first chamber. The user merely makes the desired connection and completes the plug assembly. The plug 10 is extremely versatile as the manufacturer of the plug 10 may assemble the major portions thereof, and yet enable the manufacturer of the accessories utilizing the plugs 10 to select different leads and secure the leads to the conductors of the plug 10. Alternatively, the plugs 10 can be shipped completely assembled with leads and end caps thereon. The plug is simple in construction, has a simple insulating sleeve between the conductor elements, and the overall structure is economical and comprises molded parts of insulating material and formed metal conducting elements. The overall length of the plug 10 is sufficient for projecting the outer end thereof beyond the dash board so that the plug may be withdrawn from the lighter receptacle by grasping the cap portion of the plug and it is not necessary to pull on the leads. Furthermore, the closure member and the cap are secured to the housing without the use of fasteners, and the conducting members are held in place in the plug without any extra fasteners.

While in the foregoing, there has been provided a detailed description of a particular embodiment of the present invention, it is to be understood that all equivalents obvious to those having skill in the art are to be included within the scope of the invention as claimed.

What I claim and desire to secure by Letters Patent is:

1. An electrical connector for connecting electrical power leads to an electrical power source in cigarette lighter receptacles, said connector comprising, in combination, a unitary, substantially cylindrical housing having an outer periphery, sized and shaped for insertion into said receptacle, an axial bore at one end of said housing and an opening at the other opening of said housing, a peripheral opening in a side of said housing, a first contact member slidably carried in said axial bore and projecting axially outwardly beyond said housing for making electrical contact with a first source of electrical power in said receptacle, a closure member for said opening on said other end of said housing and defining a first enclosed chamber within said housing, cooperating interconnecting means unitary with and on both said housing and on said closure member for defining the sole means for interconnecting said closure member to said housing, a pair of spaced channel means defined between said housing and said closure member for providing communication between said chamber and the exterior of said housing, a first electrical conducting member positioned within said chamber and, at one end thereof, being in electrical conducting and biasing relationship with said first contact member, and at the other end thereof, projecting outwardly from said chamber through one of said channel means, and a second electrical conducting member positioned within said chamber and defining a second portion extending laterally outwardly beyond the periphery of said housing and through said peripheral opening in said housing, said second electrical conducting member providing electrical contact with a second power source in said receptacle, the rear portion of said second electrical conducting member projecting outwardly from said chamber and through the other of said spaced channel means.

2. The device of claim 1 wherein said axial bore includes a unitary cylindrical wall portion, said first contact member is cylindrical and is slidably carried within said cylindrical wall portion, and cooperating means are provided on said first contact member and said cylindrical wall portion for providing axial slidable and non-rotatable relationship therebetween.

3. The device of claim 1 including means defining the sole interconnecting means therebetween for aligning said channel means with at least said peripheral opening in said housing, and said second conducting member is in substantial alignment with said peripheral opening and with one of said channel means.

4. The device of claim 1 including insulating means positioned within said housing chamber for electrically insulating said first and second conducting members from each other.

5. The device of claim 1 including a cap intercon-

nected to said housing for defining a second enclosed chamber between said closure member and said cap, said cap and said housing including unitary cooperating means defining the sole means for interconnecting said cap to said housing, said second chamber containing the outer ends of said electrical conducting members.

6. The device of claim 5 wherein said leads are each connected to said conductive members with solderless, electrically conducting, crimping members.

7. The device of claim 5 wherein said cap and said housing include cooperating, non-rotatable, locking means therebetween.

8. The device of claim 8 wherein said housing is axially elongated for projecting outwardly a sufficient distance from said receptacle for manually grasping said connector without the need of grasping the leads thereof.

9. An electrical connector for connecting electrical power leads to an electrical power source in cigarette lighter receptacles, said connector comprising, in combination, a cylindrical housing having an outer periphery, sized and shaped for insertion into said receptacle, an axial bore at one end of said housing and an opening at the other opening of said housing, a peripheral opening in a side of said housing, a first contact member slidably carried in said axial bore and projecting axially outwardly beyond said housing for making electrical contact with a first source of electrical power in said receptacle, a closure member for said opening on said other end of said housing, cooperating means unitary with and on both said housing and on said closure member for securing said closure member to said housing, a pair of spaced channel means defined between said housing and said closure member for providing communication between said chamber and the exterior of said housing, a first electrical conducting member positioned within said chamber and, at one end thereof, being in electrical conducting and biasing relationship with said first contact member, and at the other end thereof, projecting outwardly from said chamber through one of said channel means, a second electrical conducting member positioned within said chamber and defining a second portion extending laterally outwardly beyond the periphery of said housing and through said peripheral opening in said housing, said second electrical conducting member providing electrical contact with a second power source in said receptacle, the rear portion of said second electrical conducting member projecting outwardly from said chamber and through the other of said spaced channel means, a cap secured to said housing, cooperating means unitary with and on both said housing and said cap for securing said cap to said housing, and electrical leads passing through said cap and electrically connected to the projecting ends of said conducting members.

10. The device of claim 1 wherein said first contact member is lockably received within said axial bore, said axial bore and said first contact member including cooperating locking means.

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