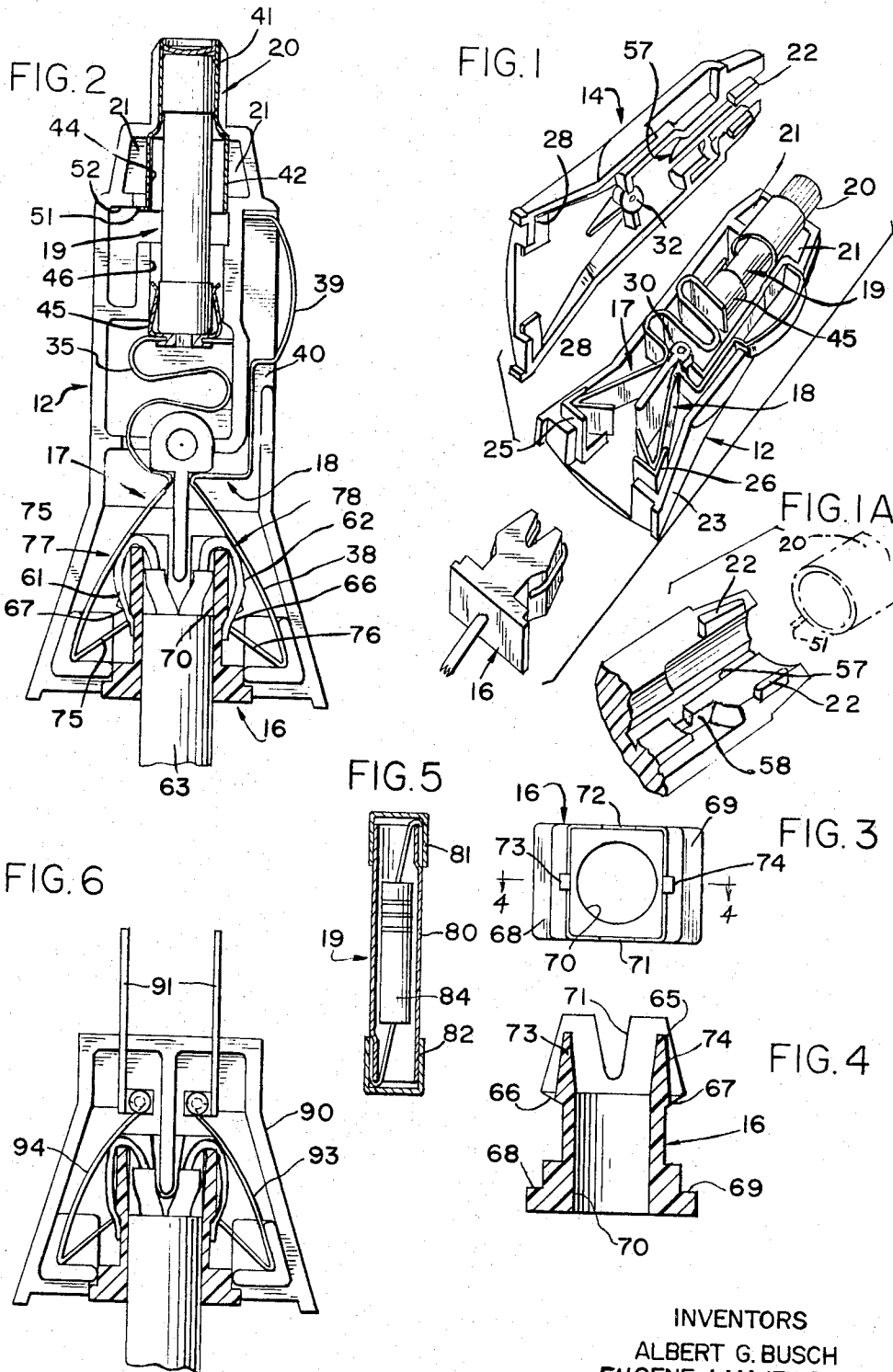


April 9, 1968

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PLUG FOR ELECTRICAL CORD

3,377,610

Filed Sept. 30, 1966



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PLUG FOR ELECTRICAL CORD

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Filed Sept. 30, 1966, Ser. No. 583,318
9 Claims. (Cl. 339—95)

This invention relates to electrical connectors and more particularly, although in its broader aspects not exclusively, to a bayonet plug adapted for insertion into an automotive cigarette lighter socket.

In recent years, a variety of electrically operated automotive accessories have become available. Included among these are portable television sets, tape recorders, trouble lights, defrosting devices, and electric shavers. Since such accessories are normally disconnected from the automobile electrical system, it is desirable to provide means for connecting such accessories quickly and easily to the battery source when their use is required. The conventional cigarette lighter socket positioned on the car's dashboard constitutes an extremely convenient connection point. In consequence, plugs have been developed which are adapted to mate with these sockets and provide a connection between the lead cord of the accessory and the electrical terminals within the socket.

One form of electrical plug connector of this type is shown in United States Patent 2,954,544 which issued to J. W. Focosi on Sept. 27, 1960. While the plug disclosed in this patent possesses certain significant advantages, it has certain shortcomings as well. Connections between the line cord and the plug are made by means of terminals which must be securely crimped to the cord conductors. When one attempts to remove the plug from the receptacle by pulling on the cord, there is substantial likelihood of the crimped connection being broken.

In addition, it is often desirable to provide means for connecting a fuse, resistor, or similar component in the line cord circuit at the plug. The plug shown in the Focosi patent fails to make any provision for the connection of such components.

It is a general object of the present invention to provide an improved electrical connector of simple, durable construction.

It is a further object of the invention to provide an improved bayonet plug adapted for insertion into a cigarette lighter socket.

It is a still further object of the invention to provide an arrangement within the plug for connecting a fuse, resistor, or similar component into the line cord circuit.

It is an object of a further aspect of the invention to provide a secure mechanical and electrical connection between one or more electrical conductors and an electrical connector.

In accordance with a first aspect of the invention, a new and improved arrangement is provided for connecting an electrical conductor to the central supply terminal in an automotive cigarette lighter receptacle. The housing for this novel connector is provided with a generally cylindrical end portion adapted for insertion into the receptacle, the end section including an axially aligned bore for slidably carrying an outwardly projecting conductive contact member. This contact member is provided with an open end adapted to receive and make electrical contact with one end of a cylindrical, fuse-type cartridge. A socket is provided within the housing for receiving the other end of this cartridge and means are employed for spring-load-

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ing the socket in a direction tending to force the socket, fuse cartridge and the contact member axially outward through the bore. A keyway recessed within the sidewalls of the bore and extending axially along the bore receives a projection which extends radially outward from the contact terminal. The keyway terminates at a peripheral shoulder such that, as the contact member is inserted through the bore and then rotated, the engagement between the shoulder and the projection thereafter prevents the contact member from being ejected from the bore under the impetus of the spring-loading.

According to a further aspect of the present invention, a novel arrangement is employed to provide a secure electrical and mechanical connection between the electrical terminals on the connector and the attached electrical conductors. According to this feature of the invention, a novel strain-relief assembly is employed which includes a block adapted for insertion through an opening in the connector housing. The block is shaped to include an enlarged end which defines first and second shoulder surfaces on opposite sides of the block. A passageway extends entirely through the block from the enlarged end. An electrical cable including first and second conductors is inserted through this passageway and the uninsulated ends of the conductors are folded back to overlay the first and second shoulder surfaces. According to a further feature of this aspect of the invention, first and second resilient spring arms are mounted in spaced apart relation within the housing to project from opposite sides into the path of the block as it is inserted into the opening. These arms are adapted to flex outwardly around the enlarged end of the block as the block is inserted and thereafter to snap inwardly against the uninsulated ends of the conductors. Each conductor is accordingly clamped between one shoulder surface and the projecting end of a resilient spring arm. These spring arms also serve to hold the block in place, even though substantial stress is applied to the cable.

In a preferred construction embodying the invention, a single resilient spring band or ribbon may be shaped to provide both the spring means acting against the socket and one of the resilient spring arms. The electrical connection is accordingly made directly from a conductor through this shaped spring band to the fuse socket. A second resilient band or ribbon may be shaped to provide the other resilient arm contacting one of the conductors and, in addition to provide a spring-loaded contact terminal for engaging the sidewalls of the cigarette lighter receptacle.

The application of the principles of the invention permits the construction of a simple yet rugged and durable connector capable of lasting, trouble-free performance.

These and other objects, features and advantages of the invention will become more apparent through a consideration of the following detailed description. In the course of this description, reference will frequently be made to the attached drawing in which:

FIGURE 1 is a perspective view of a preferred embodiment of the invention shown in disassembled form;

FIGURE 1A is an enlarged view of a portion of FIGURE 1 showing certain details thereof;

FIGURE 2 is a plan view showing the internal parts mounted within one half of the connector housing;

FIGURE 3 is an end view of the strain-relief block employed in conjunction with the connector illustrated in FIGURES 1 and 2;

FIGURE 4 is a cross-sectional view of the strain-relief block taken along the line 4—4 of FIGURE 3;

FIGURE 5 shows a cartridge mounted resistor which may be used in conjunction with the embodiment of the invention shown in FIGURES 1 and 2; and

FIGURE 6 is a cross-sectional view of a second embodiment of the invention illustrating the manner in which the novel strain-relief assembly employed in the embodiment of the invention shown in FIGURES 1 through 5 may also be used in conjunction with another form of connector.

As shown in FIGURE 1 of the drawing, the connector comprises seven principle parts; a molded phenolic housing made up of two halves indicated generally at 12 and 14; a strain-relief block indicated generally at 16; a pair of resilient spring elements indicated generally at 17 and 18; a fuse type cartridge 19; and a contact member 20 which projects outwardly from one end of the connector housing.

As clearly seen in FIGURE 1, the housing halves 12 and 14 are adapted to mate securely together to form a rigid unit. The molded half 12 includes recesses at 21 near the central contact terminal 20. The recesses 21 receive the projecting tabs 22 defined on the molded half 14. At the flared end 23 of molded half 12, a pair of angle-shaped projections 25 and 26 are positioned to engage with the interior corners 27 and 28 respectively defined in the molded half 14. Accordingly, a single bolt or rivet passing through the transverse holes 30 and 32 in halves 12 and 14 respectively may be employed to fully secure the two housing halves together.

Each of the spring elements 17 and 18 serve a dual function. The spring element 17 includes a generally S-shaped spring section 35 and a V-shaped latching section 37 which, as will be discussed, is operatively associated with the strain-relief block 16. The spring band 18 also includes a similar V-shaped latching section indicated at 38 as well as an outwardly bowed section 39 which engages under spring tension against the sidewalls of a cigarette lighter receptacle of the like into which the connector is inserted. In domestic, "negative ground" automotive electrical systems, the outwardly bowed section 39 of spring band 18 accordingly provides a connection to the negative terminal of the receptacle.

The connection to the positive supply terminal, centrally located within the receptacle, is made by the spring-loaded central contact member 20. The contact member 20 is generally cylindrical in shape and includes a crimped outer end portion 41 and an interior skirt portion 42. The skirt portion 42 is slidably carried within an axially aligned barrel 44 defined by the housing halves 12 and 14. Contact terminal 20 is hollow and receives the fuse-type cartridge 19 therein, the interior walls of the crimped end portion being sized to snugly engage against one metallic end cap of the cartridge 19. A hole 43 is provided in the crimped end 41 to facilitate removal of the cartridge 19. The other end cap on cartridge 19 fits within a socket 45, a portion of which is inserted into an inner barrel 45 defined by the housing halves 12 and 14. The socket 45 is preferably constructed of brass and includes axially aligned slots as shown in FIGURE 1 to allow the sidewalls of the socket to flex outwardly to receive and make contact with the metallic end cap on cartridge 19. The socket 45 is riveted or otherwise affixed to the spring section 35 of spring band 17.

The spring section 35 tends to force the socket 45, the cartridge 19, and the central contact terminal 20 outwardly. In the assembled connector, outward movement is normally prevented by the engagement between tab 51 which extends radially outward from the skirt 42 on contact member 20 and a shoulder 52 defined at the interior end of the barrel 44. By pressing inwardly and rotating the contact terminal 20 counterclockwise until the tab 51 is aligned with a keyway 57 (shown most clearly in the enlarged view of FIGURE 1A), the contact terminal 20 and the fuse-type cartridge 19 may be removed from the connector housing. This feature permits the cartridge 19

to be replaced when necessary. The contact member 20 may be reinserted by pressing it fully inward and thereafter rotating the tab clockwise beyond a barrier wall 53 adjacent keyway 57. When the contact member 20 is allowed to move outwardly under the spring pressure from band 17, the barrier 58 thereafter prevents inadvertent alignment of tab 51 and keyway 57.

A novel strain-relief assembly is employed in the present invention to provide secure mechanical and electrical connections between the conductors 61 and 62 of a cable 63 and the spring bands 17 and 18 respectively. The details of strain-relief block 16 are more clearly shown in FIGURES 3 and 4 of the drawing. The block 16 includes an enlarged tapered end section 65 defining a pair of beveled shoulder surfaces 66 and 67. The other end of block 16 is also enlarged to define shoulders 68 and 69. A passageway 70 extends through the block from one enlarged end to the other. The sidewalls of the enlarged end 65 are notched at 71 and 72 to provide an entryway for the longitudinal barrier 75 (shown in FIGURE 2) defined by the housing halves 12 and 14. With the insulation removed from the ends of the conductors 61 and 62, the cable 63 is inserted through the passageway 70 in block 16 and the uninsulated ends of conductors 61 and 62 are folded back over the enlarged portion 65 of the block to overlay the beveled shoulder surfaces 66 and 67 respectively. The enlarged end 65 is provided with recessed channels at 73 and 74 for guiding the ends of conductors 61 and 62 respectively.

The passageway 70 may be sized to conform to any selected cable cross-section. The outer dimensions of block 16 need not be varied; consequently, a variety of interchangeable blocks may be used for different cables without requiring any variation in the remainder of the connector.

The projecting arms 75 and 76 form part of the V-shaped sections 37 and 38 respectively. The arms 75 and 76 firmly clamp the conductors 61 and 62 respectively against the shoulders 66 and 67 as clearly seen in FIGURE 2. Moreover, the extending arms 75 and 76 hold the block 16 in position, forcing it axially toward the tip end of the connector, and pressing the uninsulated, folded over portions of the conductors 62 and 61 against V-shaped sections 37 and 38 as indicated at 77 and 78 respectively. Thus, multiple contact is made between conductor and each spring band to insure a low resistance electrical connection.

The cartridge 19 may take the form of a conventional automotive fuse. Alternatively, the cartridge 19 may house a resistor as shown in FIGURE 6 of the drawing. The cartridge in this case takes the form of a rigid, insulated sleeve 80 capped by a pair of metallic end cups 81 and 82. The pigtails of a conventional resistor 84 are clamped between the exterior sidewalls of the sleeve 80 and the end cups 81 and 82. Thus, the cartridge forms a rigid housing for the resistor 80 and protects the pigtails against breakage due to repeated flexing as the connector is used.

The novel strain-relief assembly illustrated in conjunction with the embodiment of the invention illustrated in FIGURES 1 and 2 may also be used to produce a novel and improved household electrical plug of the type shown in FIGURE 7. This plug includes a molded housing 90 through which project a pair of spade terminals 91. These terminals are directly affixed to V-shaped spring bands 93 and 94. The remaining elements of the strain-relief assembly are identical in both design and function to those discussed in conjunction with FIGURES 1 and 2 and consequently a discussion of these features need not be repeated here.

It is to be understood that the arrangements which have been described are merely illustrative of applications of the principles of the invention. Numerous modifications may be made by those skilled in the art without departing from the true spirit and scope of the invention.

What is claimed is:

1. An electrical connector comprising, in combination,
 - a housing provided with at least one electrical contact terminal accessible from the exterior of said housing,
 - a strain-relief block having first and second enlarged ends defining first and second shoulder surfaces respectively and including a passageway therethrough from said first enlarged end to said second enlarged end,
 - an electrical conductor inserted through said passageway, an uninsulated end section of said conductor being folded back to overlie said first shoulder surface,
 - an opening in said housing for receiving said block, said opening being sized to allow the passage therethrough of said first enlarged end but not said second enlarged end such that, when said first block is fully inserted into said opening, said second shoulder abuts at least a portion of the outer surface of said housing which surrounds said opening,
 - a resilient spring arm mounted within said housing to project into the path of said block as said block is inserted through said opening, said arm being adapted to flex outwardly around said first enlarged end as said block is inserted and thereafter to flex inwardly against the uninsulated end of said conductor to clamp said conductor between said first shoulder surface and the projecting end of said resilient arm, and
 means within said housing for connecting said arm to said contact terminal.
2. An electrical connector comprising, in combination,
 - a housing provided with at least two electrical contact terminals accessible from the exterior of said housing,
 - a strain-relief block having a first enlarged end and a second end opposite thereto, said block including a passageway therethrough extending from said first to said second end, said first enlarged end defining first and second shoulder surfaces on opposite sides of said block,
 - an electrical cable including first and second electrical conductors inserted through said passageway, said conductors having uninsulated end sections folded back to overlie said first and second shoulder surfaces respectively,
 - an opening in said housing for receiving the enlarged end of said block,
 - first and second resilient spring arms mounted in spaced apart relation within said housing to project from opposite sides into the path of said block as said block is inserted into said opening,
 - said arms being adapted to flex outwardly around said enlarged end as said block is inserted and thereafter to flex inwardly against the uninsulated end of said conductors to respectively clamp the uninsulated end sections of said first and second conductors between the ends of said first and second resilient arms and said first and second shoulder surfaces, and
 means within said housing for connecting said arms to respective ones of said terminals.
3. An electrical connector for connecting an electrical conductor to the central supply terminal in an automotive cigarette lighter receptacle which comprises, in combination,
 - a housing having a generally cylindrical end portion adapted for insertion into said receptacle, said end section including an axial bore for slidably carrying an outwardly projecting conductive contact terminal, said contact terminal having an open end adapted to receive and make contact with one end of a cylindrical cartridge,
 - a metallic socket within said housing for receiving the other end of said cartridge,
 - means for spring loading said socket in a direction tending to force said socket, cartridge, and central

- contact member axially outward from said housing, a radial projection on said contact terminal,
- a keyway for receiving said radial projection extending axially along said bore, said keyway terminating at a peripheral shoulder adapted to engage with said projection to prevent said contact from being ejected from said bore under the impetus of said spring means, and
- means within said housing for providing an electrical connection between said socket and said electrical conductor.
4. An electrical connector as set forth in claim 3 including an elongated opening in the side of said cylindrical end portion of said housing, and
- a resilient spring member extending through said side opening and connecting with a second conductor in said cable.
5. An arrangement as set forth in claim 3 including a barrier ridge on said peripheral shoulder adjacent said keyway for preventing inadvertent alignment between said keyway and said projection.
6. An arrangement as set forth in claim 3 wherein said cartridge is an automotive fuse.
7. An arrangement as set forth in claim 3 wherein said cartridge comprises a rigid insulated cylindrical tube closed at each end by a metallic end cap and an electrical impedance element mounted in said tube with its leads connected to said end caps.
8. An arrangement as set forth in claim 3 wherein said contact terminal includes a crimped end for snugly engaging with one end of said cartridge.
9. An electrical connector for connecting an electrical conductor to the central supply terminal in an automotive cigarette lighter receptacle which comprises, in combination,
 - a housing having a generally cylindrical end portion adapted for insertion into said receptacle, said end portion including an axial bore for slidably carrying an outwardly projecting conductive contact terminal, said contact terminal having an open end adapted to receive and make contact with one end of a cylindrical fuse-type cartridge,
 - a radial projection on said contact terminal,
 - a keyway for receiving said radial projection extending axially along said bore, said keyway terminating at a peripheral shoulder adapted to engage with said projection to prevent said contact member from being removed from said bore when said projection is out of alignment with said keyway,
 - a metallic socket within said housing for receiving the other end of said cartridge,
 - a resilient spring band within said cartridge having first and second sections, said first section being adapted to spring load said socket in a direction tending to force said socket, said cartridge, and said central contact member axially outward from said housing,
 - an opening in said housing opposite from said central contact member,
 - a strain relief block having a first enlarged end and a second end opposite thereto, said block including a passageway therethrough extending from said first enlarged end to said second end, said first enlarged end defining a shoulder surface thereon,
 - an electrical conductor inserted through said passageway, an uninsulated end section of said conductor being folded back to overlay said shoulder surface, said second section of said resilient spring band being mounted within said housing to project into the path of said block as said block is inserted through said opening, said second section being adapted to flex outwardly around said first enlarged end as said block is inserted and thereafter to flex inwardly against the uninsulated end of said conductor to clamp said conductor between said shoulder surface and the projecting end of said second section, and

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means including said resilient spring band for retaining
said block within said housing.

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