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A. C. WALL
MULTICIRCUIT CONNECTOR
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2,409,004

Fig. 1.

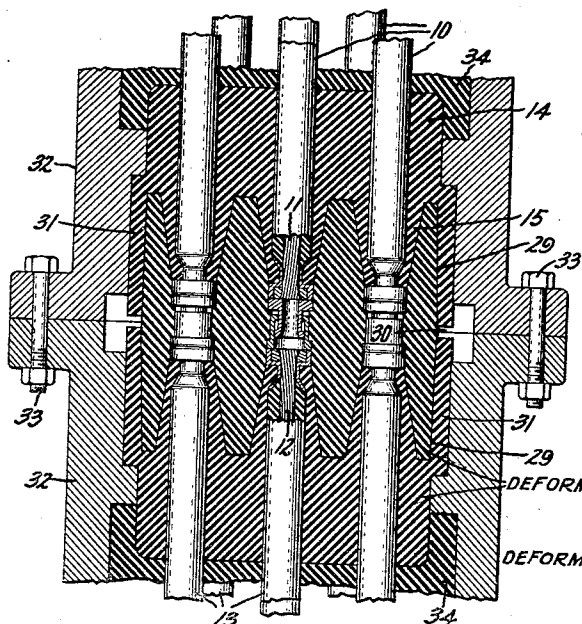


Fig. 2.

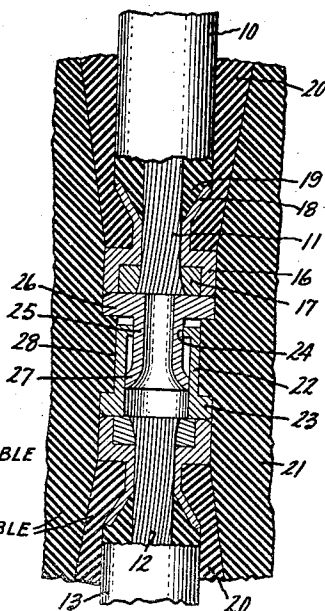


Fig. 3.

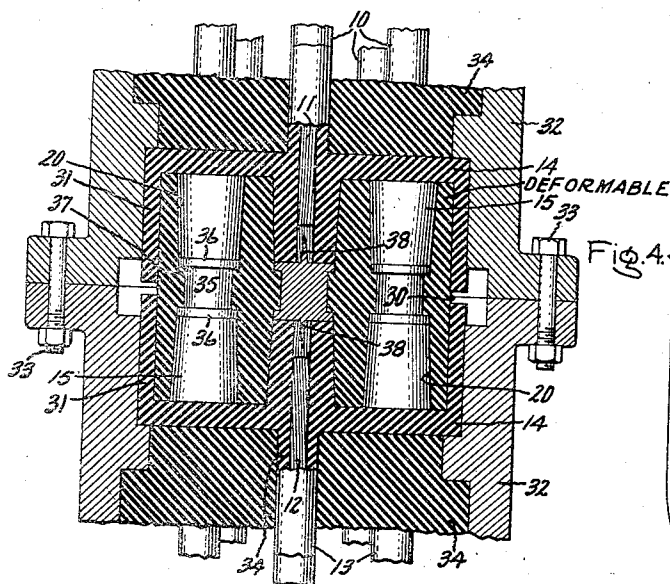
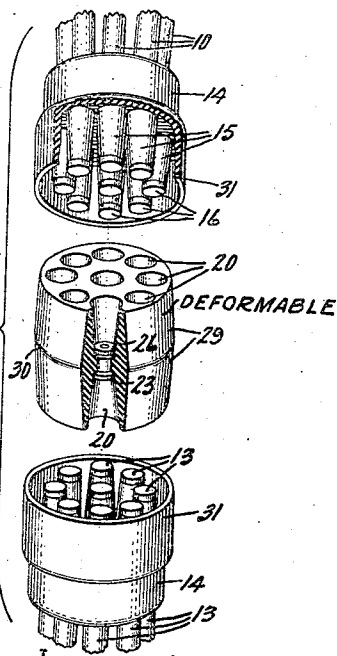


Fig. 4.



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UNITED STATES PATENT OFFICE

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MULTICIRCUIT CONNECTOR

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5 Claims. (Cl. 173—328)

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My invention relates to multicircuit connectors wherein a plurality of conductors is adapted to be connected to another corresponding number of conductors and it is desirable to make these connections in a limited space with as long a flash-over path as is practicable.

An object of my invention is to provide an improved multicircuit connector construction.

Another object of my invention is to provide a relatively small multicircuit connector with relatively long flash-over paths between conductors substantially greater than the spacing between the conductors.

Further objects and advantages of my invention will become apparent and my invention will be better understood from the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In the drawing, Fig. 1 is a longitudinal sectional view of a multicircuit connector embodying my invention; Fig. 2 is an enlarged sectional view of a part of the connector shown in Fig. 1 illustrating the details of the terminals and the connectors used in this construction; Fig. 3 is a longitudinal sectional view of a multicircuit connector provided with another embodiment of my invention; and Fig. 4 is an exploded view, partly in section, of the multicircuit connector shown in Figs. 1 and 2.

Referring to the drawing, I have shown in Figs. 1, 2, and 4 an embodiment of my invention applied to a multicircuit connector such as may be used to advantage in ignition systems having multiple conductors of relatively high voltage electrical paths. In this type conductor, it is desirable that substantially all air paths in the connection be eliminated to minimize the possibility of flash-over, corona, and other electrical discharges from the relatively high voltage conductors. In order to provide such an arrangement, a plurality of insulated conductors 10 is adapted to be supplied with relatively high voltage electrical power, and include electrically conductive stranded portions 11 with which the connector is adapted to form an electrical circuit to supply the power to corresponding stranded electrically conductive elements 12 in a corresponding plurality of insulated conductors 13. The conductors 10 and 13 are adapted to extend into similar terminal plug members which are preferably formed of a relatively deformable elastic insulating material and provided with base portions 14

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and a plurality of frusto-conical projections 15 formed with the longer diameters thereof on one side of the base portion 14. The conductors 10 and 13 extend through central passages which are formed through the projections 15 and through the plug bases 14, and the stranded electrically conductive portions 11 and 12 of the conductors form a good electrical contact with terminal elements 16 of electrically conductive material by being flared at the ends and secured to the terminal elements in a suitable manner, as by soldering, as shown at 17. The terminal elements 16 are provided with outwardly extending flared base flanges 18 which extend over a tapered end portion 19 of the insulation on the conductors 10 and 13. The passages formed through the plug bases 14 and projections 15 are preferably made of a slightly smaller diameter than the outer diameter of the conductors 10 and 13, so that when the conductors are secured in position in the projections 15 by the outwardly extending flange 18 of the terminal members 16, substantially no air remains within the passage about the conductors 10 and 13 or about the inner end of the terminal elements 16, thereby eliminating all discharge paths through the plugs. The terminal plugs are adapted to be connected together to complete the electrical circuits between the various conductors in the pair of plugs by insertion of the plug projections 15 into apertures or openings 20 formed in a connecting socket member 21, also preferably formed of a relatively deformable elastic insulating material. The apertures 20 are formed as two sets of oppositely extending and communicating frusto-conical openings with the longer diameters thereof in the outer surfaces of the socket and the contours of the apertures are complementary to the contours of the projections on the plugs, so that the plug projections 15 are adapted to fit snugly into the apertures 20 to provide fluid-tight seals therewith. A connector of electrically conductive material is arranged in each socket passage adjacent the small diameter inner ends of the frusto-conical apertures, and this connector is adapted to provide an electrical contact with the conductors and conductor terminals of the plugs when the plug projections are inserted in the socket apertures. Each of these connectors includes a cup-shaped element 22 having a flange 23 at the outer edge thereof and an opening 24 formed in the base thereof through which a stem 25 of a second connector element extends. This second connector element is formed with an end flange 26, and the two parts of the connector are

adapted to be inserted from opposite ends of the socket apertures with the stem 25 of one connector element extending through the opening 24 in the base of the other connector element, after which the end 27 of the stem 25 is spread to secure the flanges 26 and 23 in tight engagement about a collar 28 formed of insulating material at the inner ends of the oppositely extending apertures 20. This flared end 27 also secures together the two elements of the connector. The outer surface of the socket is formed with a double frusto-conical surface 29 with the longer diameter 30 of these conical surfaces substantially in the middle of the socket. Each plug is formed with a sleeve 31 of insulating material with an inner frusto-conical surface complementary to the outer socket surface and adapted to provide a snug fluid-tight fit therewith when the plugs are in the positions shown in Fig. 1. The two plugs and the connector element are adapted to be secured together in fluid-tight relationship by a pair of rigid members 32 which extend about the plugs 14 and are adapted to be secured together in any suitable manner as by a plurality of bolts 33. An insulating compound 34 is arranged in the outer rigid electrically conductive members 32 about the conductors 10 and 13 to provide additional insulation between the conductors extending to the plugs 14. This construction is particularly advantageous as it provides a relatively long flash-over path between adjacent plug terminals and between plug terminals and the outer casing and also minimizes the possibility of air pockets and flash-over paths in the space between the plug projections and the apertures in the socket.

In Fig. 3 I have shown another embodiment of my invention wherein the insulation 34 on the conductors 10 and 13 is fused or vulcanized to the insulating material of the plugs such that the insulation 34 on the conductors of the bases 14 of the plugs and the projections 15 form a unitary insulating element. This further insures against the possibility of flash-over or discharge paths within the plugs. As shown in this construction, the plug terminal elements 16 may be omitted and connectors may be provided within the socket apertures to provide good electrical contact with the ends of the conductive elements 11 and 12 of the conductors 10 and 13 in the plugs. Each of these connector elements includes a block 35 of conductive material formed as a spool with flanges 36 at each end thereof for locating the block within the apertures 20 at the inner small diameter ends thereof. The inner ends of the sockets are formed with shoulders 37 which extend about the spools or blocks 35 and are preferably formed of a slightly greater length than the distance between the inner sides of the flanges 36 of the spools to provide a slight amount of compression of these shoulders 37 when the spools 35 are in position within the aperture 20. This assures against dislocation of the connector spools 35 and also assures against voids or air pockets around the connectors. The connector spools 35 are provided with double pointed contact elements 38 extending through the center of the connector spool and secured therein by a shoulder formed around the central portion of the pointed contact element 38. The ends of the element 38 project beyond the ends of the contact spools 35, such that when the plugs are inserted into the socket, the pointed ends of the contact element 38 extend into the ends of the conductors 11 and 12 and assure good

electrical contact of the conductors and the connector element, even if the lengths of the conductors in the plugs vary slightly. The remainder of the plug and socket construction is essentially the same as that shown in the other figures of the drawing and the same numerals in this figure indicate corresponding parts described with reference to these other figures.

While I have illustrated and described particular embodiments of my invention, modifications thereof will occur to those skilled in the art. I desire it to be understood, therefore, that my invention is not to be limited to the particular arrangements disclosed, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

I claim:

1. A circuit connector including a terminal plug member of insulating material having a base portion and a plurality of projections, said projections being formed with a central passage therethrough which extends through said plug base portion, an electrical conductor extending through each of said passages in said plug base and projections, insulation about each of said conductors substantially filling said passages about said conductors in said plug base portion and projections, a connecting socket of insulating material having a plurality of apertures having contours complementary to the contours of said projections, said projections being adapted to fit snugly into said apertures providing substantially fluid-tight seals therewith, a connector in each of said socket apertures having a projecting element on each side thereof adapted to provide an electrical contact with said conductors in said plug projections when said plug projections are inserted in said socket apertures said socket having a double frusto-conical outer surface with the longer diameter of said conical surfaces intermediate the ends of said socket, and a sleeve of insulating material on each of said plugs with the inner frusto-conical surfaces complementary to said socket outer surface adapted to provide a snug fluid-tight fit therewith.

2. A circuit connector including a pair of terminal plug members of insulating material each having a base portion and a plurality of projections, each of said projections being formed with a central passage therethrough which extends through said plug base portion, an electrical conductor extending through each of said passages in said plug base and projections, insulation about each of said conductors substantially filling said passages about said conductors in said plug base portion and projections, a connecting socket of insulating material having a plurality of apertures having contours complementary to the contours of said projections, said projections being adapted to fit snugly into said apertures providing substantially fluid-tight seals therewith, a connector in each of said socket apertures adapted to provide an electrical contact with said conductors in said plug projections when said plug projections are inserted in said socket apertures said socket having a double frusto-conical outer surface with the longer diameter of said conical surfaces intermediate the ends of said socket, and a sleeve of insulating material on each of said plugs with the inner frusto-conical surfaces complementary to said socket outer surface adapted to provide a snug fluid-tight fit therewith.

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3. A circuit connector including a pair of terminal plug members of insulating material each having a base portion and a plurality of projections, each of said projections being formed with a central passage therethrough which extends through said plug base portion, a terminal element secured to each of said projections, an electrical conductor extending through each of said passages in said plug base and projections, means for electrically connecting said conductors to said terminal elements, a connecting socket of insulating material having a plurality of apertures having contours complementary to the contours of said projections, said projections being adapted to fit snugly into said apertures providing substantially fluid-tight seals therewith, a connector in each of said socket apertures adapted to provide an electrical contact with said plug terminal elements when said plug projections are inserted in said socket apertures, said socket having a double frusto-conical outer surface with the longer diameter of said conical surfaces intermediate the ends of said socket, a sleeve of insulating material on each of said plugs with the inner frusto-conical surfaces complementary to said socket outer surface adapted to provide a snug fluid-tight fit therewith, and means including a pair of relatively rigid members of electrically conductive material adapted to be arranged about said plugs and socket when joined together for biasing said plug projections into said socket apertures for securing said plugs and said socket together in substantially fluid-tight relationships.

4. A circuit connector including a pair of terminal plug members of insulating material each having a base portion and a plurality of frusto-conical projections adjacent said base portion, each of said projections being formed with a central passage therethrough which extends through said plug base portion, a terminal element secured to each of said projections, an electrical conductor extending through each of said passages in said plug base and projections, means for electrically connecting said conductors to said terminal elements, insulation about each of said conductors substantially filling said passages about said conductors in said plug base portion and projections, a connecting socket of insulating material having a plurality of passages therethrough formed as two sets of oppositely extending frusto-conical apertures with the longer diameter thereof adjacent the outer surfaces of said socket and having contours complementary to the contours of said projections, said projections being adapted to fit snugly into said apertures providing substantially fluid-tight seals therewith, a connector in each of said socket passages adjacent the inner ends of said frusto-conical aperture portions adapted to provide an electrical contact with said plug terminal elements when said plug projections are inserted in said socket apertures to provide an electrical connection between conductors in different of said pair of plugs, said socket having a double frusto-conical outer surface with the longer diameter of said conical surfaces intermediate the ends of said socket, a sleeve of insulating ma-

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terial on each of said plugs with the inner frusto-conical surfaces complementary to said socket outer surface adapted to provide a snug fluid-tight fit therewith, and means including a pair of members of electrically conductive material adapted to be arranged about said plugs and socket when joined together for biasing said plug projections into said socket apertures for securing said plugs and said socket together in substantially fluid-tight relationships.

5. A circuit connector including a pair of terminal plug members of relatively deformable elastic insulating material each having a base portion and a plurality of frusto-conical projections with the longer diameters thereof adjacent said base portion, each of said projections being formed with a central passage therethrough which extends through said plug base portions, an electrically conductive material terminal element arranged in the outer end of each of said projection passages and having an outwardly extending flange at each end thereof for securing said terminal element to each of said projections, each of said terminal elements having a central passage therethrough, an electrical conductor to extending through each of said passages in said plug base and projections and said terminal elements and substantially filling the passage through said terminal element, means for electrically connecting said conductors to said terminal elements, insulation about each of said conductors substantially filling said passages about said conductors in said plug base portion and projections, a connecting socket of relatively deformable elastic insulating material having a plurality of passages therethrough formed as two sets of oppositely extending communicating frusto-conical apertures with the longer diameter thereof in the outer surfaces of said socket and having contours complementary to the contours of said projections, said projections being adapted to fit snugly into said apertures providing substantially fluid-tight seals therewith, a connector of electrically conductive material in each of said socket passages adjacent the inner small diameter ends of said frusto-conical apertures adapted to provide an electrical contact with said plug terminal elements when said plug projections are inserted in said socket apertures to provide an electrical connection between conductors in different of said pair of plugs, said socket having a double frusto-conical outer surface with the longer diameter of said conical surfaces substantially in the middle of said socket, a sleeve of insulating material on each of said plugs with inner frusto-conical surfaces complementary to said socket outer surface adapted to provide a snug substantially fluid-tight fit therewith, and means including a pair of relatively rigid members of electrically conductive material adapted to be arranged about said plugs and socket when joined together for biasing said plug projections into said socket apertures and said plug sleeves about said outer socket surfaces for securing said plugs and said socket together in substantially fluid-tight relationships.

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