FIG. 1.

FIG. 2.

FIG. 3.

INVENTORS
DONALD J. GIMPEL
ARTHUR L. NELSON

BY
Elliot & Pastoriza
ATTORNEYS
FLUIDPROOF ELECTRICAL CONNECTOR
Donald J. Gimpel, Santa Monica, and Arthur L. Nelson, La Jolla, Calif., assignors, by mesne assignments, to
Electro-Opalics, Inc., a corporation of California
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ABSTRACT OF THE DISCLOSURE

This disclosure relates to an electrical connector for use in a fluid medium, such as water. The connector comprises a pair of resilient body members or cables made from a non-wetting, electrically insulating material and which have metal contacts embedded therein. The contacts have exposed surfaces flush with an adjacent flat end face of the body members and the body members are provided with one or more channels extending inwardly from the end faces thereof. The end faces are initially urged together with the metal contacts and channels out of alignment with respect to each other and then the body members are relatively rotated to bring the contacts into alignment with each other to effect an electrical connection therebetween and to effect by wiping action removal of water on the contacts into the channels. A connector means is provided to hold the end faces in tight abutting engagement with each other when the electrical connection is effected.

The present invention relates to electrical connectors, and more particularly to a novel fluidproof electrical connector for use in a fluid medium, such as water, and in which an electrical connection is effected by moving exposed contacts in adjacent end faces of electrically insulating body members into engagement with each other.

An object of the present invention is to provide a new and improved electrical connector of a highly practical and economical construction for forming an electrical connection in a fluid medium, such as water.

Another object of the present invention is to provide a new and improved electrical connector, as defined in the preceding object, in which a large number of electrical connections can be made simultaneously.

Still another object is to provide an underwater connector in which automatic wiping of the contacts occurs when the same are connected so that the contacts are wiped free of the fluid medium or water whereby improved metal to metal contact between the contacts is effected.

Briefly, these and other objects and advantages of the present invention are attained by providing first and second resilient body members or cables made from a non-wetting, electrically insulating material and which have metal contacts embedded therein. The contacts have an exposed surface disposed flush or substantially flush with an adjacent end face of the body members. The body members are provided with one or more channels or recesses, preferably cross-shaped channels, extending inwardly from the end faces thereof.

The end faces of the body members are initially urged together with the metal contacts being out of alignment with respect to each other and then the body members are relatively rotated to bring the contacts into alignment with each other to effect an electrical connection therebetween. During this relative rotation of the body members, the end faces wipe the contacts free of any fluid or water, the fluid or water wiped therefrom being received in the channels. A suitable connector means, preferably a quick connective and disconnective coupling, is provided for holding the end faces in full surface engagement with each other upon the contacts being aligned.

The advantages of the foregoing electrical connector structure are that a large number of contacts can be provided on the end faces and corresponding electrical connections rapidly made, the contacts are wiped free of any fluid or water so that an improved metal to metal surface contact between the contacts is provided, and that the contacts will be fully insulated from the surrounding fluid medium or water once the connection has been made.

Other objects, novel characteristics and advantages of the present invention will be apparent to those skilled in the art by referring now to the embodiment shown in the accompanying drawings, in which:

FIGURE 1 is a fragmentary perspective view of a fluid proof connector embodying the present invention;
FIGURE 2 is a fragmentary axial cross-sectional view of the connector shown in FIGURE 1 and showing the relative positions of the connector components preparatory to effecting an electrical connection in a fluid medium, such as water;
FIGURE 3 is a fragmentary axial cross-sectional view similar to that shown in FIGURE 2, but showing the relative positions of the connector components when an electrical connection is effected; and
FIGURE 4 is a fragmentary top plan view looking in the direction of the arrows 4—4 in FIGURE 3.

Although the electrical connector of the present invention could be used in various kinds of fluid media, it is particularly useful as an underwater electrical connector, and for the purposes of illustration will be herein described as being used for that purpose.

Referring to FIGURES 1 and 2 of the drawings, the electrical connector 10 comprises first and second resilient body members or cables 11 and 12 which are made from a non-wetting, electrically insulating material, such as neoprene. The body members 11 and 12 can be of any cross-sectional shape and are shown in FIGURE 1 as being cylindrical in shape. The body members 11 and 12 terminate in end faces 13 and 14, respectively, which are flat and extend at right angles to the longitudinal axes of the body members 11 and 12.

Embedded within the body member 11 is a plurality of metal electrical contacts 15. The contacts 15 each have an exposed circular surface portion which is flush or substantially flush with the end face 13. The total number of contacts 15 provided, as illustrated, is sixteen and with the contacts being symmetrically arranged in sets of four at quadrant locations in the end face 13, as shown in FIGURE 1. It will, of course, be understood that a greater or lesser number of contacts and/or contacts having exposed surface areas either circular or non-circular could be employed, if desired. The contacts 15 or sets of contacts are connected to suitable internal metal conductors 16 embedded within the body member 11.

Similarly, embedded within the body member 12 is a plurality of electrical contacts 17. The contacts each have an exposed surface portion which is flush with or substantially flush with the end face 14. The number and location of the contacts 17 are the same as that for the contacts 15, previously described. The contacts 17 or sets of contacts are connected to suitable internal metal conductors 18 embedded within the body member 12.

The relative positions of the contacts 15 and 17 in the end faces 13 and 14, respectively, are such that corre-
sponding ones thereof will be aligned with and engage each other to effect an electrical connection therebetween when the end faces 13 and 14 are abuttingly engaged with one another and held in place.

The body members 11 and 12 are adapted to be releasably connected together so that the end faces 13 and 14 thereof are held in abutting engagement with one another by a quick-connective coupling means 19. The coupling means 19 comprises an annular socket member 20 which is suitably anchored at one end thereof in the body member 11, as indicated by reference numeral 21, and which is adapted to telescopically receive an annular plug member 22 suitably anchored at one end thereof in the body member 15, as indicated by reference numeral 23.

The plug member 22, when received in the socket member 20, is coupled or locked thereto by a bayonet-type locking structure. To this end, the plug member 22 carries a pair of radially extending pins 24 at spaced circumferential locations which are receivable in bayonet-type slots 25 in the socket member 29. As best shown in FIGURE 4, the slots 25 each include an axially extending slot portion 26 and a circumferentially extending slot portion 27, the slot portions 27 at their endsremote from the slot portions 26 being of a greater width than at their ends adjacent the slot portions 26 so as to define abutment 28 at the ends of the slot portions 25 such as when the coupling 19 is connected, and in a manner to be hereinafter more fully described.

From the foregoing description, it can be seen that the body members 11 and 12 are connected together to electrically connect the contacts 15 with the contacts 17 by first aligning the pins 24 with the plug member 22 with the axially extending slot portion 26 of the slots 25 and then moving the plug and socket members toward each other to effect insertion of the plug member 22 into the socket members 20 as shown in FIGURE 2. As the coupling member moves into the socket member, the end faces 13 and 14 are brought into engagement with each other and then urged or forced against each other to effect compression of the resilient body members 11 and 12. At least slight compression of the resilient body members 11 and 12 is required in order to align the pins 24 with the circumferentially extending slot portions 27 of the slots 25. The plug and socket members are then relatively rotated to cause the pins 24 to be received in the slot portions 27, as shown in FIGURES 3 and 4. When this is effected and the coupling members released, the elastic forces of the body members 11 and 12 tend to force the same away from each other and, thus, at least a slight relative axial movement between the plug and socket members outwardly of each other takes place. This relative outward movement causes the pins 24 to be locked in position behind abutments 28 so that the end faces 13 and 14 will be securely held in tight abutting engagement with each other and so that relative circumferential movement of the coupling members does not take place.

It should be noted that the contacts 15 and 17 in the end faces 13 and 14, respectively, are angularly offset or out of alignment with each other (see FIGURE 1) during axial movement of the plug member 22 relative to the socket member 20. The contacts 15 and 17, however, are brought into engagement and alignment with each other at the end of the circumferential movement of the plug member 22 relative to the socket member 20 to connect the coupling members together.

The coupling means 19 can be rapidly disconnected, when desired, by first moving the coupling members 20 and 22 toward each other in opposition to the elastic forces of the body members 11 and 12 so as to enable the pins 24 to clear the abutments 28, and then reversing the above described procedure for connecting the coupling means.

In accordance with the provisions of the present invention, the end faces 13 and 14 of the body members 11 and 12 are respectively provided with channel or recess means 29 and 30 for receiving water wiped from the contacts 15 and 17 by the end faces 13 and 14 when the body members 11 and 12 are relatively rotated. Since the channel means 29 and 30 for the end faces 13 and 14 are of an identical form, only the channel means 29 in the end face 13 of the body member 11 will be described in detail, and corresponding parts of the channel means 30 will be given the same reference numerals.

The channel means 29 is preferably cross-shaped and includes first and second diametrically extending channels 31 and 32 which intersect each other at right angles. The channels 31 and 32 in the illustrated embodiment are in communication in the body member 11, as shown in FIGURE 1, and the outer side of the body member 11. The channels 31 and 32 extend inwardly or rearwardly from the end face 13 a distance such that any and all water wiped from the contacts is freely received therein. The channels 31 and 32 divide the end face into four quadrants and with each quadrant containing a set of preferably four contacts, as shown in FIGURE 1.

The cross-shaped channel means 29 and 30 are angularly offset or out of alignment with respect to each other when the end faces 13 and 14 are urged or forced into engagement with each other and, in response to axial movement of the pins 24 in the socket member 20. The channel means and contacts are brought into alignment with each other when the body members 11 and 12 are relatively rotated while their end faces 13 and 14 are in pressure engagement with each other in response to relative circumferential movement of the plug and socket members to connect the body members together. During this latter movement, any water on the contacts 15 and 17 is wiped theretofrom into the channels 31 and 32 of the channel means 29 and 30 by the end faces 13 and 14, respectively.

The coupling means 20 and 22 are provided with suitable openings 33 and 34, respectively, through which water may escape during the coupling operation.

The advantages of the novel electrical connector of the present invention are that electrical connections and disconnections can be rapidly made between a large number of contacts and that the surface portions of the contacts 15 and 17 are wiped free of any water so that an excellent metal to metal contact therebetween is effected. Moreover, since the end faces 13 and 14 are securely held in tight abutting engagement with each other by the coupling means 19, the contacts 15 and 17 will be maintained in a dry state and be fully insulated from the surrounding water.

While the illustrative embodiment of the present invention has been described in considerable detail, it is to be understood that the invention is not limited to the construction shown. For example, only one channel need be provided rather than the cross channel configuration as described.

From the foregoing, it should be apparent that the hereinafore enumerated objects and others have been accomplished and that a new and improved electrical connector of a highly practical and economical construction has been provided.

What is claimed is:

1. A fluidproof electrical connector comprising: first and second body members made from an electrically insulating material and respectively having first and second end faces which are adapted to be held in contact with each other upon relatively moving said first and second body members toward each other; first and second contacts respectively embedded within said first and second body members and being substantially flush with the adjacent portions of said first and second end faces, one of said body members having a recess extending inwardly from the end face thereof; said recess also extending across the end face of said one of said body members to communicate with the outer periphery of said one of said body num-
bers; and means operatively connected with said first and second members for holding said end faces in abutting engagement with each other, said first and second contacts being in abutting engagement with each other to effect an electrical connection therebetween and being insulated from environmental fluid when said first and second end faces are held in abutting engagement with one another, said recess providing an escape for fluid to the periphery of said body members trapped between said end faces upon the latter being moved into engagement with each other.

2. A fluidproof electrical connector as defined in claim 1, wherein the other of said body members has a recess therein extending inwardly from the end face thereof and across the end surface to communicate with the outer periphery of said other of said body members.

3. A fluidproof electrical connector as defined in claim 1, wherein said means for holding said end faces in abutting engagement with each other comprises first and second members operatively connected with said first and second body members, respectively; and means for releasably connecting said first and second members together.

4. A fluidproof electrical connector comprising: first and second resilient body members made from an electrically insulating material and respectively having first and second end faces which are adapted to be engaged with each other upon relatively moving said first and second body members in endwise directions toward each other; first and second contacts respectively embedded within said first and second body members and being substantially flush with the adjacent portions of said first and second end faces, each of said body members having a recess therein extending inwardly from the end face thereof and diametrically across the same to communicate with the peripheries of said body members, said first and second contacts being angularly offset with respect to each other when said body members are relatively moved in endwise directions toward each other to place their end faces in abutting engagement with each other and being moved into alignment with each other to effect an electrical connection therebetween by relatively rotating said body members about their longitudinal axes while their end faces are in abutting engagement, said first and second end faces respectively wiping said second and first contacts to effect removal of any fluid thereon into said recesses when said first and second body members are relatively rotated to effect said electrical connection; and means operatively connected with said first and second body members for holding said end faces in abutting engagement with each other.

5. A fluidproof electrical connector as defined in claim 4, wherein said recesses are cross-shaped and divide the end faces into four quadrants, each of the quadrants having at least one contact embedded therein.

6. A fluidproof electrical connector as defined in claim 5, wherein said end faces are flat and in which each end face includes a plurality of additional contacts correspondingly positioned to be engaged when connection of said first and second contacts is effected.

7. A fluidproof electrical connector as defined in claim 4, wherein said means for holding said end faces in abutting engagement with each other comprises a quick connective coupling means.

8. A fluidproof electrical connector as defined in claim 7, wherein said quick connective coupling means includes a socket member connected with said first body member and a plug member connected with said second body member adapted to be telescopically received in said socket member, said coupling members including pin and bayonet slot means for locking the coupling members together, relative rotation of the coupling members to effect the bayonet locking connection therebetween resulting in said wiping of said contacts.

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MARVIN A. CHAMPION, Primary Examiner
J. H. McGILYNN, Assistant Examiner

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