Dec. 22, 1942. J. W. DALGLEISH 2,306,206

ELECTRIC COUPLING

Filed Sept. 29, 1941

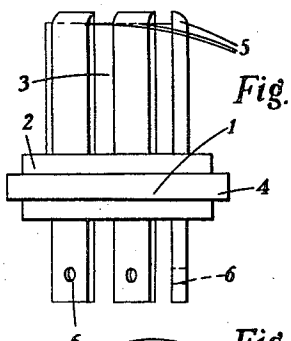


Fig. 1.

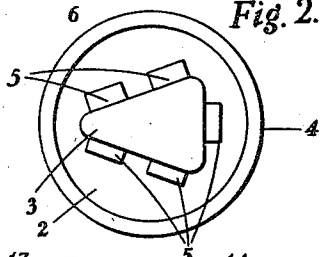


Fig. 2.

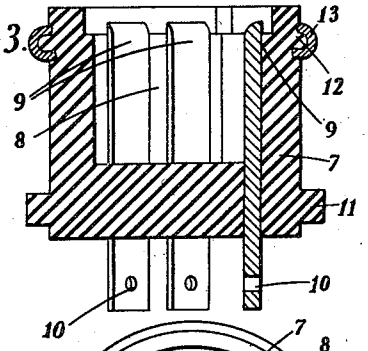


Fig. 3.

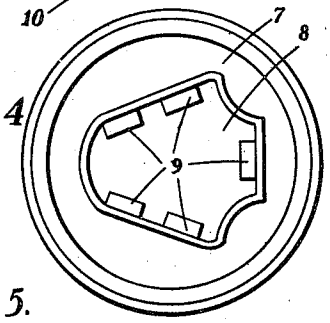


Fig. 4

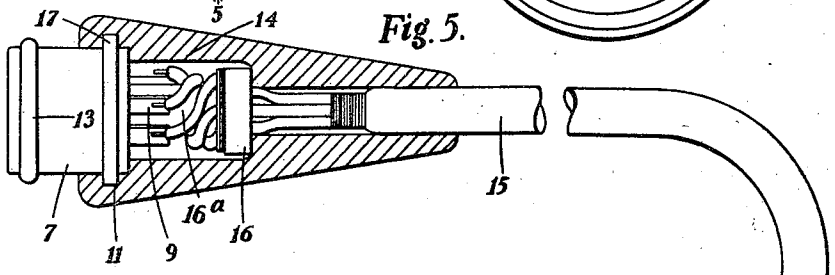
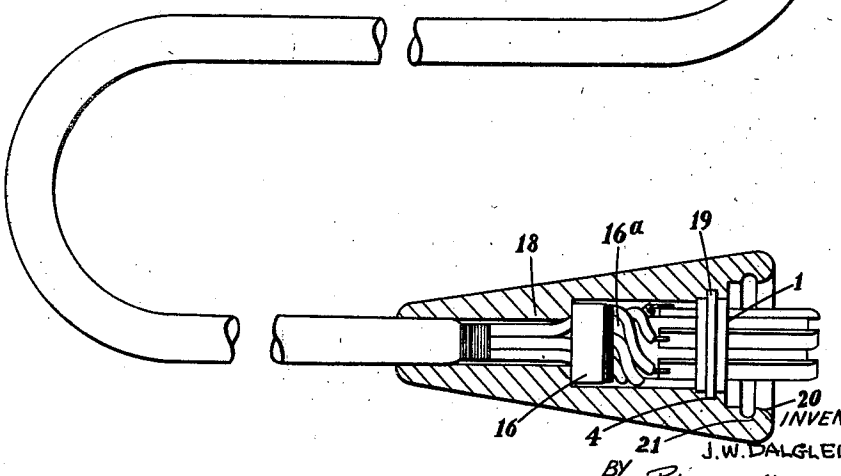


Fig. 5.



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ELECTRIC COUPLING

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Application September 29, 1941, Serial No. 412,879
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5 Claims. (Cl. 173—332)

This invention relates to electric couplings and more particularly to plug and socket couplings.

An object of this invention is to provide a form of coupling which has a lead-carrying capacity which is capable of extension to the connection of a large number of leads, as circumstances may require, and which may be capable of rapid disconnection by "snatching" in the event of an emergency requiring such disconnection. Another object of the invention is to prevent access of water to the conductors of cables connected to the coupling. A further object of the invention is to provide a simple method of manufacturing plug and socket couplings by mass-production methods.

The invention provides an electric coupling comprising a socket and a plug which is adapted to fit into the socket, the socket having an inner wall carrying conductors on its surface with which conductors carried on the surface of an outer wall of said plug are adapted to engage, at least one of said walls being of rubber or like resilient material, whereby on insertion of the plug into the socket the resilient material is stressed so as to maintain the inter-engaging conductors in contact.

Preferably both of said walls are of resilient material and preferably also the entire body of the plug and socket are both made of the resilient material. Alternatively, the use of the resilient material may be confined to the said walls or either of them, the remainder of the plug or socket, as the case may be, being made of some other material.

The conductors carried on a resilient wall are preferably bonded directly to the surface thereof by a bonding process. Rubber bonding processes are known by which metal can be so securely bonded to the rubber that the rubber tears before the metal can be separated therefrom.

The socket may be of annular or tubular form, as a sheath, of internal cross-section appropriate to receive a plug in the form of a prism, cylinder, flat strip or other parallelopiped, or other desired shape. The socket may, alternatively, be cup-shaped internally, for example, hemispherical or in the shape of a conical frustum, the plug being shaped complementarily. If desirable, suitable means may be provided to ensure that the socket and plug will be complementary to each other in a unique relation, such as by means of a groove in one of the parts and a complementary rib in the other part, or alternatively, for this purpose, the plug may have an irregular cross-section such as by forming it in the shape of an irregular prism. In another form the socket may be in the form of a channel, open at its ends, and with contacts spaced along the inner surface of one or both of its walls, the plug being in the form of a strip fitting within the socket. With this form the socket channel and plug strip may be made in any suitable length and cut off to the desired length according to the particular requirements.

The plug and socket may have shallow recesses or grooves in the surfaces of their cooperating walls for receiving and locating the conductors in position. The conductors may project from their respective surfaces or the conductors of one part may so project while the conductors of the other part are recessed in its surface. Preferably, however, the conductors comprise flat metal portions.

The dimensions of the socket within its conductors are made less than those of the plug over its conductors so that in inserting the plug in the socket, the interengagement of the conductors causes the resilient material of the plug and/or that of the socket to be stressed, thereby bringing into play forces maintaining the conductors in contact. In this way the contacting conductors are all subjected to the same pressure maintaining them in contact, in view of the distribution of the stresses respectively in the resilient materials of the socket and plug. The contacting conductors are, moreover, self-aligning due to the rocking action afforded to them about their resilient supports.

The plug and socket may be housed in cases of metal or of synthetic resin or other plastic insulating material or may be completely sheathed in tough rubber or a similar material.

The before mentioned conductors of the plug and socket may constitute contacts and be adapted or provided with suitable terminal means for connecting to the leads to be connected together.

In order that the invention may be more clearly understood, an embodiment thereof will now be described, by way of example with reference to the accompanying drawing in which:

Figure 1 is a side elevation of a plug according to the invention.

Figure 2 is a plan view of Figure 1.

Figure 3 is a section through a complementary socket.

Figure 4 is a plan view of Figure 3 and

Figure 5 shows the plug and socket elements secured to the ends of a cable.

Referring to the drawing the plug comprises a rubber moulding, generally designated 1, hav-

ing a disc portion 2 with an upwardly extending triangular portion 3. The disc portion 2 is formed with a peripheral flange 4 the purpose of which will be hereinafter explained.

The metal contact elements 5 are in the form of strips which pass through correspondingly shaped apertures in the disc portion 2 adjacent the base of the triangular portion 3 and bear along their length upon the surface of this triangular portion being secured thereto by any suitable adhesive. Preferably, however, the contacts are fitted as inserts in the moulding die and are thus moulded in position during the moulding process and simultaneously bonded to the rubber in known manner. The upper ends of the contacts are bevelled in order to facilitate the insertion of the plug into the complementary socket. The plug shown comprises five contacts which are disposed around the triangular portion in the manner shown in Figure 2. The opposite ends of the contacts extend below the disc portion 2 and constitute terminal tags, and may be provided with apertures 6 to facilitate connection of conductors thereto.

A complementary socket is shown in Figures 3 and 4 and comprises a rubber moulding 7 generally of a cylindrical form, having its centre hollowed out to form a recess 8, generally of triangular cross-section. The preferred cross-section, however, is shown in the plan view of Figure 4, in which two corners of the triangular recess are filled in, in order to reduce the possibility of the plug being incorrectly inserted in the socket.

To the inner walls of this triangular recess 8 are secured five flat strip metal contacts 9 which project through apertures formed in the base of the socket, the lower extensions constituting terminal tags for the attachment of the conductors and being provided with apertures 10 to facilitate this connection. The upper ends of the contacts 9 are bevelled to facilitate the insertion of the contacts in the socket. These contacts are preferably moulded and bonded in position during the moulding process.

The internal dimensions between the contacts 9 are made slightly less than the corresponding dimensions over the contacts 5 of the plug so that in inserting the plug in the socket the inter-engagement of the contacts causes the resilient material of the socket and/or of the plug to be distorted, whereby the contacts on the plug and socket are pressed firmly into contact with one another. Due to the fact that the triangular portion 3 and triangular recess 8 are not equilateral, the plug and socket elements can only be connected together in an unique relation.

The outer periphery of the socket moulding 7 is formed with a peripheral flange 11 and also at its upper end with a peripheral ridge 12 upon which is mounted a metal ring 13 having a cross-section as shown in Figure 3. The ring 13 may be moulded as an insert in the die and simultaneously be bonded to the rubber. It gives support to the upper end of the socket to maintain its general shape and prevents the socket from being distorted to such an extent as would permit the plug to be inserted therein in any position.

Figure 5 shows a length of cable having a plug connected to one end and a socket to the other. The socket is carried in a housing 14 made of rubber or like resilient material which is preferably bonded or vulcanised to the sheathing of the cable 15 or alternatively held thereto by the disc member 16 of rubber or other suitable material to which the conductors are secured and which is disposed in an enlarged portion of the housing 14 whereby the latter may not be removed from the end of the cable. The socket 7 is held in the housing by the inter-engagement of its peripheral flange 11 with a groove 17 formed in the inner surface of the housing adjacent its open end, as is clearly shown in Figure 5. The flange 11 is cemented in the groove 17. The conductors are soldered or otherwise secured to the terminal tags at the ends of the contacts 9. The disc member 16 carries an extension 16a which extends between the terminal tags and bears against the rear surface of the socket 7. The conductors are lashed to this extension and are coiled thereabout, the arrangement thus preventing any pull on the coupling from being transmitted through the soldered joints.

The plug 1 is carried by a similar complementary housing 18 of rubber or other suitable resilient material which is attached to the opposite end of the cable in a manner similar to the housing 14. The plug is held in its housing 18 by the engagement and cementing of its peripheral flange 4 in a groove 19 formed in the internal surface of the open end of the housing 18. This open end has an enlarged mouth portion 20 with a further groove 21, which mouth portion and groove are adapted to accommodate the cylindrical body of the socket 7 and metallic ring 13. When a plug is inserted in a socket, the external surface of the socket slides within the enlarged mouth 20 until the metal ring 13 engages in the groove 21, the housing 18 distorting to allow its engagement, due to its being made of resilient material. In this way the plug and socket are firmly held together but in a way which permits the two parts to be rapidly disconnected by "snatching" in the event of an emergency requiring such disconnection. The coupling is also watertight.

Although a particular embodiment according to the invention has been described it is to be understood that this is only by way of example and that various modifications may be made without departing from the scope of the invention as defined by the appended claims. For example, a tubular or annular open-ended socket may be furnished with two plugs one for each end of the socket. Also for connecting together rubber or similarly sheathed cables, a cable end may be used to serve as a plug of the coupling, by bending back the bared ends of the conductors of the cable over its rubber sheathing and bonding them thereto and inserting the so prepared end of the cable into a sleeve socket (preferably of rubber or like resilient material) through one end thereof, the end of the other cable being inserted in the other end of the socket and having its bared conductor ends arranged around the inner surface of the sleeve (and preferably bonded thereto) to engage the bent back conductor ends of the first cable. Alternatively, both cable ends may be formed into plugs in the manner described and introduced from opposite ends into a similar sleeve socket having contact strips secured or bonded to its inner surface to effect electrical connection between the cables.

I claim:

1. A multi-pole electric coupling comprising a socket having an inwardly facing wall, a plurality of conductors carried by said socket and abutting against said inwardly facing wall, a plug adapted to fit into the socket with an outwardly facing wall of the plug adjacent the said inwardly facing

wall of the socket, a plurality of conductors carried by said plug and abutting against said outwardly facing wall and adapted to engage with said conductors on the inwardly facing wall of the socket when the plug is inserted therein, the material of at least one of said walls beneath the conductors abutting thereagainst being of resilient material and the dimensions of the socket within its conductors being made less than those of the plug over its conductors whereby, on inserting the plug in the socket, the interengagement of the conductors causes the resilient material to be stressed transversely to the direction of insertion to maintain the interengaging conductors in contact with the pressure between one pair of conductors being taken up by a counter-pressure between another pair of conductors.

2. A multi-pole electric coupling comprising a socket made substantially entirely of resilient rubber-like material, a plurality of conductors bonded to the internal surface of said socket, a plug having a shape appropriate to enter said socket which is also made substantially entirely of resilient rubber-like material, a plurality of conductors bonded to the external surface of said plug and adapted to engage with the conductors on the socket when the plug is inserted therein, wherein the dimensions of the socket within its conductors is made less than those of the plug over its conductors so that in inserting the plug in the socket the interengagement of the conductors causes the resilient rubber-like material of the plug and socket to be stressed transversely to the direction of insertion, thereby maintaining the conductors in contact.

3. An electric coupling as claimed in claim 2, wherein the socket is provided with a reinforcing ring adjacent its open end to maintain its general shape.

4. A multi-pole electric coupling comprising a socket of resilient material, a plurality of conductors bonded to the internal surface of said socket, a first housing of resilient material embracing at one end thereof a part of said socket, an electric cable fitted within the other end of said housing, the ends of the cable conductors within said housing being connected to the conductors bonded to the socket, a plug of resilient material, a plurality of conductors bonded to the external surface of said plug, a second housing of resilient material adapted to accommodate said plug, said second housing being secured to the opposite end of said cable with the cable conductors at that end connected to the conductors bonded to said plug, said second housing having a mouth portion adapted to embrace the free end of the socket when the plug is inserted in the socket.

5. A multi-pole electric coupling comprising a socket of annular form, one end of which is closed by an end wall, said annular portion and end wall being made of resilient material, a plurality of contacts bonded to the internal surface of said annular portion with their ends passing through said end wall, and a reinforcing ring surrounding said annular portion adjacent the open end thereof, and a plug comprising a disc portion having a stem portion extending substantially axially therewith, said disc and stem portions being made of resilient material, a plurality of contacts bonded to the external surface of said stem portion with their free ends passing through said disc portion, the dimensions within the contacts of the socket being less than those over the contacts of the plug so that in inserting the plug in the socket the interengagement of the conductors causes the resilient material of the plug and socket to be stressed transversely to the direction of insertion, thereby to maintain the conductors in contact.

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