Aug. 9, 1932. N. H. WATTS 1,871,397

ELECTRICAL CONNECTING APPARATUS

Filed July 29, 1929

FIG. 1.

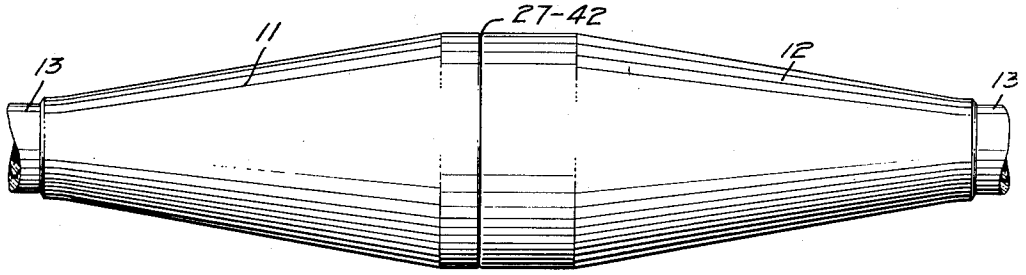


FIG. 2.

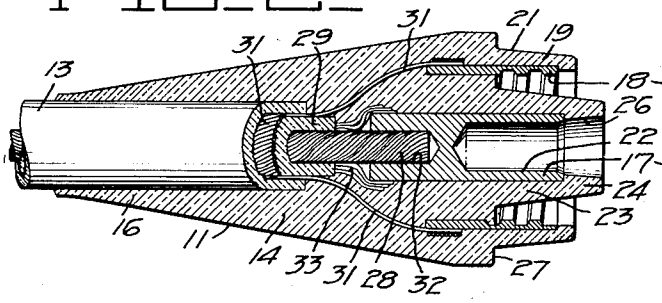


FIG. 3.

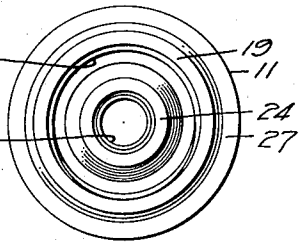


FIG. 5.

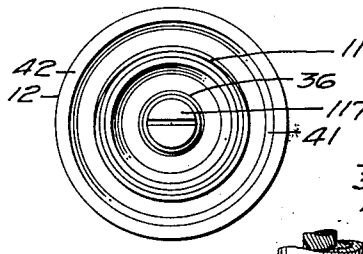


FIG. 4.

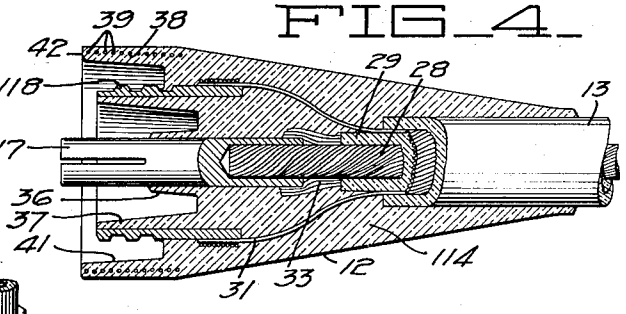
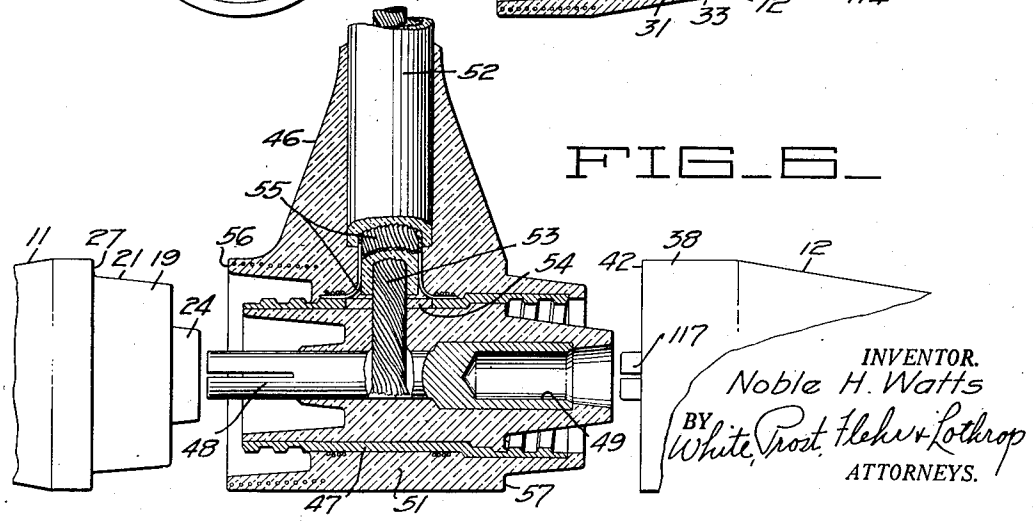


FIG. 6.



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UNITED STATES PATENT OFFICE

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ELECTRICAL CONNECTING APPARATUS

Application filed July 29, 1929. Serial No. 381,699.

This invention relates generally to apparatus including two or more devices carrying contact terminals which can be detachably connected together for establishing or connecting electrical circuits. The individual devices of such apparatus are generally known as terminals, sockets, receptacles or outlets, and are commonly employed when a portable electrical device is connected to a source of current supply.

It is an object of the present invention to devise apparatus of the above character which will permit a tight seal being formed between two complementary terminal devices, thereby making the connection impervious to water or other fluids.

It is a further object of this invention to devise apparatus of the above character which will afford good positive electrical connection between the contact elements.

It is a further object of this invention to utilize resilient material, such as vulcanized rubber, to best advantage in the construction of terminal connector devices, whereby a portion of the rubber is compressed as the two devices are forced together

It is a further object of this invention to devise novel means for protecting the contact elements of terminal devices against accidental injury.

It is another object of this invention to devise terminal devices particularly adapted for carrying relatively heavy currents.

Further objects of the invention will appear from the following description in which I have set forth the preferred embodiment of my invention. It is to be understood that the appended claims are to be accorded a range of equivalents consistent with the state of the prior art.

Referring to the drawing:

Figure 1 is a side elevational view, disclosing apparatus incorporating my invention, the apparatus in this case consisting of two complementary terminal devices formed upon the ends of flexible cables.

Fig. 2 is a cross sectional detail illustrating the construction of one of the devices shown in Fig. 1.

Fig. 3 is an end view of the device shown in Fig. 2.

Fig. 4 is a view similar to Fig. 2, illustrating the complementary device.

Fig. 5 is an end view of the device shown in Fig. 4.

Fig. 6 is a side elevational view, partly in cross section, illustrating an intermediate connector device which can be inserted between the devices of Fig. 1.

The invention as illustrated in the drawing includes two complementary devices 11 and 12, which in Fig. 1 are shown operably connected together. These devices can be variously connected to the conductors of one or more electrical circuits, and can be mounted either stationary or portable. In the specific embodiment shown they are both formed upon the ends of flexible electrical cables 13.

One suitable construction for device 11 is shown in Fig. 2. In this case it is formed of a body member 14, which is preferably of resilient insulating material, such as resilient vulcanized rubber. The portion 16 of reduced diameter surrounds the adjacent end portion of cable 13. Generally it is preferable to utilize a cable having a sheet of resilient insulating material, such as vulcanized rubber, and in the process of manufacture, the material of the body 14 is vulcanized about and thus securely bonded to the sheath of the cable. One or more contact elements are carried by the body 14, depending upon the character of the circuit with which the device is to be used. In the particular instance illustrated, two contact elements 17 and 18 are employed. Element 18 is in the form of a sleeve which is preferably surrounded by a projecting annular portion 19. It is desirable to form portion 19 of resilient material, such as vulcanized rubber, and it can be integral with the body 14 as shown. The outer peripheral surface 21 of portion 19 is preferably tapered as shown, for a purpose which will be presently explained.

Contact element 17 is shown in the form of a pin disposed centrally of body 14 and in alignment with the axis of sleeve 18. This pin has an opening or bore 22 extending inwardly from the forward end of the same,

to accommodate a complementary contact element which will be presently described. The inner end of contact element 17 is suitably mounted within the body 14, preferably by embedding it in the resilient material of the body.

In order to prevent arcing between contact elements 17 and 18, and in order to increase the effective leakage path between these elements, I preferably provide a sleeve 23 of insulating material surrounding the element 17, and this sleeve is extended beyond the outer end of element 17 to form an insulating shroud 24. Sleeve 23 is also preferably formed of resilient insulating material, and can be formed integral with the body 14 as shown. Sleeve 23 preferably tapers to a smaller diameter from the body 14 toward its outer end, while the inner peripheral surface 26 of shroud 24 is preferably tapered in the opposite direction. The annular portion 19 is preferably of smaller diameter than the adjacent portion of body 14, so as to form a flat annular seating surface 27.

The particular cable 13 illustrated is adapted for carrying relatively heavy currents, and has a central stranded conductor 28, covered by insulating material 29. Wires or strands 31 are wrapped about insulation 29, to form the other cable conductor. To make electrical connection with elements 17 and 18, the central conductor 28 can be extended into a suitable socket 32 formed on the inner end of element 17, and welded or soldered thereto to provide good electrical contact. The individual wires 31 of the other cable conductor can be spread where they project from the cable sheath, and individually soldered or welded about the inner edge of sleeve 18. Tape or other suitable insulation 33, can be wrapped about the inner end of contact element 17 to preclude possible short circuiting between wires 31, and conductor 28 or element 17, while the device is being manufactured. Generally the contact elements 17 and 18 are made of some suitable metal such as brass, which will effectively bond to the resilient rubber.

The device shown in Fig. 4 is complementary to that of Fig. 2 and is likewise preferably constructed with a body 114 formed of resilient insulating material, such as vulcanized rubber. The complementary contact elements 117 and 118, which are carried by the body 114, are adapted to interfit with elements 17 and 18. For example element 117 is in the form of a pin adapted to fit within the bore 22 in element 17. In order to cooperate with sleeve 23 to prevent arcing between the contact elements, a boss 36 extends outwardly from the body 114 about pin 117, and this boss has an outer tapered surface so that it will closely interfit the inner surface 26 of shroud 24. A sleeve 37 of insulating material is also disposed about the inner peripheral surface of contact element 118, and has an inner tapered surface adapted to fit the sleeve 23.

Surrounding but spaced from the contact element 118, I provide a shroud 38 which is preferably formed integral with body 114, and therefore is also of resilient insulating material. The rubber constituting this shroud is preferably reinforced by embedded reinforcing cords 39 which extend in a circumferential direction. Shroud 38 has an inner tapered peripheral surface 41 adapted to fit upon the peripheral surface of device 11.

In place of simply relying upon frictional engagement between the devices 11 and 12 for retaining the same together, I preferably provide positive means, such as parts of which have threaded engagement with each other, Thus two complementary contact elements, in this case elements 18 and 118 are shown provided with relatively coarse threads for engagement with each other.

For connecting together the two devices 11 and 12, the operator guides contact element 117 into shroud 24 and into the contact element 17. When the contact elements 18 and 118 contact, the two devices are rotated relative to each other to screw contact element 118 into contact 18, thus drawing the two devices together. Relative rotation and drawing movement of the two devices together result in engagement of the end surface 42 of shroud 38, with the corresponding surface 27 on device 11. Since surfaces 42 and 27 are resilient, the rotation can be continued a sufficient amount to jam these surfaces together to form a good fluid tight sealed engagement, and the friction occassioned between the surfaces is sufficient to prevent the devices from unscrewing until considerable manual force is applied. Just before the two devices are screwed into final set position, tapered surface 41 of shroud 38 contacts with the complementary tapered surface 21 of the device 11, so that the slight additional rotation between the two devices to secure final set position tends to force the resilient surfaces together to form a sealing engagement, and slightly expands the shroud 38. A certain amount of friction is also occasioned by the latter tapered surfaces, tending to prevent the two devices from unscrewing until manual force is applied. A sealed fit can also be provided between sleeve 23 and the complementary surfaces provided on device 12, to prevent possible arcing between the contact elements, although ordinarily such sealing engagement is not necessary.

From the above description it is evident that when my two devices are oppositely connected together, the junction between the two devices, or in other words the space about the contact elements, is sealed against entrance of water or other fluids, or any foreign mat-

ter. Because of this sealing engagement, it is impossible for an operator handling a cable having such connector devices, to obtain a shock when the exterior of the cable happens to be wet or covered with a fluid which is a conductor of electricity. Device 11 is preferably connected to the live end of the circuit, since the contact elements of this device are protected so that they cannot be accidentally touched by an operator.

The compression of the resilient rubber adjacent the surfaces which are jammed together tends to normally force the contact elements apart, thus aiding in forming a positive electrical contact between the threaded contact elements 18 and 118. The amount of force with which the sealing surfaces are forced together can be determined by the pitch of the threads provided on contact elements 18 and 118. With the devices illustrated, good results have been secured by employing about three threads per inch. In place of or in addition to threading contact elements 18 and 118, it is evident that contact elements 17 and 117 may be threaded to, or a threaded engagement can be formed by parts other than the contact elements.

The use of shroud 38 not only makes possible the results explained above, but also tends to prevent the contact elements of this device from being accidentally struck and battered, when the device is in use. Extension of rubber beyond the ends of contact elements 17 and 18 of the device 11, likewise protects these elements. The reinforcing of shroud 38 by cords 39 prevents gradual permanent expansion or growth of shroud 38 when the device is used over long periods, and also prevents possible enlargement of the shroud due to contact with oil.

While I have described two complementary devices which are both formed of resilient material, and which both provide sealing surfaces of resilient character, it is apparent that the advantages of my invention can be secured by constructing one of these devices of rigid material, providing a rigid seating surface adapted to cooperate with a complementary resilient sealing surface. Furthermore it is possible to interpose an intermediate member between the devices 11 and 12, so that sealing is effected between the surfaces provided upon each device and surfaces provided upon the intermediate member.

In Fig. 6 I have shown an intermediate device adapted to be connected between devices 11 and 12, to supply current to or to make connections with a third cable or electrical circuit. This intermediate device, designated generally at 46, includes in this instance a metallic sleeve 47 having threaded ends adapted to cooperate respectively with contact elements 18 and 118. Within sleeve 47, there is a central conductor 48 having its one end portion formed to provide a pin to cooperate with contact element 17 and its other end formed to provide a socket 49 to receive the contact element 117 of device 12. The body 51 of this intermediate device can also be formed of resilient insulating material, such as vulcanized rubber, but in this instance the associated cable 52 extends in a lateral direction. The central conductor 53 of cable 52 is extended through an aperture 54 in sleeve 47, and connects to central conductor 48, while the individual wires 55 of the other cable conductor are spread and electrically connected to sleeve 47. The ends of device 46 are complementary and are constructed similar to the corresponding parts of devices 11 and 12. That is the end portion adapted to cooperate with device 11 is formed similar to device 12, while conversely the end portion for cooperating with device 12, is constructed similar to device 11. Thus when the two devices 11 and 12 are operably connected with device 46, sealing surface 27 of device 11 is forced against a sealing surface 56 formed on device 46, and similarly sealing surface 42 on device 12, is forced against a sealing surface 57 formed on device 46.

It is evident that the devices described above can be constructed in various sizes for operation with circuits or conductors of different current carrying capacities. However because of the good electrical contact afforded between the contact elements, the devices are particularly valuable when used in connection with heavy duty cables for carrying relatively heavy currents, as for example cables of an electrical welding outfit. As has been previously indicated the devices need not be associated with flexible electrical cables, but can be incorporated in a permanently installed receptacle or outlet box. Furthermore the devices can be constructed with a single electrical contact element, or more than two contact elements can be employed if the number of conductors to be connected necessitates such construction.

I claim:

1. Means for making detachable electrical connections comprising two devices adapted to be detachably connected, each of said devices including a body and an electrical contact element carried by each body, means for forming a fluid tight seal about said contacts when the devices are forced together, said means including tapered interfitting sealing surfaces, at least one of which is resilient, and means for forcing said devices together when one device is rotated relative to the other device whereby the sealing surfaces are forced together.

2. A connector device comprising a body formed of resilient insulating material, a metal sleeve contact embedded in said body, a central contact element disposed axially of the sleeve and carried by the body, and resilient tapered integral parts formed on said

body about each contact and adapted to interfit a complementary device in order to make a fluid tight joint therewith.

3. Means for making detachable electrical connections comprising a connector device including a body formed of resilient rubber and a contact element accessible from one end of said body, another complementary device including a body formed of resilient rubber and a complementary contact element adapted to have threaded engagement with the contact element of the other device, the bodies of the two devices having interfitting tapered parts formed of resilient rubber, said parts affording cooperating resilient sealing surfaces whereby said surfaces can be forced together when one contact element is screwed upon the other.

4. A terminal for a duplex flexible cord, comprising in combination, a cylindrical contact threaded for a portion of its length and connected electrically to one conductor of said cord, a contact pin coaxially disposed with relation to said cylindrical contact and connected electrically to the other conductor of said cord, and a resilient insulating body imbedding said contacts and molded onto the end of said cord, said insulating body extending beyond the outer ends of said contacts and provided with concentric recesses to permit access to the respective contacts, at least one side of said recesses being tapered, thereby providing a surface for cooperating with tapered surfaces of a complementary terminal for making a fluid tight joint.

5. A terminal for a flexible cord having a plurality of conductors therein, a plurality of contacts connected severally to the conductors thereof, a resilient insulating body molded to the end of said cord and embedding said contacts, said body being provided with concentric recesses adjacent the respective contacts, said recesses having at least one tapered side, and means whereby the turning of a complementary terminal, when brought into correct juxtaposition, draws one terminal tightly against the other thereby causing a fluid tight joint to be made between cooperating tapered surfaces.

In testimony whereof, I have hereunto set my hand.

NOBLE H. WATTS.