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J. R. FREI ET AL  
ELECTRICAL CONNECTING MEANS

2,521,056

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Fig. 1

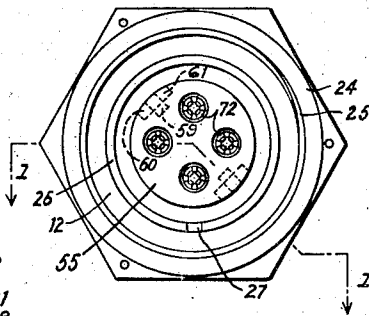
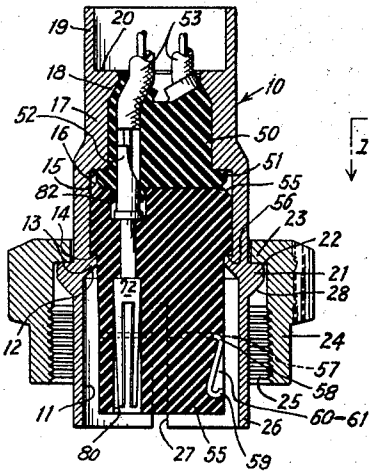


Fig. 3

Fig. 6

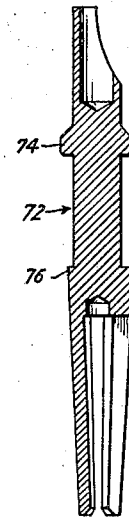


Fig. 2

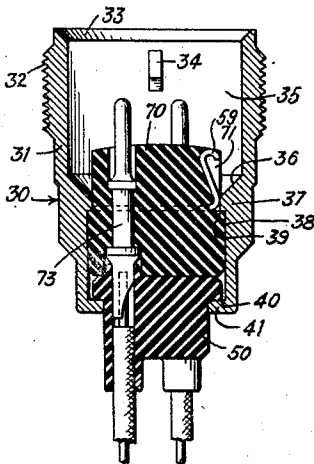


Fig. 4

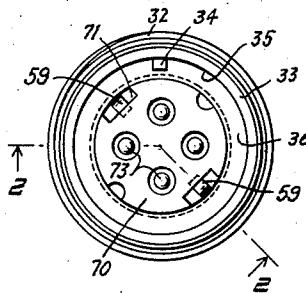


Fig. 5

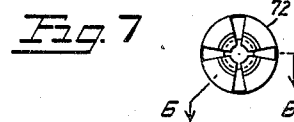
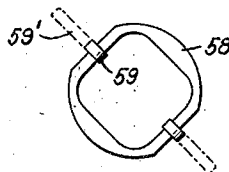
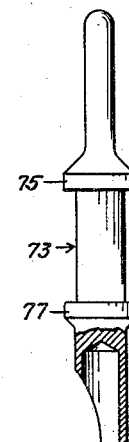


Fig. 8



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## UNITED STATES PATENT OFFICE

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## ELECTRICAL CONNECTING MEANS

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Application August 18, 1945, Serial No. 611,373

2 Claims. (Cl. 173—328)

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This invention relates to electrical connectors, and particularly to means for connecting electrical conduits. This invention is a modification and, to some extent, an improvement of the invention described in my co-pending application Serial No. 611,372 filed of even date herewith.

It is an object of the invention to make a connection that will mechanically and electrically shield a pin and socket connection so that vibration will not jar the connection loose or destroy the electric shielding.

Another object of the invention is to mount a pin and socket in resilient mountings under compression in order to protect the connection against the entry of liquids or dampness.

Another object is to construct a pin and socket so that they may be interchangeably mounted in resilient and protective mounting means.

Another object is to assemble a plurality of pins in a single mount with enough resilience to let them yield to assume cooperative and correctly aligned positions in respect to similarly mounted sockets when the connection between the parts is made.

Another object is to prepare pin and socket contacts for connecting electric conductors having resistance approaching that of copper wire, and which have extensive surfaces in contact whereby to reduce resistance.

Another object is to prepare from material of low resistance, spring sockets that retain their resilience at temperatures harmful to the resilience of prior art sockets.

A further object is to make a socket having spring fingers adapted to make contact with the surface of a pin along substantially the length of the telescoped parts.

A further object is to mount pins and sockets removably in connectible metal shells in mountings having greater resilience during assembling of the parts than after the connection has been completed.

A particular object of this invention is for the aforementioned purposes, to reduce the number of parts employed in the electrical connection constituting the invention described in my co-pending application to make a simple connection having all or a substantial part of the advantages of my said invention, and to reduce the amount of metal employed in constructing the plugs and jacks of the connection.

Another particular object of this invention is to provide for the ready dismounting of the resilient inserts from the strong protective shells of electrical connections corresponding to the

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inventions described herein and in my said application.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a section on the line 1—1 of Fig. 3, taken through one cooperating part of an electrical connector constructed according to the principles of this invention;

Fig. 2 is a section on the line 2—2 of Fig. 4 through the cooperating part of the said connector;

Fig. 3 is an inverted plan view of the structure shown in Fig. 1 showing the ends of the four sockets of a four wire connection;

Fig. 4 is a plan view of the structure shown in Fig. 2 showing the ends of four contact pins adapted to cooperate with the four sockets;

Fig. 5 is a detail of the ring and hooks by which the inserts may be removed from their mounts;

Fig. 6 is a section on the line 6—6 of Fig. 7 showing a section through a socket;

Fig. 7 is an inverted plan view of the socket shown in Fig. 6; and

Fig. 8 is an elevational view, partly in section, of a plug or pin.

This invention presents a novel means of connecting and protecting the terminals of electric lines, particularly of joining the ends of conduits having one or a plurality of insulated wires to be joined in proper relation, and is the first connection based upon electrical and scientific principles adapted to the needs of modern service.

Referring now to the numerals on the drawings and particularly to Fig. 1, 10 is a tubular shell having an internal cylindrical section 11 terminating in a conical surface 12 on an annular abutment 13, the abutment having a face 14 opposite the surface 12 that is substantially normal to the longitudinal axis of the shell and serves as a wall to retain an insert to be hereinafter described. Beyond the abutment 13 is a cylindrical section 15, of lesser diameter than the portion 11, that serves as a chamber for the recep-

tion of the abutting annular flanges of mounting blocks and terminates in a wall 16 forming an abutment to retain the end flange of a mounting block. From the wall 16 the inner surface of the shell continues as a section 17 cylindrical at one end and provided toward the other end with a conical part 18. Beyond the section 17 the shell 10 is continued as a sleeve 19 serving to receive the end of a flexible or rigid conduit. A wall 20 separates the inner surface of the sleeve 10 from the section 17 and serves as an abutment for the end of the conduit, not shown, that serves to protect and radio shield the insulated wire beyond the connection which forms the subject matter of this invention.

The external surface of the shell is provided with an annular abutment 21 having a wall or face 22 serving to retain the flange 23 of a clamping ring 24 which is provided with a polygonal head for the seating of a wrench and with internal screw threads 25 adapted to cooperate with similar threads on a cooperating portion of the connector. The shell 10 at its lower end, as shown in Fig. 1, is provided with a sleeve 26 having a slot 27. The abutment 21 has an annular spherical face 28 serving as an abutment for the end of a cooperating sleeve, which will now be described.

Referring now to Fig. 2 there is provided a shell 30 having a sleeve 31 on which are external screw threads 32 and which has at its end a conically bevelled face 33 for seating upon the spherical abutment 28 of the shell 10 when the two shells are in assembled relation. The exterior diameter of sleeve 26 and the interior diameter of sleeve 31 are substantially the same to provide a close fit so that when they are in telescoped relation these parts prevent the application of bending forces that would tend to weaken the connection between the electrical parts, the pins and sockets, to be hereinafter described. In addition, these overlapping sleeves conjoin through the spherical-conical seat of the parts 28, 33 to give a perfection of electrical shielding which is believed to be unexampled. The interior of sleeve 31 is provided with a key 34 adapted to cooperate with the slot 27 in sleeve 26, and has a cylindrical section 35 terminating in a conical surface 36 between section 35 and a section 38 that is bounded by walls 39 and 40 of which the former is substantially normal to the axis of the shell and forms a part of abutment 37 and the latter is also substantially normal to the axis of the shell and forms a part of the annular end flange 41 of the shell. The section 38 is adapted to receive and retain the flanges of a plurality of resilient mounting blocks.

From the foregoing description it will be understood that there has been provided a protective structure having cooperating parts adapted to easy assembling and dismounting, which is adapted to protect the electrical connections contained therewithin from blows and from bending stresses, and which is adapted to prevent the escape of emanations originating in the electrical connections themselves and to deny access to electrical emanations from other sources. These shells may be made of aluminum, other metals, or of strong resinous materials that are adapted to the formation of such shapes, for instance, phenol-formaldehyde resins. The slot 27 and stud 34 are preferably adapted to align the shells within 30 minutes of arc and are adapted to give as fine or as coarse alignment as is advantageous

with particular numbers of plugs or particular arrangements of parts.

The described structures are not only useful and advantageous for these reasons but because they are well adapted to the mounting of the inserts and the members constituting the electrical connections. These blocks and electrical connections are highly novel and are adapted to simple methods of manufacture and to easy mounting and dismantling.

Referring now to Fig. 1, it will be observed that the section 17 and the abutment 13 are of different diameters, the purpose of which is to serve as a novel and simple method of mounting a plurality of resilient mounting inserts. The first of these resilient mounting inserts is given the number 50 and has a body portion equal in diameter to the inner diameter of the wide portion of the section 17, or smaller or larger, and is provided at its end with a flange 51 of such size that it can be forced through, or passed through, the annular abutment 13 and brought up against the wall 16 which brings it to a stop and serves to prevent the insert being forced further into the section 17. The conical abutment 18 in the section 17 compresses the other end of the insert 50, serving to compress it uniformly against the insulated wires to form a seal, and to assist in preventing the insert from being thrust too far into the section 17 by pressure applied at the time or subsequently on joining the parts of the shell. The insert 50 serves to protect the joints 52 between the ends of the sockets, or pins, to be hereinafter described, and the connected ends of insulated wires 53. The nature of those connections is set forth in detail in my said co-pending application.

The insert 55 is of diameter equal to or preferably somewhat greater than the diameter of section 15, the size being restricted to that which will pass the abutment 13. Insert 55 has an end flange terminating in a shoulder 56 which cooperates with the shoulder or face 14 to prevent the block from being easily withdrawn from the shell after it has been inserted. The longitudinal extent of the flange 51 and the flange on the end of block 55 is preferably such that when the inserts are inserted they are held under a certain amount of compression by the annular walls 16 and 14, making a firm mounting for the pins and sockets. The size of section 15 is equal to the size of section 38 to permit of interchangeable mounting of the inserts in the shells.

In order to withdraw the insert 55 from the shell, there is provided in the insert an annular groove 57 in which is seated a ring 58 having hooks 59 preferably formed integral therewith, and bent to shape as shown in Fig. 5. These hooks may be moulded in the resilient insert or, by appropriate selection of part dimensions, seated in a pre-formed groove in the insert. Extending from the groove 57 is a groove containing, or a plurality of grooves 60, 61 which lie beside, the hook 59 and give access to a tool capable of engagement with the hook or hooks. After the tool has been engaged with the hooks, a pull will suffice to draw the insert 55 out of the shell. The insert 50 can then be pushed out from the other end. As mounted in the insert 55 of Fig. 1, the grooves 60, 61 do not extend to the end of the insert, but access for the tool is provided by the space between the insert and the sleeve 26. The tool for dismounting the parts may be a piece of strong wire with loops at both ends adapted to hook over the hook ends. A wrench

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handle can be slipped through the wire and pulled to withdraw the insert.

As shown in Fig. 5, the ring member 58 may be stamped or otherwise made out of a flat piece of metal having projecting ears 59', shown in broken lines, which are subsequently formed to the hook shape 59 before mounting in the insert.

The cooperating shell shown in Fig. 2 is also provided with cooperating mounting inserts of design similar to that which has been described, differing mainly in that the mounting insert 70 is shorter than the mounting insert 55 in the length between the shoulder 39 and the face of the insert. This insert is also provided with an end flange adapted to cooperate with the end flange of insert 50, between flange 41 and the abutment 37 in the manner described for the inserts 50 and 55. The inner diameter of the flange 41 and of abutment 37 bear the same relation as the inner diameter of the section 17 and the abutment 13 so that the same principle of mounting may be employed and the parts may be made interchangeable without interfering with the complete cooperation and functioning of all the parts of the two shells. The insert 70 differs from the insert 55 in that the hooks 59 extend to the end of the insert in group 71 so that the ends of the hooks 59 are visible, which is not true in the case of insert 55.

The sockets 72 and pins 73 are similar in their method of operation to the sockets and pins claimed in another of my copending cases, directed more or less specifically to their novelty, differing therefrom in having shorter body portions and abutment flanges 74, 76, 75, 77 of less length. The sockets and pins as so modified require less metal in their making.

The novel structure which has been described is assembled into a unitary and protected electrical connection that is believed to be superior to anything heretofore devised for connecting the ends of electrical conductors, having not only high mechanical strength offering superior protection to the electrical parts, but superior shielding, superior durability, and offering superior protection against the entrance of liquids either through joints or through the insulation of the wires acting as wicks. The general and particular superiority of the connection will be pointed out more particularly in the description of the mounting of the parts.

In mounting the elements of Fig. 1 the wires 53 are freed of insulation and cleaned at their ends and brought through the shell 10 and through the unmounted insert 50 into the solder wells at the ends of the sockets 72 wherein they are soldered. The sockets are then mounted in the inserts 55 by thrusting them point foremost through the holes thereof until their reduced body portions are seated in the reduced portions of the holes 80 extending through the inserts 55. Alternatively the inserts may be inserted in the shells and the sockets inserted in the inserts. The resilient rubber or other dielectric material of which the insert 55 is made grips the reduced portion of the socket firmly by reason of having in its normal position a hole diameter less than the diameter of the body portion of the socket so that the socket is normally held by the said insert under some compression. The insert 50 is now slid down over the wires 53 until it covers the joint between the wires and the sockets and abuts the insert 55. The entire sub-assembly is then thrust into the position shown in Fig. 1. These mounting steps are comparatively simple

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and can be done rapidly. The compression offered to the insert 50 by the reduced portion 18 of the section 17 serves to seal the end of the insert around the insulation, but insulation is sometimes of fibrous nature and a perfect sealing may not be accomplished due to the wick action of the insulation, some moisture may make its way within the passages of the insert 50 through insulation acting as a wick. However, such moisture is prevented from penetrating to the socket connection by means of conical bosses 82 formed on the face of the insert 50 which cooperate with the ends of holes 80 in the insert 55 to prevent any moisture from making its way along the sockets to the connections with the pins and to reduce the possibility of electrical flashovers, and creepage. Similar construction between insert 50 and insert 70 prevents access of moisture to the connection through shell 30. One of the inserts 55 and 70 has a spherical abutting face designed to squeeze moisture and air out from between the contact faces.

The inserts with their associated pins and sockets are mounted in the shells by alignment of the slot 27 with the stud 34, alignment being preferably within 30 minutes of arc. Thus in Fig. 3 the sockets 72 are diametrically aligned with the slot 27 and the pins 73 are diametrically aligned as shown in Fig. 4 with the stud 34, to about the same degree of accuracy. Thus, when the stud is aligned with the slot the cooperating pins and sockets will be properly aligned with each other and can be forced into engagement by hand or preferably by the use of the clamping ring 24 in engagement with the screw threads 32.

After the faces of inserts 55 and 70 are brought into abutment, they are put under compression, to hold the parts firmly, by the use of ring 24, thus tightening the seal and reducing the effect of vibration upon the pins and sockets. The end flanges on inserts 50 are sufficiently resistant to withstand the pressures thus applied. The apparatus is thus, when assembled, capable of protecting the electrical connection against all manner of disruptive and destructive influences, such as bending or breaking stresses, which do not reach the pins and sockets, crushing forces, that are resisted by the shells, and corrosive substances, that are excluded by the seals. These inventions are believed to constitute the first scientific connection for the ends of conductors.

The advantages of this particular construction over that described in the said co-pending case include simplicity of construction, simplicity of assembly, fewer parts, and in reducing the time and improving the ease of assembly and dismantling. Both of the types are satisfactory and adapted to a general field, but have special adaptabilities in particular fields.

Although only a single embodiment of the present invention is herein illustrated and described, it is to be expressly understood that the same is not limited thereto. Various changes may be made therein, particularly in the design and arrangement of the parts illustrated without departing from the spirit and scope of the invention, as will now be apparent to those skilled in the art.

What is claimed is:

1. A resilient insert of insulating material, adapted for use in association with other parts of a mount for electrical connectors, having an annular groove and an elemental slot, and a metal ring of flat stock seated in said groove

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having a hook extending toward the end of the insert in said slot.

2. A resilient block of insulating material adapted for use in association with other parts of a mount for electrical connectors, having at least one grip sunk within the outlines of the block and attached to a member that is anchored within the outlines of the block, said block having means adapted to admit a tool for engagement with the grip.

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