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J. T. KEITH ETAL

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ELECTRICAL CONNECTOR WITH CONTACT RETENTION SLEEVE

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FIG. 1.

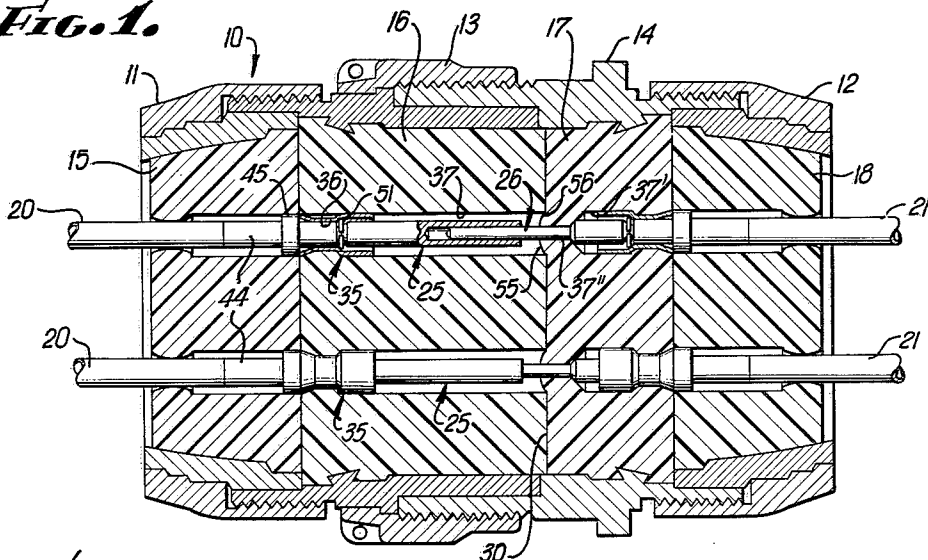


FIG. 2.

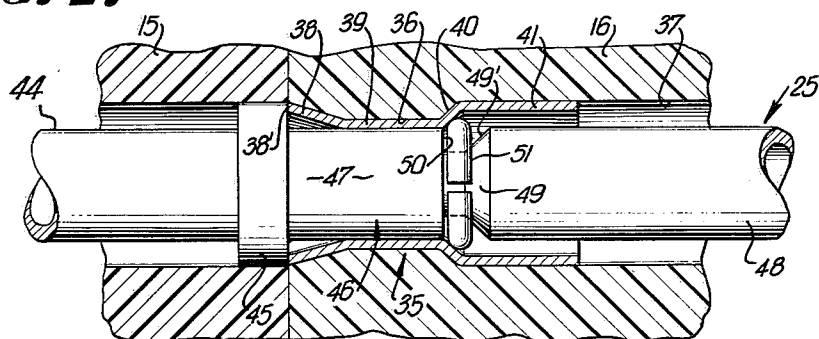
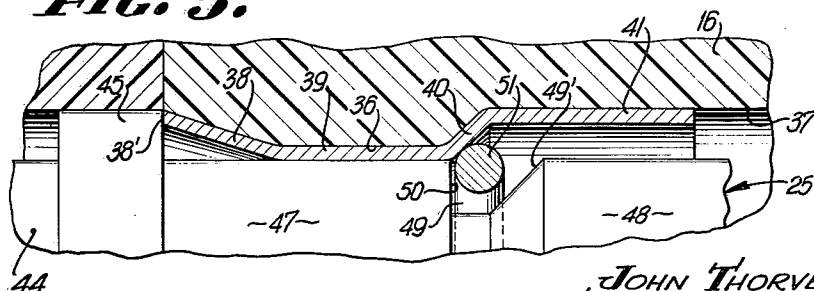


FIG. 3.



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1

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ELECTRICAL CONNECTOR WITH CONTACT RETENTION SLEEVE

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This invention relates to electrical connectors and in particular to an improvement in connectors having removable and replaceable contact terminals.

Connectors are known wherein a pair of opposed cooperating insulation bodies or blocks, usually contained in cooperating shells, and having mating contact terminals mounted in the body, for example, a pin in one insulation block and a socket in the opposite insulation block may be brought into physical juxtaposition for effecting electrical connection between conductors which are connected to the respective contact terminals. It is found advantageous in certain types of construction and under certain uses to provide removability of the contact terminals for replacement of damaged parts or for the purpose of altering the pattern of a plurality of contact terminals in a single connector or for other obvious reasons. This has been accomplished by the use of a compressible spring retaining member such as a C ring associated with the contact terminal and expanding into a portion of the insulation block bore in which the contact terminal is mounted.

It has been found, however, that if the insulation block is of a relatively soft and yielding elastomer, such material may yield rather than effect a compression of the spring member and introduction of the contact terminal fails, or is at least difficult, to accomplish. The trouble is more pronounced in making the attempt to remove the contact terminal. If, on the other hand, the insulation block should be of a hard and brittle material, the radial force imposed upon the wall bore of the material by the spring member may crack it, or possibly abrade it.

It is therefore a principal object of the present invention to provide a specially designed reinforcing sleeve or lining for embodiment in the bore of an insulation block wherein a terminal contact member having a spindle type mounting section may be readily inserted into the insulation block after the latter is formed, and will be satisfactorily retained therein during ordinary use, but may be removed by impact or sufficient force imposed upon the contact terminal in the reverse direction to force it out of the insulation block in the direction from which it entered.

A further and more particular object is to provide in a structure of the character described a metallic or other hard material sleeve, preferably bonded to or molded in the bore of an insulation block, the latter being made of a material generally unsuitable to the snap-in contact type of installation, such, for example, as a relatively soft elastomer or a relatively brittle insulation material, the sleeve having a flared entrance ramp for contracting with relative mechanical advantage a split ring carried in a groove on the contact terminal, the entrance ramp merging into a constricted cylindrical neck section which will firmly guide and radially support a cylindrical mounting section of the contact terminal, the inward end of the neck section terminating in an annular shoulder merging into an enlarged diameter of the insulation block bore. This type of sleeve will protect the insulation block against undue radial distortion and it will, at the same time, provide a firm operating non-yielding surface for the split ring to slide against and ultimately expand against the

2

shoulder. The sleeve also provides at the extremity of its flared entrance ramp a stop shoulder against which a cooperating stop member, such as an annular flange on the contact terminal, may abut, to cooperate with the split ring in axial positioning by the contact member.

The foregoing and other objects of the invention will become further apparent from a consideration of the description which follows, had in reference to the drawings.

In the drawings:

FIG. 1 is a vertical section of an assembled connector with parts cut away illustrating the sleeve insert in the insulation block and its associated parts;

FIG. 2 is an enlarged fragmentary section showing a portion of the device of FIG. 1; and

FIG. 3 is a still further magnified section of a fragment of the device shown in FIGS. 1 and 2.

The present invention may be employed in connectors of various external configurations, and for the sake of example, only, and not by way of limitation, there is shown a connector shell 10 made up of a plurality of cylindrical sections or sleeves 11, 12, 13 and 14, which can be assembled by means of the cooperating threads illustrated to form a continuous housing for a series of insulation members 15, 16, 17 and 18. The end insulation members 15 and 18, sometimes referred to as "grommets," are ordinarily made of a softer material than the central insulating sections 16 and 17 in order to provide a close elastic contact with conductor members 20 and 21, and thus seal off moisture from the interior of the connector where the terminals are located.

One contact terminal such as a socket 25 is installed in the insulation block 16, and a mating pin terminal 26 is located in the insulation block 17 and makes electrical contact with the socket 25; there may be a plurality of sockets in one section of the connector and a complementary plurality of pins in the other section of the connector, the whole connector assembly being separable for disconnection generally along the line 30 which is the junction of meeting faces of the insulation blocks 16 and 17.

There is shown face-to-face contact between the grommet 15 and the insulator 16 and between the grommet 18 and the insulator 17, and these parts are also respectively separable, and would be separated for inserting or removing the contact terminals from the insulation blocks.

The important part of the present invention resides in the means by which the terminals are mounted in or removed from the insulation blocks 16 or 17. As indicated, this is accomplished prior to assembly of all the parts as shown in FIG. 1 and prior to the assembly of the grommets in contiguous relationship to the respective insulators. The purpose is to provide an improved form of "snap-in" contact, meaning a contact or terminal which can be pushed into place in a cylindrical bore in an insulating block and become automatically locked therein subject to removal by an adequate impact or axial force exerted in the direction opposite to that of entry.

A principal feature is the provision of a retention sleeve 35 bonded or molded in an end region 36 of generally cylindrical bore 37. The sleeve, which is made of metal or other tough, hard, relatively non-yielding material, provides the receptacle for firm seating of the terminal. It enables the use of snap-in contacts in insulators which would be too soft to provide suitable coaction with stops and locking rings or other locking members on or associated with the terminals.

The sleeve has a flared end 38 tapering into a reduced neck or tubular section 39, the latter of which terminates in an expansion shoulder 40 followed by a cylindrical skirt 41. In the preferred construction the sleeve, as mentioned, not only is bonded by any suitable agent and

molded into the insulator but its own configuration, having a reduced diameter in the center, provides external abutments at the flare 38 and the shoulder 40 which aid in anchoring the sleeve against axial dislodgement in either direction.

The terminal 25 includes a hollow solder or crimping cup 44 which conductively receives the wire of conductor 20. Integral with the cup 44 is an annular shoulder 45 of greater diameter than the cup 44. This diameter, namely, the external diameter, of shoulder 45 is generally equal to the external diameter of the extreme end 38' of the flare 38 against which end it abuts when the parts are assembled. Succeeding the shoulder 45 is a stem 46 which has an external diameter providing a sliding but snug fit in the neck portion 39 of the sleeve and is free of the wall of the bore 37. This stem 46 may be regarded as embodying a positioning section 47 located in the neck 39 and a contact socket section 48 adapted for reception of the pin 26, the two sections being separated by a groove 49 of special configuration. This groove has an annular plane flat surface 50 located approximately at the smaller diameter end of the shoulder 40 when the parts are assembled, and a tapered shoulder or face 49' opposite the surface 50. The width and depth of the groove is sufficient to accommodate a snap C ring 51 allowing for contraction of the latter when it is located in and passing through the neck section 39 of the sleeve. When permitted to expand, the resilient ring 51 lodges between the internal surface of the shoulder 40 and the tapered surface 49' of the terminal, bearing primarily upon the shoulder 40.

In assembling the contact in the insulation block, the C ring 51 which is of spring material is slipped over the contact (forward) end of the terminal 25 and brought to rest in the groove 49. The terminal is then pushed axially through the sleeve 35 from left to right as viewed in FIG. 2. The flared section 38 of the sleeve on its inside surface provides an entrance ramp which contributes a camming action to contract the ring 51 so that the latter may slide into and then through the neck 39, and when it reaches the shoulder 40 it expands. The terminal is then lodged against axial movement of any consequence in either direction by reason of the stop shoulder 45 abutting against the annular end face 38' of the flared section 38 of the sleeve and in opposition thereto, the expanded ring 51 is seated in the groove 49 and abutting against the interior surface of the shoulder 40.

The pin contact terminal 26 is removably mounted in the insulation block or body 17 by means which are identical to those described in detail with reference to the sleeve or socket contact terminal 25. The following difference in detail relative to the bore in which the mounting sleeve is contained is as follows: The bore 37' has a relatively short length and is reduced at 37'' to provide auxiliary support and guide means for the projecting pin of the contact terminal 26. It is also noted that the insulation block 17 is formed with an annular boss 55 axially concentric with the reduced bore section 37'' and engaging in a complementary socket 56 in the adjacent face of the insulation block 16.

The friction retention obtained by opposite co-action of shoulder 45 and C ring 51 is more than adequate to hold the terminals in the insulation blocks during ordinary connecting and disconnecting of the sockets and pins.

If however, it is desired to remove the terminal for any reason, axial impact or force may be imposed upon the terminal in a direction from right to left, as seen in FIG. 2, and upon application of sufficient impact or force the tapered surface 49' pressing against the ring 51 will cause it to be cammed against the inner surface of the shoulder 40 to contract the ring sufficiently for it to be moved through and out of the neck 39 in a direction rearwardly (from right to left as seen in FIG. 2).

The taper in the entrance ramp ordinarily will be gradual, rendering contraction of the C ring compara-

tively easy for insertion of a terminal. However, the inclination of the shoulder 40 will usually be relatively sharp, so that ordinary axial pressure encountered in making contact will not provide sufficient force to dis-

lodge the terminal.

While the sleeve 35 preferably will be preformed, and the elastomer or other dielectric material molded around it with a bonded attachment by means known to the art, it is possible to provide the sleeve 35 by other methods.

Thus, the bore 37 may be molded with the sleeve area formed in the shape desired, and the sleeve may be formed by a metallic plating or a coating of any suitable material of the requisite thickness; or a plain cylindrical metal tube may be inserted and then spun or otherwise caused to conform to the molded wall of the bore.

The inner surface of the sleeve should be non-abrading under slippage of the C ring, and preferably should be of sufficient tensile strength to confine the C ring during contraction thereof, as well as firmly to position the terminal, with little or no transmittal of radial force to the body of the insulation block; and the end surface of the entrance ramp should present a hard and substantial stop means for engagement by the shoulder or collar 45, thus preventing undue indentation of a soft elastomer insulation material, if used, or chipping of a brittle insulation material, if the latter be used.

While we have herein shown and described our invention in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

We claim as our invention:

1. A first connector element adapted to contain a first contact terminal for making physical and electrical contact with a mating terminal in a complementary second connector element and in which said first terminal includes an intermediate mounting section, a rearwardly disposed stop element, and a forwardly disposed resiliently contractible retainer means having a normal diameter greater than that of the mounting section and being contractible to a diameter no greater than the mounting section, said first connector element comprising a molded insulation body having a bore therethrough opening at a forward end and at a rearward end, a metallic sleeve comprising a cylinder entirely formed with a continuous annular wall and molded into said insulation body in a position to line a portion of said bore, the material of the insulation body having a direct, intimate and permanent bond with substantially the entire outer surface of said sleeve, the inner surface of said sleeve defining an intermediate constricted annular neck portion of a diameter to lodge the mounting section of said first terminal, an annular shoulder portion extending radially outwardly from the forward end of the neck portion and facing forward and adapted to restrain the retainer means on such terminal against rearward axial dislodgment, and a flared entrance ramp portion extending from the rearward end of the neck portion rearwardly and having a smaller angle relative to the axis of the bore than said annular shoulder portion, said ramp portion providing a cam surface to constrict the retainer means on such terminal for sliding entrance into the neck portion whereby such terminal may be advanced so that the retainer means slides through the neck portion and expands to its normal diameter upon reaching the said shoulder portion, said outer surface of the sleeve being generally parallel to the inner surface of the sleeve and providing an annular depression in the outer surface of the sleeve intermediate the ends, said depression being filled by material of the insulation body whereby a mechanical anchor against axial dislodgment of the sleeve is afforded to supplement the bond between insulation material and sleeve.
2. A first connector element adapted to contain a first

5

contact terminal for making physical and electrical contact with a mating terminal in a complementary second connector element and in which said first terminal includes an intermediate mounting section, a rearwardly disposed stop element, and a forwardly disposed resiliently contractible retainer means having a normal diameter greater than that of the mounting section and being contractible to a diameter no greater than the mounting section, said first connector element comprising a molded insulation body having a bore therethrough opening at a forward end and at a rearward end, a metallic sleeve comprising a cylinder entirely formed with a continuous annular wall and molded into said insulation body in a position to line a portion of said bore, the material of the insulation body having a direct, intimate and permanent bond with substantially the entire outer surface of said sleeve, the inner surface of said sleeve defining an intermediate constricted annular neck portion of a diameter to lodge the mounting section of said first terminal, an annular shoulder portion extending radially outwardly from the forward end of the neck portion and facing forward and adapted to restrain the retainer means on such terminal against rearward axial dislodgment, and a flared entrance ramp portion extending from the rearward end of the neck portion rearwardly and having a smaller angle relative to the axis of the bore than said

6

annular shoulder portion, said ramp portion providing a cam surface to constrict the retainer means on such terminal for sliding entrance into the neck portion whereby such terminal may be advanced so that the retainer means slides through the neck portion and expands to its normal diameter upon reaching the said shoulder portion, the rear end of said sleeve presenting a rearwardly facing annular abutment surface exposed within the bore adapted for engagement by the rearwardly disposed stop element on the first mentioned terminal.

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