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ELECTRIC PLUG AND SOCKET CONNECTORS

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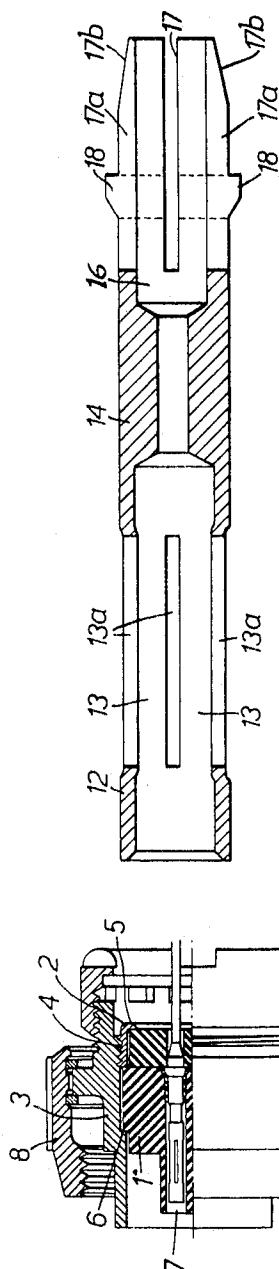


FIG. 1.

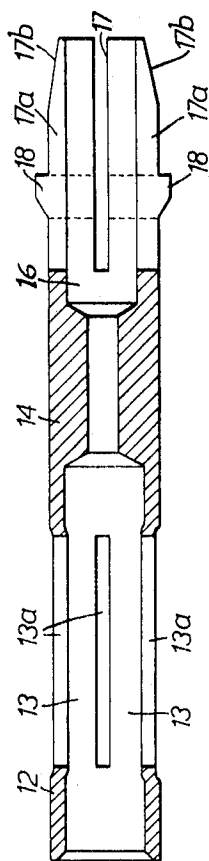
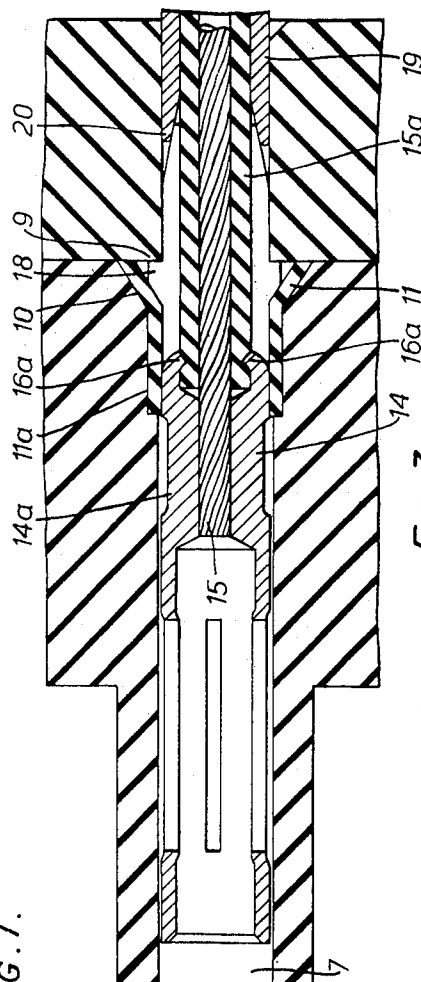


FIG. 3.

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1

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ELECTRIC PLUG AND SOCKET CONNECTORS
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4 Claims. (Cl. 339-217)

This invention relates to electrical plug and socket connectors and is concerned with the socket assemblies of such connectors of the kind in which, owing for example to the high temperatures to which the assembly may be subjected in use (e.g. in aircraft), the metallic socket member or each of a number of such socket members which are mounted in an insulating body and are to co-operate with one or more plug members mounted in a second insulating body, has to be attachable to the end of its associated insulated electric cable by crimping, that is to say by deforming a part of the socket member surrounding a bore into which the end part of the electric cable projects so that such end part is firmly held within and in intimate electrical contact with such part of the socket member, as opposed to soldering the conducting cable to the socket.

In many cases it is also a requirement that the socket assembly as a whole shall withstand a pressure difference between the front face into which the plug or plugs are inserted and the back face from which the conducting cable or cables attached to the socket member or members extend, while moreover a large degree of reliability and a very low millivolt drop across the plug and socket connection when in use is required.

Further, the socket members are preferably supported in their insulating body in a manner providing for a degree of flexibility to ensure proper mating with the plug members with which they are to co-operate.

It is an object of the invention to provide an improved form of socket assembly which will meet some or all the above requirements to a satisfactory degree.

A socket assembly of the kind referred to according to the present invention comprises a body of insulating material, at least one bore extending through the body, and a conducting socket member which extends within the bore and comprises tubular end parts one of which lies adjacent to one of the open ends of the bore and is formed for engagement by a contact pin of a co-operating plug member while the other is formed to receive the end portion of an insulated electric cable and an intermediate part which lies between the two tubular end parts and has a relatively small diameter bore to receive an end portion of the conducting cable, the tubular end part which is formed to receive the insulated cable including also an external flange or projection which lies within a corresponding recess in the body of insulating material so as to serve normally to maintain the socket member within the bore and being slotted longitudinally to provide for resilient radial inward displacement of the parts between the slots and having an externally tapered end portion for engagement with the bore of an extraction tool which can be inserted through the adjacent end of the bore of the insulating body to cause such inward radial displacement and thus reduce the effective external diameter of the flange or projection to permit withdrawal of the socket member bodily from the bore in the insulating body.

Preferably the flange has a frusto-conical face, the circumferential groove in which it lies has a corresponding cooperating frusto-conical face and a resilient sealing

2

washer is interposed between these two faces to form a fluid-tight seal around the socket member.

The intermediate part is preferably formed so that it can be plastically deformed as by crimping to secure the end of the conducting cable therein.

The invention also consists in an electrical socket element for a pin-and-socket electrical connection, having a tubular formation at one end, which is slotted lengthwise to permit radial inward displacement of the wall of the tubular formation, the said tubular wall being formed with external projections which serve as anchorages when the wall parts are splayed outwards. The tubular formation will preferably be formed with an external taper, so that a tubular tool driven over the end of the tubular formation will deform the wall parts inwards.

Preferably, while the slotting in the end of the tubular part through which the electric cable is to pass extends to the end of the part, the slotting at the end of the tubular part which is intended for entry of the cooperating plug member does not extend to the end of that part, thus leaving a complete ring of metal through which the plug passes into the slotted part.

A construction of socket assembly according to the invention is shown by way of example in the accompanying drawings, in which

FIGURE 1 is a side elevation partly in cross-section of a complete socket assembly including a number of sockets of which the only one which appears is shown for convenience in side elevation,

FIGURE 2 is a sectional side elevation on an enlarged scale of a socket as incorporated in the assembly shown in FIGURE 1 but before the attachment of such socket to an insulated electrical conductor, and

FIGURE 3 is a sectional side elevation on the same scale as FIGURE 2 showing in detail the form of the socket when lying within its associated body of moulded insulating material and attached to the end of an insulated conductor, that is to say the general form and arrangement which each of the sockets in the assembly shown in FIGURE 1 would have when incorporated in that assembly, FIGURE 3 also including part of a withdrawing tool for use with such assemblies.

In the construction shown in the drawings the assembly comprises a body of moulded insulating material consisting of two mouldings 1 and 2 secured face to face within a metallic housing 3 by means of a screwthreaded clamping ring 4 which has a flange 5 bearing on the outer face of the part 2 so that the parts 1 and 2 are clamped together between the flange 5 and an internal flange 6 formed in the housing 3 and engaged by a shoulder on the part 1. The body of moulded insulating material thus constituted by the two mouldings 1 and 2 is formed to provide a number of cylindrical bores of which one is shown at 7, these bores being spaced from one another within the body of insulating material in a manner common for socket assemblies of the character in question and containing sockets constructed and arranged as hereinafter described for cooperation with the pins of an associated plug assembly (not shown) which, after the pins have been inserted into the sockets, can be secured to the socket assembly by a clamping ring shown at 8 in conventional manner.

The general form of each of the sockets which lies within one of the bores 7 is shown in FIGURES 2 and 3, FIGURE 2 showing the form of the socket before attachment thereto of an insulated electric conductor and its assembly within its associated bore 7, while FIGURE 3 shows the form of the socket after such attachment and assembly.

3

As will be seen more particularly from FIGURE 3, each of the bores 7 is provided adjacent to the joint face between the parts 1 and 2 with a circumferential groove having one radial face 9 and one frusto-conical face 10, a thin frusto-conical sealing washer 11 extending over the frusto-conical face 10 and having formed integral with it a tubular extension 11a lying within a slightly enlarged portion of the bore in the part 1 as shown. Mounted within the bore 7 is a metallic one piece socket member which comprises a circumferentially complete tubular end part 12 having a bore of slightly greater diameter than the external diameter of the pin which will enter it when a plug assembly is applied to the socket assembly, a tubular part 13 lying adjacent to the part 12 having a bore slightly less than that of the part 12 and formed with a series of longitudinally extending circumferentially spaced slots 13a so that the part 13 consists in effect of a series of spaced bars giving to it a degree of radial resilience so that when a pin is pressed into it it will grip the pin and make a good electrical contact therewith in a manner generally known per se, the end of the part 13 remote from the part 12 of the socket being provided with a body part 14 having a bore considerably smaller in diameter than the bore of the part 12 and intended to receive the end of an electric conductor 15 as indicated in FIGURE 3 while the end of the socket member remote from the part 12 has a bore 16 of a diameter suitable for accommodating the insulating covering 15a with which the conductor 15 is covered except where it projects from the end of such covering as shown in FIGURE 3.

In addition the end of the socket member remote from the part 12 is provided with a series of circumferentially spaced slots 17 so that it consists in effect of a series of fingers 17a and with an external flange or projection 18 through which the slots 17 also extend, the flange 18 being appropriately dimensioned for accommodation within the groove 9, 10 in the bore 7 as shown in FIGURE 3.

As mentioned above, FIGURE 2 shows the form of a socket member before its attachment to an insulated electric conductor, while FIGURE 3 shows the socket member after such attachment. The method of attachment is as follows: An appropriate length of the insulating covering 15a of the conductor 15 having been removed so as to expose the end portion of the conductor 15 which is to be electrically connected to the socket member, this end portion and the adjacent part of the insulating covering are pushed into the righthand end of the socket member shown in FIGURE 3 so that the bare end of the conductor 15 enters the bore in the part 14 and the adjacent part of the insulating covering enters the bore 16 so as substantially to fill that bore. The part 14 is now deformed by crimping as shown at 14a in FIGURE 3, while the parts of the socket member immediately adjacent to the ends of the slots 17 are deformed as shown at 16a in FIGURE 3 so that the end of the conductor 15 is firmly gripped within the bore of the part 14 while the end of the insulating covering 15a is held within the lefthand end of the bore 16. It will be understood that the metal of which the socket member is formed is such as to allow for the crimping and deformation referred to.

When each of the sockets incorporated in the socket assembly shown in FIGURE 1 has thus been attached to the end of its associated insulated electric conductor, these socket members are pressed into place within the bores 7 from the righthand ends of such bores. During this operation, when the frusto-conical surface of the flange 18 reaches the righthand end of the bore 7 sufficient pressure may be applied to the socket to cause the fingers 17a to be forced inwards so as to reduce the effective diameter of the flange 18 and allow the flange 18 to pass into and through such righthand end of the bore 7 until the flange 18 reaches the circumferential recess 9, 10, whereupon the fingers 17a spring outwards so that the socket member is held in position. Alternatively the fingers 17a may be

4

pressed inwards by a tool such as the withdrawing tool hereinafter referred to, to facilitate or permit the passage of the flange 18 through the righthand end of the bore 7. Each socket member, therefore, after insertion into its bore 7 is in the form and occupies the position indicated in FIGURE 3. It will be seen that, when the socket member occupies the position shown in FIGURE 3, the end portion of the part 11a lies closely around the adjacent portion of the body part 14 so as to form a seal between this portion of the body part and the wall of the bore 7.

If a socket member is to be withdrawn from the assembly, this can be effected by means of a withdrawing tool one end of which is shown at 19 in FIGURE 3, this withdrawing tool having, as shown, a tubular end which is freely slidable into the bore 7 around the insulated covering 15a and has at the end of its bore a frusto-conical part 20 which co-operates with a corresponding frusto-conical part 17b on the adjacent end of the socket member to press the fingers 17a inwards and thus reduce the effective diameter of the flange 18 to a point where this flange can be withdrawn through the righthand end of the bore 7.

It will be understood that when the withdrawing tool is being used in this way an appropriate pressure will be applied to the lefthand end of the socket member to prevent its being forced to the left as the effective diameter of the flange 18 is being reduced, and to force it to the right when that diameter has been reduced by the tool 19 to a point where the flange 18 can pass through the righthand end of the bore 7. It will also be understood that the end portion 19 of the tool will be formed in two semicylindrical parts to enable it to be assembled around the insulating covering 15a prior to insertion into the bore 7 as shown in FIGURE 3.

What I claim as my invention and desire to secure by Letters Patent is:

1. An electrical socket assembly for co-operation with a plug assembly, comprising a body of insulating material, at least one bore extending through the body and a conducting socket member which extends within the bore and comprises tubular end parts one of which lies adjacent to one of the open ends of the bore and is formed for engagement by a contact pin of a co-operating plug member while the other is formed to receive the end portion of an insulated electric cable and an intermediate part, which lies between the two tubular end parts and has a relatively small diameter bore to receive an end portion of the conducting cable, the tubular end part which is formed to receive the insulated cable including also an external flange or projection which lies within a corresponding recess in the body of insulating material so as to serve normally to maintain the socket member within the bore and being slotted longitudinally to provide for resilient radial inward displacement of the parts between the slots and having an externally tapered end portion for engagement with the bore of an extraction tool which can be inserted through the adjacent end of the bore of the insulating body to cause such inward radial displacement and thus reduce the effective external diameter of the flange or projection to permit withdrawal of the socket member bodily from the bore in the insulating body.

2. An electrical socket assembly as claimed in claim 1, in which the face of the flange or projection which lies adjacent to the end of the socket member intended first to enter the bore during insertion is frusto-conical while its other face lies in a plane substantially normal to the axis of the socket.

3. An electrical socket assembly as claimed in claim 1, in which an intermediate part of the socket formed with a bore to receive the end of the conducting cable therein is plastically deformed or deformable by crimping to grip said end.

5

4. An electrical socket assembly as claimed in claim 3, in which the end portion of the socket member into which the electrical conducting cable extends has a larger bore formed to receive an electric conducting cable with its insulating covering from the inner end of which larger bore opens a smaller bore to receive a part of the conducting cable without insulating covering, parts of the socket surrounding the large bore being plastically deformed or deformable to grip said insulating covering.

6

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