

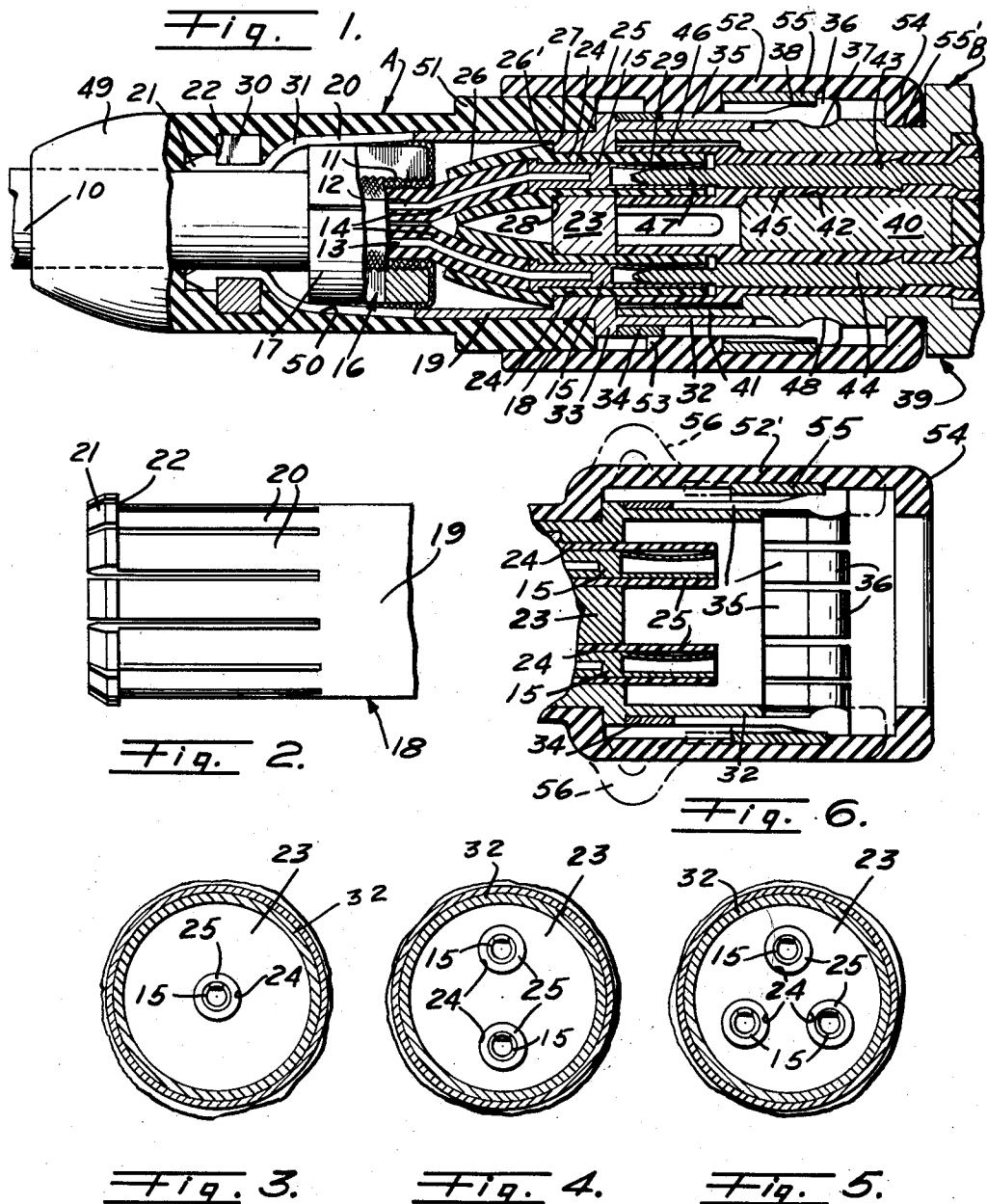
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UNIVERSAL ELECTRIC CONNECTOR

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UNIVERSAL ELECTRIC CONNECTOR

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The present invention relates generally to electrical connectors for conductors, primarily for coaxial cables, and is more particularly concerned with connectors of the miniature type having universal application in that it may be utilized as a quick push-pull connector, a sealed weatherproof connector, or a connector in which the parts are interlocked in connected relation.

To such end, the present invention has for one object a more economical construction than in conventional arrangements, wherein the only soldering required is prior to assembly. After soldering the contact members to the conductors of the cable, the parts may be assembled into cooperative relationship without further soldering.

A further object resides in the provision of a connector for coaxial cable which requires no special tools for assembly.

Still another object is to provide a ferrule construction which may be selectively adapted for use with coaxial cables having a single inner conductor or a plurality of inner conductors, thus making it unnecessary to produce sleeves which are respectively constructed and molded in place to accommodate a predetermined number of conductors.

Still another important object is to provide a unique arrangement in which the contacts of the connector may be moisture sealed.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing the invention without placing limitations thereon.

Referring to the accompanying drawings, which are for illustrative purposes only:

FIG. 1 is a view in longitudinal section of an electrical connector embodying the features of the present invention, the connector parts being in connected relation and locked against separation;

FIG. 2 is an enlarged fragmentary detailed view showing the details of the connected end of the connector sheath, prior to assembly;

FIGS. 3, 4 and 5 are transverse views schematically illustrating the manner in which the connector may be adapted for a coaxial cable having a single inner conductor or a plurality of inner conductors; and

FIG. 6 is a fragmentary view showing a modified construction.

Referring now more specifically to the drawings, for illustrative purposes, the electrical connector of the present invention is disclosed as of the two-part type, wherein mating connectors, usually of a male and female type, are adapted for endwise axial movement into connected telescoped relation and separated non-telescoped relation.

More specifically, referring to FIG. 1, the connector is shown as comprising a part as generally indicated at A, and a part as generally indicated at B, which will now be described in detail.

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For purposes of detailed consideration, the part A has been illustrated as comprising the female, or receptacle part, while the part B has been illustrated as comprising the male, or plug part of the connector. The part A is associated with a coaxial cable 10 having an outer conductor sheath 11, and a plurality of inner conductors, in this case inner conductors 12 and 13, which are respectively contained within insulating sleeves 14. Prior to assembly of the connector, the sheath 11 is removed from an end portion of the coaxial cable so as to leave projecting insulating sleeves containing the inner conductors. Endmost portions of the insulating sleeves are then removed to provide and expose the ends of the inner conductors. These bare ends are respectively soldered to contact members 15, in each case. This is the only soldering required, since further assembly of the connector may be accomplished without the need of special tools, or further soldering.

An anchor ring 16 is now engaged around the exposed portion of the outer conducting sheath. This anchor ring is of split construction and has a plurality of axially extending fingers 17 which may be flexed under pressure into engagement with the conducting sheath.

Provision is made for connecting the conducting sheath 11 and the anchor ring 16 with a tubular ferrule of suitable metal, such as brass, and which may be silver plated, this ferrule being generally indicated by the numeral 18. The ferrule is constructed with a tubular body portion 19 intermediate its ends, one end of this body portion being extended to provide axially extending circumferentially spaced arms 20, as shown in FIG. 2. Each of these arms at its outermost end terminates in a head portion 21 having an inwardly spaced radial shoulder 22.

Referring again to FIG. 1, the body portion 19 is provided with an integrally formed transversely extending wall 23 which is initially of solid construction, but which may be readily adapted for coaxial cables having one, two, three or four inner conductors by the simple expedient of drilling or otherwise forming the required number of passages 24 therethrough, as schematically illustrated in FIGS. 3, 4 and 5. In the embodiment illustrated in FIG. 1, the connector is arranged to be utilized with a coaxial cable having two inner conductors, and for this reason, the wall 23 is illustrated as being provided with two through passages 24.

Each contact member 15 is now insulated by being inserted endwise into a tubular sleeve 25 of insulating material, this sleeve having an enlarged end portion 26 which is adapted to extend over the end insulation 14 of the inner conductor. The contact member 15 and insulator sleeve have circumferential outer and inner abutment shoulders 26' and 27 which act to relatively position the assembled parts and limit the axial movement of the conducting element in a righthand direction within the insulating sleeve, as viewed in FIG. 1. The insulating sleeve is positionable within a passage 24, and has a circumferentially extending outer shoulder 28 which is adapted to abut the adjacent face of the wall 23 and limit further movement of the insulating sleeve in a righthand direction as viewed in FIG. 1. With the insulating sleeve thus inserted, it will be observed that its other end extends past the opposite face of the wall 23, and encases socket connector elements 29 carried by the contact member 15.

During the positioning of the sleeves 25 in the wall 23, the previously assembled anchor ring 16 will be axially moved to a position under the innermost ends of the arms 20, it being noted that strands of the outer sheath are folded back over the inner end of the anchor ring so as to have portions thereof positioned between adjacent surfaces of the anchor ring and tubular ferrule.

With the parts assembled as explained above, they are now secured in position by deflecting the outermost ends of the arms 20 radially inwardly towards the outer periphery of the coaxial cable. The arms are secured against the outer surface of the cable by means of a C-ring 30, this ring being retained in position by the action of the radial shoulders 22 on the arms 20. As shown in FIG. 1, it will be observed that deflection of the arms produces bend portions 31 between the C-ring 30, and the adjacent end of the anchor ring 16, which act as camming surfaces to force the axially extending fingers 17 of the anchor ring 16 into clamped contact relation with the outer conducting sheath 11 of the coaxial cable, thus providing good electrical connection between the sheath and the ferrule.

On the other side of the wall 23, as shown in FIG. 1, the body portion 19 comprises a tubular extension 32 which surrounds and encases the projecting ends of the insulating sleeves 25. Surrounding the tubular extension 32 and soldered or otherwise bonded thereto adjacent a circumferentially extending flange 33 is a ring member 34 having a plurality of integrally formed elongate springlike fingers 35 which are spaced apart circumferentially around the tubular extension with outermost ends extending therebeyond and being provided with head portions 36 in each case. Each head portion 36 has a rounded inner surface 37, and on its outer surface has a groove 38 inwardly spaced from its outer end.

The mating part B of the connector of this invention is also shown in FIG. 1, and comprises a tubular sleeve 39 of conducting material, this sleeve having an inner transverse wall 40 intermediate its end. This sleeve on one side of the wall 40 is formed to provide a tubular extension 41 which is adapted to telescopically seat within the tubular extension 32 of part A, when parts A and B are interconnected. As in the case of the wall 23, of part A, the wall 40 of part B is similarly provided with passages 42, the number of these passages depending upon the number of inner conductors of the coaxial cable to be interconnected. In the illustrated arrangement, there are two passages to accommodate two conductor elements 43 and 44 respectively. These conducting elements are each insulatingly supported within an insulating sleeve 45 which terminates at the end within extension 41 in an enlarged tubular end portion 46 adapted to receive the adjacent end of insulating sleeve 25 of part A therein in telescoping relation to provide a long leakage path around the connected conducting elements. The conductor element is formed at one end with a plug portion 47 for making mating engagement with the socket connector elements 29, when parts A and B are interconnected. In the interconnected relationship of parts A and B, the rounded inner surfaces 37 of the fingers 35 are adapted to seat in a circumferentially extending groove 48 in the outer surface of the tubular sleeve 39, to thus releasably retain the parts A and B in interconnected relation. With the parts thus described, a quick push-pull connector is provided, which is releasably latched in connected position, but which may be readily disconnected by the application of a pulling force.

A bend relief 49 of suitable material, such as rubber, neoprene, or the like, is formed at one end so as to grippingly surround and engage the outer surface of the coaxial cable and receive the C-ring 30 and adjacent end of the tubular ferrule 18 within an interior cavity 50 thereof. The inner end of the bend relief has its outer diameter increased in its end portion 51 which abuts the flange 33.

Associated with the end portion 51 is a tubular sleeve 52 of suitable material, such as rubber, neoprene, or the like. This sleeve has an internal flange 53 which is in sliding gripping relation with the exterior surface of the ring 34 and its associated fingers 35. One end of the tubular sleeve is in gripped sliding relation with the end portion 51, while the other end of the sleeve extends over the head portions 36 of the fingers 35 and is formed with an intumed end flange 54 which is adapted to seat in a circumferential groove 55' of the tubular sleeve and make sealing engagement therewith when the parts A and B are in interconnected relation. Moreover, the sleeve 52 bears against the head portions 36 of the fingers 35 and biases the fingers radially inwardly in their latching position in the groove 48 of the sleeve 39.

Provision is made for locking the parts A and B in connected position, by providing an inner metallic ring 55 in the tubular sleeve 52, this ring being so positioned that it may be axially moved into and out of the grooves 38 of the fingers. When the edge of ring 55 is positioned in the grooves 38, the fingers are held against radial outward movement, thus acting to lock the parts A and B in connected position. However, by axial sliding movement of the tubular sleeve 52 to a position, wherein the ring 55 is disengaged with respect to the grooves 38, the fingers are free to move radially outwardly and release parts A and B for separation.

The structure described above therefore makes provision for sealing the contact elements in the connectors against external moisture, as well as provides for locking the parts A and B in connected relation, but enables release thereof when desired.

Referring now to FIG. 6, the bend relief is shown as being modified by integrally forming a tubular sleeve 52' thereon, this sleeve portion having the ring 55 internally mounted as in the previously described arrangement. However, in this arrangement movement of the ring 55 to release position is accomplished by flexing the portion 52' by pulling thereon to form a buckled portion, as indicated by phantom lines at 56. With this arrangement, when the pull is released, the ring will automatically move back to locking position.

Various modifications may suggest themselves to those skilled in the art without departing from the spirit of my invention, and, I do not wish to be restricted to the specific form shown or uses as mentioned, except to the extent indicated in the appended claims.

I claim:

1. In an electric connector for a coaxial cable having an inner conductor and an outer conducting sheath, a clamp ring engaging said outer sheath, said ring having a greater outer diameter than the outer diameter of said cable, a conducting tubular ferrule having axially extending circumferentially spaced arms at one end surrounding said ring at their inner ends, and having their outer end margins deflected inwardly over said clamping ring to the outer surface of said cable, a C-ring clamped around and restraining said deflected ends, and a contact member insulatingly supported within the other end of said ferrule, said contact member having electrical connection with said inner conductor.

2. In an electric connector for a coaxial cable having a plurality of insulated inner conductors and an outer conducting sheath, a clamp ring engaging said outer sheath, said ring having a greater outer diameter than the outer diameter of said cable, a conducting tubular ferrule having axially extending circumferentially spaced arms at one end surrounding said ring at their inner ends, and having their outer end margins deflected inwardly over said clamping ring to the outer surface of said cable, a C-ring clamped around and retaining said deflected ends, and a plurality of contact members insulatingly supported within the other end of said ferrule, said contact members respectively having electrical connection with said inner conductors.

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3. In combination in an electrical connector for use with a cable having an inner conductor, an outer conductive braid, first insulating material between the inner conductor and the outer braid and second insulating material surrounding the braid, a clamping ring disposed on an exposed portion of the braid and provided with a plurality of fingers at one end for disposition in clamping relationship to the braid, a ferrule made from a conductive material for electrical coupling to the braid and disposed on the clamping ring for retaining the exposed portion of the braid between the clamping ring and the ferrule and provided with a plurality of fingers for disposition over the fingers on the clamping ring to clamp the fingers on the clamping ring against the braid, the fingers on the ferrule being provided with reduced dimensions at their ends for disposition in clamping relationship to the second insulating material, and a ring disposed on the fingers of the ferrule at the ends of the fingers to clamp the fingers of the ferrule against the second insulating material and the fingers on the clamping ring against the braid.

4. In combination in an electrical connector for use with a cable having an inner conductor, an outer conductive braid and insulating material between the inner conductor and the outer braid, a clamping ring disposed on the braid and provided with a configuration to exert a clamping relationship on the braid, a ferrule made from a conductive material and disposed on the clamping ring at a first position and disposed on the braid at a second position removed from the first position and provided with a configuration to exert a clamping action against the clamping ring at the first position and against the cable at the second position, and clamping means disposed on the ferrule for clamping the ferrule against the clamping ring at the first position and against the cable at the second position.

5. The combination set forth in claim 4 in which the ferrule is provided with at least one arm at the first position and in which the clamping means are disposed on the arm of the ferrule to clamp the arm against the braid.

6. The combination set forth in claim 4 in which the clamping ring is provided with at least one finger and in which the ferrule is disposed on the finger of the clamping ring to clamp the finger against the braid.

7. The combination set forth in claim 4 in which the ferrule is provided with at least one arm at the first position and in which the arm is bent at a position adjacent to the clamping ring to facilitate the clamping action by the ferrule against the clamping ring.

8. The combination set forth in claim 4 in which the ferrule is provided with at least one arm at the first position and in which the arm is bent at a position adjacent to the clamping ring to facilitate the clamping action by the ferrule against the clamping ring and in which the clamping ring is provided with at least one finger and in which the ferrule is disposed on the finger of the clamping ring to clamp the finger against the braid.

9. In combination in an electrical connector for use with a cable having an inner conductor, an outer conductive braid and insulating material between the inner conductor and the outer braid, a clamping ring disposed on the braid and provided with at least one finger at one end and disposed with the finger in clamping relationship to the braid, a ferrule made from a conductive material and disposed on the braid in electrically coupled relationship to the braid and provided with at least one inwardly tapered arm, the ferrule being disposed on the clamping ring with the tapered portion of the arm on the ferrule disposed on the braid in electrically coupled relationship to the braid, and clamping means disposed on the finger on the ferrule for clamping the finger against the cable to obtain a clamping of the finger on the clamping ring and against the braid.

10. The combination set forth in claim 9 in which the clamping means includes a ring disposed on the arm of

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the ferrule to clamp the arm on the ferrule against the braid.

11. In combination in an electrical conductor for use with a cable having a plurality of inner conductors, an outer conductive braid and insulating material between the inner conductors and between the inner conductors and the outer conductive braid, a conductive clamping ring disposed on the conductive braid in electrically coupled relationship to the braid, a ferrule made from a conductive material and disposed on the braid at a first position in electrically coupled relationship to the braid and disposed on the clamping ring at a second position displaced from the first position in electrically coupled relationship to the clamping ring, clamping means disposed on the ferrule for mechanically clamping the ferrule against the conductive braid, there being in the ferrule a plurality of passages disposed in spaced relationship to one another, each of the passages in the plurality being formed to define an internal shoulder, a plurality of insulating sleeves each disposed within a different passage in the plurality and having an external shoulder disposed against the internal shoulder of the passage to provide a locking action on the sleeve, each of the insulating sleeves in the plurality also having an internal shoulder, and a plurality of contact members each made from a conductive material and electrically coupled to a different one of the inner conductors of the cable and each disposed within a different one of the insulating sleeves in the plurality and having an external shoulder disposed against the internal shoulder of the sleeve to provide a locking action on the contact member.

12. The combination set forth in claim 11 in which the ferrule is provided with an arm at the first position and in which the clamping means is disposed on the arm in mechanically clamped relationship with the arm and in which the clamping ring is provided with a finger and in which the ferrule is disposed on the finger on the clamping ring at the second position to mechanically clamp the finger against the braid.

13. In combination in an electrical connector for use with a cable having an inner conductor, an outer conductive braid and insulating material between the inner conductor and the outer braid, a sleeve made from a conductive material, a ferrule made from a conductive material and disposed on the outer conductive braid of the cable in electrically coupled relationship to the conductive braid and in electrically coupled relationship to the sleeve, clamping means disposed on the ferrule for mechanically clamping the ferrule against the outer conductive braid of the cable, the ferrule and the sleeve being formed to provide a clamping relationship between the ferrule and the sleeve, the ferrule having an integrally formed transverse wall at a position displaced from the position of clamping to the outer conductive braid of the cable, there being a passage through the integrally formed transverse wall of the ferrule and a passage through the conductive sleeve, a first insulating sleeve disposed within the passage in the conductive sleeve, a second insulating sleeve disposed within the passage in the ferrule and in engaging relationship with the first insulating sleeve, a first contact member disposed within the second insulating sleeve and made from a conductive material and electrically coupled to the inner conductor of the cable, a second contact member disposed within the first insulating sleeve in electrically coupled relationship to the first contact member, the ferrule being disposed on the conductive braid at a first position and being provided with an arm at the first position and the clamping means being disposed on the arm at the first position to clamp the arm against the braid, and a clamping ring disposed on the braid at a second position displaced from the first position, the clamping ring being provided with a finger, the ferrule being disposed on the finger on the clamping ring and being constructed to clamp the finger on the conductive braid, the integrally formed transverse wall

on the ferrule being disposed at a third position displaced from the first and second positions.

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