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(71) Applicant: **ALLIED CORPORATION**
Columbia Road and Park Avenue P.O. Box 2245R (Law
Dept.)
Morristown New Jersey 07960(US)

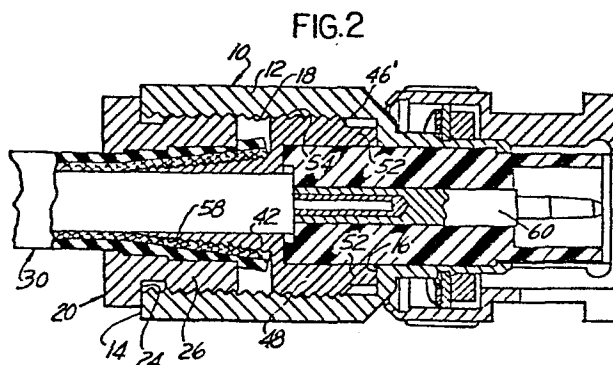
(72) Inventor: Kirby, Allan Black
RD No. 2, Box 307A
Sidney Center New York 13839(US)

(72) Inventor: Hogan, Edward Patrick
13 Sunset Avenue
Sidney New York 13838(US)

(74) Representative: Brullé, Jean et al,
Service Brevets Bendix 44, rue François 1er
F-75008 Paris(FR)

(54) An electrical connector assembly including means for grounding and terminating a coaxial cable.

(57) In an electrical connector assembly, an electrically conductive ferrule (40) terminated to a free end of a coaxial cable and having external thread (54) and an end face (46) and an electrically conductive connector shell (12) having internal thread (18) and an end wall (16), the thread interengaging to draw the ferrule (40) into the shell (12) so that the end wall (16) is in metal-to-metal abutment with the end face (46). Abutment between the end wall and end face and engagement between the threads provides the assembly with two ground paths, whereby the terminated end of the coaxial cable is shielded from RFI. Thread (58) on the ferrule (40), also of the same sense as the other thread, engages the braid (36).



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AN ELECTRICAL CONNECTOR ASSEMBLY
INCLUDING MEANS FOR GROUNDING AND
TERMINATING A COAXIAL CABLE

This invention relates to an electrical connector assembly including means for grounding and terminating a free end of a coaxial cable, the coaxial cable being of the type including a dielectric separating a central conductor from a conductive braid and including an insulator jacket surrounding the shield conductor.

U.S. Patent 3,373,243 issuing March 12, 1968 to Janowiak for "An Electrical Multi-Conductor Cable Connecting Assembly," U.S. Patent 3,634,815 issuing January 11, 1971 to Stevens for "A Connector Assembly Adapted For Use With A Coaxial Cable," assigned to the assignee of the instant application, and U.S. Patent 3,074,045 issuing January 15, 1963 to Overholser for a "Cable Connector and Method of Assembly" provided a conductive frusto-conical ferrule for terminating the free end of a coaxial cable and grounding the cable braid to the connector shell. Although not appreciated earlier, the manner in which and the force by which a connector assembly grips and/or clamps the coaxial cable may be responsible for an electrical open circuit developing between the braid shield and the connector shell. During temperature cycling, the insulator jacket has been found to flow and/or relax and the conductive ferrule axially backing off from abutting contact with the connector shell, thereby leading to the open circuit. Clearance fitting of the ferrule in the shell provides an inadequate conductive path for shielding and provision of a resilient or rubber-like seal member between the shell and ferrule prevents shielding altogether.

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Accordingly, a more desirable electrical connector assembly for use with a coaxial cable would reliably maintain closed circuit relationship between the conductive braid of the cable and the connector shell.

5 An object of the instant invention is to provide an electrical connector assembly for terminating a coaxial cable which offers good radio frequency interference shielding performance coupled with ease of assembly.

10 Another object of the instant invention is to provide a coaxial electrical termination having redundant means for shielding against radio frequency interference.

Still another object is to provide an improved termination requiring only a minimum of redesign of an existing termination.

15 Briefly stated, the foregoing and other objects are accomplished by a conductive cylindrical shell having an interior cavity receiving a conductive ferrule, a collar and the free end of a coaxial cable, the shell having internal thread adjacent the entry to its cavity engaging
20 external thread on the collar, the collar and ferrule being disposed about the cable end with the insert being wedged between the braid shield and the dielectric and the collar being disposed against the jacket.

25 A ground arrangement for grounding the braid shield to the connector shell includes the interior wall of the shell having internal thread and an interior end wall, and the ferrule having a stepped annular shoulder defining spaced end faces and circumferential faces, one of the circumferential faces being provided with external
30 thread, the external thread being adapted to threadably interengage with the internal thread whereby the end wall may be axially, threadably, drawn together into abutment with one of the end faces and be disposed in metal-to-metal contact, both the engaged thread and the

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end face being abutted with the end wall providing a redundant electrical path between the braid and connector shell.

One way of carrying out the invention is described in detail below with reference to the drawings which illustrate the specific embodiment of this invention, in which:

FIGURE 1 is a view, in cross-section, of a prior art electrical connector assembled to a coaxial cable.

FIGURE 2 is a view, in cross-section, of an electrical connector assembled to a coaxial cable.

Referring to FIGURE 1, a prior art plug electrical connector 10 is shown terminating the free end of a coaxial cable 30. The coaxial cable 30 is of the type which comprises a central conductor 32, a dielectric 34, an outer conductor or braid shield 36 and an external rubber insulator jacket 38, each being coaxial one with the other.

The plug electrical connector 10 comprises a hollow cylindrical shell 12 of electrically conductive material; a tubular collar 20 having external thread 28 and a radial flange 22 extending outwardly therefrom; and a tubular ferrule 40, the ferrule and the collar being coaxially received in the shell so as to be generally concentric with central conductor 32 with each cooperating to clamp about the cable. The connector shell 12 has a primary axis, an external end face 14, and an interior cavity which includes a generally cylindrical interior wall that terminates at an end wall 16 transverse to its primary axis, the interior cavity receiving ferrule 40 and collar 20 and the interior wall including internal thread 18 therearound.

Collar 20 includes a tubular sleeve 26 which has successively increasing internal diameter sections 26a, 26b, and 26c which define shoulders whose edges trace an imaginary cone and bite against the jacket 38.

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Ferrule 40 is of electrically conductive material and includes a frusto-conical, wedge-shaped body 42, an annular flange 48 having an end face 46 and an internal bore 44 extending axially therethrough, the diameter of internal bore 44 being slightly greater than the external diameter of dielectric 34.

Ferrule 40 and collar 20 are disposed about the free end of the cable with ferrule body 42 being wedged between dielectric 34 and outer conductor 36 and collar 20 being driven into engagement with the cable jacket, the body applying an outward radial pressure to both the braid shield 36 and the rubber jacket 38 and the shoulders defined by diameter sections 26a, 26b and 26c axially engaging cable jacket 38.

Radio frequency interference protection must come as a result of metal-to-metal contact between end face 46 of ferrule 40 and end wall 16 of shell 12, the metal contact providing a continuous electrical circuit path between plug shell 12 and braid shield 36. Temperature effects on jacket 38 could allow axial back-off of the ferrule from metal-to-metal contact.

In accord with this invention, FIGURE 2 shows improved RFI shielding connection between plug connector 10 and coaxial cable 30. Shell 12 includes end wall 16 and internal thread 18. Ferrule 40 includes adjacent its end face 46 a stepped annular shoulder 52 spacing an end face 46' therefrom and defining, respectively, a first circumferential face around annular shoulder 52 and a second circumferential face around annular flange 48, the circumferential face around flange 48 including external thread 54 and the circumferential face around shoulder 52 being without external thread. The end faces 46, 46' of ferrule 40 and end wall 16 of shell 12 are disposed, respectively, in a plane perpendicular and inclined to the primary axis of the connector and end wall 16 is

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adapted to abut end face 46 when assembled into the shell. The internal thread 18 is adapted to engage with the external thread 54 and the external thread 28 on collar 16.

5 The internal/external thread provide thread surfaces which contact to increase frictional forces resisting any rotation of the ferrule leading to axial back-off from metal-to-metal contact. In this regard, tight abutment of end wall 16 with the end face 46 also enhances
10 frictional forces tending to resist rotation.

 The wedge-shaped frusto-conical body 42 includes helical cam surfaces 58, such as thread, about its exterior surface to threadably engage with shield braid 36 when the wedge-shaped body is axially, rotatably,
15 inserted between the dielectric and outer conductor braid. Such cam surfaces cooperate to resist external axial pull forces which may act on the cable. The annular shoulder 52 would be hexagonal in cross-section to assist the threadable assembly of ferrule 40 into the
20 braid 36.

 As a result of assembly of ferrule 40 into connector shell 12, the end wall 16 is abutting the end face 46 to provide a first ground path and the internal/external thread 18, 54 are engaging to provide a second ground
25 path. The sense of all threads 18, 54 and 58 would, preferably, be the same so that when ferrule 40 is threaded either into braid shield 36 or into shell 12 or when the collar 16 is threadably inserted into the shell, all thread engagements are further tightened.

30 For assembly, the cable 30 is trimmed to provide a square-cut free end for termination. Collar 20 is then slipped over the cable and positioned axially rearward of the square-cut end and ferrule 40 is threadably inserted between the braid shield 36 and dielectric 34. A contact
35 pin 60 is passed over a bare projecting end of central

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conductor 32 and soldered thereto. Following this, shell
12 is joined to the cable passing over ferrule 40.
Collar 20 is screwed into the sleeve 12 and its end face
24 brought into engagement with the end face 14 and the
5 jacket 38.

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Claims:

1. An electrical connector assembly including means for terminating and grounding in electrical circuit relationship a free end of a coaxial cable (30), said connector assembly comprising an electrically conductive shell (12), a tubular collar (20) and an electrically conductive ferrule (40) including a frusto-conical outer surface and a radial flange (48) having an end face (46), said cable (30) being of the type including a dielectric (34) circumposed between a central conductor (32) and an outer conductive shield (36) and an insulator jacket (38) encircling said shield, said collar (20) being secured to the shell (12) and disposed around said jacket such that its inner wall is engaging the jacket, said ferrule (40) being adapted to circumpose said dielectric (34) and have its frusto-conical outer surface engage said shield, said shield (36) and said jacket (38) being axially and radially clamped between the inner and outer surfaces, respectively, of said collar (20) and said ferrule (40), said terminating and grounding means being characterized by:

said shell (12) including a transverse end wall (16) and internal thread (18) on its interior wall, the thread being adjacent to the end wall; and

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said radial flange (48) including external thread (54) on its outer circumference for engaging the internal thread (18) on the shell (12) and bringing said end face (46) into abutting relation with said end wall (16),
5 interengagement between the thread providing a first electrical circuit path and ensuring that the ferrule does not axially back-off from abutting contact with the shell, and contacting engagement between the end wall and the end face providing a second electrical circuit path,
10 the assembly providing a redundant two-path electrical circuit relationship between the shield and the connector.

2. The invention as recited in Claim 1 wherein the
15 frusto-conical outer surface of the ferrule (40) includes thread (58) for threadable engagement with the conductive braid (36) to establish electrical circuit relation therebetween.

20 3. The invention as recited in Claim 2 wherein the flange (48) is stepped and includes an annular shoulder (52), the shoulder having a second end face (46') adjacent to the flange and including the other end face (46), said other end face (46) being hexagonal in cross-
25 section to assist threadable assembly of ferrule (40) into braid (36).

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4. An electrical connection between an electrical contact and a coaxial cable, the coaxial cable (30) of the type including an inner conductor (32) and an outer conductor of braid (36) separated by a dielectric (34) and further including a jacket (38) of insulation surrounding the outer braid conductor, said contact comprising a cylindrical shell (12) of electrically conductive material and having an interior wall defining a cavity, termination means (40) operative with a free end of said cable for terminating said cable, and retainer means (20) for retaining said termination means within said cavity, the improvement characterized by:

said shell (12) having a transverse end wall (16) and first thread (18) disposed around the interior wall adjacent to said end wall; and

said termination means (40) comprises ferrule (40) of electrically conductive material disposed in electrical and mechanical engagement with said outer braid conductor and including a circumferential face and a transverse end face (46), said end face (46) abutting said end wall (16) and the outer circumference of said flange having second thread (54) interengaged with said first thread, engagement between the thread maintaining the end wall in abutment with the end face to provide two ground paths between the shell and the braid conductor.

5. The electrical connection as recited in Claim 4 wherein said retainer means comprises a tubular collar disposed around said cable and threadably secured to said interior wall.

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FIG. 1

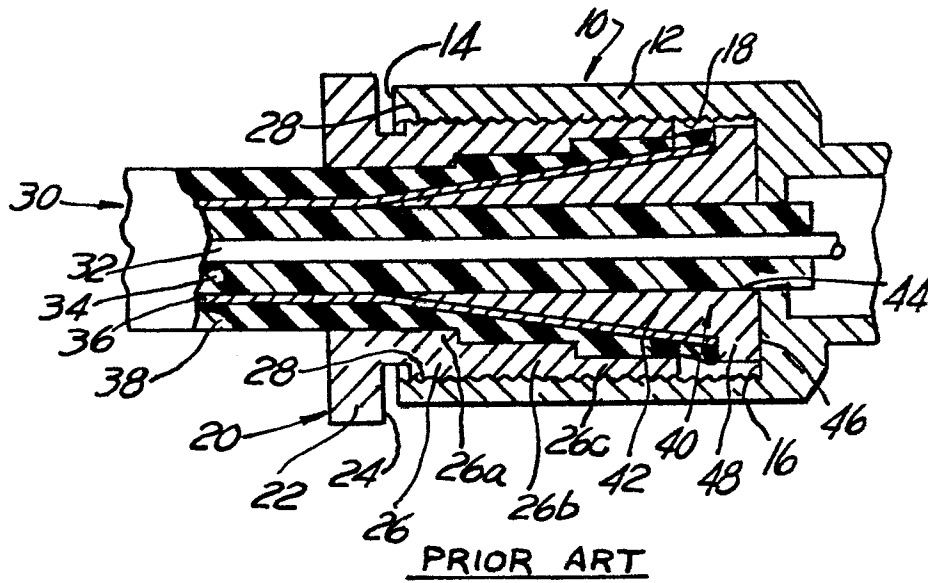


FIG. 2

