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[54] COAXIAL CABLE CONNECTOR

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[51] **Int. Cl.**.....**H01r 17/04**

[58] **Field of Search** .....339/60 C, 89 C, 90 C, 91 P, 339/94 C, 177 R, 177 E; 174/75 C, 88 C, 89

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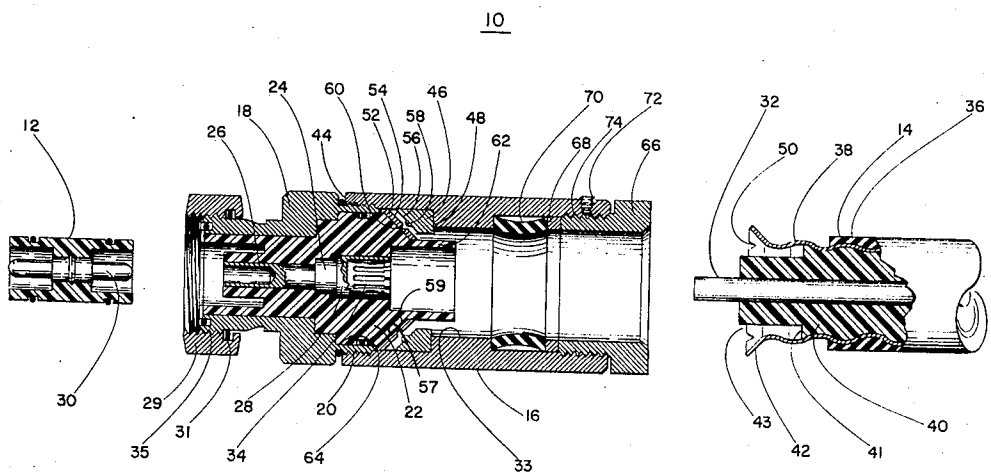
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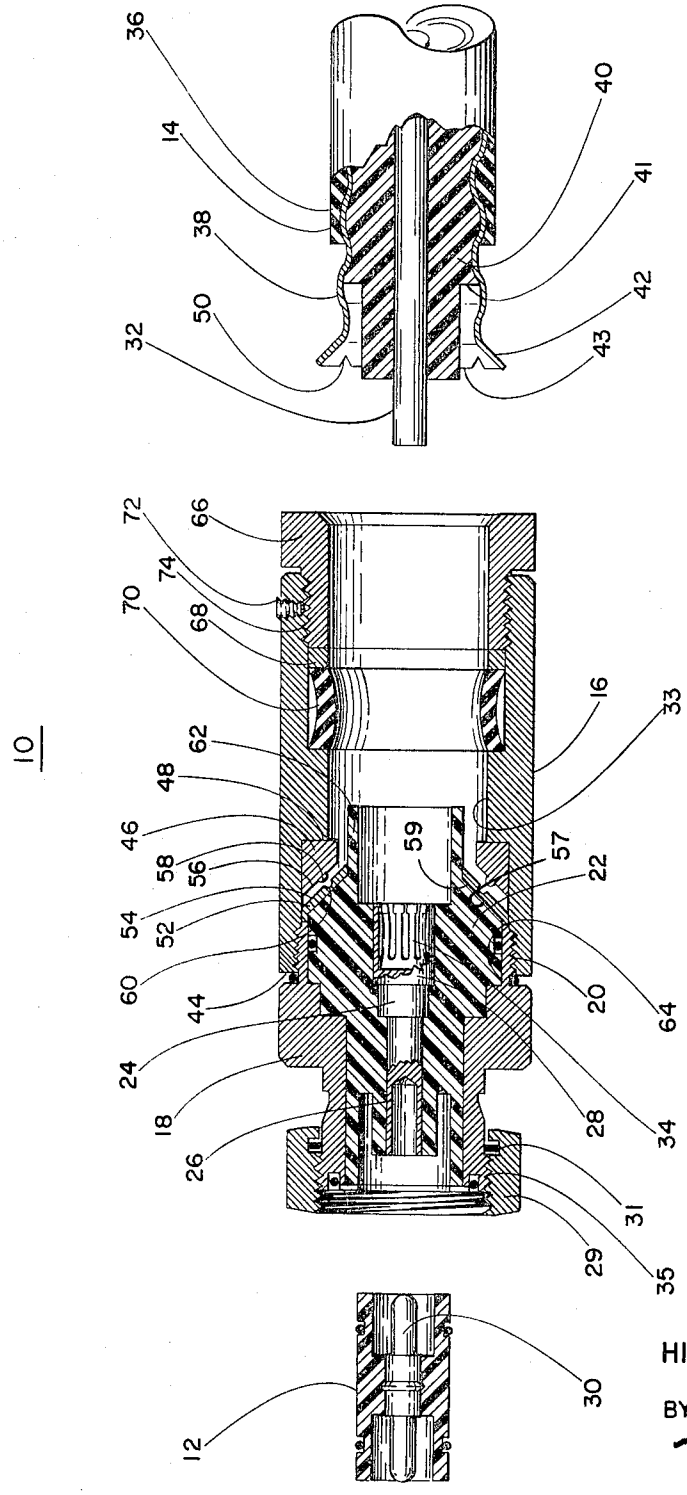
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[57] **ABSTRACT**

A connector for coaxial cables suitable for use on a group of cables having the same impedance characteristics and similar nominal size but different structural details. A backshell of the connector which is sufficiently large to receive each cable of the group fastens to a body which contains a mass of dielectric material in which a central conductor contact is fitted. A seat and collar with complementary frustoconical surfaces adapted to receive an outwardly and forwardly flared end of the outer conductor of the cable are positioned generally within the transition between the backshell and the body. Complementary fastening means on a body and the backshell force the collar and seat together against the flared end of the outer conductor.

5 Claims, 1 Drawing Figure





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COAXIAL CABLE CONNECTOR

BACKGROUND OF THE INVENTION

The invention described herein was made in the course of, or under contract AT(29-2)-20 with the U.S. Atomic Energy Commission.

This invention relates to connectors for coaxial cables of the RF (radio frequency) type.

The use of coaxial cables in the transmission of intelligence by way of the propagation of electromagnetic energy is well known. It is also well known that the maintenance of uniform impedance characteristics throughout the transmission path is essential in order to minimize distortion of the intelligence during transmission. Accordingly, coaxial cables are designed and manufactured to certain standardized increments of impedance characteristics such as 50 ohms, 75 ohms, 100 ohms, etc., to which other components of an intelligence link, i.e., transmitter, receiver, amplifier, etc., also conform.

In some applications in which coaxial cables are used, the environments to which various portions of the transmission link are exposed are drastically different. One such application is in the telemetry networks utilized in connection with testing nuclear explosives. A portion of the link may be required to withstand high temperature. Another (or same) portion may be required to have high mechanical strength in order to support its own weight over many feet, such as when the test is of an explosive emplaced for detonation thousands of feet below the surface of the earth. High mechanical strength may also be required in portions of the links placed on the surface of the ground in places where surface vehicles may on occasion run over them. Some portions of the links may need to be gas tight, moisture proof, or satisfy any number of other criteria. On the other hand, there may be significant portions of particular transmission links where very minimal physical characteristics are adequate.

The particular service environment to which a cable is designed will, of course, affect its cost. When it is realized that one nuclear test may entail the use of a thousand or more individual telemetry links, each traversing thousands of feet, it can be appreciated that considerable savings can be realized by the selection of a number of cables of differing physical characteristics to satisfy particular requirements of the various portions of each telemetry link. However, a large number of individual criterion for cable applications as well as individual manufacturing preferences and/or techniques of cable manufacturers has resulted in a proliferation of cable configurations.

For instance, a single manufacturer provides five different cables of 50 ohm impedance and seven-eights inch nominal diameter. Each of these five cables has its own advantages with respect to each of the others. The inner diameter (I.D.) of the outer conductor varies from 0.795 to 0.965 inch and the outer diameter (O.D.) from 0.948 to 1.005 inches for these five cables. Four of the five have heliax outer conductors. The outer diameter of the inner conductor, which in the case of this manufacturer are all tubular, varies from 0.312 to 0.358 inch. There is only one duplication in this group of five with respect to all conductor dimensions. Another manufacturer provides three cables in this same nominal size and impedance characteristic. Each has non heliax outer conductors having an O.D. of 0.875 inch and an I.D. varying from 0.758 to 0.801 inches. Each of these three has a solid core inner conductor, the O.D. of which varies from 0.288 to 0.300 inch. When the total number of manufacturers, nominal cable sizes, and impedance ratings are considered, it can be seen that the number of individual cables available is truly legion.

The problem of supplying connectors for this multitude of cables is not insignificant. It can be appreciated that the costs involved in procuring, maintaining inventory, and other handling for a multitude of difference cable connectors can be very significant, and particularly so for large users of cables. It has been only in relatively recent years that a number of standard interfaces for coaxial cable connectors have been developed in order to insure that, for example, all 50 ohm cables (within certain size limitations) can be connected together, provided the connectors used with them incorporate a particular standard interface. However, generally speaking, each particular cable has utilized a different connector with a backshell designed for attachment onto that particular cable configuration and essentially none other. Accordingly, a user of all eight of the cables alluded to above has in the past had to procure, warehouse, handle, etc., seven different cable connectors.

SUMMARY OF INVENTION

Accordingly, it is an object of this invention to provide a cable connector which permits one connector to be suitable for use on a group of coaxial cables having the same impedance characteristics and the same or similar nominal size, but having different structural details. Briefly summarized, this and additional objects of the invention are accomplished by a connector with a backshell having an inner cylindrical surface of larger diameter than the outer conductor of the largest of the group of cables, and a body with an inner cylindrical surface with a diameter larger than that fastened to the forward end of the backshell. The body contains a mass of dielectric material within which is fitted a central conductor contact which receives the inner conductor of the cable. Complementary frustoconical surfaces on a seat and a collar, positioned longitudinally between the two inner cylindrical surfaces, generally traverse the radial distance between the two inner cylindrical surfaces. An outwardly and forwardly flared end portion of the outer conductor of the cable is received between these frustoconical surfaces of the seat and collar. Complementary fastening means on the body and the backshell fasten the body and backshell together and force the frustoconical surfaces against the flared end portion of the outer conductor of the cable.

BRIEF DESCRIPTION OF DRAWING

The single FIGURE of drawing is a longitudinal section of a coaxial cable connector in accordance with the invention, with an end of a cable to be connected and a standard interface inner contact assembly shown in exploded, broken away relationship.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the single FIGURE of drawing, the connector **10** in accordance with the invention is shown in conjunction with interface inner contact assembly **12** and coaxial cable **14**, each of the latter two shown in exploded away relationship from their connection positions. The major components of connector **10** are backshell **16** and body **18** which are joined together by suitable means such as complementary screw threads **20**, body **18** being the male member. Snugly fitted within body **18** is a mass of dielectric material **22** into which connector inner conductor **24** is snugly fitted. Contact sleeve portions **26** and **28** at either end of conductor **24** are adapted to receive and make electrical connection with inner conductors **30** and **32** of interface assembly **12** and coaxial cable **14**, respectively. Inner cylindrical surface **33** of backshell **16** and contact sleeve **28** are each large enough to receive the largest individual member of that group of cables for which a particular connector **10** is intended. Seat **46** and collar **52**, each made from a conducting material, are positioned, generally speaking, in the transition between the backshell and the body. These will be explained in more detail hereinafter.

A slotted, tubular insert **34** of a conductor material may be utilized to facilitate the electrical connection with inner conductor **32** in those configurations of cable **14** within the group of cables for which connector **10** will be utilized for which conductor **32** is too small to snugly fit within contact sleeve **28**. The front end of connector **10**, together with inner contact connector assembly **12**, make up a standard interface for connectors of a particular impedance rating. Accordingly, con-

ductor **30** and sleeve **26** are designed to fit snugly together, and the use of an insert such as **34** is not necessary.

Of course the front end of connector **10** may be joined to the front end of any other connector of same impedance rating which utilizes the same standard interface. One nut **29**, retained on body **18** by snap ring **31**, is utilized to tighten the two connectors together. The nut on the other connector is run rearwardly off of threads **35** out of the way of the first nut and is merely retained on the body as a nonfunctioning part. The two connectors may be identical in the event the cables to be joined are both within the same group of cables for which a particular connector **10** is designed. In the event the cable falls outside of that group, the second connector may be identical in concept to connector **10** but have a configuration rearwardly of the standard interface which differs in dimensional detail. On the other hand, as long as the second connector is of the same impedance and embodies the standard interface, connection can be made, and the remaining structural details of the second connector are of no real significance.

Now that major components of connector **10**, cable **14** and the interface including assembly **12** have been described, the remaining structure of the connector and cable will be described in conjunction with a description of the procedure by which the cable is prepared and joined to connector **10**. In preparing cable **14** for connection to connector **10**, outer protective cover **36**, outer conductor, or shield, **38**, dielectric **40** and inner conductor **32** are trimmed to the relative lengths shown. These relative lengths can be readily determined by a suitable trimming guide. An outer, substantially annular portion of dielectric **40** is removed to form shoulder **41** and outer cylindrical surface **42** for a purpose to be explained later.

Backshell **16**, unfastened from body **18**, is then dropped over the end of cable **14** and moved along the cable until forward end **43** of the outer conductor is exposed beyond the forward end **44** of the backshell. Seat **46**, if not integral with backshell **16**, is also placed over the end of the cable and positioned against shoulder **48**. Slits are then cut in forward end **43** of the outer conductor by any suitable tool, such as a diagonal cutting shears. End **43** is then flared radially outwardly into the configuration shown. The flaring may be done directly against surface **56** of seat **46**, or against a suitable backing block, either by hand or with the assistance of a suitable flaring tool. The slits are expanded during the flaring into notches **50**.

A collar **52** having rearwardly facing surface **54** generally frustoconical in nature and complementary to surface **56** of seat **46** and forwardly facing frustoconical surface **57** which fits snugly against the complementary surface **59** of dielectric **22** is placed on the forward side of end **43** of outer conductor **38** of cable **14**. Body **18** with mass of dielectric **22** and connector inner conductor **24** contained therein is then screwed into backshell **16**. This brings the end of cable inner conductor **32** into position within contact sleeve **28** (or sleeve insert **34** if such is utilized), and complementary frustoconical surfaces of shoulder **48** and collar **52** into forceable engagement with flared forward end **43** of the cable. Complementary protuberance **58** and indentation **60** firmly grip flared end **43**. The dimensions of collar **52** relative to dielectric **22** and backshell **16** permit relative rotation of the collar with respect to the backshell and dielectric thereby facilitating the connection of the backshell and body and the forceable engagement of the flared end of the cable.

Cylindrical surface **42**, formed by trimming cable dielectric **40** as previously related, fits snugly within the rearwardly extending tubular portion **62** of dielectric mass **22**, the function of these interfitting portions of dielectric being to increase the air gap spark path between the inner and outer conducting members of the cable and connector. It will be noted that a similar arrangement is provided at the front end of body **18** and interface **12**.

It can be seen from the foregoing, then, that frustoconical surface **57** in its position longitudinally between inner cylindrical surfaces **33** of the backshell and **64** of the body serves as a transition for the outer conductor of the coaxial link including cable **14** and connector **10**. The inner surface of the outer conductor of the cable-connector assembly expands from outer conductor **38** through that transition to inner surface **64** of body **18**. It will be noted that the various expansions and contractions in the size of the outer surface of the inner conductor finds correlative changes in the size of the inner surface of the outer conductor throughout connector **10**. Those skilled in the connector art will appreciate that such correlation is necessary in order to minimize distortion of the intelligence in its transmission through the connector, i.e., impedance mismatch.

In the event it is desired that the connector be sealed from the atmosphere, or be liquid or gas tight, suitable means such as jam nut **66**, bushing **68**, tubular seal **70**, made of a deformable material such as rubber, and set screw **72** may be provided at the rearward end of backshell **16**. As is apparent from the drawing, screwing jam nut **66** into the rearward end of backshell **16** by means of complementary threads **74** forces bushing **68** against seal **70** thereby deforming it in a longitudinal and radially inward direction until it comes into sealing engagement against the outer surface of cable **14**. Suitable means, not shown, may be provided on the backshell for introducing gas under pressure, if desired.

It is to be understood that although the phrase "the same or similar nominal size" has been used herein to describe a group of cables with which a single connector configuration according to the invention may be used, it is not intended by such usage that any particular connector according to the invention is necessarily limited to application to any one particular "nominal size" that may have attained, or may hereafter attain recognition in the connector art. For instance, it will be readily apparent to those skilled in this art that one connector in accordance with the invention would be satisfactory for a group including cables of one-quarter, three-eights, one-half inch and other similar nominal sizes with, of course, the same electrical characteristics.

While the foregoing describes the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions, substitutions and/or changes may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

What is claimed is:

1. In a connector for coaxial cables of the RF type, a combination which permits one connector to be suitable for use on a group of cables having the same impedance characteristics and similar nominal size but different structural details, said combination comprising:

1. a backshell having an inner cylindrical surface of larger diameter than the outer conductor of the largest of said group of cables,
2. a body adapted for connection to the forward end of said backshell having an inner cylindrical surface of larger diameter than said surface of said backshell and containing:
   a. a mass of dielectric material snugly fitting within said cylindrical surface of said body and essentially filling said body and having a frustoconical surface extending rearwardly and radially inwardly from said cylindrical surface of said body to at least traverse the radial distance to said inner cylindrical surface of said backshell and
   b. a central conductor contact snugly fitting within said dielectric material, said contact having a rearwardly facing tubular portion of sufficient inner diameter to receive therewithin the largest inner conductor of said group of cables, and a forwardly facing portion adapted for connection with the inner conductor of a second connector,

and said body having a forward portion adapted for connection with a second connector,

3. a collar of a conducting material having a forwardly facing frustoconical surface complementary to said frustoconical surface of said mass of dielectric material and extending from said inner cylindrical surface of said body to at least traverse the radial distance to said inner cylindrical surface of said backshell and having a rearwardly facing and rearwardly and radially inwardly extending generally frustoconical surface,

4. a seat having a forwardly facing frustoconical surface complementary to said rearwardly facing surface of said collar, said complementary frustoconical surfaces on said seat and collar adapted for receiving an outwardly and forwardly flared end of the outer conductor of said cable therebetween, the longitudinal position of said seat and said collar being generally between that of said inner cylindrical surfaces of said backshell and said body and said complementary frustoconical surfaces of said seat and said collar generally traversing the radial distance between said inner cylindrical surfaces,

5. complementary fastening means of said body and said backshell, the operation of which fastens said body to said backshell and forces said collar and seat together against said flared end of said outer conductor.

2. The connector of claim 1 wherein said seat and collar have complementary protuberances and indentations in said complementary frustoconical surfaces for gripping the flared end of the outer conductor of the cable.

3. The connector of claim 1 wherein said complementary fastening means are male and female screw threads.

4. The connector of claim 3 wherein said body is the male member.

5. The connector of claim 1 including means on the rearward end of the backshell for sealing the connector from the atmosphere.

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