United States Patent

Baisz et al.

[15] **3,701,080**

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[54] **MINIATURE COAXIAL CABLE CONNECTOR**

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[73] Assignee: **The United States of America as represented by the United States Atomic Energy Commission**

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[52] **U.S. Cl.** .....**339/48,** 174/75 C, 174/88 C, 339/177 R, 339/256 S

[51] **Int. Cl.**.....**H01r 17/04,** H01r 9/12

[58] **Field of Search** .....174/75 R, 75 C, 88 R, 88 C; 339/48, 49 B, 65, 67, 74, 93, 143 R, 177, 244 R, 248, 249 R, 252 R, 252 S, 256 R, 256 S, 277 R, 277 M, 277 T, 178, 180

[56] **References Cited**

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" Unusual Uses for Helical Wire Springs," Product Engineering Design Manual, 1959, pages 320– 329.

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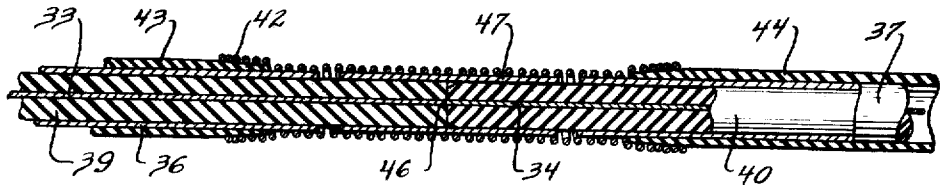
Assistant Examiner—Lawrence J. Staab
Attorney—Roland A. Anderson

[57] **ABSTRACT**

A connector for coaxial cables is formed by using a spring to pull the center conductors of a coaxial cable together to maintain electrical contact therebetween. The spring also connects the outer conductors of the coaxial cable to provide an electrical connection between the outer conductors. A sleeve is positioned between the center conductor and the spring to provide for alignment of the cable.

3 Claims, 4 Drawing Figures



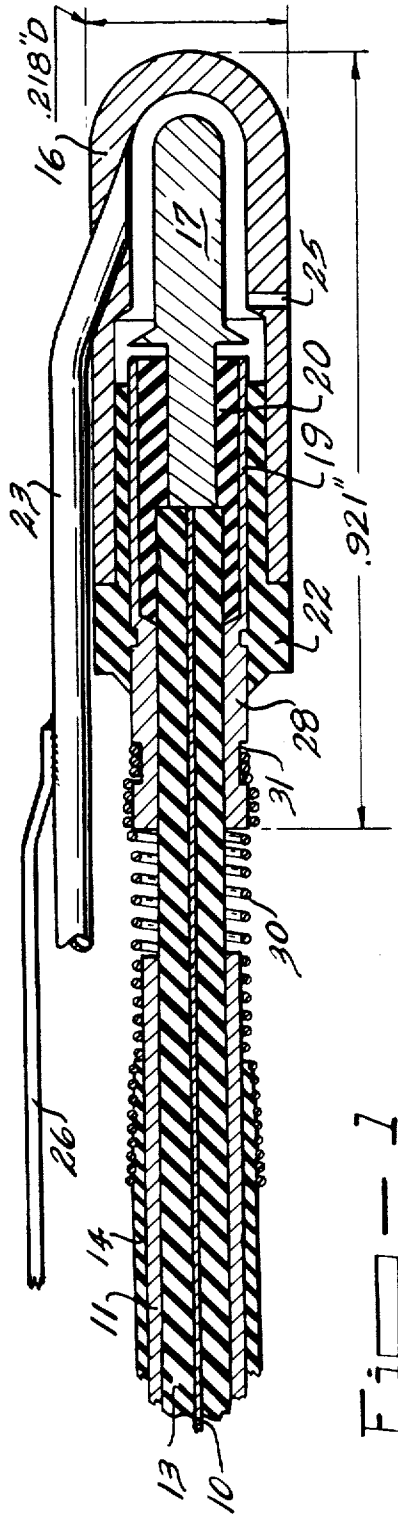

.218"D
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Fig. 1

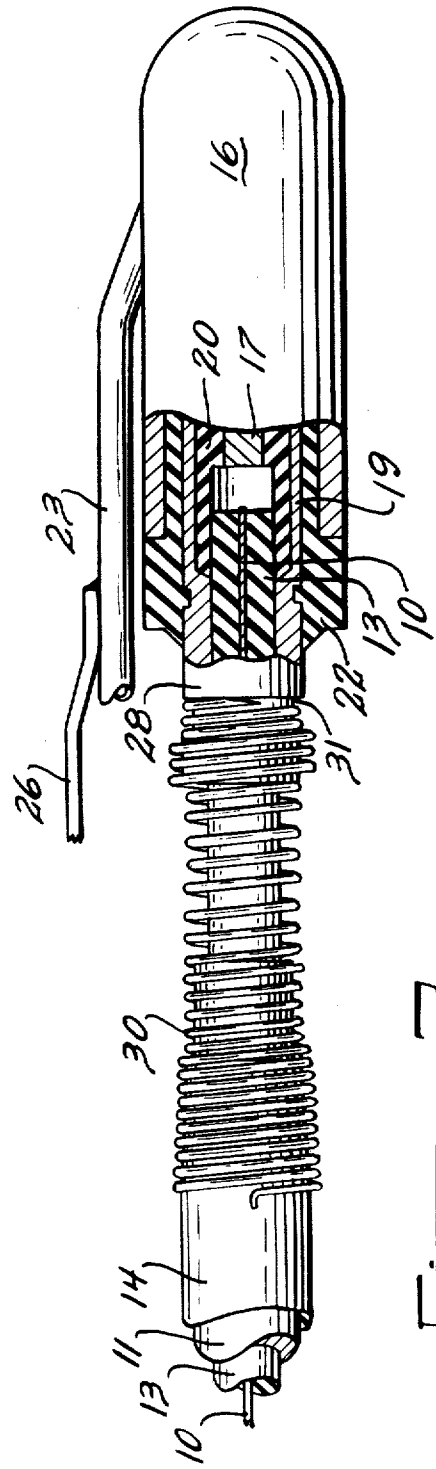
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Fig. 2

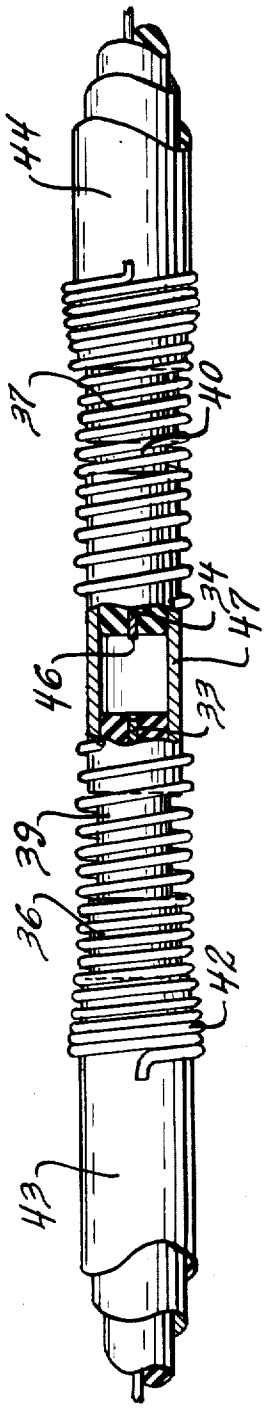

Fig. 3

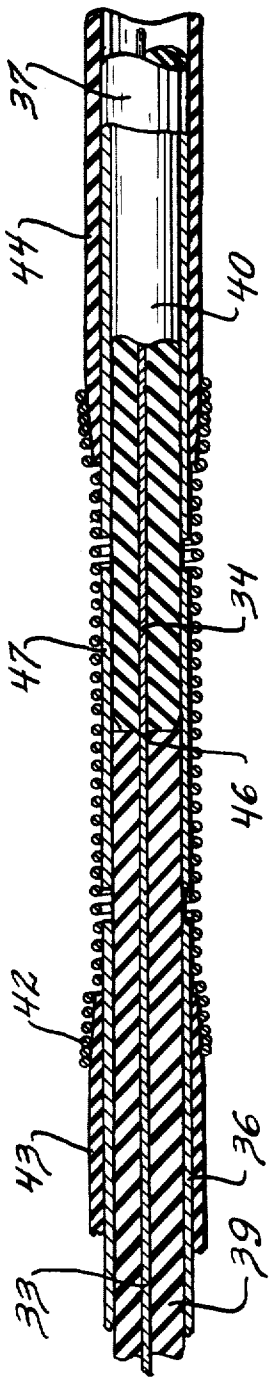

Fig. 4

MINIATURE COAXIAL CABLE CONNECTOR

CONTRACTUAL ORIGIN OF THE INVENTION

The invention described herein was made in the course of, or under, a contract with the UNITED STATES ATOMIC ENERGY COMMISSION.

BACKGROUND OF THE INVENTION

In miniature electronic equipment where coaxial cables are used, it is often important to be able to use connectors to make electrical connections with the coaxial cable. While the conventional connectors such as the BNC type are relatively small, they become very large and bulky when compared to the size of the miniature equipment presently being used. Even the so-called subminiature connectors become large in comparison with some of the electronic equipment being used with coaxial cables.

An example of this may be found in the radiobiological field where it is desired to measure an absorbed dose of radiation in the material of interest with a high degree of accuracy and precision. In regions of large spatial variation, it is important that the detectors or ionization chambers used be as small as possible. For example, an ionization chamber may be less than 1 inch long and less than one-quarter inch in diameter. Conventional coaxial connectors, even of the subminiature type, are too big to be used with such an ionization chamber. The conventional subminiature connectors also have an appreciable air volume which, when placed near the ionization chamber, would provide an additional ionization chamber volume and thereby cause errors in the measurements taken. A further problem with conventional subminiature connectors is the difficulty with which they are connected to the coaxial cable. The smaller the connector the more troublesome it is to make a good connection.

It is therefore an object of this invention to provide an improved coaxial cable connector having very small dimensions.

Another object of this invention is to provide a coaxial cable connector having substantially no air volume within the connector.

Another object of this invention is to provide a coaxial cable connector which can be easily and quickly connected to the coaxial cable.

SUMMARY OF THE INVENTION

In practicing this invention, a connector is provided for joining a pair of coaxially arranged conductors. Each of the coaxially arranged conductors has an inner and an outer conductor separated by a dielectric. Spring means is positioned around each of the coaxially arranged conductors with one end of the spring means being mechanically and electrically connected to the outer conductor of each of the coaxially arranged conductors, the mechanical connection being established by the tension of the spring against the outer conductors. A guide tube is positioned around the inner conductor of each of the coaxially arranged conductors for aligning the inner conductors. The spring means is tensioned to draw the coaxially arranged conductors together to cause the inner conductors to make electrical contact. In some embodiments of this invention, the guide means may be the outer coaxial conductor.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated in the drawings, of which:

FIGS. 1 and 2 are views of the coaxial connector of this invention used with an ionization chamber; and

FIGS. 3 and 4 are views of the connector of this invention used to connect a pair of coaxial cables.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1 and 2, there is shown a coaxial cable connected to an ionization chamber using the connector of this invention. The coaxial cable includes an inner conductor **10**, an outer conductor **11** and a dielectric **13** separating inner and outer conductors **10** and **11**. An insulating covering **14** may surround the outer conductor **11**. The ionization chamber includes a high-voltage electrode **16** forming the outer walls of the ionization chamber, a center electrode **17**, which is to be connected to the center conductor **10** of the coaxial cable. A guard ring **19** surrounds the center electrode **17** and is separated therefrom by insulator **20**. Another insulating section **22** separates the guard ring **19** from the high-voltage electrode **16**. The guard ring **19** and center electrode **17** of the ionization chamber form the outer and inner conductors of a coaxial device to which it is desired to couple the inner and outer conductors of a coaxial cable. Tube **23** is provided to introduce a desired gas into the ionization chamber. The gas is exhausted through outlet **25**. A wire **26** is connected to tube **23** which is made conductive to provide the high-voltage supply to the ionization chamber. Wire **26** is connected to a suitable power supply (not shown).

The rear portion of guard ring **19** forms a sleeve **28** into which the center conductor **10** and dielectric **13** of the coaxial cable can enter. The guide sleeve portion **28** guides the inner conductor **10** so that it can be placed in mechanical and electrical contact with the center electrode **17** to provide electrical contact therewith. A helical spring **30** made from an electrically conductive material is provided to bias the coaxial cable center conductor **10** against the center electrode **17**. Spring **30** has an inner diameter slightly smaller than the diameter of outer conductor **11** and is positioned over the outer conductor **11** to provide electrical and mechanical contact therewith. The radial tension of spring **30** holds it against outer conductor **11**. If desired, the spring may also be positioned over the outer insulating cover **14**. A groove **31** on the guard ring **19** provides a structure for connecting spring **30** to the guard ring **19** which constitutes the outer electrode of the ionization chamber coaxial system. The radial tension of spring **30** in groove **31** holds spring **30** in mechanical and electrical contact with the guard ring **19**.

Spring **30** is also placed on the coaxial cable and the ionization chamber so that the longitudinal tension of spring **30** biases the center conductor **10** of the coaxial cable against the center electrode **17** of the ionization chamber to maintain the two in electrical contact. Electrical contact between the outer conductor **11** and the guard ring **19** is provided by means of spring **30**. As shown in FIG. 2, the center conductor **10** of the coaxial cable may be pulled away from contact with the center electrode **17** by pulling on the cable. The spring tension of spring **30** will pull the cable back so that the center conductors are in contact.

Referring to FIGS. 3 and 4, there is shown the use of the connector of this invention to connect a pair of coaxial cables together. The cables have inner conductors 33 and 34, outer conductors 36 and 37 and dielectrics 39 and 40 separating the inner and outer conductors. Insulators 43 and 44 may cover the outer conductors of the coaxial cable. A spring 42 is positioned over the outer conductors 36 and 37 of the coaxial cable. The inner diameter of spring 42 is less than the outer diameter of conductors 36 and 37 so that the radial tension of spring 30 holds it in mechanical and electrical contact with conductors 36 and 37. The spring 42 may also cover a portion of the outer insulators 43 and 44 for additional mechanical strength in the connection.

Spring 42 is under longitudinal tension so that it draws the inner conductors 33 and 34 together to provide electrical connection therebetween. A portion of one of the inner conductors 46 may be slightly longer than the dielectric material between the inner and outer conductors to provide more positive electrical connection with the center conductor 33 of the other coaxial cable. A sleeve 47 is provided surrounding the dielectric material 39 and 40 and the inner conductors 33 and 34 to maintain the inner conductors 33 and 34 in conductive alignment. The electrical connection between the outer conductors 36 and 37 is provided by means of the spring 42.

Thus a very small connector for coaxial cables has been shown. The connector is only slightly larger in diameter than the coaxial cable and does not impair its flexibility. Referring to FIG. 1, it can be seen that the coaxial cable connector does not have any air space therein, so that there is no degradation of the performance of the ionization chamber by a connector having additional air space not part of the ionization chamber. The connector is also very simple to install, providing additional advantages over prior art connectors.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A connector for joining first and second coaxial conductors with each of said coaxial conductors having an inner and an outer conductor, including in combination, spring means positioned around the coaxial conductors, one end of said spring means being mechanically and electrically connected to the outer conductor of the first coaxial conductor and the other end of said spring means being mechanically and electrically connected to the outer conductor of the second coaxial conductor, guide means positioned around said inner conductor of each of said first and second coaxial conductors for aligning said inner conductors, said spring means being tensioned to draw the coaxial conductor together to cause the inner conductors thereof to make electrical contact, said spring means further being conductive to provide electrical connection between said outer conductors.

2. The connector of claim 1 wherein, said spring means is in the form of a helical spring, said helical spring having an inner diameter less than the outer diameter of said outer conductors of said first and second coaxial conductors, whereby the radial tension of said helical spring holds the same in electrical and mechanical contact with said outer conductors of said first and second coaxial conductors.

3. The connector of claim 2 wherein, said guide means is a metal sleeve surrounding said inner conductor and dielectric of each of said first and second coaxial conductors.

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