United States Patent

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[54] **FLUID-COOLED COAXIAL LINE TERMINATOR**
3 Claims, 2 Drawing Figs.

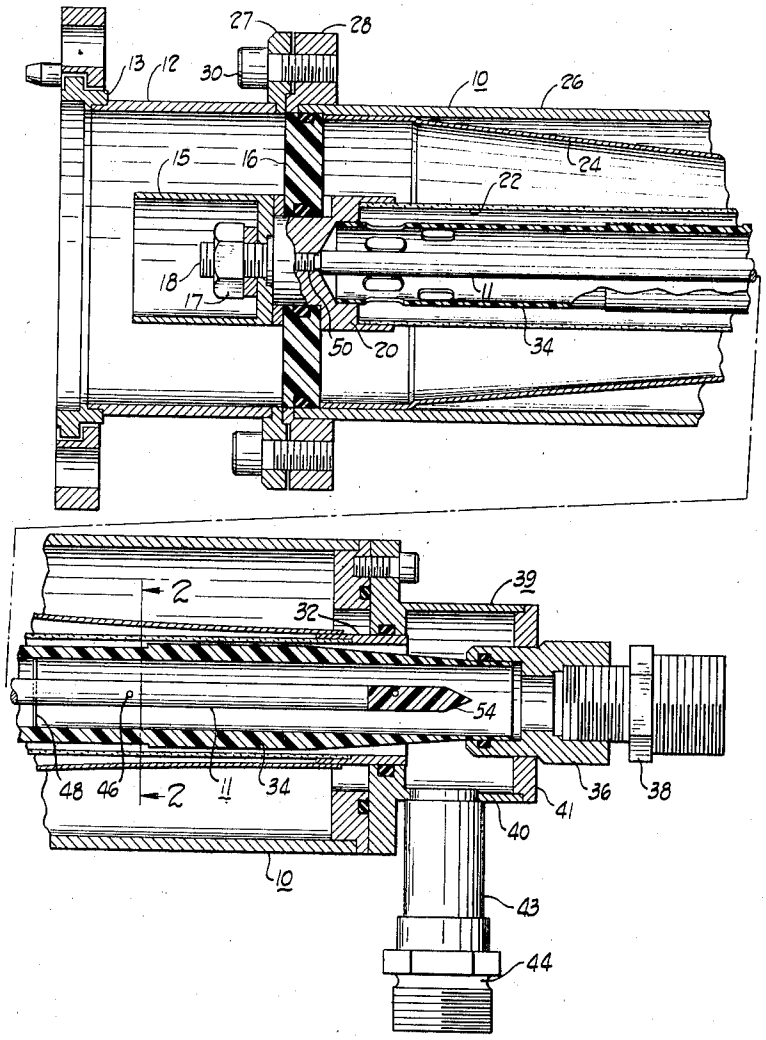
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[50] **Field of Search** ..... 333/22, 22 F, 81, 81 A; 338/216

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ABSTRACT: An electrical coaxial line termination having greatly improved voltage standing wave ratio created by inserting a solid rod conductor axially within and connected to one end of a resistor, one end is connected to the inner conductor of the coaxial line. Preferably, the resistor is positioned within a logarithmically tapered horn which is connected to the outer conductor of the coaxial line at one end and is connected to the end of the resistor remote from the connection of the resistor to the inner conductor of the coaxial line.



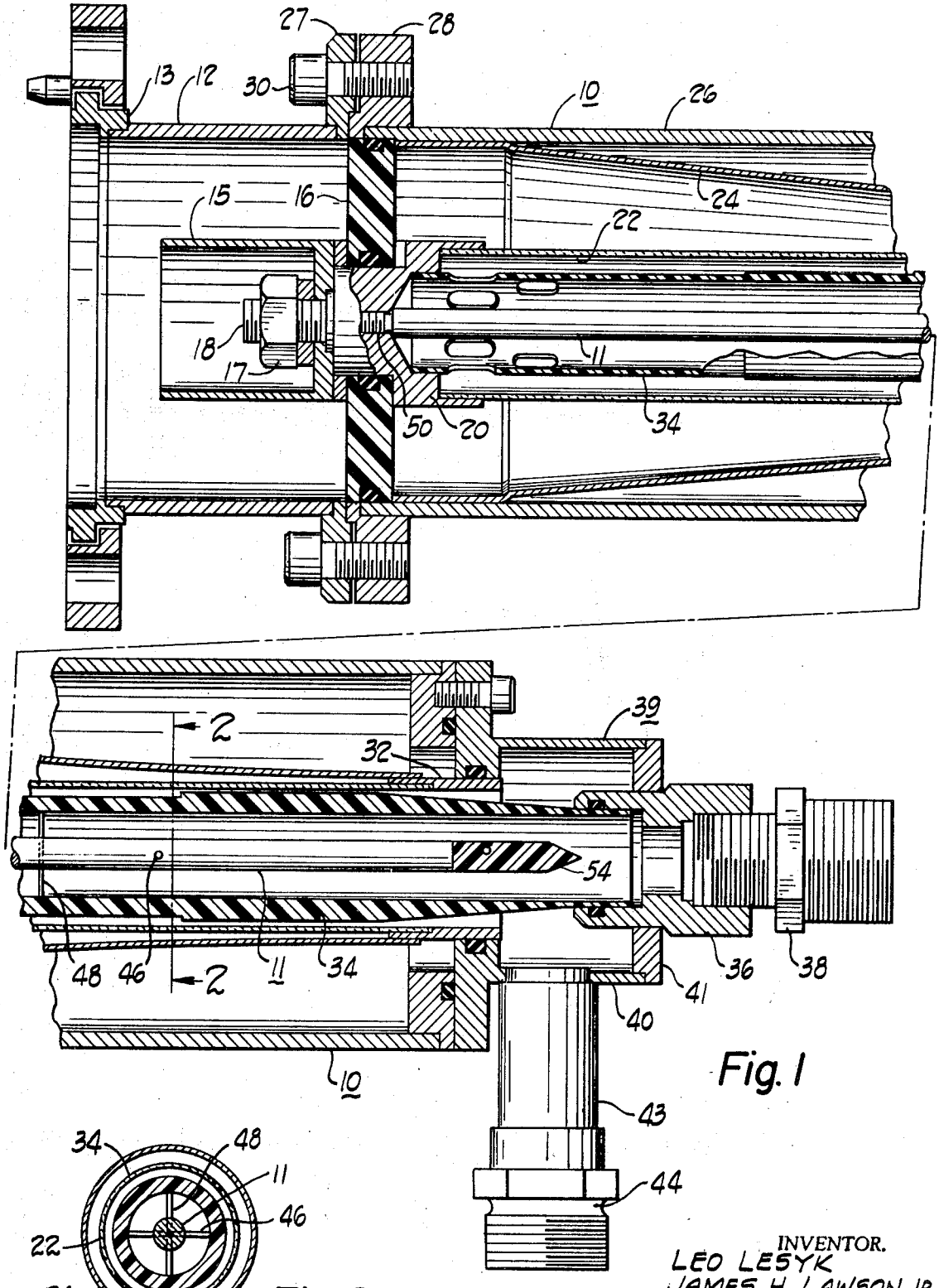


Fig. 1

Fig. 2

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FLUID-COOLED COAXIAL LINE TERMINATOR

BRIEF DESCRIPTION OF THE INVENTION

This invention relates to electrical devices for use in reflectionless terminations for coaxial transmission lines. More specifically, this relates to the discovery that the insertion of a solid rod conductor axially within and having one end connected to a cylindrical resistor of a line termination improves the electrical characteristics of the termination. The resulting combination behaves as a "lossy" load termination, i.e., exhibits a band-pass characteristic and also has a low-voltage standing wave ratio (V.S.W.R.) at power frequencies (400 c.p.s. down to direct current). One of the advantages of this combination is that it can be tested and used at power frequencies. It can also be used as a calorimetric transfer device in which the power absorbed can be determined at power frequencies by the change in temperature of a circulating coolant.

Still another advantage of this combination is that it can be readily converted from a "lossy" load to a conventional-type load by removing the axially positioned conducting rod. One of the significant features of this combination is that its band-pass characteristic can be adjusted by changing the diameter of the axially positioned rod.

Still another feature of this invention is the use of a solid "-Teflon" tip on the end of the rod remote from the connection of the rod to the resistor, which tip prevents arcing from the rod to the resistor.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiment of the invention illustrated in the accompanying drawings, forming a part of this specification, represents the best known mode of practicing the invention for effectuating the above objectives and certain other objectives having to do with details of construction and arrangements of parts which will become apparent as the description proceeds, this description being made by the use of reference numerals which indicate the parts throughout the views.

In the drawings:

FIG. 1 is a broken view in elevation, partly in section, showing the line terminating device according to one illustrative embodiment; and

FIG. 2 is a view in section taken along the line 2—2 of FIG. 1 and looking in the direction of the arrows.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1, there is depicted in broken form a view in elevation partly in section of a coaxial line attenuator embodying this invention. Generally speaking, the attenuator is of the type disclosed in FIG. 6 of Stevens et al. U.S. Pat. No. 3,300,737. The features and advantages of the subject invention are achieved by axially positioning conducting rod **11** within the coaxial line attenuator **10**. The details of the attenuator **10** are adequately described in the above-mentioned Stevens et al. Patent and the disclosure therein is hereby incorporated by reference.

Briefly, the termination **10**, as viewed in FIG. 1, has its left end connected to a coaxial line by means of a cylindrical conducting member **12** which is connected to the outer coaxial conductor, not shown, by means of a snug fitting sleeve **13**. The inner conductor of the termination **10** is connected to the inner conductor of the coaxial line by means of a cylindrical conducting member **15** mounted on a circular fluid barrier **16** by means of a nut and bolt assembly **17, 18**, respectively. The threaded bolt **18** is actually an extension of a thimblelike conducting member **20** extending through fluid barrier **16**, and receiving in the opposite end thereof a cylindrical resistor **22**, the outer surface of which is covered with a resistive coating in a manner described in detail in the above-mentioned patent. The outer conductor of the line termination includes a logarithmically tapered horn **24** which is connected to and snugly fit within cylindrical housing member **26**, and is connected by means of suitable sleeves **27, 28** and bolts **30** to conducting member **12**. The right-hand end of horn **24** is connected to a resistor **22** by means of a cylindrical sleeve **32** which is received within the right-hand end of horn **24** and constitutes the right-hand terminal for the resistive coating.

A fiber or insulating tube **34** is positioned within and preferably has its axis coincident with the axis of resistor **22** for the purpose of directing fluid flow through the interior of resistor **22** in a manner described in detail in the above-mentioned patent. The termination **10** is provided with suitable coolant inlet fittings **36, 38** which are coupled to the insulating tube **34** and a suitable combination of coolant outlet fittings including a receiving chamber **39** defined by a cylindrical member **40** and an end cap **41** and outlet tubes **43, 44**.

The conducting rod **11** is maintained with its axis coincident with the axis of insulating tube **34** and resistor **22** by means of a pair of insulating pins **46, 48** which are each of a length substantially equal to the internal diameter of the insulating tube **34**. The left-hand end of rod **11** is threadedly engaged by means of threads **50** in a suitable hole in the thimblelike conducting member **20**. Thus, the rod **11** is electrically connected to the inner conductor of the coaxial line, not shown, by means of conducting members **20** and **15**.

The presence of rod **11** within the resistor **22** causes the line termination to have a low V.S.W.R. (voltage standing wave ratio) in the power frequency range and also causes the combination to exhibit a band-pass characteristic which is typical of the performance of a "lossy" load. The particular width of the band pass and its upper and lower limits are determined by the diameter of rod **11**. One advantage of the low-loss characteristic at power frequency is that it facilitates testing of the line termination. Another advantage of this power frequency characteristic is that it makes possible both absolute or calorimetric and comparison or power testing.

With respect to the diameter of the rod, in two illustrative embodiments, rod diameters of five-eighths and one-eighth inch were employed within a resistor **22** having a diameter of 1.125 inches. The ⅝-inch diameter rod exhibited a band-pass frequency range from 600 to 1.600 mc.; whereas, the ⅛-inch diameter exhibited a frequency band pass from 200 to 1,200 mc. Another embodiment of rod **11** having a ¼-inch diameter exhibited a band-pass frequency range of 400 to 1,300 mc. In each instance, the rods were inserted within insulating tube **34** having an internal diameter of 0.725 inch. Water was employed as the coolant. Tests established that contamination of the water such as mixing the water with glycol or salt had no appreciable effect upon the electrical characteristics of the termination; whereas, without the rod, contamination of the coolant causes detrimental changes in the voltage standing wave ratio. Thus, the presence of the rod **11** increases the available frequency range of a line termination and provides it with a stable characteristic insensitive to coolant contamination. Preferably, the rod **11** is provided with a Teflon tip **54** which terminates in a point, and the presence of this Teflon tip prevents arcing from the rod **11** to the coolant fitting **36** and to the conducting end wall **31** of the line termination **10**. Preferably, the Teflon tip point engages a recess in the end wall to provide mechanical support for one end of rod **11**.

While several illustrative embodiments of the invention have been described in detail, it is understood that the concepts thereof may be utilized in various ways, numerous modifications and alterations being contemplated, it being understood that the embodiment shown in the drawing is given merely for the purpose of explanation and illustration without intending to limit the scope of the claims to the specific details involved.

What is claimed is:

1. A termination for a coaxial transmission line comprising:

a horn-shaped outer conductor;

resistance means including an elongated hollow ceramic dielectric member mounted coaxially within said outer conductor and having a resistive coating on one surface thereof, said member having an opening in one end thereof;

fluid conduit means including a tube projecting into said opening for delivering fluid coolant to the interior of said member, said tube having a smaller cross section than said opening wherein said fluid coolant is exhausted from said dielectric member between said tube and said member; and

a conducting rod positioned within said conduit means.

2. A terminating device according to claim 1 wherein said rod has its axis aligned with the axis of said resistance means.

3. A terminating device according to claim 1 wherein said rod has one end electrically connected to said resistance means.

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