March 30, 1948. V. J. ANDREW 2,438,489

CABLE TERMINAL

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Fig. 1.

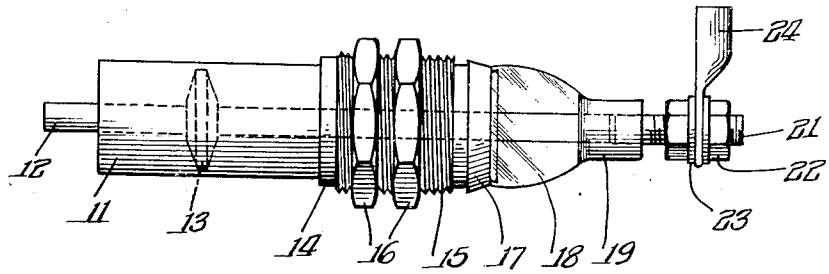


Fig. 3.

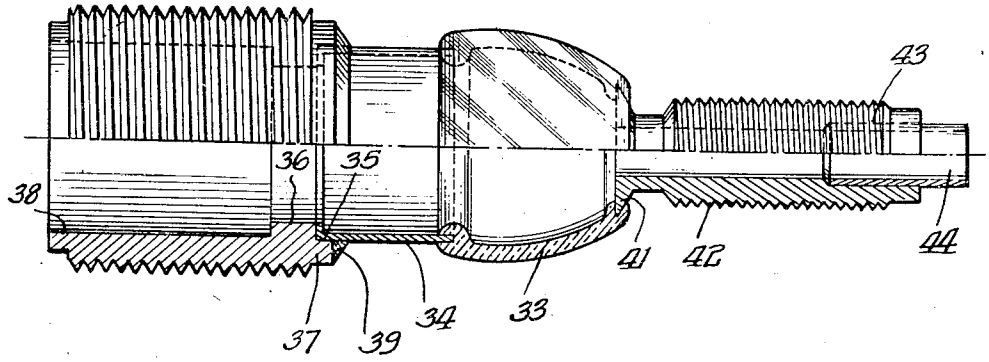
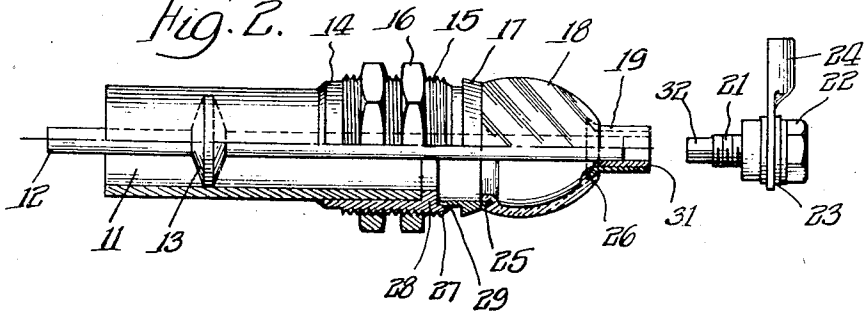


Fig. 2.



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CABLE TERMINAL

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5 Claims. (Cl. 174—19)

1

The present invention relates to cable terminals and more particularly to a coaxial conductor terminal such as used for the transmission of relatively high radio frequencies.

Coaxial cables and concentric conductors are used for the transmission of high frequency radio currents and for such transmission it is desirable to maintain the impedance of the cable or line substantially constant. This is accomplished by sealing the ends of the cable or line and filling the inside of the cable with a dry aeriform substance such as dehumidified air or nitrogen. It is common to provide a supply of the aeriform substance under pressure so that the substance in the cable is at a slight pressure to prevent condensation therein due to the action known as breathing which results from temperature changes. In order to seal such cable or concentric conductor line it is necessary to provide a proper termination for the cable which does not abruptly change the impedance. It therefore is necessary to minimize shunt capacity which obviously of course is increased by the presence of an insulator. In accordance with the present invention an insulator is provided which has a relatively good high frequency insulating characteristic and which introduces a minimum amount of shunt capacity between the inner and outer conductors of the cable. Hence the reactance of the insulator is maintained relatively high.

It therefore is an object of the present invention to provide an improved type of cable terminal for coaxial cables.

It is another object of the present invention to provide a sealed coaxial cable terminal which may be readily installed by technicians without the use of special skills or apparatus. Other and further objects of the present invention subsequently will become apparent by reference to the following description taken in connection with the accompanying drawing wherein

Figure 1 is an external view of a coaxial cable terminal placed in position at the end of a coaxial cable;

Figure 2 is another view of a coaxial cable terminal partly in cross section to illustrate its structure and the manner in which the cable is secured to the coaxial conductor; and

Figure 3 shows a modified form of the terminal shown in the other figures which is particularly suited for the smaller size coaxial cables.

Referring to Figures 1 and 2 there is shown a cable terminal associated with a coaxial line having an outer conductor 11 and an inner conductor 12 which may be supported therein by suitable

2

bead insulators 13 arranged at spaced intervals along the conductors. The outer conductor 11 is suitably bonded to an outer supporting sleeve 14 which may be provided with a threaded portion 15 upon which suitable mounting or lock nuts 16 are positioned. The forward end of the sleeve 14 is bonded to a cylindrical metal member 17 which in turn is bonded to a dome shaped glass insulator 18. The dome shaped glass insulator 18 at the top of the dome is bonded to a cylindrical member 19 which is electrically connected to the inner coaxial conductor 12 and to a threaded stud portion 21 which is provided with suitable nuts 22 and washers 23 for supporting a wire terminal 24.

As may be seen from Figure 2 the dome shaped glass insulator 18 surrounds one edge 25 of the cylindrical member 17. The cylindrical member 17 is made of metal alloy which has a temperature coefficient compatible with or substantially equal to the temperature coefficient of the insulating dome 18. While the edge 25 of the cylindrical member 17 is of lesser thickness than the body of the cylindrical member 17, the edge 25 need not be feathered or in other words reduced in cross section so as to have a knife edge. The inner end of the sleeve 19 terminates in a flanged portion 26 which is tapered appreciably but not necessarily to the extent of providing a sharp knife-like edge so that the glass 18 may surround both sides of the flanged portion 26. The member 19 is also formed of a metal similar to the metal used for the cylindrical member 17 so that the insulating dome 18 is securely bonded thereto.

Since the metal used for the cylindrical members 17 and 19 is more expensive than other metals, and furthermore requires skilled technique to bond such metal to another metal such as the copper or bronze used in a coaxial cable or lines, the sleeve 17 fits into a recessed portion 27 adjacent one end of the sleeve 14 which may be provided with a shoulder portion 28 for limiting the inward movement of the sleeve 17 and also the inward movement of the outer coaxial conductor 11. The sleeve 14 preferably is made of brass or some metal or alloy which may be readily bonded to the outer coaxial conductor 11 by soft soldering. The cylindrical metal member 17 is bonded to the sleeve 14 by any suitable process such as welding, brazing, or silver soldering. Such brazing or silver soldering is indicated by the fillet 29.

In order to facilitate the connection between the cylindrical member 19 and the inner conductor 12, the cylindrical member 19 is provided with an internal sleeve 31 of brass, copper, or the

like which in turn is bonded to the cylindrical member 19 in any suitable manner including the methods mentioned for joining the cylindrical member 17 with the sleeve 14. In order to prevent undue mechanical stress from being applied to the insulator 18 which possibly might fracture or otherwise injure the insulator, it is preferable to connect the wire terminal 24 to the threaded stud 21 by means of nuts 22 prior to the time that the stud 21 is mounted in position relative to the cylindrical sleeves 19 and 31. The stud 21 therefore is provided with a reduced cylindrical portion 32 adapted to fit within the sleeve 31. The inner conductor 12 of the coaxial cable extends into the sleeve 31 a portion of its distance, and prior to insertion thereto the end of the conductor 12 preferably is tinned with solder. Similarly the reduced portion 31 may be tinned before insertion into the sleeve 31. Thereafter heat may be applied to the cylindrical member 19 so as to bring about a sweated soldered joint. The heat required to form the sweated soft solder joint is considerably less than the heat required to introduce any adverse strains or effects in the glass insulator 18.

The glass used for the dome shaped insulator seal 18 is of a material having a certain desired temperature coefficient which may be matched by a special metal alloy of chromium, nickel, and iron. This combination provides a proper seal between glass and metal, and the alloy metal surfaces are then bonded by brazing, welding, or soldering to other metal parts which may be joined to the coaxial cable by soft soldering. If a low temperature solder containing sixty per cent tin and forty per cent lead is used, there is no danger of cracking the glass insulator from the heat of soldering. While glass does not have as good high frequency insulating qualities as other insulating materials, the volume of the glass between the inner and the outer conductors is maintained at a minimum where obviously the electric field is the greatest and hence the dielectric losses are much less than the losses encountered if a ceramic insulator were used for a terminal. For example at 400 megacycles an ordinary ceramic insulated terminal may present a capacity of 50 micromicrofarads corresponding to a reactance of 8 ohms. Assuming that the load into which the cable is operating is a 70 ohm resistive load, this load will receive a negligible portion of the transmitted power since for all practical purposes the cable is practically shorted at its terminal end. With a terminal of the type shown and described there is but a very small shunt capacitance and a very small series inductance, the effects of which may readily be balanced out. It therefore will be appreciated that there has been provided a cable terminal which gives satisfactory high frequency performance and which provides a permanent leak-proof terminal.

The modification shown in Figure 3 is particularly suited for the smaller sizes of coaxial cables and lines. In this modification the glass insulator 33 is secured to a cylindrical metal member 34 which fits into a recess 35 adjacent a shoulder 36 formed within an externally threaded member 37. The externally threaded member 37 is provided with a cylindrical internal bore 38 adapted to receive the outer conductor of a coaxial cable. The member 37 is formed of a material such as brass or copper so that it may be secured to the outer conductor of the coaxial line or cable by soft solder. The member 37 is bonded to the cylindrical member 34 by welding, brazing, or silver soldering as indicated by the fillet 39. The other end of the dome shaped insulator 33 is joined to a flanged portion 41 formed at one end of a hollow externally threaded member 42. The member 42 is also made of a metal alloy having a temperature coefficient substantially equal to or compatible with the temperature coefficient of the dome shaped glass insulator 33. In order that the member 42 may be secured by soft soldering to the inner conductor of a coaxial line or cable, one end of the member 42 is provided with a recessed portion 43 in which is mounted a sleeve 44 which sleeve is formed of brass or copper. The sleeve 44 is bonded to the member 42 by brazing, welding, or silver soldering. The modification thus illustrated is particularly adapted for smaller coaxial conductors or cables in the vicinity of one quarter inch.

While for the purpose of illustration and explanation certain specific embodiments of a coaxial line or cable terminal have been shown, it is to be understood that variations may be made in the arrangement of the components and in their structure as may be commensurate with the scope and spirit of the invention set forth in the appended claims.

The present invention is hereby claimed as follows:

1. A sealed terminal unit for concentric conductors comprising two sleeves of different size adapted to be bonded to the inner and outer conductors of concentric conductors in linear spaced apart positions, a hollow insulating member interposed between said sleeves, and a plurality of metal members each having a temperature coefficient compatible with the temperature coefficient of said insulating member, said metal members each being bonded to said insulator and to one of said metal sleeves.

2. A sealed terminal unit for a transmission line having concentric conductors comprising two metal sleeves of different size adapted to be soldered to the inner and outer conductors of said concentric conductors in linear spaced apart relation, a dome shaped thin walled hollow glass insulating member interposed between said sleeves, and metal members having a temperature coefficient substantially equal to the temperature coefficient of said insulating member, said metal members each being bonded to said insulator and to one of said metal sleeves.

3. A sealed terminal unit for connection with coaxial conductors comprising a thin walled hollow dome shaped glass insulator bonded to two cylindrical metal members of different diameters, said metal members having a temperature coefficient compatible with the temperature coefficient of said insulator, a metal sleeve of a different metal adapted to be bonded to the outside of the outer conductor of said coaxial conductors, said metal sleeve being bonded to the larger one of said cylindrical metal members, a metal sleeve of a different metal adapted to be bonded to the inner coaxial conductor, said latter metal sleeve being bonded to the smaller one of said cylindrical metal members.

4. A gas tight sealed terminal unit for connection to a coaxial line comprising an apertured dome shaped glass insulator bonded to two cylindrical metal members of different diameters, said metal members having a temperature coefficient substantially equal to the temperature coefficient of said insulator, a metal sleeve of a different metal capable of being bonded by soft solder to

the outside of the outer conductor of a coaxial line, said metal sleeve being bonded to the larger one of said cylindrical metal members, another metal sleeve of a material capable of being soft soldered to the inner coaxial conductor, said latter metal sleeve being bonded to the smaller one of said cylindrical metal members.

5. A gas tight sealed terminal unit for connection to a coaxial line having two concentric conductors comprising an apertured dome shaped thin walled hollow glass insulator, two cylindrical metal members of different diameters having a temperature coefficient substantially equal to the temperature coefficient of said insulator, the smaller one of said metal members being bonded to the aperture of said dome shaped glass insulator, the other of said metal members being bonded to the other end of said dome shaped glass insulator, a metal sleeve of a different metal adapted to receive and to be soldered with soft solder to the outside diameter of the outer conductor of a coaxial cable, said metal sleeve being bonded to the larger one of said cylindrical metal members, a second metal sleeve of a different metal adapted to receive and to be soldered with soft solder to the inner coaxial conductor, said

latter metal sleeve being bonded to the smaller one of said first mentioned cylindrical metal members.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,144,222	Hollman	Jan. 17, 1939
2,322,233	Granger	June 22, 1943
1,814,851	Prince	July 14, 1931
2,127,408	Kaar	Aug. 16, 1938
1,888,071	Case	Nov. 15, 1932
2,210,699	Bahls	Aug. 6, 1940
1,575,994	Laise	Mar. 9, 1926
2,299,750	Hull et al.	Oct. 27, 1942

FOREIGN PATENTS

Number	Country	Date
685,211	Germany	Dec. 14, 1939

OTHER REFERENCES

Serial No. 532,040, Gonnington (A. P. C.), published May 18, 1943.