Dec. 27, 1960 H. H. HELLER 2,966,639

DIMINUTIVE COAXIAL LINE RESISTIVE TERMINATION

Filed June 6, 1955

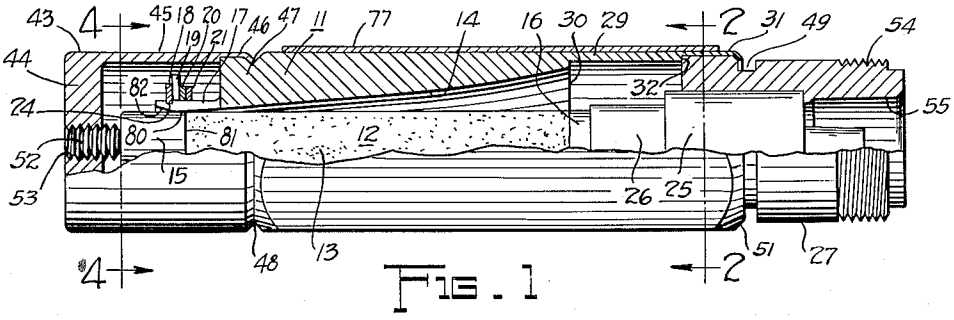

FIG. 1

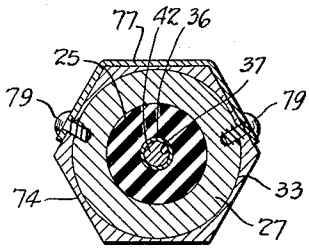

FIG. 2

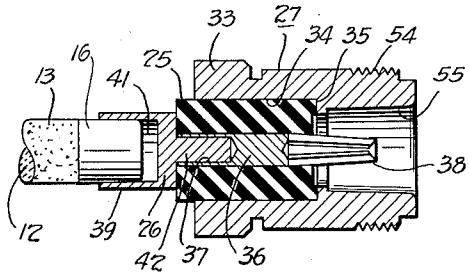

FIG. 3

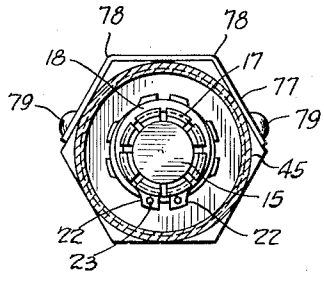

FIG. 4

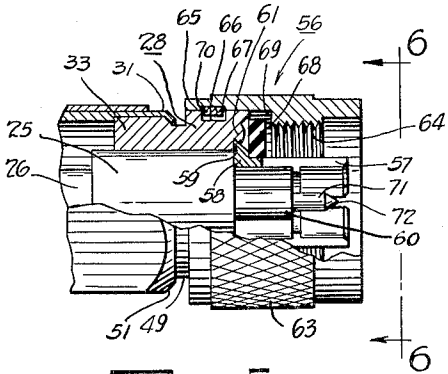

FIG. 5

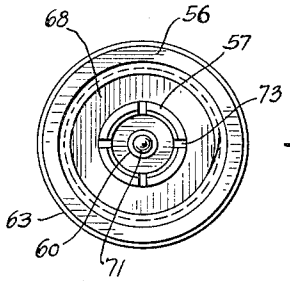

FIG. 6

INVENTOR.
Herbert H. Heller
BY
Schramm and Knowles
ATTORNEYS

United States Patent Office 2,966,639 Patented Dec. 27, 1960

2,966,639

DIMINUTIVE COAXIAL LINE RESISTIVE TERMINATION

Herbert H. Heller, Cleveland Heights, Ohio, assignor to Bird Electronic Corporation, Cleveland, Ohio, a corporation of Ohio

Filed June 6, 1955, Ser. No. 513,293

11 Claims. (Cl. 333—22)

This invention relates to high frequency line components and concerns particularly reflectionless terminations for coaxial lines. The invention is particularly concerned with the provision of such devices for use over a wide frequency band without change in electrical constants.

An object of the invention is to provide relatively inexpensive, easily made electrical connections which make good electrical contact and do not introduce discontinuities in impedance properties.

Other objects and advantages pertain to certain features of construction and combinations and arrangements of parts by which are obtained simplicity and economy as well as improved operating characteristics. Such will become apparent from the following detailed description of a preferred embodiment of the invention.

This description is made in conjunction with accompanying drawings, in which Fig. 1 is a view partially in longitudinal section, of a reflectionless terminating unit for a coaxial transmission line. Fig. 2 is a view in cross section represented as cut by a vertical plane 2—2 indicated in Fig. 1. Fig. 3 is a fragmentary view of the right hand end of the apparatus shown in Fig. 1 but illustrated in longitudinal section. Fig. 4 is a cross sectional view of the apparatus of Fig. 1 represented as cut by plane 4—4. Fig. 5 is a fragmentary view, partially in longitudinal section corresponding in part to Fig. 3, of a modification in the apparatus of Figs. 1 and 3, to adapt the apparatus to receive a coaxial-line plug type connector fitting instead of being received in a socket type connector type fitting. Fig. 6 is an end view of the modification of Fig. 5 represented as seen from a plane 6—6 indicated in Fig. 5.

Like reference numerals are utilized throughout the drawings to designate like parts.

For various purposes it is desirable to provide means for terminating a coaxial transmission line and absorbing energy transmitted through the line without producing reflections at any frequency. For example, when sections of high frequency lines are being tested, standing wave ratio measurements are being made, or where other investigations are being made in high frequency apparatus employing coaxial line connections, it may be desirable to provide a like termination. As is well known by those skilled in the art, reflections may be avoided in a terminated coaxial line having a load-absorbing resistive inner conductor by a suitable curving taper of the inner diameter of the outer conductor in relation to the magnitude of the resistance of the inner conductor.

As illustrated in Fig. 1 a compact, easily and inexpensively assembled line termination unit is provided which comprises an outer conductor or resistor housing **11** having an inner conductor **12** centrally disposed within the resistor housing **11**. The inner conductor **12** consists of a ceramic rod with a coating **13** of resistance material such as a carbon film thereon to form a resistor rod. The resistor housing **11** has an inside diameter which tapers along a curve to form a funnel shaped horn inner surface,

14. The curvature of the surface **14** and the resistance of the carbon film resistor **13** are so related in accordance with known principles that at each point along the length of the line, the center conductor termination resistance between such point and the end of the line, is equivalent to the characteristic impedance of the line measured at that point. The characteristic impedance of a coaxial line is proportional to the logarithm of the ratio of the surface diameters of the inner and outer conductors. Consequently in a line with an exponential curvature a center conductor of uniform resistance may be used and distances measured along it are in proportion to the logarithm of the internal diameter of the resistor housing **11**.

The inner conductor, **13**, is silvered or provided with metallized or conductive bands, **15** and **16**, at the ends to form surfaces of good conductivity for making electrical connection with the resistance coating **13**. Connecting means are provided for gripping the conductor bands **15** and **16** with good electrical contact and they are so constructed that the connection may be made quickly and easily in assembling the unit. The arrangement is such also as to avoid discontinuities which would interfere with the reflectionless character of the unit. In units designed for five watts or less the axially measured curved surface is approximately one and one-half inches but it will be understood that the invention is not limited to a particular size of units.

The outer conductor or resistor housing **11** has an extension at the left hand or terminal end slitted to form contact fingers **17**. The inner diameter of the extension formed by the contact fingers **17** equals the minimum diameter of the tapered inner surface **14** and corresponds to the outer diameter of the central conductor **12** so as to make good electrical contact with the conductor band **15** at the left hand end of the resistor **13**.

It will be observed that the extension consisting of the fingers **17** has a relatively small axial thickness in relation to the thickness of the resistor housing **11** at the left-hand end, so that the fingers **17** are relatively flexible.

For insuring tight gripping of the conductor band, **15** by the fingers **17** and avoiding any resistance other than that of the resistor **13** a plurality of clamping rings **18**, **19**, **20**, and **21** are employed. For example, as illustrated, there may be four such clamping rings although the invention is not ilmited thereto. Such clamping rings, **18** to **21**, may be of a form manufactured by Waldes-Kohinoor, Inc. of Long Island City, New York, and sold under the name of Tru-Arc rings. Each clamping ring such as the clamping ring **18** has a pair of ears **22** and holes **23** therein, for receiving a suitable tool to spread the rings during assembly. The bending stress of the rings contracts them after assembly has been completed. An annular groove **24**, is machined in the fingers **17**, to retain the ring **18**. The ring **18**, thus prevents the other rings **19**—**21** from slipping off the fingers **17**. Since there are no grooves for the rings **19**—**21**, these remain under stress to force the fingers **17** against the conductor band **15** for insuring good electrical contact.

The resistor housing **11** and likewise the extending fingers **17** are composed of a suitable metal of good electrical conductivity such as brass or cooper, for example. In adidtion to making electrical connection with the conductor band **15**, the contact fingers **17** serve also to support the left hand end of the resistor rod **13** centrally within the resistor housing **11**.

Insulated means are provided for supporting and making electrical connection with the conductor band **16** at the right hand or input end of the film resistor **13**. As illustrated in the longitudinal sectional view of Fig. 3, such insulated supporting means comprises a tubular insulator **25** and a socket contact fitting **26**. For sup-

porting the tubular insulator 25, there is a connector jack body 27 or plug body 28, as illustrated in Fig. 3 or 5, according to whether the termination unit is to be screwed into the threaded sleeve of a coaxial line fitting or is to be connected to a coaxial line device adapted to be plugged or screwed into the threaded sleeve of the termination unit.

In either case the right-hand or input end of the resistor housing 11 is provided with an extension 29 having an outer hex surface continuous with the outer hex surface of the remainder of the resistor housing 11 and a cylindrical inner surface of a diameter slightly larger than the maximum diameter of the tapered surface 14 to obtain a shallow radial shoulder or step 30 which lies in a plane normal to the axis of the termination. This plane preferably intersects the rod 12 at or adjacent the juncture of the film resistor 13 and the conductor band 16. For receiving the connector body 27 or 28, the extension 29 is counter-bored to a somewhat larger internal diameter at the right hand end and is also externally machined or cut down to leave a thin cylindrical shell 31 and form a shoulder 32. The connector bodies, 27 and 28, are provided with cylindrical base portions 33 adapted to fit within the shell 31 and against the shoulder 32.

In the embodiment of Figs. 1 and 3, the connector jack body 27 has a bore 34 of suitable diameter to make a press fit with the tubular insulator 25 and is provided with a shoulder 35 for limiting the axial movement of the tubular insulator 25. Centrally-located and press fitted in the tubular insulator 25 is a center connector pin 36 having a socket 37 at the inner end for supporting the resistor 12. Outer tubular end 38 of the pin is slotted axially in the provision of spring prongs that are sprung toward one another for the purpose of gripping between them the mating pin on the end of the center conductor terminal of a conventional line end fitting (not shown). The contact fitting 26 comprises a larger diameter portion 39, bored to form a socket 41, and a smaller diameter portion or stem 42 fitting in the axial socket 37 in the inner end of the connector pin 36. The socket 41 is of such diameter or is slotted axially as to form a spring fit receiving the conductor band 16 of the ceramic insulator rod 12.

It will be observed that the socket 41 and the conductor band 16 are wholly enclosed, thereby protecting the electrical connection against dust and corrosion. For similarly protecting the conductor band 15 and the contacts with the fingers 18—21, a dust cover 43 is preferably provided. The dust cover is in the form of a cup having a relatively thick circular base 44, a hollow cylindrical wall portion 45, and a thinner annular etxension or lip 46 on the cylindrical wall 45. The extension lip is adapted to fit around left hand end 47 of the resistor housing 11. At this end the resistor housing is machined or cut down as by turning to cylindrical shape and provided with a groove shown as an annular V-notch groove 48 into which is rolled the edge of the annular cap lip 47 as by a suitable pressure wheel or crimper. Likewise the end edge of the axially extending shell 31 of the resistor housing 11 is rolled or crimped into annular groove 49 and around the sloping shoulder 51 of the connector jack body 27 (or the plug connector body 28).

A set screw 52 is preferably provided, mating with a threaded central hole 53 in the base 44 of the dust cover 43 for pushing and holding the parts in assembled relation.

As illustrated in Figs. 1 and 3, the jack body 27 has an outer surface with threads 54 and is formed with a tapering inner socket surface 55 concentrically surrounding the pronged end of the center conductor pin 36 whereby the jack body may be plugged into a suitable coaxial line fitting to make contact with an outer conductor through the surfaces 54 and 55 and with an inner conductor through the tapering spring pin gripping prongs on end 38.

The reflectionless coaxial line termination unit of Fig. 1 may also be provided with a jack body having a coupling nut 56 as illustrated in Fig. 5 to receive an externally threaded connector fitting of the general type illustrated by the jack body 27 of Figs. 1 and 3. As illustrated in Fig. 5 the jack body 28 used in conjunction with a coupling nut 56 has a base portion 33, annular groove 49 and tapering shoulder 51 similar to the jack body 27 of Figs. 1 and 3, whereby it may be secured to the resistor housing 11 into the open end of which it is received by rolling down the shell portion 31 of the resistor housing or body 11. The same type of tubular insulator 25 may also be employed for receiving and supporting the socket fitting 26.

However, the jack body 28 is relatively short and instead of forming it with a shoulder such as the shoulder 35 of Figs. 1 and 3, a slotted tubular contact member 57 is provided having a base portion 58 with an outer surface in the form of a truncated cone adapted to be received against a shoulder 59 in the jack body 28 and to be held in place in the jack body 28 by spinning down the portion 61 of the jack body around the outer surface of the base 58 of the member 57.

The coupling nut 56 is in the form of a hollow cylinder with a knurled outer surface 63, a central, internally threaded, minimum diameter portion 64 and an inner end portion 65 counterbored to provide a loose fit around the outer surface of the jack body 28. Annular grooves 66 and 67 are formed in the jack body 28 and the coupling nut 56, respectively, for cooperating with a spring ring 70 of the expanding type which holds the coupling nut 56 in place axially on the jack body 28, but permits rotation thereof. As illustrated, the radial depth of the groove 66 is as great as that of the ring 70. But the radial depth of the outer groove 67 is less than that of the ring 70. Preferably a gasket 68 of insulating material is provided which surrounds the cylindrical portion of the conductor fitting 57 lying between the end of the jack body 28 and the shoulder 69 at the inner end of the threaded portion 64 of the nut 56.

In the embodiment of Fig. 5, a center conductor pin 60 is employed which is received within the tubular insulator 25 as in the case of the pin 36 of Fig. 3, and the pin 60 is provided with a socket (not shown) corresponding to the socket 37 of Fig. 3. However, the right hand end of the conductor pin 60 of Fig. 5 is of different form terminating in a reduced diameter end portion 71 having a conical end taper 72. The conical end taper 72 is adapted to enter and spread a split end type of connector pin such as the pin end 38 of Fig. 3. Likewise the shell 57, having slots 73, is adapted to be sprung inward for making electrical contact when engaging a tapered inner surface of a coaxial line connection such as the Fig. 3 tapered inner surface 55.

The construction illustrated is especially advantageous in providing a larger yield with a lower standing wave ratio than coaxial line terminations heretofore available. Moreover, the construction illustrated lends itself so well to mass production and accurate reproduction that on a statistical basis the product is better than that heretofore available.

The invention is not limited to forming the resistor housing 11 with a specific external shape. However for convenience in handling and preventing rolling of the unit, it has been found convenient to form the housing 11 with flat outer surfaces. For example, as illustrated in Figs. 2 and 4, the housing 11 may be hexagonal with six flat surfaces 74. The ends 47 and 31, however, of the resistor housing 11 are turned down to form cylindrical outer surfaces to fit the cylindrical cover wall 45 and the connector body base 33, respectively. The hexagonal shape of the body illustrated is adapted to receiving a name plate 77 of bent sheet form having two 120-degree angles 78 and provided with drive screws 79 which serve at the right-hand end to prevent relative rotation

and to provide additional securing means with the connector body **27** or **28** as the case may be.

Before the unit as a whole is assembled the resistor sub-assembly consisting of the elements **12**, **25**, **26**, **27** and **36** shown in Fig. 3 is assembled. The stem **42** of the contact fitting **26** is first soldered into the socket **37** of the center conductor pin **36**. The ceramic rod **12** having the film resistor **13** and the conductive band **16** is then pressed into the cup **39** of the fitting **26**. The tubular insulator **25**, first received over the conductor pin **36**, is then pressed into the connector body **27**.

Then the resistor sub-assembly is inserted axially into the resistor housing **11** through the right hand end of the latter. Thereupon the Truarc rings, **21**, **20** and **19** are assembled in that order onto the fingers **17** by the use of a tool fitting the ears **22**. Thereafter the last Truarc ring, **18**, is assembled, being permitted to drop into the slot **44** for holding the other Truarc rings in place axially. The electrical performance of the apparatus may then be tested. The radial forces applied continuously to the axial contact fingers **17** by the stressed rings **18**, **19**, **20** and **21** cause the fingers to grip the ceramic rod yieldingly. The curved inner surface **14** of the housing **11** is continued onto the fingers **17** and the inner surfaces of the fingers at their outer ends are relieved at **82** in the provision on each of the fingers of an axially short land **80** which bears strongly against the conductor band **15** at circular juncture line **81** between the conductor band and the resistive film **13**.

The shell **31** of the resistor housing **11** is then rolled over the sloping shoulder **51**, the dust cap **43** is assembled and its lip or edge **46** is rolled into the V-notch groove **48**. Thereafter, the set screw **42** is inserted.

Holes are drilled into the resistor housing **11** to receive the drive screws **79** and the name plate **77** is attached by means of the screws **79**.

If electrical performance has not already been tested it may also be tested after the name plate has been attached. As a final step after assembly and testing, the set screw **52** may be secured by a suitable cement or varnish. A drop of adhesive liquid is applied thereto such as a synthetic varnish or cement of the alkyd-resin type, for example, that sold under the trade name Glyptal.

In assembling the form of apparatus represented by Fig. 5, the resistor sub-assembly consisting of the ceramic rod **12**, the connector body **28**, the tubular contact **57**, the tubular insulator **25**, the socket fitting **26** and the pin **60**, is first assembled. This sub-assembly is then assembled with the resistor housing **11** and the Truarc rings **18**, **19**, **20**, and **21** are assembled in place. Electrical performance is then tested, if desired. The shell **31** is rolled over the sloping shoulder **51**, after which the dust cap **43** is assembled as previously described and the name plate is attached. If not previously done, preferably the electrical performance is then tested, after which the connecting nut **56** is assembled by means of the expanding ring **70** after inserting the gasket **68**. The final step, as before, is applying the Glyptal resin to the set screw **52**.

In accordance with the patent statutes, the principles of the present inventon may be utilized in various ways, numerous modifications and alterations being contemplated, substitution of parts and changes in constructions being resorted to as desired, it being understood that the embodiment shown in the drawings and described above are given merely for purposes of explanation and illustration without intending to limit the scope of the claims to the specific details disclosed.

What is claimed is:

1. A reflectionless termination unit for a coaxial electrical line comprising in combination a hollow elongated one piece metal housing of uniform external size over the major portion of its length and having an internal tapered surface of circular section progressively reducing in diameter from a maximum at its input end to a minimum at its terminal end, said housing constituting the outer conductor of the unit, an elongated center conductor coaxial to the housing surface extending from the input end to the terminal end and comprising cylindrically surfaced resistance material, the center conductor having input and terminal ends, a fitting electrically contacting the center conductor at the input end thereof, said housing having an axial extension at the input end thereof, said housing extension having an internal cylindrical surface coaxial to and of substantially the same diameter as the maximum diameter of said internal tapered surface, a jack body, a tubular insulator in said jack body, a connection pin within said tubular insulator and having connection with said fitting, said housing at the terminal end of the outer conductor having a relatively thin tubular axial extension, said housing extension comprising radially yieldable contact means, the inner surface of such terminal extension contact means constituting an extension of the internal surface of the housing for making electrical contact with the terminal end of the center conductor, clamping ring means fitting around said tubular extension gripping the latter and pressing said contact means yieldingly inward against the center conductor for maintaining a shorting electrical connection between the tapered surface and the center conductor while permitting relative axial sliding thereof, and a hollow dust cover shorter than the housing enclosing the terminal end of the center conductor, the tubular terminal end extension of the housing and the ring means, said cover being secured to the housing at a point of the latter intermediate its ends and spaced axially toward the input end from the ring means with the major portion of the housing outside the dust cap.

2. A reflectionless termination unit for a coaxial electrical line comprising in combination a hollow elongated one piece metal housing of uniform external size over the major portion of its length and having an internal tapered surface of circular section progressively reducing in diameter from a maximum at its input end to a minimum at its terminal end, said housing constituting the outer conductor of the unit, an elongated center conductor coaxial to the housing surface extending from the input end to the terminal end and comprising cylindrically surfaced resistance material, the center conductor having input and terminal ends, a fitting electrically contacting the center conductor at the input end thereof, a jack body, a tubular insulator in said jack body, a connection pin within said tubular insulator and having connection with said fitting, said housing at the terminal end of the outer conductor having a relatively thin tubular axial extension, said housing extension comprising radially yieldable contact means, the inner surface of such terminal extension contact means constituting an extension of the internal surface of the housing for making electrical contact with the terminal end of the center conductor, clamping ring means fitting around said tubular extension gripping the latter and pressing said contact means yieldingly inward against the center conductor for maintaining a shorting electrical connection between the tapered surface and the center conductor while permitting relative axial sliding thereof, an end member connected to the housing intermediate the terminal extension and the input end, said end member extending axially beyond the terminal extension, and screw means carried wholly by the end member and engaged against the terminal end of the center conductor, said screw means being coaxial to the center conductor and actuatable to shift the latter axially in relation to the housing.

3. A termination for a coaxial electrical line, said termination comprising an elongated tubular housing having a main portion formed with an internal conductive surface comprising the outer conductor of the termination, means carried by the housing connected to one end of the surface for electrically connecting such surface to

the outer conductor of such a line, an elongated center conductor within the housing and generally spaced from the conductive surface, said center conductor comprising cylindrically surfaced resistance material, means connected to one end of the center conductor for electrically connecting the center conductor to the inner conductor of such a line, insulating means supporting the second mentioned connecting means in the first mentioned connecting means, the center conductor having a radial shoulder abutting said insulating means, the housing including a portion extending as an axial extension of the main portion at the other end of said conductive surface and having radially yieldable elements providing conductive surface means electrically connected to and extending as a continuation of said internal surface, resilient means biasing the elements toward and holding said surface means in mechanically yielding constant electrical contact with the center conductor at the other end of the latter in the provision of a shorting electrical connection between said other ends of the conductive internal surface and the center conductor, an adjusting element, and means carried by the housing and supporting the adjusting element wholly outside the shorting connection for relative movement and adjustment to react against the center conductor while the shorting connection is maintained and to thereby hold the shoulder against the insulating means.

4. A termination as claimed in claim 3 in which the housing includes an attaching portion intermediate and spaced axially from both ends of the center conductor and located radially outwardly from the extension portion and said supporting means for the adjusting element is secured to the attaching portion.

5. A termination as claimed in claim 3 in which the supporting means straddles said other end of the center conductor, the yieldable elements and the biasing means and is connected to the housing solely at points axially located intermediate the ends of the center conductor, and the adjusting element threadedly engages the supporting means and is adapted for axial shifting movement relative to the housing and against the center conductor.

6. A termination as claimed in claim 5 in which the supporting means comprises a cup having a rim fast to the housing and providing a closed chamber outside the space between the internal conductive surface and the center conductor, said other end of the center conductor, said yieldable elements, and said biasing means being disposed in the closed chamber, and the adjusting element being threaded through the bottom of such cup.

7. A reflectionless termination unit for a coaxial electrical line comprising in combination an elongated tubular housing member having a tapered internal conductive surface, an elongated center conductor comprising a resistor extending through the housing member in coaxial relation, means at one end of the housing member for connecting the conductive surface and the center conductor to the outer and inner conductors, respectively, of such a line, means providing a shorting connection between the conductive surface and the center conductor at the other end of the housing member, the housing member being relatively thin walled at said one end and relatively thick walled at said other end, said conductive surface and center conductor defining and being separated by an annular dielectric space which decreases in cross sectional area progressively from said one thin walled end toward said other thick walled end of the housing member, said center conductor projecting out through and extending axially beyond the housing member at said thick walled end, said shorting means comprising means fast to the housing member at the thick end providing a plurality of generally axially extending radially yieldable fingers, each of said fingers having a radially inwardly directed surface substantially flush with and extending as a continuation of the tapered internal surface, resilient means embracing the axial fingers and clamping them against the projecting end of the center conductor to effect said shorting connection between the center conductor and the conductive surface of the housing member, means anchored to said thick walled end of the housing member and enclosing the projecting end of the center conductor, the yieldable fingers and the resilient means, and adjusting means carried by said enclosing means and actuatable to apply axial load to said projecting end of the center conductor.

8. A termination unit for a coaxial electrical line comprising in combination an outer conductor with input and terminal ends and which includes an elongated hollow housing externally of generally uniform shape throughout the major portion of its length, the housing comprising a body portion formed with an internal tapered surface of circular section progressively reducing in diameter from the input end toward the terminal end, the body portion being radially relatively thin at the input end and relatively thick at the terminal end, an elongated resistive center conductor within and coaxial to the housing surface extending from the input end to the terminal end, the center conductor having input and terminal ends respectively adjacent the input and terminal ends of the outer conductor, a fitting supportingly and electrically contacting the input end of the center conductor, a conductive jack body fast to the housing at the input end and having an internal surface electrically continuous with the tapered internal surface, a tubular insulator in said jack body, a connection pin within said tubular insulator and having connection with said fitting for supporting the latter and the input end of the center conductor, said housing having at the thick terminal end of the body portion a tubular axial extension portion embracing the terminal end of the center conductor, said terminal extension portion being radially yieldable and thin relative to the body portion at the terminal end and having an inner surface continuous with the tapered surface to constitute an axial extension of the tapered surface, said surface of the terminal extension being in yielding electrical contact with the terminal end of the center conductor providing for axial movement of the center conductor relative to the housing while said yielding contact is maintained, clamping ring means fitting around said tubular extension gripping the latter and pressing it inward against the center conductor, and a hollow dust cover enclosing the terminal end of the center conductor, the terminal extension portion of the housing and the ring means with an intervening annular clearance between the cover and the enclosed extension portion and ring means and an intervening axial clearance between the cover and the enclosed terminal end of the center conductor, the major portion of the housing being outside the cover and said cover having an open end secured to and closed by the thick end of the body portion of the housing at the terminal end.

9. A termination unit for a coaxial electrical line comprising in combination an outer conductor with input and terminal ends and which includes an elongated hollow housing externally of generally uniform shape throughout the major portion of its length, the housing comprising a body portion formed with an internal tapered surface of circular section progressively reducing in diameter from the input end toward the terminal end, the body portion being radially relatively thin at the input end and relatively thick at the terminal end, an elongated resistive center conductor within and coaxial to the housing surface extending from the input end to the terminal end, the center conductor having input and terminal ends respectively adjacent the input and terminal ends of the outer conductor, a fitting supportingly and electrically contacting the input end of the center conductor, a conductive jack body fast to the housing at the input end and having an internal surface electrically continuous with the tapered internal surface, a tubular

insulator in said jack body, a connection pin within said tubular insulator and having connection with said fitting for supporting the latter and the input end of the center conductor, said housing having at the thick terminal end of the body portion a tubular axial extension portion embracing the terminal end of the center conductor, said terminal extension portion being radially yieldable and thin relative to the body portion at the terminal end and having an inner surface continuous with the tapered surface to constitute an axial extension of the tapered surface, said surface of the terminal extension being in yielding electrical contact with the terminal end of the center conductor providing for axial movement of the center conductor relative to the housing while said yielding contact is maintained, a cover over the terminal end of the center conductor and the terminal extension portion of the housing with an intervening radial clearance between the cover and such terminal extension and an intervening axial clearance between the cover and the center conductor terminal end, said cover being secured to the thick end of the body portion of the housing at a point adjacent the terminal end of the outer conductor, and screw means threadedly engaged in the cover and wholly supported thereby, said screw means being adapted to bear axially against the terminal end of the center conductor to limit said relative axial movement.

10. A termination unit for a coaxial electrical line comprising in combination an outer conductor with input and terminal ends and which includes an elongated hollow housing externally of generally uniform shape throughout the major portion of its length, the housing comprising a body portion formed with an internal tapered surface of circular section progressively reducing in diameter from the input end toward the terminal end, the body portion being radially relatively thin at the input end and relatively thick at the terminal end, an elongated resistive center conductor within and coaxial to the housing surface extending from the input end to the terminal end, the center conductor having input and terminal ends respectively adjacent the input and terminal ends of the outer conductor, a fitting supportingly and electrically contacting the input end of the center conductor, a conductive jack body fast to the housing at the input end and having an internal surface electrically continuous with the tapered internal surface, a tubular insulator in said jack body, a connection pin within said tubular insulator and having connection with said fitting for supporting the latter and the input end of the center conductor, said housing having at the thick terminal end of the body portion a tubular axial extension portion embracing the terminal end of the center conductor, said terminal extension portion being radially yieldable and thin relative to the body portion at the terminal end and having an inner surface continuous with the tapered surface to constitute an axial extension of the tapered surface, said surface of the terminal extension being in yielding electrical contact with the terminal end of the center conductor providing for axial movement of the center conductor relative to the housing while said yielding contact is maintained, clamping ring means fitting around said tubular extension gripping the latter and pressing it inward against the center conductor, a cover over and enclosing the terminal end of the center conductor, over and enclosing the terminal extension portion of the housing and over and enclosing the ring means, with an intervening annular clearance between the cover and such terminal extension and an intervening axial clearance between the cover and the center conductor terminal end, said cover being secured to the thick end of the body portion of the housing at a point adjacent the terminal end of the outer conductor, and screw means threadedly engaged in the cover and wholly supported thereby, said screw means being adapted to bear axially against the terminal end of the center conductor to limit said relative axial movement.

11. A coaxial electrical line termination unit having input and terminal ends, said unit comprising in combination an outer conductor which includes an elongated hollow housing externally of generally uniform shape throughout the major portion of its length, the housing comprising a body portion formed with an internal surface of circular section progressively reducing in diameter toward the terminal end, the body portion being radially relatively thin in section adjacent the input end and having an end part relatively thick in section adjacent the terminal end, an elongated center conductor within and coaxial to the housing surface extending from the input end to and projecting axially beyond the thick sectioned end part of the housing body portion, the center conductor having a resistive portion and input and terminal ends, a fitting supportingly and electrically contacting the input end of the center conductor, a conductive jack body fast to the housing at the input end and having an internal surface electrically continuous with the internal surface of the body portion, a tubular insulator in said jack body, a connection pin within said tubular insulator and having connection with said fitting for supporting the latter and the input end of the center conductor, said housing having a tubular terminal extension portion fast to the thick sectioned end part, said extension portion projecting axially beyond such thick part and embracing the projecting end of the center conductor, said extension portion being thin and radially yieldable relative to the thick part of the body portion and having an inner surface continuous with the internal surface of the body portion to constitute an axial extension of the latter surface, and means maintaining said surface of the terminal extension bearing yieldingly radially against and in electrical contact with the projecting end of the center conductor.

References Cited in the file of this patent

UNITED STATES PATENTS

2,438,915	Hansen	Apr. 6, 1948
2,443,635	Morris et al.	June 22, 1948
2,556,642	Bird	June 12, 1951
2,740,098	Phillips	Mar. 27, 1956
2,793,352	Bird	May 21, 1957
2,839,730	Rosenberg	June 17, 1958
2,844,792	Bird	July 22, 1958

FOREIGN PATENTS

819,549	Germany	Nov. 5, 1951