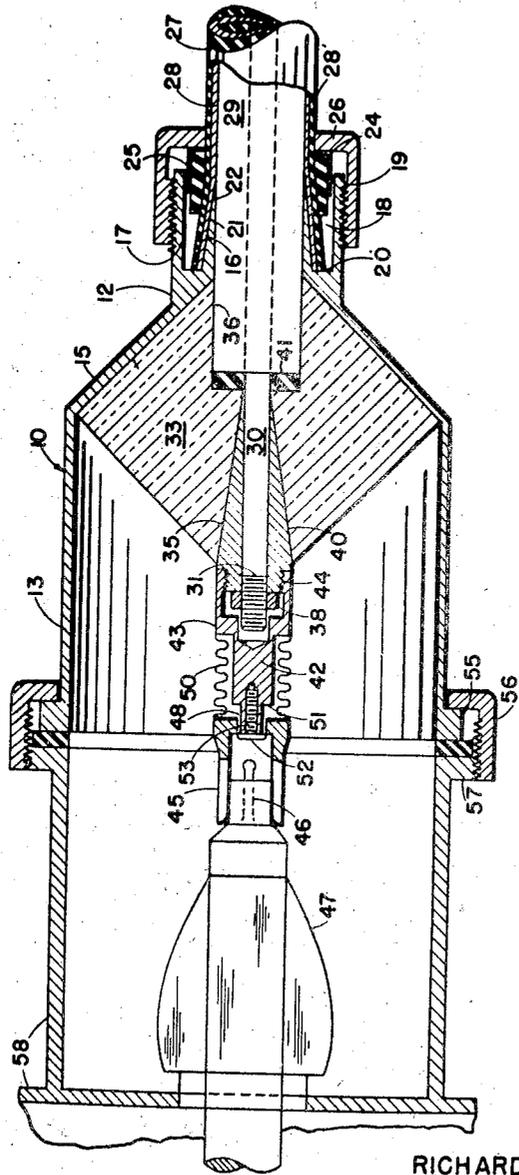


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R. J. VIOLETTE
ELECTRICAL CONNECTOR
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Inventor

RICHARD J. VIOLETTE

By *Reynolds Chappel*

Attorney

UNITED STATES PATENT OFFICE

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ELECTRICAL CONNECTOR

Richard J. Violette, Washington, D. C.

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This invention relates to electrical coupling devices for use with coaxial transmission lines and, more particularly, to an improved connector device or adaptor designed especially for coupling a solid dielectric coaxial transmission line to the center electrode terminal of an electron discharge tube operating at ultra high frequencies.

The invention is particularly applicable to those systems which employed pressurized R.-F. lines. Such systems are well known, and as the present invention relates only to the coupling means for connecting a solid dielectric coaxial output cable to the pressurized enclosure or outer shield member surrounding an electron discharge tube, it is thought to be unnecessary to illustrate and describe the entire system in further detail.

Accordingly, one object of the invention is the provision of means for electrically coupling a coaxial cable to the output terminal of an electron discharge tube and a portion of its shielding container.

Another object of the invention is to provide an improved output lead connector device for coupling an electron discharge tube to a coaxial transmission line in such a way that the anode cap of the tube will be connected to the inner conductor and the tube shielding structure will be securely connected to the outer conductor.

A further object of the invention is to provide an easily assembled output lead connector device which will maintain proper electrical connections between the tube and a coaxial transmission line of the size to which the connector is designed to be attached.

A still further object of the invention is to provide an electrical output connector of the above character which will improve the impedance match at the point of connection between the coaxial transmission line and the electron discharge tube.

Still another object of the invention is to provide an electrical coupling connector which will permit small variations in the positioning of the electrode cap terminal with respect to the central contact of the tube and yet will avoid strain of the glass portions of the tube adjacent to the cap terminal.

A further object of the invention is to provide a means of this character which will afford both a pressure seal and an electrical connection which will withstand the normal pressurizing of the gas line of such systems without pressure leaks adjacent to the point where the connector joins the cable as well as affording a breakdown path of

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greater dielectric strength at such point of connection.

A better understanding of the objects, features, and advantages of the present invention will be obtained from the following detailed description of a practical embodiment thereof when read in conjunction with the accompanying drawing whose single figure shows, in substantially vertical longitudinal section, the improved output lead connector device of the invention as applied to an electronic tube to couple the latter to a solid dielectric coaxial cable, the representation being partly diagrammatic and partly in detail.

Referring more particularly to the drawing, there is shown a connector device which comprises a tubular metal housing 10 having a reduced neck portion 12 of considerably smaller diameter connected to an enlarged hollow cylindrical body portion 13 by means of the conically tapered portion 15.

The neck 12 includes inner and outer concentric annular sleeve-like portions 16 and 17, the inner sleeve 16 being spaced from the outer sleeve 17 by an annular recess 18 which extends axially inwardly of the neck 12 from its outer end. The neck portion 12 of the housing is externally screw-threaded, as shown at 19, and is provided with an annular flange or shoulder 20 which forms the inner end wall of the reentrant recess 18.

The inner sleeve 16 has a conically tapered outer surface forming one side wall of the recess 18, as shown at 21, and is provided with a cylindrical axial bore 22.

Within the recess 18 of the neck 12 is located a gland sleeve 24 in the form of a short hollow cylinder of resilient rubber having an outer annular metal ferrule 25 with its annular base adjacent to the inner end face of the annular flanged gland nut 26, which is screwed onto the threaded portion 19 of the neck 12.

In the operation of securing the coaxial cable 27 to the housing, the cable is led successively through the respective coaxial openings in the annular nut 26, the gland sleeve 24, and the inner sleeve 16 of the neck 12, after which the cable-end enters the interior of the housing proper. Before positioning the cable 27 inside the housing 10, a length of the outer braided metallic conductor 28 with its plastic covering 28' of the cable is removed to expose a portion of the intermediate solid dielectric layer 29 which surrounds the inner central metallic conductor 30 of the cable. A short length of the exposed dielectric layer 29 adjacent to the cable end is

also removed to bare the inner central conductor 30 therebeneath, which is screw threaded at its free end 31, all of which is clearly illustrated in the drawing. The cable is then forced inward of the neck of the housing until the stripped end of the outer conductor 28 abuts against the shoulder 20 in the course of which movement the conical surface of the sleeve 16 is forced under the outer conductor 28 and between it and the adjacent dielectric layer 29 to produce a wedging action which acts to spread open and flare this end of the outer conductor while at the same time making good electrical and mechanical contact with the undersurface thereof. The flanged gland nut 26 is now tightened thereby forcing the rubber gland sleeve 24 further into the recess 18, thereby compressing the sleeve material tightly against the outer surface of the now flared end of the outer conductor 28 of the cable.

Within the housing is located a double-cone insulator 33 of polyethylene having one of its conical surfaces adjacent to the inner surface of the tapered portion 15 of the housing 10. The cone 33 has a central opening extending axially there-through, the opening being formed of the conically recessed section 35 whose inner smaller diameter end communicates with a cylindrical recess 36 within which is accommodated the bared end portion of the dielectric layer 29 which extends through the neck 12 into the interior of the housing 10.

The inner conductor 30 of the cable projects completely through and somewhat beyond the central conical recess 35 and has screwed onto its extended screw-threaded end portion 31 a nut 38 which abuts the outer end of the metallic conically tapered plug or wedge 40 which is slidably fitted upon the inner conductor 30. Tightening of the nut 38 serves to force the wedge 40 into firm seating engagement with the conical sides of the recess 35. The wedge 40 and that portion of the dielectric layer 29 of the cable which is housed within the recess 36 serve to retain the cone 33 supported in the desired relationship with respect to the housing 10. A dielectric washer 41 of polyisobutylene abuts the inner end of the dielectric layer 29 of the cable to provide a yieldable dielectric material between the polyethylene cone insulator 33 and the solid dielectric layer 29 of the cable whereby there will be maintained a continuity of dielectric protection with no air space at the junction points which might give rise to electrical and pressure breakdowns.

A stepped coupling 42 has an enlarged annular or cup-like base 43 which is adapted to be screwed onto the reduced screw-threaded portion 44 at the enlarged end of the conical wedge 40. A split sleeve connector 45, which has insertible connection on the terminal contact 46 at the end of the output lead 47 from a transmitter tube, is slidably mounted upon the small cylindrical step 48 of the coupling 42, the connector 45 being secured thereto by means of the flexible metal bellows 50. Any slight variation in the position of the center contact 46 of the tube output lead 47 is taken care of by the bellows 50 which permits appropriate lateral and longitudinal movement of the contact or connector 45 about the step 48 of the coupling 42 between the abutment 51 thereof and the enlarged head 52 of the screw 53 which is screwed into the end of the step 48. The flexible mounting arrangement of the sleeve connector 45 thus pro-

vided also allows for vibration without imposing heavy strain on the fragile glass-to-metal seals of the tube (not shown). The housing 10, nut 26, conical wedge 40, terminal connector 45, bellows 50, stepped coupling 42 and stop-screw 52 are each preferably silver-plated to increase their surface conductivity.

The larger end of the housing 10 is provided with an enlarged annular flange 55 which, in cooperation with the annularly flanged nut 56 therearound, forms fastening or attaching means distal from the neck portion 12 for securing the housing 10 to a suitable screw threaded flange 57 of the outer shield member 58 which surrounds the electron discharge tube (not shown).

The particular cable constitutes no part of the present invention except insofar as the layer 29 is solid dielectric filling and substantially coextensive with the inner and outer conductors of said cable. The layer 28 underneath the plastic outer covering 28' may comprise copper braid.

It will be clear from the foregoing description that the structural arrangement of this connector is one which not only offers an impedance match between the cable and the electronic tube to which it is attached, but also it protects the pressurized gas line from loss of pressure whenever such a system is employed.

While there has been described a preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention, and it is, therefore, to be distinctly understood that no limitations are intended other than are imposed by the scope of the appended claims and limited by the prior art.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. A connector for solid dielectric coaxial cables comprising a tubular housing of electrical conducting material fixedly secured and electrically connected to the outer conductor of said cable at one end thereof, flexible connector means within said housing to electrically connect the inner conductor of said cable to the central output terminal contact of an electron discharge tube, said last named means including a bellows member operative to absorb the mechanical stresses incident to lateral and longitudinal displacement of said tube contact with respect to the axis of said inner conductor, a tapered dielectric member concentrically supporting said connector means within said housing and operative to provide an impedance match between said cable and said housing, and fastening means movably mounted on said housing for securing the housing to the shield structure normally enclosing said electron discharge device.

2. A connector for solid dielectric coaxial cables comprising a tubular housing of electrical conducting material having a reduced neck portion detachably secured and electrically connected to the outer conductor of said cable at one end thereof, flexible connector means within said housing to electrically connect the inner conductor of said cable to the central output terminal contact of an electron discharge tube, said last named means including a bellows member operative to absorb the mechanical stresses incident to lateral and longitudinal displacement of said tube

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contact with respect to the axis of said inner conductor, a tapered dielectric member concentrically supporting said connector means within said housing and operative to provide an impedance match between said cable and said housing, and fastening means rotatably mounted on said housing at the end thereof distal from said neck portion for securing the housing to the shield structure normally enclosing said electron discharge device.

3. An electrical connector comprising a tubular metallic housing having a neck portion at one end, expander means in said neck to firmly engage and electrically connect the outer conductor of a coaxial transmission line to said housing, flexible connector means for electrically coupling the inner conductor of said line to the output terminal of an electron discharge tube, said last named means including a bellows member operative to absorb the mechanical stresses incident to lateral and longitudinal displacement of said tube contact with respect to the axis of said inner conductor, a tapered dielectric member concentrically supporting said connector means within said housing and operative to provide an impedance match between said cable and said housing, and releasable attaching means for securing said housing and electrically connecting it to a shield enclosure member normally surrounding said electron discharge tube.

4. An electrical connector comprising, a tubular electrically conductive housing having a neck portion at one end, a conductive sleeve member within said neck having a tapered expander portion for insertion beneath and in engagement with the undersurface of the end portion of the outer conductor of a coaxial transmission line to thereby enlarge and flare said conductor end, means arranged to firmly engage and grip the said outer conductor of said coaxial transmission line thereby establishing an electrical and mechanical connection between said outer conductor and said housing, a conductive flexible connector element within the interior of said housing electrically connecting said inner conductor therein to the output terminal contact of an electron discharge tube, said connector element including a bellows member operative to absorb the mechanical stresses incident to lateral and longitudinal displacement of said tube contact with respect to the axis of said inner conductor, a tapered dielectric member concentrically supporting said connector element within said housing and operative to provide an impedance match between said cable and said housing, and fastening means establishing electrical connection therebetween to detachably secure said housing to a shield member normally enclosing said electron discharge tube.

5. In a device for connecting a coaxial cable having an inner and an outer conductor to a terminal of an electron discharge tube and its shield respectively, impedance matching means including said cable-end, a tubular metallic housing, connector means on said housing disposed exteriorly of the outer conductor of the coaxial cable to connect it electrically to said housing, an insulator around and supported by said inner

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conductor and maintaining it along the central axis of said housing, coupling means including a bellows member yieldably mounting a terminal connector with its axis normally substantially coincident with the axis of the housing, said coupling means allowing for lateral and longitudinal displacement of said terminal connector within fixed limits, and fastening means for detachably securing said housing to a shield member which normally surrounds and encloses the electron discharge tube to be connected to said coaxial line.

6. An electrical connector for use in coupling a coaxial cable to the output electrode terminal of an electron discharge tube comprising a tubular conductive housing having a tubular neck portion, means within said neck having a conically tapered expander portion adapted to be inserted beneath and along the outer conductor end of said cable to enlarge and flare said conductor end when the cable end is forced thereon, compressible sealing means slidable within said neck toward said cable end into tight sealing relation with the outer surface of said outer conductor, means on said neck for moving said sealing means into sealing engagement with said outer conductor when said cable-end is inserted through said neck to project into the interior of said housing, a dielectric member within said housing around said cable-end, said dielectric member having inwardly directed from one side a conically-tapered central opening the smaller end of which communicates with and is coaxial with respect to a central cylindrical recess for accommodating the dielectric end portion of said cable-end extending inwardly from the opposite side of said dielectric member, a conductive conical wedge within said conically tapered recess and of corresponding taper, said wedge being slidable along the bared end of said inner conductor of the cable, means for moving said wedge into tight engagement with said dielectric member, coupling means carried by the inner conductor of said cable to electrically connect the latter to the output terminal of the electron discharge tube, said coupling means including a bellows member operative to absorb the mechanical stresses incident to lateral and longitudinal displacement of said tube contact with respect to the axis of said inner conductor, and fastening means for securing the housing to the shield structure normally surrounding and enclosing said electron discharge device.

RICHARD J. VIOLETTE.

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