

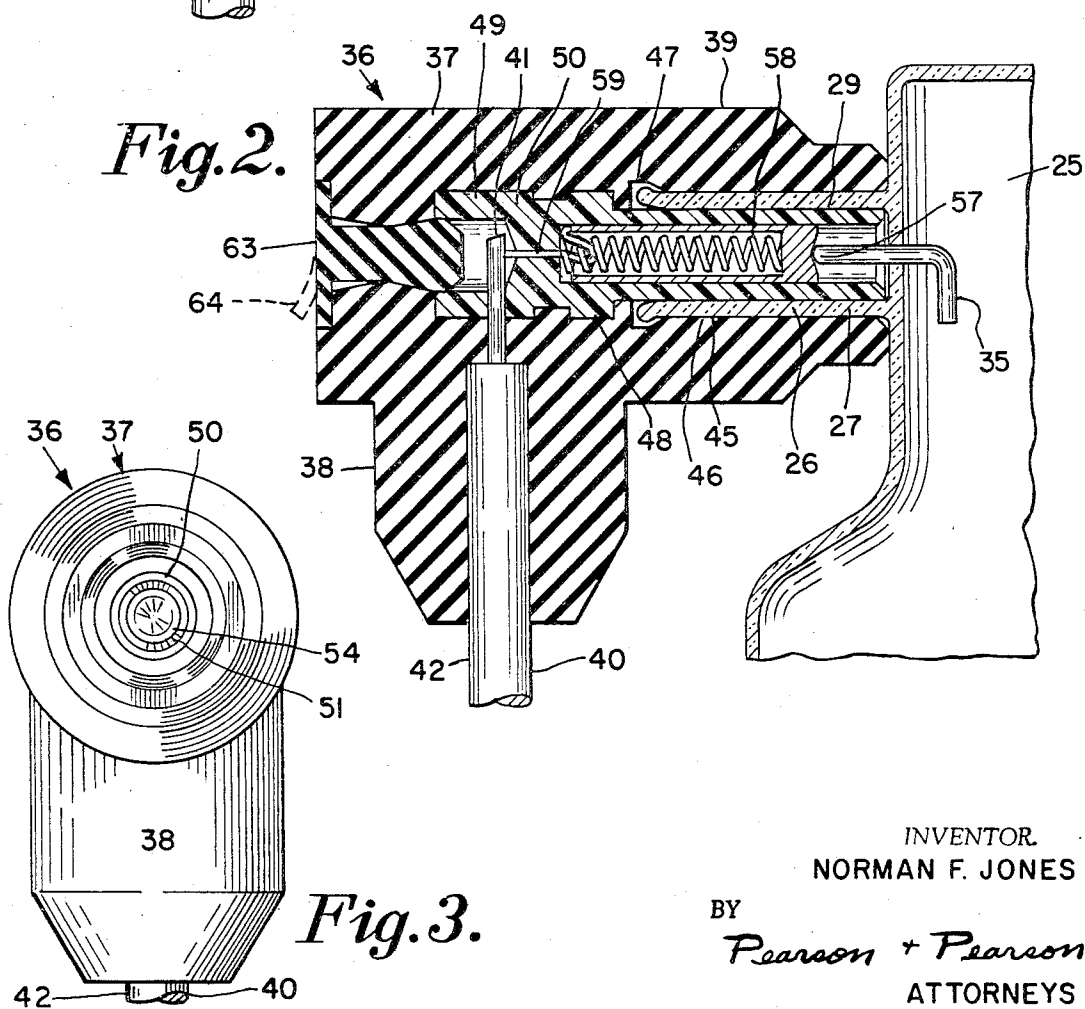
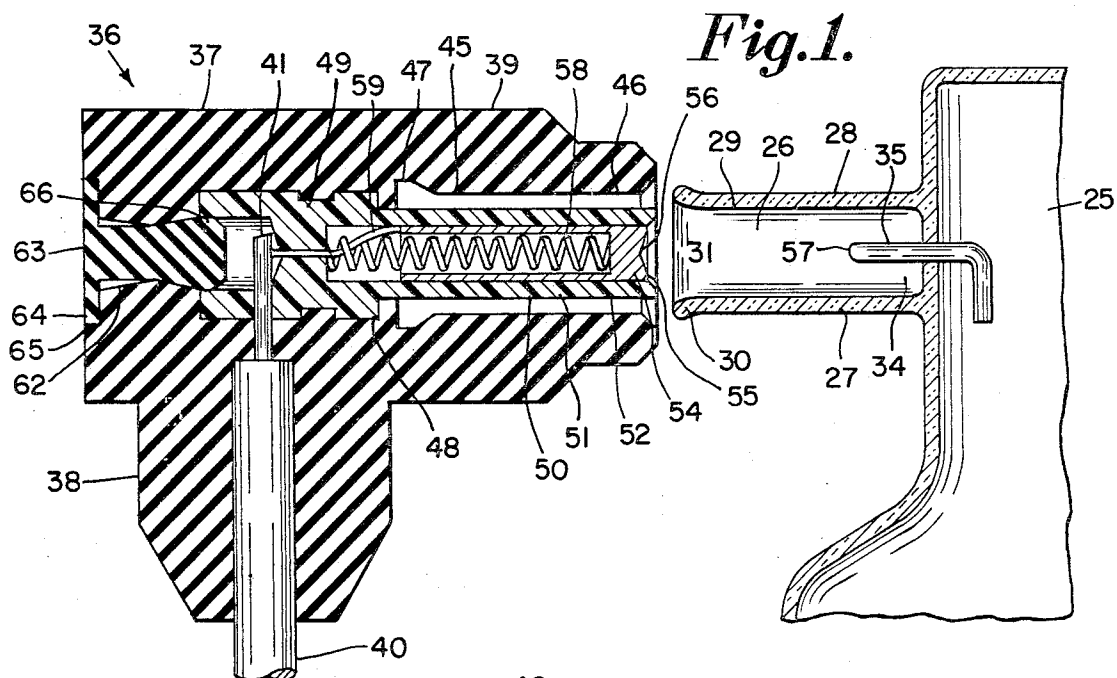
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N. F. JONES

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HIGH VOLTAGE CONNECTOR

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INVENTOR.
NORMAN F. JONES

BY
Pearson + Pearson
ATTORNEYS

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HIGH VOLTAGE CONNECTOR

Norman F. Jones, Amherst, N.H. 03031

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6 Claims

ABSTRACT OF THE DISCLOSURE

A firm, sealed, electrical connection with a contact pin, encircled by a fragile tubulation on a vacuum tube envelope, is obtained with a right angular, high voltage connector having a silicone rubber cable molded into one leg and having the other leg formed with an inner and outer insulative sleeve slidably mating with the tubulation. A spring-pressed brass plunger within the inner Teflon sleeve engages the contact pin.

BACKGROUND OF THE INVENTION

High voltage connectors in which single, or concentric multiple male and female parts slide into mating engagement are well known, for example, as shown in U.S. Pat. 2,958,844 to Smith of Nov. 1, 1960. It is also known to provide in a connector a conductive knob-like configuration to one terminal and a spring-loaded plunger having a depression for receiving the knob, on the other terminal, as exemplified in U.S. Pat. 513,949 to Munson of Jan. 30, 1894, or U.S. Pat. 1,236,404 to Clerget of Aug. 14, 1917. A connector having a spring-pressed plunger contact movable along an axis and having a terminal plug of a cable removably mounted normal to that axis is disclosed in U.S. Pat. 1,634,403 to Douglas of July 5, 1927.

However, none of the above devices are suitable for right angular electrical connection on the delicate hollow glass tube projecting from the glass envelope of an X-ray tube, or the like, there being an axially extending contact pin, usually made of Kovar, that serves as the electrical conductor within the base of the glass tubulation. This is for the reason that the tubulation is not only delicate and easily broken, but in blowing the tube there are usually wide dimensional variations as to length of the tube, thickness of the glass walls and eccentricity. On the other hand, despite the wide dimensional variations, a snug fit is required so that a suitable seal is achieved without breaking the frangible material of the tube. In addition, there must be no comparatively direct leakage paths in such a connector, since it must operate reliably at up to 60 kilovolts without corona development or discharge to adjacent electrical grounds and with minimal noise under such adverse conditions as it may be subjected.

SUMMARY OF THE INVENTION

To accomplish the above objectives, the high voltage connector of this invention is preferably formed with a silicone rubber body of generally right angular configuration, with the silicone rubber insulated lead-in cable permanently molded and sealed in one leg thereof. The other leg of the body includes an elongated recess adapted to slide over the full length of the tubulation. A Teflon sleeve has its base portion embedded in the body to encompass the bare terminal tip of the cable and has its free portion adapted to slide within the tubulation for the full length thereof. A spring-pressed brass plunger slidably moves within the Teflon sleeve to engage the Kovar pin in the base of the tubulation. A vent hole in back of the plunger assembly permits a dielectric grease to fill the connector during installation, trapped air to be vented

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and the body then sealed by inserting a hard high dielectric strength plastic plug, which seals the connector.

BRIEF DESCRIPTION OF DRAWING

In the drawing:

FIG. 1 is a side elevation in half section of the connector of the invention about to be slid onto a tubulation;

FIG. 2 is a view similar to FIG. 1, showing the connector in place on the tubulation, with the plunger retracted by the pin and the vent plug bent for removal to permit release of trapped air, as grease, applied to the glass tubulation, prior to insertion in the connector, is forced into inner parts of the connector body; and

FIG. 3 is a front elevation of the connector.

DESCRIPTION OF PREFERRED EMBODIMENT

As shown in the drawing, 25 is a typical glass envelope, such as an X-ray tube, having a hollow cylindrical tubulation, or tube, 26, integrally formed of the same frangible material as the vacuum, or gas filled, tube 25. Tubulation 25 may be about two inches in length with a cylindrical wall, 27, having an outer cylindrical face 28, an inner cylindrical face 29, and a flared mouth 30 at the free end 31. The base 34 of the tubulation 26 includes an elongated contact pin 35, usually made of Kovar, which is coaxial and concentric with the tubulation and is a conductive terminal of tube 25 to which high voltage is to be directed.

The high voltage connector 36 of the invention includes the body 36 of electrically insulating material, such as a suitably flexible silicone rubber, the body 37 preferably being right angular to configuration with one leg 38 and another leg 39 normal thereto. An electric conductor 40, having a bare terminal tip 41 and insulation, preferably also of silicone rubber 42, is molded into the leg 38 when the body 37 is molded, so that it is integrally fixed in place and completely sealed against leakage. Conductor 40 is called the lead-in cable herein and is connected to any suitable power source, not shown.

The other leg 39 of body 37 includes a hollow cylindrical recess 45, having an inner cylindrical face 46, and substantially coextensive in length, but slightly larger in diameter than, the outer face 38 of tubulation 26, so that it substantially, slidably receives the tubulation. A seat 47, of enlarged diameter at the bottom of the recess accommodates the flared mouth 30 of the tubulation, these parts serving as a detachable lock when the connector is fully installed on the tubulation.

The recess 45 includes a portion 48 centrally of the body 37, in which the base portion 49 of a hollow cylindrical sleeve 50 is firmly embedded and molded, when the body 37 is being molded. Sleeve 50 is preferably of Teflon (polymerized tetrafluoroethylene) of E. I. du Pont de Nemours & Co., Inc., or an equivalent insulative material with slippage, non-stick, characteristics and the bare terminal tip 41 of cable 40 extends within the hollow base portion 49. Teflon sleeve 50 includes an elongated free portion 51 which is coaxial, concentric and coextensive in length with recess 45 and tubulation 26, the outer face 52 of the free portion 51 being at a spaced distance from the inner face 29 of the recess to be slidably received within tubulation 26. The sliding fit is not loose but is somewhat tight, requiring slight pressure in an axial direction, but not enough to damage the tubulation. The connector will not fall, or drop, off the tubulation, but is well sealed and must be pulled firmly, with a slight twisting, to be withdrawn.

A cup-shaped, conductive plunger 54, preferably of brass, is slidably mounted within the Teflon sleeve 50, plunger 54 having a front wall 55, which is concaved at 56 to engage the tip 57 of pin 35 for reliable electric connection. Plunger 54 is spring loaded outwardly by beryl-

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limum copper coil spring 58 and is electrically connected to the tip 41 of cable 40 by a flexible wire conductor 59. Plunger 54 is limited in outward travel by conductor 59 or by other suitable means not shown, such as a conventional retainer ring located in an annular groove on the inside of sleeve 50.

A second recess 62 is preferably provided in body 37, coaxial with, but oppositely disposed to, recess 45, there being a vent plug 63 in the second recess as shown. Plug 63 is of hard, non-distortable, high dielectric strength material, such as plastic, silicone rubber, or the like, with a thin disc-like flange 64 in the countersink 65, so that the flange can be pried outwardly with the fingernail, or a tool, to distort and withdraw the plug. At the time of installation on tubulation 26, the plug 63 is removed to vent the cavity of body 37, as the cavity is filled with silicone grease. When the silicone grease application is completed, the vent plug 63 is pushed back into sealing position, the enlarged diameter tip 66 of the plug, snapping it into locked, sealed position.

What is claimed is:

1. A high voltage connector for mating engagement with a hollow cylindrical tubulation of frangible material on a vacuum tube envelope, said tubulation having a contact pin extending coaxially and concentrically at the base thereof, said connection comprising:

- a right angular body of insulating material having one leg with a lead-in cable molded therein, and having the other leg with a cylindrical recess therein, adapted to slidably receive substantially the full length of said cylindrical tubulation;
- a hollow cylindrical sleeve of insulative material having a base portion embedded in said body, the bare terminal tip of said cable extending into said base portion, said sleeve having a free portion coextensive in length with and within said recess and adapted to be slidably received within said tubulation;
- and a cylindrical plunger of electrically conductive material, slidable within said sleeve and spring-biased outwardly therein, said plunger being electrically connected to the said terminal tip of said cable and having an outer face adapted to resiliently engage said contact pin for electrical connection therewith.

2. A high voltage connector, as specified in claim 1, wherein:

- the inner cylindrical face of the recess in said body and the outer cylindrical face of said sleeve are spaced apart a predetermined distance greater than the thickness of the wall of said tubulation to compensate for relatively wide variations in eccentricity of said tubulation.

3. A high voltage connector, as specified in claim 1, wherein:

- said sleeve is formed of "Teflon" (polymerized tetrafluoroethylene) to provide an additional leakage

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path for reliable operation at sea level up to 60 kv. with minimal noise.

4. A high voltage connector, as specified in claim 1, wherein:

- said body includes a second recess oppositely disposed to, but coaxial with, said first named recess, said second recess connecting with the interior of the base portion of said sleeve,

and a removable vent plug of non-distortable, high dielectric strength, plastic material plugging said second recess,

whereby said connector may be packed with silicone grease at the time of installation on said tubulation, any trapped air vented, and said plug then reinserted in said second recess.

5. A combination as specified in claim 4, wherein:

- said second recess includes a countersunk recess at the mouth thereof, and said vent plug includes a disc-like flange fitting said countersunk recess, whereby said plug is withdrawable by prying a portion of said flange outwardly.

6. An electrical connector for mating engagement on a hollow, cylindrical tube having a contact pin axially thereof, said connector comprising:

- a connector body of silicone rubber having a cylindrical recess therein adapted to slidably receive substantially the full length of said tube,
- a hollow cylindrical Teflon sleeve extending coaxially within said recess and coextensive in length therewith, said sleeve adapted to be slidably received within said tube and having a base portion fixed within said body,
- a lead-in cable having silicone rubber insulation molded into said body normal to the axis of said recess, said cable having a terminal conductive tip within the base portion of said sleeve,
- and a spring-loaded, cylindrical brass plunger slidable axially within said sleeve for resiliently engaging said contact pin, said plunger being electrically connected to said cable tip.

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ERNEST R. PURSER, Primary Examiner

I. A. CALVERT, Assistant Examiner

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