

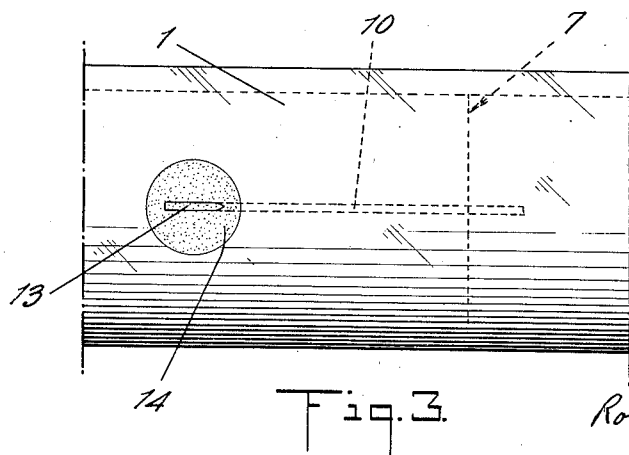
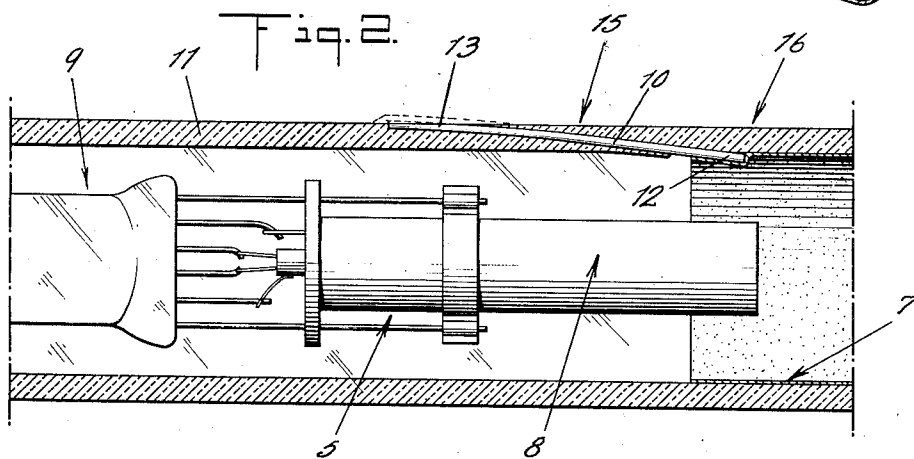
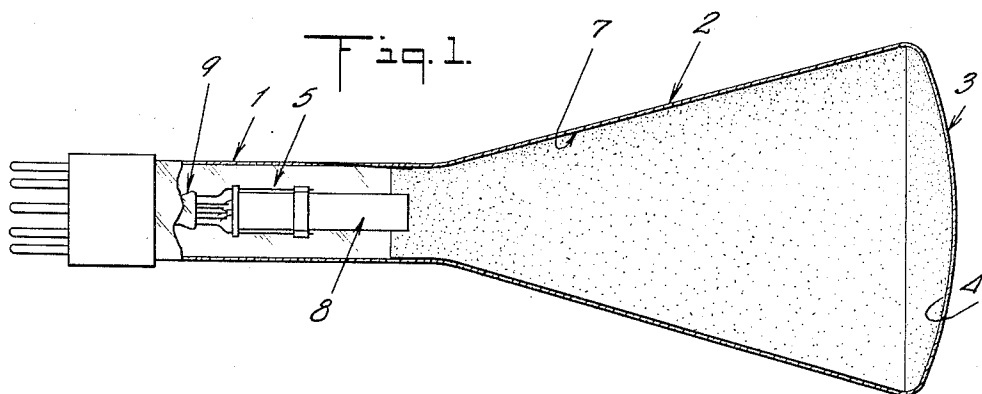
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SEALED LEAD-IN FOR CATHODE-RAY TUBES AND THE LIKE

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SEALED LEAD-IN FOR CATHODE-RAY
TUBES AND THE LIKE

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This invention relates to sealed lead-in wires and more especially to lead-in wires as are employed in evacuated devices such as cathode-ray tubes and the like.

A principal object of the invention is to provide an improved form of sealed lead-in wire for making connection through the enclosing wall of an electron discharge tube such for example as a cathode-ray tube.

Another object is to provide an improved method of sealing-in a lead-in wire through the wall of an electron discharge device.

Heretofore in cathode-ray tubes wherein a high potential electrode, such as the usual second anode, is employed it has been the practice to provide a lead-in wire extending through the wall of the tube substantially perpendicularly thereto. In order to make proper connection to this lead-in wire it has been necessary to cement a separate cylindrical metal cap to the exterior of the bulb wall the cap being connected to the wire as by soldering. On the interior of the bulb the exposed end of the wire has been electrically connected to a conductive coating deposited on the inner surface of the wall. This prior method of making contact externally and internally with the conductive coating possesses a number of disadvantages amongst which are the following:

1. After the lead-in has been sealed-in, the entire glass bulb or at least the greater part of the glass bulb must be subjected to an annealing operation.

2. If the tube is to be operated with an enclosing metal shield, a small hole must be provided in the shield through which the high potential lead must insulatingly pass.

3. The high voltage cannot be confined to one small region of the apparatus, for example a television set, in which the tube is incorporated.

By the present invention, the above noted and other disadvantages are avoided by bringing the high potential or second anode lead out through the neck of the bulb, instead of through the enlarged or conical portion. This lead terminates on the outside of the bulb in a flat metallized area which does not materially protrude beyond the outer surface of the glass neck. In fact the outer exposed part of the lead can be ground so as to be flush with an conform to the curvature of the glass neck thus eliminating the possibility of accidental breaking of the lead, as would be the case where the lead protrudes outwardly beyond the glass. Likewise the lead-in wire has its length sealed through the glass wall at a very slight angle to the longitudinal axis of the neck

and the inner end is substantially parallel to the glass wall thus providing a greater contact area with the conductive coating.

Other objects and advantages not specifically enumerated will be apparent after a consideration of the following detailed descriptions and the appended claims. While the invention will be disclosed herein as embodied in one particular form of electron tube, it will be understood that this is done merely for explanatory purposes and not by way of limitation. Accordingly, in the drawing:

Fig. 1 is a general plan view of a cathode-ray tube embodying the invention.

Fig. 2 is an enlarged sectional view of part of the tube of Fig. 1.

Fig. 3 is a top plan view of the part of the tube shown in Fig. 2.

Referring to Fig. 1 there is shown a cathode-ray tube of conventional shape comprising an evacuated glass envelope having an elongated neck portion joined to a truncated conical portion 2, the latter being closed at its larger end by a substantially flat window portion 3. The inner surface of window 3 carries a coating 4 of any wellknown fluorescent material to form the reproducing screen. Mounted within the neck 1 is any wellknown form of electron gun or cathode-ray developing and focussing means schematically shown and designated by the numeral 5. Also mounted adjacent the reduced end of the portion 2 are the usual ray deflecting means which may be either magnetic or electrostatic as well known in the art. The tube is coated over a localized area on its inner surface with a conductive material preferably of "Aquadag" or colloidal graphite, this coating being intended to act as the second or higher potential anode. The potential difference between said second anode and the first anode cylinder 8 which forms part of the electron gun 5, constitutes the second electron lens in the electron optical system whereby the rays are focussed in an elemental spot on the screen 4. The connections to the cathode, control electrode and first anode of the electron gun are made through the reentrant stem 9 in the usual manner.

Connection to the second anode coating 7 is made by a round tungsten wire 10 of the order of 0.010 inch in diameter as shown in detail in Fig. 2. It will be understood of course that any other kind of wire having the same coefficient of expansion as glass 1 may be employed. Preferably, and in accordance with the invention, the wire 10 is sealed through the wall 11 at a very

slight angle to the longitudinal axis of neck 1 so that it is imbedded throughout its entire length. The end portion 12 is imbedded to approximately one-half its thickness, thus leaving the unimbedded half exposed so that it may be coated with the "Aquadag" 7. The left hand exteriorly exposed portion 13 is preferably ground so that it does not project beyond the wall 11, and after grinding, it presents an exposed surface as shown in Fig. 3. Electrical contact to the exposed part 13 is effected by metallizing the outer surface of wall 11 in a localized area as indicated by numeral 14. This metallization may be effected in any wellknown manner, for example by applying a paste of finely divided silver, silver oxide and certain essential oils such as lavender oil, the paste being subsequently baked to form a white conducting surface of silver. Alternatively the metallization may be effected by placing a mask over the portion of the neck 1 which is not to be metallized, and then spraying the area 14 with copper or other suitable conductive material.

The lead wire 10 is sealed-in preferably in the following manner. A piece of selected tungsten wire of the desired small diameter and length is oxidized to the desired extent and is then slipped into the end of a glass capillary tube in such a manner that the end 12 extends outside the capillary tube. The capillary tube is preferably a few inches longer than the tungsten wire, and the two are then beaded together in the wellknown manner, leaving the excess capillary tube sealed to the left hand end of the wire. In the manner wellknown in the art, a very small hole is then drawn in the neck wall 11 at a point 15. This operation is performed prior to sealing in the gun and to the application of the conductive coating to the inside of the bulb. The beaded wire is then inserted through the hole in a direction substantially perpendicular to the length of neck 1, and with the flame playing on the glass 11 around the beaded wire, the wire is wiggled around until the molten glass 11 is bonded to the capillary tube on the wire thus closing the hole in wall 11. The flame is then increased in size and is allowed to play on that portion of glass 11 between the points 15 and 16. The outwardly extending portion of the beaded wire is then tilted to the left, causing the portion inside the neck to tilt to the right until it comes in contact with the hot glass 11 and seals itself thereto. The exposed portion 12 of the wire thereupon imbeds itself for approximately half its thickness in the glass 11. The flame is then directed to the region of the neck extending both to the right and to the left of point 15 until the bead and wire have partially imbedded themselves in the neck. The excess capillary tube is then pulled off and the whole region of the neck is made round and smooth by blowing while the glass is soft and by using a carbon paddle. This latter procedure is wellknown in the glass blowing art. If necessary, the dotted portion of Fig. 2 is then raised as shown, by heating that particular area and blowing. By proper use of the paddle, it is pos-

sible not to depress the ridge produced by the tungsten wire and bead.

After annealing and cooling, the dotted ridge portion of Fig. 2 is ground off with a small emery wheel or other suitable abrasive wheel to expose the ground surface of the wire as shown in Fig. 3. The portion 12 of the wire which is exposed within the neck may then be cleaned by electrolyzing with sodium nitrate solution or sodium hydroxide solution, whereupon the neck 1 which has already been fastened to the section 2, is ready to have the "Aquadag" coating 7 applied thereto in any wellknown manner, the coating extending beyond and covering the portion 12 of the lead-in wire.

While certain specific materials and procedures have been described herein, various changes and modifications may be made without departing from the spirit and scope of the invention.

What I claim is:

1. In combination, an enclosing glass envelope and a lead-in wire sealed into the wall of the envelope in a vacuum-tight manner, said wire having one end exposed on the inner surface of the wall and the opposite end exposed on the outer surface of the wall, both of said ends being imbedded in the wall, a conductive coating on the inner surface of the wall in contact with said inner exposed end, and a conductive coating on the outer surface of the wall in contact with said outer exposed end, the outer end of the wire being substantially flush with the outer wall surface.

2. A cathode-ray tube comprising an enclosing envelope having a neck portion and a frusto-conical body portion joined thereto, a conductive coating on the interior surface of said body portion and means to effect contact with said coating including a wire sealed in a vacuum-tight manner through the wall of the neck portion at a very slight angle to the longitudinal axis thereof, so that the area of contact between the wall and wire is many times the wall thickness, the inner and outer ends of said wire being imbedded in the wall of the neck portion, the outer end of said wire being substantially flush with the wall surface, and the surrounding region of the outer surface of the neck being covered with a conductive coating.

3. An electron discharge tube comprising a glass wall enclosing envelope, a conductive coating on the interior surface of said wall, and means to effect contact with said coating including a wire sealed in a vacuum-tight manner through the wall at a slight angle to the wall so that the area of contact between the wall and wire is many times the wall thickness, the inner and outer ends of said wire being imbedded in the wall with the outer end of the wire substantially flush with the wall surface, and a conductive coating on the outer surface of the wall surrounding the exposed surface of the wire and in contact therewith.

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