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METAL/CERAMIC CATHODE RAY TUBE

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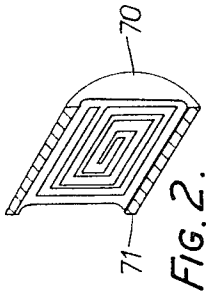


FIG. 2.

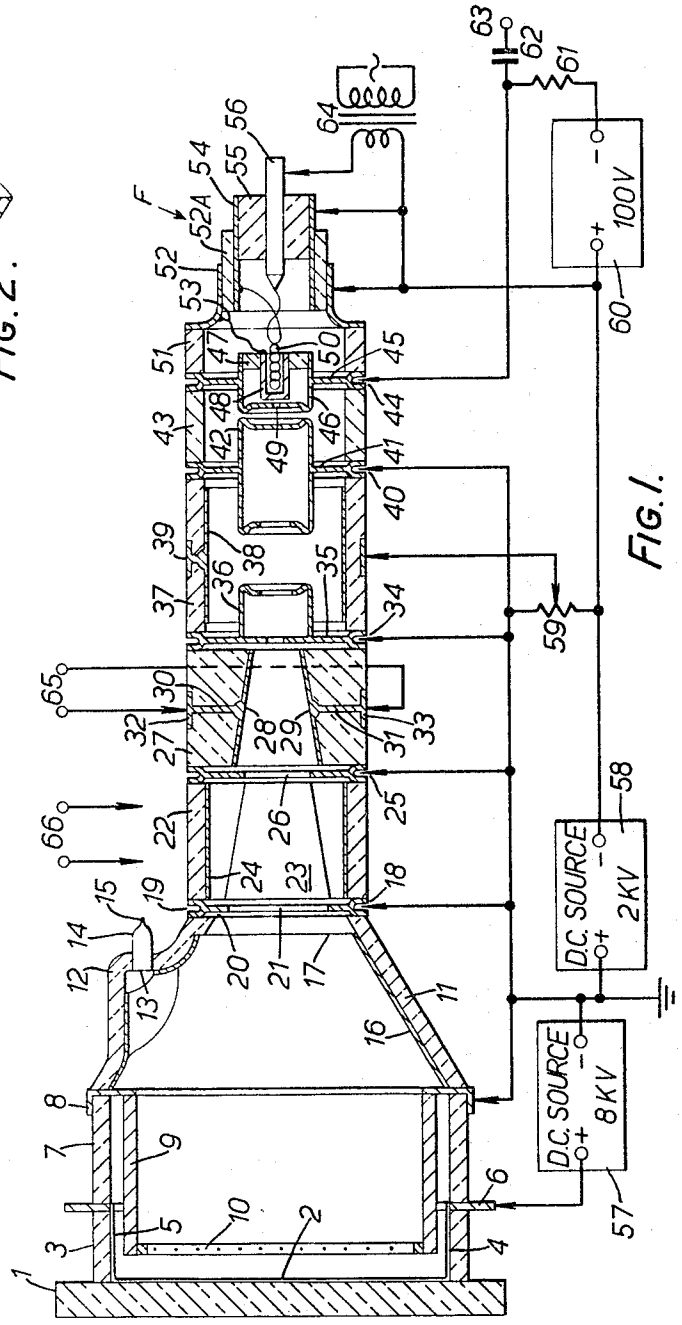


FIG. 1.

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METAL/CERAMIC CATHODE RAY TUBE

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ABSTRACT OF THE DISCLOSURE

A metal/ceramic cathode ray tube all the parts of which are constructed of materials capable of being conveniently shaped to close tolerances and most connections of which are accessible from the outside of the envelope of the tube. The tube has an envelope portion sealed to a transparent face plate to form a vacuum space, a plurality of electron beam-forming electrodes being disposed within said space. The envelope portion is formed by a plurality of aligned apertured members alternately made of metallic and ceramic material. The tube further comprises a sealed coaxial foot assembly formed by radially juxtaposed members alternately of metallic and ceramic material. A first one of the apertured members of the envelope portion is sealed peripherally to the face plate and a second one of said apertured members is sealed to the foot assembly to close the envelope portion. Each one of the apertured members of the envelope portion other than the aforesaid first and second apertured members are sealed to each of two adjacent ones of the apertured members made of the other one of said materials.

The present invention has for its object the provision of a cathode ray tube in which the envelope possesses improved strength and accuracy of form as compared with known cathode ray tubes.

It is a further object of the invention to provide a cathode ray tube in which all possible parts are constructed of materials capable of being accurately shaped to within close limits.

It is an additional object of the invention to provide a cathode ray tube in which numerous connexions to internal electrodes are conveniently made accessible on the surface of the envelope.

These and other features and advantages of the present invention will best be understood from the following description taken in conjunction with the accompanying drawings, comprising FIGURES 1 and 2, of which:

FIGURE 1 is a sectional elevation of one embodiment of cathode ray tube according to the present invention, showing also suitable associated circuitry, and

FIGURE 2 is a sectional perspective view of an alternative embodiment for some of the elements of FIGURE 1.

The cathode ray tube shown in the drawing comprises a glass disc 1 forming the faceplate of the tube. This plate carries on its inner face a conductive layer 2, upon or beneath which is deposited a phosphor layer forming the luminescent screen. To faceplate 1 is sealed a cylindrical ceramic tube 3, upon the inner cylindrical surface 4 of which is deposited a conductive layer 5 making electrical connection with layer 2 on the faceplate. At the end of tube 3 remote from the faceplate it is sealed to a metal annulus 6, with which layer 5 makes contact. Potentials applied to annulus 6 are thus applied also to the screen of the tube.

The annular member 6 is sealed to a further cylindrical tube 7 of ceramic material, conveniently of equal diameter with tube 3, and to the end of this tube 7 remote

from the annulus 6 is sealed a cupped annular member 8, of which the cup portion fits closely about tube 7 and the annular part projects within the tube. To the inwardly-projecting margin of member 8 is sealed another tubular member 9, which is of less diameter than members 7 and 3 and extends nearly to the screen carried upon faceplate 1. At the end of member 9 nearest the faceplate is secured a mesh electrode 10, which is electrically connected to annular member 8 by making tube 9 of metal or making it of ceramic and providing on its surface a conductive coating extending from annular member 8 to mesh electrode 10.

To annular member 8 on the side remote from the faceplate 1 is sealed a generally frusto-conical ceramic member 11, conveniently provided with a protrusion 12 in which is pierced an aperture 13 parallel to the tube axis. In aperture 13 is sealed a metal tube 14, through which the interior of the cathode ray tube may be evacuated and which, after pumping is complete, may be sealed off by a pinch weld, as indicated at 15. Frusto-conical member 11 is provided internally with a conductive layer 16, which is connected to annulus 8 and which terminates well clear of the narrow end of cone 11, as indicated by line 17.

The end of member 11 remote from the tube faceplate 1 is sealed to a metal ring 18, consisting of an outwardly channel-section outer portion 19 with an inwardly-projecting planar web or diaphragm 20. A member of this form provides spaced annular surfaces to which adjacent ceramic members are sealed. Web 20 is pierced by an aperture 21 sufficiently large not to intercept the deflected electron beam which passes therethrough. To the other side of ring 18 is sealed a ceramic body 22 consisting of a generally tubular cylindrical outer portion from which project inwardly two portions of trapezoidal section, diametrically opposed to one another and spaced from the axis. One only of those portions is seen at 23 in the drawing. The flat inner surfaces of these trapezoidal portions are equally inclined to the axis of symmetry, being wider apart at the ends nearer the tube faceplate 1. These inner faces are covered by conductive coatings forming deflector plates, connections to which are led out to contacts on the outer surface of member 23 as described in more detail in relation to adjacent member 26. The cylindrical wall portions 24 of member 22 are inwardly coated with a conductive layer which is connected to ring 18. Obviously the deflector plates may be made parallel to the axis if required.

To the end of member 22 remote from tube faceplate 1 is sealed a further metal ring 25, generally similar in construction to ring 18, but having a smaller aperture 26. To the the far side of ring 25 is sealed another ceramic body 27 generally similar in construction to member 22, but having deflector plate surfaces 28, 29 perpendicular to those of member 22. These surfaces are coated with conductive layers to which connection may be made from outside the tube by way of conductive rods 30, 31 sealed into narrow radial holes pierced in member 27. The outer ends of rods 30, 31 are joined to contact members 32, 33 which are conveniently recessed in member 27 as shown.

The end of member 27 remote from faceplate 1 is sealed to another channel-section metal ring 34 with a central diaphragm 35 carrying a tubular extension 36. Ring 34 is also sealed to a tubular ceramic member 37 provided with an internal conducting coating 38 to which connection is made from an external contact ring 39. The end of member 37 remote from ring 34 is again sealed to a similar metal ring 40, the diaphragm 41 of which carries a double tubular projection 42, of which the left-hand end approaches the right-hand end of tubular extension 36 of ring 34 within coating 38 to form a unipotential lens, while the right-hand end of extension 42

approaches a modulator electrode yet to be described. The ends of extension 42 are closed by apertured diaphragms. Ring 40 is sealed to a plain tubular member 43 of ceramic material, to the far end of which is sealed another channel-section metal ring 44, the diaphragm portion 45 of which is pierced by a tubular modulator electrode 46. Ring 44 is sealed to a further ceramic tube 51. Within the skirt of modulator 46 is placed a cathode insulator 47 which is centrally pierced by a tubular cathode 48, the end of which facing modulator aperture 49 is coated in known manner with thermionic emissive material. Within cathode 48 is contained a heater element 50.

Tube 51 is also sealed to a sealed coaxial foot assembly F comprising an outwardly flanged tubular metal member 52, to which connection from cathode 48 is made by a lead 53 within the tube. Within the tubular portion of member 52 and sealed to it is a ceramic tube 52A, and within this again and likewise sealed to it is a metal tube 54, to which one end of heater element 50 is connected. Within metal tube 54 is a further ceramic tube 55, sealed to tube 54 and pierced axially by a metal rod 56 sealed to tube 55. To rod 56 is connected the remaining end of heater element 50.

In the operation of a tube as thus far described the circuit arrangement illustrated in the drawing may be employed. It is convenient in operation for annulus 8 and rings 18, 25, 34 and 40 to be held at earth potential. Flange 6, to which the screen is connected, may be held at a potential of 8 kv. positive with respect to earth by a suitable direct current source 57. Cathode 48 is held at a potential 2 kv. negative with respect to earth by means of a suitable conventional direct current source 58 and wall coating 38 which forms one electrode of the beam-focusing lens is taken to the slider of a potentiometer 59 connected across the 2 kv. source. A further 100 v. direct-current source 60 serves to provide a suitable bias for the modulator 46 of the tube. The modulator is returned to the negative terminal of this source, the positive terminal of which is connected to cathode 48, by way of a resistor 61 and modulation potentials are applied by way of a capacitor 62 to modulator 46 from a drive terminal 63.

Alternating current is supplied to heater 50 from the secondary winding of a transformer 64, the primary winding of which is fed from a suitable alternating-current source.

Deflector plates 28, 29 formed in member 27 are connected to terminals 65 at which suitable deflector voltages are received, while the similar plates formed in member 22 receive appropriate deflection voltages by way of terminals 66.

It will be appreciated that an advantage of the invention is that the use of conventional basing arrangements, with the accompanying difficulties of alignment and risk of damage to thin pins, is avoided, leaving instead a rigid structure capable of convenient construction in minimum size, and to close tolerances since all the parts are susceptible of being machined to exact sizes and assembled to close positional tolerances.

The diaphragms forming part of members 34, 40 and 44 described in relation to FIGURE 1 may in some cases advantageously be replaced by pierced members or by spiders which position and align centrally disposed electrode members while offering minimum obstruction to the flow of residual gas during pumping.

It will probably be most convenient to form bodies such as bodies 22, 27 carrying deflector plates, or body 70 carrying a deflector coil, in two halves which are appropriately machined and have the necessary conductors formed upon and through them before being combined into an effectively unitary structure.

It will be appreciated by those skilled in the art that modifications may be made to the cathode ray tube structure particularly described above, without departing from the invention. In particular, deflector plates 23, 28, 29 may be replaced by deflector systems employing deflector coils formed as printed circuits upon appropriately positioned surfaces formed on ceramic bodies generally similar in form to bodies 22 and 27. FIGURE 2 shows a perspective sectional view of such a ceramic body 70 having an internal surface adjacent the path of the undeflected electron beam, upon which is placed a spiral deflector winding 71. Connections to this winding are made by conductors piercing body 70 after the manner of conductors 30, 31 of FIGURE 1, and leading to separate contact members for each coil.

While particular embodiments of the invention have been shown and described, it is apparent that changes and modifications may be made without departing from the invention in its broader aspects. The aim of the appended claims, therefore, is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. A cathode ray tube including a transparent faceplate; an envelope portion sealed to said faceplate to enclose an evacuable space and a plurality of electron beam-forming electrodes within said space, said envelope portion including a plurality of axially apertured members formed alternately of a metallic and of a ceramic material; a sealed coaxial foot assembly comprising radially juxtaposed rotationally symmetrical members alternately of metallic and of ceramic material; means sealing a first one of said axially aperatured members peripherally to said faceplate; means sealing said foot assembly to a second one of said apertured members to close said envelope portion; and means sealing each one of said axially apertured members other than said first and said second axially apertured member to each of two adjacent ones of said axially apertured members of the other said material.

2. A cathode ray tube including a transparent faceplate, an envelope portion sealed to said faceplate to enclose an evacuable space and a plurality of electron beam-forming electrodes within said space, said envelope portion including a plurality of axially apertured members formed alternately of a metallic and of a ceramic material; and a sealed foot assembly closing said space, wherein one of said metallic axially apertured members includes an apertured planar portion peripherally bounded by an outwardly channel-shaped portion presenting axially spaced annular surfaces sealed to adjacent ones of said ceramic members.

3. A cathode ray tube as claimed in claim 2, wherein said one metallic member includes an apertured diaphragm constituting a said beam-forming electrode.

4. A cathode ray tube as claimed in claim 2, wherein said one metallic member includes a centrally apertured planar portion; a tubular portion mounted normally in said aperture in said planar portion and apertured diaphragms mounted in ends of said tubular portion.

5. A cathode ray tube as claimed in claim 1 wherein said envelope portion includes a said ceramic member internally formed to present two planar surfaces radially spaced from said axis; conductive coatings upon said surfaces; contact members disposed externally of said envelope upon said ceramic member; and electrical connections piercing said ceramic member between each said conductive coating and an individual one of said metallic members.

6. A cathode ray tube as claimed in claim 5 wherein said planar surfaces lie in planes equally and oppositely inclined to said axis to diverge outwardly in the direction of motion of said electron beam.

7. A cathode ray tube as claimed in claim 1 wherein said envelope portion includes a said ceramic member having parallel internal surfaces parallel to and equally spaced from said axis, a spiral conductive coating on each said surface; contact members on an outer surface of said ceramic member; and electrical connections

from the ends of said spiral coatings to individual ones of said contact members.

8. A cathode ray tube including a transparent faceplate; an envelope portion sealed to said faceplate to enclose an evacuable space and a plurality of electron beam-forming electrodes within said space, said envelope portion including a plurality of axially apertured members formed alternately of a metallic and of a ceramic material; and a sealed coaxial foot assembly closing said space, wherein said envelope portion includes a annular metallic member having a portion extending inwardly of said ceramic members adajcent thereto; a hollow cylindrical member; means sealing an end of said cylindrical member to said projecting portion; a mesh electrode; means sealing said mesh electrode across the other end of said cylindrical member; and an electrical connection between said mesh electrode and said metallic member.

9. A cathode ray tube including transparent faceplate (1); a hollow cylindrical ceramic member (3); means sealing one end of said ceramic member peripherally to said faceplate; a first annular metallic member (6); means sealing said annular metallic member to the other end of said cylindrical ceramic member (3); a second hollow cylindrical ceramic member (7); means sealing one end of said second ceramic member to said first annular metallic member (6); a second annular metallic member (8); means sealing said second metallic member to the other end of said second ceramic member (7); said second metallic member having a portion extending radially inwardly of said second hollow ceramic member; a tubular member (9); a mesh electrode (10); means sealing said mesh electrode to one end of said tubular member (9); means sealing the other end of said tubular member to said inwardly projecting portion of said second annular metallic member (8) with said mesh electrode adjacent said faceplate (1); a hollow generally frusto-conical ceramic member (11); means sealing the wide end of said frusto-conical member to said second metallic member (8); a neck portion comprising an assembly of axially juxtaposed coaxial rotationally symmetrical members (19, 22, 25, 27, 34, 37, 40, 43, 44, and 51) formed alternately of a metallic and of a ceramic material; a sealed coaxial foot assembly (F) formed of coaxially juxtaposed rotationally symmetrical members (52, 53, 54, 55) formed alternately of a metallic and of a ceramic material; means sealing an end one of the metallic neck members (19) to the narrow end of said frusto-conical member (11); means sealing a metallic member (52) of said foot assembly to a ceramic end member (51) of said neck portion; means sealing each of said neck members of one said material other than said end members, to each of two axially adjacent members of the other said material; whereby said faceplate together with said cylindrical, annular, frusto-conical, and neck members and said foot assembly define an evacuable space; a plurality of electron-beam-forming electrodes within said space; and an electrical connection from each said metallic member to an individual one of said beam-forming electrodes.

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