

Description

This invention relates to electron guns, and to cathode ray tubes including such electron guns. Embodiments of the invention are particularly, but not exclusively, suitable for use in high resolution colour cathode ray tubes and in beam-index colour cathode ray tubes.

High resolution colour cathode ray tubes require an electron gun which has an excellent beam focusing characteristic. Thus, previously there have been proposed various types of electron guns having large-aperture anodes, so as to reduce the spherical aberration of the electron lens, particularly of the principal lens. There is known, for example, a large aperture electron gun in which a conductive coating is applied to the inside of the bulb neck portion of the envelope of a cathode ray tube, and which serves as the second anode, but such a cathode ray tube is not reliable because the neck of the cathode ray tube is not round, and thus there will be eccentricity between the first and second anodes.

There has also been proposed an electron gun having a large aperture anode such as illustrated in Figure 3 of the accompanying drawings. The electron gun has a cathode K which is supported by common insulating support members 3. Mounted in the electron gun is a control electrode G1 of generally cylindrical-shape with an opening in its end face, and an accelerating electrode G2 of generally cylindrical shape with an opening in its end face. A first anode G3 is formed of a generally cylindrical-shaped first portion 5 of smaller diameter than a second portion 2 which has a larger diameter. The electrodes G1 and G2 and the first anode G3 are supported by the supporting members 3, the first anode G3 being supported by the support members 3 at the smaller diameter portion 5 as illustrated. A second anode G4 has a larger diameter cylindrical portion 1 which extends around the larger diameter portion 2 of the first anode G3, and also extends beyond the end of the larger diameter portion 2. The second anode G4 also has a smaller diameter portion 17 which is concentric with the smaller diameter portion 5 of the first anode G3, and the second anode G4 is supported from the support members 3 which have supports that extend to the smaller diameter portion 17 of the second anode G4.

The electron gun of Figure 3 has the first anode G3 in which the cross-sectional dimension remains close to a perfect circle. However, since the first anode G3 is supported at its smaller diameter portion 5 by the support members 3, and also since the point of support of the smaller diameter portion 5 is a relatively large distance from the principal lens-forming portion which is between the

portions 2 and 1, and also since the first anode G3 is rather long and the larger diameter portion 2 which forms a part of the principal lens is rather heavy, mechanical instability exists, and it is very difficult to obtain and maintain symmetry between the larger diameter portion 2 of the first anode G3 and the larger diameter portion 1 of the second anode G4.

Our UK patent specification GB-A-2 115 605 discloses an electron gun having features similar to the pre-characterizing part of claim 1.

According to the present invention there is provided an electron gun for a cathode ray tube, the electron gun comprising:

a cathode, a control electrode, an accelerating electrode, a first anode, and a second anode mounted in alignment:

said second anode comprising a smaller diameter end portion and a larger diameter cylindrical portion connected thereto;

said second anode being formed with windows at positions away from where a principal lens of said electron gun is formed; and

said first anode being supported by insulating support members which extend through said windows to said first anode:

characterized in that:

said first anode extends within said smaller diameter portion of said second anode and out of contact therewith and has a larger diameter end portion which forms a component of said principal lens of said electron gun.

Embodiments of the invention may provide an electron gun having a large aperture anode, in which it is assured that the large cylindrical portions of the first and second anodes are maintained concentric and symmetrical, so as to provide an improved principal lens and rendering the electron gun very accurate and reliable.

So as to achieve these effects, an embodiment of electron gun may have a cathode, a control electrode, an accelerating electrode, a first anode and a second anode coaxially arranged in succession, with the principal lens formed between the first anode and the second anode. It is arranged that the second anode has a smaller diameter supported end portion and a larger diameter cylindrical portion which is connected thereto. The larger diameter portion is formed with a number of windows, and an end wall portion which joins the smaller diameter portion to the larger diameter portion. Longitudinal insulated support members have portions which extend into the windows, and further support members extend from the insulating ends of the support members to support the larger diameter portion of the first anode. The first anode passes through the smaller diameter portion of the second anode without making contact therewith,

and the larger diameter portion of the first anode is mounted within the larger diameter portion of the second anode and within the windows, such that the ends of the support members can be connected by the further support members to the larger diameter portion of the first anode.

The form of the larger diameter portion of the first anode is not limited to the cylindrical form described above, but it may be of any shape or form such, for example, that its diameter gradually increases towards its front end, so as to be of a so-called trumpet shape. Although the first anode may be supported at its large diameter portion through the windows, it is to be realised that it may also be supported through windows in the portion which extends through the smaller diameter portion of the second anode.

Thus, there is formed a large aperture first anode and a second anode of cylindrical shape, and so the spherical aberration of the main lens can be decreased. Since the relatively long first anode is supported through the windows of the second anode, the mechanical support for the first anode can be made very strong, and no eccentricity will exist between the first anode and the second anode, and they will be held so that they are coaxial. Under vibration conditions, the first anode will be firmly fixed relative to the second anode. In addition, by supporting the first anode at its smaller diameter portion through the windows, the alignment of the principal lens is ensured and also the diameter of the principal lens can be made larger.

The invention will now be described by way of example with reference to the drawings, throughout which like parts are referred to by like references, and in which:

Figure 1 is a cross-sectional view showing an embodiment of electron gun for a cathode ray tube and according to the present invention;

Figure 1a illustrates a modification of the embodiment;

Figure 2 is a partly-sectioned plan view of the embodiment; and

Figure 3 is a cross-sectional view illustrating a previously proposed electron gun.

The embodiment of electron gun 10 for a cathode ray tube, illustrated in Figures 1 and 2, is mounted in a bulb neck portion 4 of the cathode ray tube.

The electron gun 10 is of bipotential type and comprises a plurality of longitudinally extending insulating support members 12 on which are mounted a control electrode G1, and then an accelerating electrode G2, a first anode G3 and a second anode G4. The second anode G4 has a larger diameter cylindrical portion 1 which is spaced closely to the bulb neck portion 4, and a smaller diameter cylindrical portion 6 which is connected to

the larger diameter portion 6 by an end wall 18. The smaller diameter portion 6 of the second anode G4 is supported by the support members 12. A pair of windows 11 are formed in the larger diameter portion 1 of the second anode G4. Ends 15 of the support members 12 extend over the windows 11, and further support members 16 extend from the ends 15 to engage and support the first anode G3 by connecting to a larger diameter portion 2 of the first anode G3.

The first anode G3 is also formed with a smaller diameter portion 5 connected to the larger diameter portion 2 by an end wall 13, and which extends into the smaller diameter portion 6 and the larger diameter portion 1 of the second anode G4. In the embodiment of Figure 1, the larger diameter portion 2 of the first anode G3 covers the windows 11, and the first anode G3 is supported by the ends 15 of the support members 12 and the further support members 16 which extend through the windows 11 to engage the larger diameter portion 2. The larger diameter portion 2 of the first anode G3 and the larger diameter portion 1 of the second anode G4 form the principal lens. The electrodes G1 to G4 are fixedly supported by the pair of common insulating support members 12, with the second anode G4 supported at its smaller diameter portion 6 and the first anode G3 supported at its larger diameter portion 2.

In the described structure, the larger diameter portion 2 of the first anode G3 is supported in an insulated manner through the windows 11 formed in the larger diameter portion 1 of the second anode G4, and therefore the mechanical support of the first anode G3 is secure, and also problems of eccentricity between the first anode G3 and the second anode G4 in the principal lens are avoided, in that the first and second anodes G3 and G4 can be maintained concentric with each other and be very accurately positioned.

Although in the above embodiment, the first anode G3 is described as being supported at its larger diameter portion 2 in an insulated manner through the windows 11 made in the larger diameter portion 1 of the second anode G4, it is to be realised, of course, that it could also be supported at its smaller diameter portion 5 by forming a window or windows through the smaller diameter portion 6 of the second anode G4. Such an arrangement is illustrated in Figures 1a. This arrangement also solves the problem of eccentricity in the principal lens, and also the advantage is obtained that the outer diameter of the larger diameter portion 2 of the first anode G3 can be made to be very close to the inner diameter of the larger diameter portion 1 of the second anode G4, and thereby the diameter of the principal lens can be made larger.

So as to ensure that the second anode G4 remains round, it is possible to fit another part on it, and form the second anode G4 into a two part structure.

Also, the first anode G3 may be provided with an auxiliary support 14 at its smaller diameter portion 5 as shown by dotted lines in Figure 1, or by fitting a ring spacer thereon, so that the insulating support of the first anode G3 becomes more secure.

Since the embodiment is structured such that the larger diameter portion 2 of the first anode G3 is mounted within the larger diameter portion 1 of the second anode G4, a larger aperture principal lens can be formed, and an electron gun having excellent beam focussing characteristics can be obtained. Particularly, since the windows 11 are formed in the larger diameter portion 1 of the second anode G4, and the larger diameter portion 2 of the first anode G3 is arranged so that it is supported in an insulated manner through the windows 11, the first and second anodes G3 and G4 will be concentric, which results in an improved principal lens. Also, since the support of the first anode G3 is adjacent to the end of the first anode G3, the principal lens parts will not move relative to each other, and a more secure and improved structure results.

If the first anode G3 is supported at its larger diameter portion 2, sufficiently high mechanical strength is achieved in the supports, so that the first anode G3 can be securely supported in an insulated manner and, thus, a highly reliable electron gun can be obtained. If the first anode G3 is supported in an insulated manner at its smaller diameter portion 5 through the windows 11, it is then possible to bring the outer diameter of the first anode G3 very close to the inner diameter of the larger diameter portion of the second anode G4, and a principal lens of larger aperture can therefore be provided. Thus, embodiments of electron gun according to the present invention are suitable for use in high resolution colour ray tubes and also beam-index colour cathode ray tubes.

Claims

1. An electron gun (10) for a cathode ray tube, the electron gun (10) comprising:
 - a cathode (K), a control electrode (G1), an accelerating electrode (G2), a first anode (G3), and a second anode (G4) mounted in alignment;
 - said second anode (G4) comprising a smaller diameter end portion (6) and a larger diameter cylindrical portion (1) connected thereto;
 - said second anode (G4) being formed with windows (11) at positions away from where a

principal lens of said electron gun is formed; and

said first anode (G3) being supported by insulating support members (12, 16, 16a) which extend through said windows (11) to said first anode (G3);

characterized in that:

said first anode (G3) extends within said smaller diameter portion (6) of said second anode (G4) and out of contact therewith and has a larger diameter end portion (2) which forms a component of said principal lens of said electron gun.

2. An electron gun according to claim 1 wherein said support members (12) have inner ends (16) connected to said larger diameter portion (2) of said first anode (G3).
3. An electron gun according to claim 1 wherein said support members (12) have inner ends (16a) connected to a smaller diameter portion (5) of said first anode (G3).
4. An electron gun according to claim 2 or claim 3 wherein a smaller diameter portion (5) of said first anode (G3) is also insulatingly supported (14) at a second position remote from said second anode (G4).
5. A cathode ray tube comprising an electron gun according to any one of the preceding claims.

Revendications

1. Canon à électrons (10) pour un tube à rayons cathodiques, le canon à électrons (10) comportant:

une cathode (K), une électrode de commande (G1), une électrode accélératrice (G2), une première anode (G3) et une seconde anode (G4) montées en alignement;

ladite seconde anode (G4) présentant une portion d'extrémité (6) de plus petit diamètre et une portion cylindrique (1) de plus grand diamètre qui lui est reliée;

ladite seconde anode (G4) présentant des fenêtres (11) en des positions éloignées du lieu où est formée une lentille principale dudit canon à électrons; et

ladite première anode (G3) étant supportée par des éléments supports isolants (12, 16, 16a) qui, à travers lesdites fenêtres (11), s'étendent jusqu'à ladite première anode (G3);

canon caractérisé par le fait

que ladite première anode (G3) s'étend à l'intérieur de ladite portion (6), de diamètre plus petit, de ladite seconde anode (G4) et sans



So as to ensure that the second anode G4 remains round, it is possible to fit another part on it, and form the second anode G4 into a two part structure.

Also, the first anode G3 may be provided with an auxiliary support 14 at its smaller diameter portion 5 as shown by dotted lines in Figure 1, or by fitting a ring spacer thereon, so that the insulating support of the first anode G3 becomes more secure.

Since the embodiment is structured such that the larger diameter portion 2 of the first anode G3 is mounted within the larger diameter portion 1 of the second anode G4, a larger aperture principal lens can be formed, and an electron gun having excellent beam focussing characteristics can be obtained. Particularly, since the windows 11 are formed in the larger diameter portion 1 of the second anode G4, and the larger diameter portion 2 of the first anode G3 is arranged so that it is supported in an insulated manner through the windows 11, the first and second anodes G3 and G4 will be concentric, which results in an improved principal lens. Also, since the support of the first anode G3 is adjacent to the end of the first anode G3, the principal lens parts will not move relative to each other, and a more secure and improved structure results.

If the first anode G3 is supported at its larger diameter portion 2, sufficiently high mechanical strength is achieved in the supports, so that the first anode G3 can be securely supported in an insulated manner and, thus, a highly reliable electron gun can be obtained. If the first anode G3 is supported in an insulated manner at its smaller diameter portion 5 through the windows 11, it is then possible to bring the outer diameter of the first anode G3 very close to the inner diameter of the larger diameter portion of the second anode G4, and a principal lens of larger aperture can therefore be provided. Thus, embodiments of electron gun according to the present invention are suitable for use in high resolution colour ray tubes and also beam-index colour cathode ray tubes.

Claims

1. An electron gun (10) for a cathode ray tube, the electron gun (10) comprising:
a cathode (K), a control electrode (G1), an accelerating electrode (G2), a first anode (G3), and a second anode (G4) mounted in alignment;
said second anode (G4) comprising a smaller diameter end portion (6) and a larger diameter cylindrical portion (1) connected thereto;
said second anode (G4) being formed with windows (11) at positions away from where a

principal lens of said electron gun is formed; and

said first anode (G3) being supported by insulating support members (12, 16, 16a) which extend through said windows (11) to said first anode (G3);

characterized in that:

said first anode (G3) extends within said smaller diameter portion (6) of said second anode (G4) and out of contact therewith and has a larger diameter end portion (2) which forms a component of said principal lens of said electron gun.

2. An electron gun according to claim 1 wherein said support members (12) have inner ends (16) connected to said larger diameter portion (2) of said first anode (G3).
3. An electron gun according to claim 1 wherein said support members (12) have inner ends (16a) connected to a smaller diameter portion (5) of said first anode (G3).
4. An electron gun according to claim 2 or claim 3 wherein a smaller diameter portion (5) of said first anode (G3) is also insulatingly supported (14) at a second position remote from said second anode (G4).
5. A cathode ray tube comprising an electron gun according to any one of the preceding claims.

Revendications

1. Canon à électrons (10) pour un tube à rayons cathodiques, le canon à électrons (10) comportant:
une cathode (K), une électrode de commande (G1), une électrode accélératrice (G2), une première anode (G3) et une seconde anode (G4) montées en alignement;
ladite seconde anode (G4) présentant une portion d'extrémité (6) de plus petit diamètre et une portion cylindrique (1) de plus grand diamètre qui lui est reliée;
ladite seconde anode (G4) présentant des fenêtres (11) en des positions éloignées du lieu où est formée une lentille principale dudit canon à électrons; et
ladite première anode (G3) étant supportée par des éléments supports isolants (12, 16, 16a) qui, à travers lesdites fenêtres (11), s'étendent jusqu'à ladite première anode (G3);
canon caractérisé par le fait
que ladite première anode (G3) s'étend à l'intérieur de ladite portion (6), de diamètre plus petit, de ladite seconde anode (G4) et sans



- contact avec elle et qu'elle présente une portion d'extrémité (2) de plus grand diamètre qui forme un composant de ladite lentille principale dudit canon à électrons.
2. Canon à électrons selon la revendication 1, dans lequel lesdits éléments supports (12) présentent des extrémités intérieures (16) reliées à ladite portion (2) de plus grand diamètre de ladite première anode (G3). 5
 3. Canon à électrons selon la revendication 1, dans lequel lesdits éléments supports (12) présentent les extrémités intérieures (16a) reliées à une portion (5) de plus petit diamètre de ladite première anode (G3). 10
 4. Canon à électrons selon la revendication 2 ou la revendication 3, dans lequel une portion (5) de plus petit diamètre de ladite première anode (G3) est également supportée (14), avec isolation, en une seconde position éloignée de ladite seconde anode (G4). 15
 5. Tube à rayons cathodiques comportant un canon à électrons conforme à l'une quelconque des revendications précédentes. 20
 2. Elektronenkanone nach Anspruch 1, wobei die genannten Stützglieder (12) innere Enden (16) haben, die mit dem großen Durchmesser aufweisenden Bereich (2) der ersten Anode (G3) verbunden sind. 5
 3. Elektronenkanone nach Anspruch 1, wobei die genannten Stützglieder (12) innere Enden (16a) haben, die mit einem kleineren Durchmesser aufweisenden Bereich (2) der genannten ersten Anode (G3) verbunden sind. 10
 4. Elektronenkanone nach Anspruch 2 oder 3, wobei ein Bereich (5) mit kleinerem Durchmesser der genannten ersten Anode (G3) auch isolierend (14) an einer zweiten Position unterstützt ist, die von der genannten zweiten Anode (G4) beabstandet ist. 15
 5. Kathodenstrahlröhre mit einer Elektronenkanone nach einem der vorhergehenden Ansprüche. 20
 5. Tube à rayons cathodiques comportant un canon à électrons conforme à l'une quelconque des revendications précédentes. 25

Patentansprüche

1. Elektronenkanone (10) für eine Kathodenstrahlröhre, wobei die Elektronenkanone (10) umfaßt: eine Kathode (K), eine Steuerelektrode (G1), eine Beschleunigungselektrode (G2), eine erste Anode (G3) und eine zweite Anode (G4), die in einer Ausrichtung angeordnet sind; wobei die zweite Anode (G4) einen Endbereich (6) mit einem kleineren Durchmesser und einem zylindrischen Bereich (1) mit einem größeren Durchmesser, der damit verbunden ist, umfaßt; wobei die zweite Anode (G4) mit Fenstern (11) in Positionen versehen ist, die von der entfernt sind, wo eine Hauptlinse der genannten Elektronenkanone gebildet wird; und wobei die erste Anode (G3) durch isolierende Stützglieder unterstützt wird, welche sich durch die genannten Fenster (11) der erstgenannten Anode (G3) erstrecken; **dadurch gekennzeichnet,** daß die erste Anode (G3) sich innerhalb des ersten kleineren Durchmesserbereichs (6) der genannten zweiten Anode (G4) erstreckt und außer Kontakt damit ist und einen Endbereich (2) größeren Durchmessers hat, der eine Komponente der genannten Hauptlinse der genannten Elektronenkanone bildet. 30

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