

Description

This invention relates to an electron gun assembly having a reinforced heater tab which minimizes cathode-ray tube failure caused by a shorted heater tab.

U.S. Patent No. 3,555,640, issued to Lundvall on January 19, 1971, discloses a method for mounting a heater within a tubular cathode. A U-shaped tab is welded to the legs of the heater, and a transverse portion of the tab is removed after the heater is positioned within the tubular cathode. The removal of the transition portion electrically isolates the arms of the tab so that the heater can be energized. The tab is shown as substantially flat; however, a step-like offset of the heater tab is shown in U.S. Patent No. 4,523,124, issued to Blanken et al. on June 11, 1985. The offset facilitates centering of the heater within the tubular cathode and permits thermal expansion of the tab structure during tube operation, but provides little structural strength. US-A-4484102 discloses a deep-drawn, cup-shaped electrode simply employing strengthening gussets in the electrode sidewall.

A problem with the conventional, so-called conformal, heater tab is that sufficient transverse motion of the arms, subsequent to the removal of the transition portion, can cause the arms to contact one another and short-out the heater. Thus, there is a need for a reinforced heater tab that is structurally strong, yet easily weldable, to support components within the electron gun assembly.

In accordance with the invention, there is provided an electron gun assembly for use in a cathode-ray tube, said gun assembly including a pair of insulating support rods, three inline indirectly heated cathodes including a center cathode and two outer cathodes for generating three electron beams, attachment means for attaching said cathodes to said support rods, a heater for each of said cathodes, each of said heaters having a pair of heater legs, heater tab means attached to said heater legs, oppositely disposed pairs of heater bead straps for attaching the heater tab means to said support rods, and a plurality of electrodes for focusing and accelerating said electron beams, characterized in that the heater tab means comprise a pair of reinforced heater tabs associated with said outer cathodes and a conformal heater tab associated with said center cathode, each of said heater tabs having a main body portion including first and second parts respectively attached to the legs of one of said heaters, each of said heater tabs having a pair of outwardly directed feet which are connected to said parts of said main body portion by respective substantially orthogonal legs extending therebetween, each of said reinforced heater tabs including primary and secondary re-

inforcing means, said primary reinforcing means extending between said parts of said main body portion and said orthogonal legs of the reinforced heater tab, and between said orthogonal legs and said feet, to maintain the rigidity of said reinforced heater tabs, said secondary reinforcing means being formed in one surface of each of said feet of the reinforced heater tab, said feet of each reinforced heater tab being affixed to a different one of said oppositely disposed pairs of heater bead straps to provide a substantially rigid box-like structure, said feet of said conformal heater tab being attached to an orthogonal leg of respective ones of said reinforced heater tabs, with said conformal heater tab disposed between said reinforced heater tabs.

In the drawings:

FIGS. 1a and 1b are plan and bottom views, respectively, of a conventional conformal heater tab during electron gun construction.

FIG. 2 is a broken-away, front elevational view of an electron gun assembly according to the present invention.

FIG. 3 is a bottom view along section line 3-3, showing nested heater tabs, of the electron gun of FIGURE 2.

FIGS. 4a, 4b and 4c are plan, bottom and side views, respectively, of the heater tab of the present invention during electron gun construction.

FIG. 5 is an enlarged view of the portion of the heater tab, shown within circle 5, of FIG. 4c.

A conformal, i.e., conventional, heater tab 10 is shown in FIGURE 1a. The conformal tab 10 comprises a main body portion 12 including a first part 14 and a second part 16, which are temporarily connected, during electron gun construction, by a removal portion 18 located below a score line 19. As shown in FIGURE 1b, the conformal tab 10 includes a pair of outwardly directed feet 20, each of which is connected to the parts 14 and 16 of the main body portion 12 by substantially orthogonal legs 22 extending therebetween. A pair of heater legs 24 for a heater 25 are attached, for example by welding, to the parts 14 and 16. As indicated above, a problem with the conformal tab 10 is that sufficient motion of the parts 14 and 16 in the direction A-A, subsequent to the removal of portion 18, can cause the parts 14 and 16 to contact one another and short-out the heater.

FIGURE 2 shows structural details of an improved inline electron gun assembly 31 mounted in the neck 33 of a cathode-ray tube, CRT. The structure of this electron gun is similar to the electron gun assembly described in U.S. Pat. No. 4,484,102, issued to J.R. Hale on November 20, 1984.

The CRT includes an evacuated glass envelope having a rectangular faceplate panel (not shown), and a funnel (also not shown) with the neck 33 integrally attached thereto. A glass stem 35 having a plurality of leads or pins 37 extending therethrough is sealed to and closes the end of the neck 33. A base 39 is attached to the stem 35 and serves to locate the pins 37.

The inline electron gun assembly 31 is centrally mounted within the neck 33 and is designed to generate and direct three electron beams along spaced, co-planar convergent paths toward a screen (not shown) on the faceplate panel. The gun assembly comprises two insulating glass support rods 41a and 41b from which various electrodes are supported to form a coherent unit, in a manner well known in the art. These electrodes include three substantially equally transversely-spaced co-planar indirectly heated cathodes 43 (one for producing each beam), a control grid electrode 45 (also referred to as G1), a screen grid electrode 47 (also referred to as G2), a first accelerating and focusing electrode 49 (also referred to as G3), a second accelerating and focusing electrode 51 (also referred to as G4), and a shield cup 53, longitudinally spaced in the order named along the support rods 41a and 41b. The various electrodes of the gun assembly 31 are electrically connected to the pins 37 either directly or through metal ribbons 55. The gun assembly 31 is centered within the neck 33 by snubbers 57 on the shield cup 53, which press on and make contact with an electrically conductive internal coating 59 on the inside surface of the neck 33. The internal coating 59 extends over the inner surface of the funnel and connects to an anode button (not shown). A getter assembly 61 comprises an elongated spring 63, which is attached at one end to the cup 53 and extends in cantilever fashion in the funnel of the envelope. A metal getter container 65 is attached to the other, extended end of the spring 63.

The three cathodes 43 are substantially identical and comprise a cylinder closed at one end by a cap having a suitable electron emissive coating thereon. A heater 25 having a pair of heater legs 24 is disposed within each of the cathodes 43. The heater legs are attached, for example, by welding, to a plurality of heater tabs.

As shown in FIGURE 3, a pair of reinforced heater tabs 10' are associated with the outer cathodes 43a and 43c, and a conventional conformal heater tab 10 is associated with the center cathode 43b. With respect to FIGURES 4a, 4b and 4c, the reinforced heater tab 10' is similar to the conformal heater tab 10 (FIGS. 1a and 1b), and corresponding elements of the reinforced tab are designated by a prime. The reinforced heater tab 10' comprises a main body portion 12' including a first part

14' and a second part 16' which are temporarily connected during electron gun construction by a removal portion 18' located below a score line 19'. The reinforced tab 10' has a pair of outwardly directed feet 20' each of which is connected to one of the parts 14' and 16' of the main body portion 12' by substantially orthogonal legs 22' extending therebetween. The reinforced heater tab 10' is different from the conformal tab 10 in that the reinforced tab 10' includes a first pair of oppositely disposed gussets 71 formed between the two parts 14' and 16' of the main body portion 12' and the legs 22', and a second pair of oppositely disposed gussets 73 formed between the legs 22' and the feet 20'. The gussets 71 and 73 are formed at about a 45° angle which is shown as angle θ in FIG. 4b. By way of example, the reinforced heater tab 10' is formed of 0.20 mm thick 304 stainless steel or nickel-iron. Each of the gussets 71 and 73 has a width of about 0.38 mm. The gussets 71 and 73 reinforce the tab 10' by strengthening the interconnections between the parts 14' and 16' of the main body portion 12' and the legs 22', and between the legs 22' and the attached feet 20'. The reinforced tab 10' is more rigid and resistant to transverse motion in the direction A'-A' than the conformal tab 10, and thus is less likely to permit a heater short resulting from contact between the parts 14' and 16'.

The reinforced heater tab 10' also includes a stamped portion 75, shown in FIGS. 4a, 4c and 5, formed in one surface of each of the feet 20'. The stamped portion 75 extends for a distance d, of about 0.08 mm, into each of the feet 20' and flattens the feet to provide mechanical stability to the tab 10', without creating a protuberance on the opposite surface of each of the feet 20'. The flattening facilitates attachment of the feet 20' of the tab 10' to a plurality of heater bead straps 77 which are shown in FIG. 3. The heater bead straps 77 are embedded into the insulating support rods 41a and 41b. As shown in FIG. 3, the reinforced heater tabs 10' extend between oppositely disposed pairs of heater bead straps 77. The stamped portions 75 (shown in FIGS. 4a, 4c and 5) provide flat surfaces on the feet 20' to permit planar-to-planar contact between the feet 20' and the heater bead straps 77 and splash-free welding of the contacting components. The reinforced outer heater tabs 10', which are welded to the heater bead straps 77, provide a substantially rigid, box-like support structure for the attachment of the conformal center cathode heater tab 10. The conformal heater tab 10, associated with the center cathode 43b, is a compliant structure without the reinforcing gussets present in heater tabs 10'. The conformal heater tab 10 has one foot 20 attached to a leg 22' of one of the heater tabs 10' and the other foot 20 attached to a leg 22'

of the other heater tab 10'. The conformal heater tab 10 associated with the center cathode 43b accommodates to the configuration of the reinforced heater tabs 10' without distorting the nested arrangement of the heater tabs 10 and 10'. After attachment of the conformal heater tab 10 to the reinforced heater tabs 10', the removal portions 18 and 18' (FIGS. 1a and 4a) are detached at the score lines 19 and 19' respectively. The orientation of the parts 14 and 16 of the conformal heater tab 10 in a plane substantially parallel to the planes of the support rods 41a and 41b minimizes the compression on the tab 10 and decreases the probability that the two parts 14 and 16 will experience a transverse motion that will cause the parts to contact one another. Accordingly, there is little likelihood that the nested heater tab structure of FIG. 3 will short-out.

Claims

1. An electron gun assembly for use in a cathode-ray tube, said gun assembly including a pair of insulating support rods, three inline indirectly heated cathodes including a center cathode and two outer cathodes for generating three electron beams, attachment means for attaching said cathodes to said support rods, a heater for each of said cathodes, each of said heaters having a pair of heater legs, heater tab means attached to said heater legs, oppositely disposed pairs of heater bead straps for attaching the heater tab means to said support rods, and a plurality of electrodes for focusing and accelerating said electron beams, characterized in that the heater tab means comprise

a pair of reinforced heater tabs (10') associated with said outer cathodes (43a,43c) and a conformal heater tab (10) associated with said center cathode (43b), each of said heater tabs (10',10) having a main body portion (12',12) including first (14',14) and second (16',16) parts respectively attached to the legs (24) of one of said heaters (25), each of said heater tabs having a pair of outwardly directed feet (20',20) which are connected to said parts of said main body portion by respective substantially orthogonal legs (22',22) extending therebetween, each of said reinforced heater tabs including primary and secondary reinforcing means, said primary reinforcing means (71,73) extending between said parts (14',16') of said main body portion (12') and said orthogonal legs (22') of the reinforced heater tab, and between said orthogonal legs (22') and said feet (20'), to maintain the rigidity of said reinforced heater tabs, said secondary reinforcing

ing means (75) being formed in one surface of each of said feet (20') of the reinforced heater tab, said feet (20') of each reinforced heater tab being affixed to a different one of said oppositely disposed pairs of heater bead straps (77) to provide a substantially rigid box-like structure, said feet (20) of said conformal heater tab being attached to an orthogonal leg (22) of respective ones of said reinforced heater tabs, with said conformal heater tab disposed between said reinforced heater tabs.

2. The electron gun assembly as described in claim 1, characterized in that said primary reinforcing means comprises gussets (71,73) formed in said reinforced heater tabs (10').
3. The electron gun assembly as described in claim 1, characterized in that each of said secondary reinforcing means includes a stamped portion (75) to flatten said reinforced heater tabs feet (20') to facilitate connection to said heater bead straps (77) and to provide stability to said reinforced heater tabs (10').

Patentansprüche

1. Elektronenkanonen-Anordnung zur Verwendung in einer Kathodenstrahl-Röhre, wobei die Kanonen-Anordnung beinhaltet ein Paar von Isolier-Stützstäben, drei indirekt beheizbare Inline-Kathoden mit einer Mittenkathode und zwei Außenkathoden zum Erzeugen dreier Elektronenstrahlen, Anbringungsmittel zum Befestigen der Kathoden an den Stützstäben, eine Heizung für jede der Kathoden, wobei jede der Heizungen ein Paar von Heizanschlußbeinen hat, Heiz-Anschlußmittel, die an die Heizanschlußbeine angebracht sind, gegenüberliegend angeordnete Paare von Heizperlenstützstreifen zum Anbringen der Heiz-Anschlußmittel an den Stützstäben und mehrere Elektroden zum Fokussieren und Beschleunigen der Elektronenstrahlen, **dadurch gekennzeichnet**, daß die Heiz-Anschlußmittel enthalten: ein Paar von verstärkten Heiz-Anschlüssen (10'), die den äußeren Kathoden (43a, 43c) zugeordnet sind, und einen winkeltreuen Heiz-Anschluß (10), der der Mittenkathode (43b) zugeordnet ist, wobei jeder der Heiz-Anschlüsse (10', 10) einen Haupt-Rumpfabschnitt (12', 12) mit ersten (14', 14) bzw. zweiten (16', 16) Teilen hat, die an die Beine (24) eines der Heizungsteile (25) angebracht sind, jeder der Heiz-Anschlüsse ein Paar von auswärts weisenden Füßen (20', 20) hat, die mit den Teilen des Haupt-Rumpfabschnitts über jeweilige im



wesentlichen senkrechte Schenkel (22', 22'), die sich dazwischen erstrecken, verbunden sind, jeder der verstärkten Heiz-Anschlüsse primäre und sekundäre Verstärkungsmittel enthält, wobei die primären Verstärkungsmittel (71, 73) sich zwischen den Teilen (14', 16') des Haupt-Rumpfabschnittes (12') und den senkrechten Schenkeln (22') des verstärkten Heiz-Anschlusses und zwischen den senkrechten Schenkeln (22') und den Füßen (20') erstrecken, um die Steifigkeit der verstärkten Heiz-Anschlüsse aufrechtzuerhalten, und wobei die sekundären Verstärkungsmittel (75) in einer Oberfläche jedes der Füße (20') des verstärkten Heiz-Anschlusses gebildet sind, der Fuß (20') jedes verstärkten Heiz-Anschlusses an verschiedene der gegenüber angeordneten Paare von Heizperlenstützstreifen (77) befestigt ist, um eine im wesentlichen steife kastenähnliche Struktur zu erhalten, wobei der Fuß (20') des winkeltreuen Heiz-Anschlusses an jeweils einem senkrechten Schenkel (22) der verstärkten Heiz-Anschlüsse angeordnet ist, wobei der winkeltreue Heiz-Anschluß zwischen den verstärkten Heiz-Anschlüssen angeordnet ist.

2. Elektronenkanonen-Anordnung nach Anspruch 1,

dadurch gekennzeichnet,

daß das primäre Verstärkungsmittel Eckverstärker (71, 73) enthält, die in den verstärkten Heiz-Anschlüssen (10') gebildet sind.

3. Elektronenkanonen-Anordnung nach Anspruch 1,

dadurch gekennzeichnet,

daß jedes der sekundären Verstärkungsmittel einen geprägten Bereich (75) zum Abflachen der verstärkten Heiz-Anschlußfüße (20') enthält, um eine Verbindung mit den Heizperlenstützstreifen (77) zu erleichtern und zum Stabilisieren der verstärkten Heiz-Anschlüsse (10').

Revendications

1. Structure de canons à électrons pour utilisation dans un tube à rayons cathodiques, ladite structure de canon incluant une paire de tiges de support isolantes, trois cathodes en ligne chauffées indirectement comprenant une cathode centrale et deux cathodes extérieures pour produire trois faisceaux électroniques, un moyen de fixation pour fixer lesdites cathodes auxdites tiges de support, un élément de chauffage pour chacune desdites cathodes, chacun desdits éléments de chauffage comportant une paire de branches d'élément de chauffage, une pièce de jonction pour élément

de chauffage fixée auxdites tiges de support des paires mises en opposition de liaisons de raccordement de l'élément de chauffage pour fixer la pièce de jonction pour l'élément de chauffage auxdites tiges et une pluralité d'électrodes pour focaliser et accélérer lesdits faisceaux électroniques, caractérisée en ce que les pièces de jonction renforcées pour élément de chauffage (10') associées auxdites cathodes extérieures (43a, 43c) et une pièce de jonction conforme pour élément de chauffage (10) associée à ladite cathode centrale (43b), chacune desdites pièces de jonction (10', 10) comportant une partie de corps principale (12', 12) incluant des première (14', 14) et seconde (16', 16) parties respectivement fixées aux branches (24) de l'un desdits éléments de chauffage (25), chacune desdites pièces de jonction pour élément de chauffage ayant une paire de pieds dirigés vers l'extérieur (20', 20) qui sont connectés auxdites parties de ladite partie de corps principal par des branches respectives sensiblement orthogonales (22', 22) s'étendant entre elles, chacune desdites pièces de jonction pour élément de chauffage incluant des moyens de renforcement primaire et secondaire, ledit moyen de renforcement primaire (71, 73) s'étendant entre lesdites parties (14', 16') de ladite partie de corps principal (12') et lesdites branches orthogonales (22') de la pièce de jonction renforcée pour élément de chauffage, et entre lesdites branches orthogonales (22') et lesdits pieds (20'), pour maintenir la rigidité desdites pièces de jonction renforcées pour élément de chauffage ledit moyen secondaire de renforcement (75) étant formé dans une surface de chacun desdits pieds (20') de la pièce de jonction renforcée pour élément de chauffage, lesdits pieds (20') de chaque pièce de jonction renforcée étant fixés à l'une différente desdites paires mises en opposition de liaisons de raccordement de l'élément de chauffage (77) pour fournir une structure analogue à une boîte sensiblement rigide, lesdits pieds (20) de ladite pièce de jonction conforme pour élément de chauffage étant fixés à une branche orthogonale (22) de celles respectives desdites pièces de jonction renforcées pour élément de chauffage, ladite pièce de jonction conforme pour élément de chauffage étant disposée entre lesdites pièces de jonction renforcées pour élément de chauffage.

2. Structure de canon à électrons selon la revendication 1, caractérisée en ce que ledit moyen primaire de renforcement comprend des goussets d'assemblage (71, 73) formés dans lesdites



tes pièces de jonction renforcées (10').

3. Structure de canon à électrons selon la revendication 1, caractérisée en ce que chaque moyen secondaire de renforcement inclut une partie matricée (75) pour aplatir lesdits pieds (20') desdites pièces de jonction renforcées pour élément de chauffage pour faciliter la connexion auxdites liaisons de raccordement de l'élément de chauffage (77) et pour fournir de la stabilité auxdites pièces de jonction renforcées pour élément de chauffage (10').

5

10

15

20

25

30

35

40

45

50

55

6