

Description

The present invention relates to a multibeam electron gun and a method for assembling that gun. The gun and method can provide better alignment of successive grid apertures, better control of spacing between successive grid electrodes and a reduction in electron gun distortion, as compared with prior gun designs.

U.S. Patent 4,298,818, issued to McCandless on November 3, 1981, describes an electron gun for use in a multibeam cathode-ray tube. The gun includes at least two spaced successive electrodes brazed directly to metallized patterns on one surface of a ceramic support, and a plurality of cathode support assemblies brazed directly to metallized patterns on the opposite surface of the ceramic support. Each electrode comprises a single metal plate having three beam-defining apertures therethrough, which apertures are so aligned as to permit the passage of three electron beams. The sizes and shapes of the electron beams are determined, in part, by the sizes, shapes and alignments of the apertures. Apertures that are misaligned by as little as 0.0125 mm (0.5 mil) can cause distorted beam shapes and degrade the performance of the tube.

U.S. Patent 4,500,808, issued to McCandless on February 19, 1985, describes an improved electron gun similar to that of U.S. Patent 4,298,818 above, except that the second electrode comprises a composite structure having a metal support plate brazed directly to a metallized pattern on one surface of a ceramic support. The metal support plate has a window therein opposite each of the apertures in a first electrode which is also brazed directly to a separate metallized pattern on the same surface of the ceramic support. Separate metal plates are brazed to the metal support plate and close the windows therein. Each of the metal plates has a single electron beam-defining aperture therein which is separately aligned with one of the apertures in the first electrode. This structure provides more accurate alignment of successive grid apertures than previous structures.

In each of the above-described electron guns, the successive electrodes and the cathode support assemblies are simultaneously brazed directly to metallized patterns formed on the ceramic support. This simultaneous brazing process has several drawbacks, some of which include: the difficulty of adjusting the spacing between successive electrodes; the difficulty of removing the completed assembly from the brazing fixture; dirt in the brazing fixture can effect alignment of the apertures; forming the electrode contact leads can change the spacing between the electrodes; and, most importantly, the brazing operation frequently distorts the

metal parts and imparts stress into the ceramic support which can crack the ceramic support. As a result, a structure and assembly process are required which reduce or eliminate the drawbacks of the prior art.

In accordance with the present invention, there is provided a multibeam electron gun for a cathode-ray tube according to claim 1 and a method for assembling a multibeam electron gun for a cathode-ray tube according to claim 11.

In the drawings:

FIGURE 1 is a partially cut-away, side elevational view of a preferred embodiment of the inventive electron gun.

FIGURE 2 is an enlarged side elevational view of a cathode-grid subassembly of the electron gun of FIGURE 1.

FIGURES 3 and 4 are an enlarged plan view and an enlarged side sectional view, respectively, of a portion of the cathode-grid subassembly during its manufacture.

FIGURE 5 is an enlarged view of the portion of the cathode-grid subassembly shown within the circle 5 of FIGURE 4.

FIGURES 6 and 7 are an enlarged plan view and a side sectional view, respectively, of a transition member according to the present invention.

FIGURE 8 is an enlarged front sectional view of a portion of the cathode-grid subassembly during its manufacture.

As shown in FIGURE 1, an improved electron gun 10 includes a cathode-grid subassembly 12. The improved gun 10 is similar to the gun disclosed in the above-identified U.S. Patent 4,500,808, except for the cathode-grid subassembly 12 and the method of fabricating the subassembly with these electrodes. The gun 10 comprises two glass support rods 14, also called beads, upon which various electrodes of the gun are mounted. These electrodes include three equally-spaced inline cathode assemblies 16, one for each electron beam (only one of which is shown in the view in FIGURE 1), a control grid electrode 18, a screen grid electrode 20, a first focusing electrode 22, a second focusing electrode 24 and a shield cup 26, spaced from the cathode assemblies in the order named.

The first focusing electrode 22 comprises a substantially rectangularly cup-shaped lower first member 28 and a similarly shaped upper first member 30, joined together at their open ends. The closed ends of the members 28 and 30 have three apertures therethrough, although only the center apertures are shown in FIGURE 1. The apertures in the first focusing electrode 22 are aligned with the apertures in the control and screen grid electrodes 18 and 20. The second focusing

electrode 24 also comprises two rectangularly cup-shaped members, including a lower second member 32 and an upper second member 34, joined together at their open ends. Three inline apertures also are formed in the closed ends of the upper and lower second members 32 and 34, respectively. The center apertures in the upper and lower second members 32 and 34 are aligned with the center apertures in the other electrodes; however, the two outer apertures (not shown) in the second focusing electrode 24 are slightly offset outwardly with respect to the two outer apertures in the first focusing electrode 22, to aid in convergence of the outer beams with the center beam. The shield cup 26, located at the output end of the gun 10, has appropriate coma correction members 36 located on its base around or near the electron beam paths, as is known in the art.

Each of the cathode assemblies 16 comprises a substantially cylindrical cathode sleeve 38 closed at the forward end and having an electron emissive coating (not shown) thereon. The cathode sleeve 38 is supported at its open end within a cathode eyelet 40. A heater coil 42 is positioned within the sleeve 38, in order to indirectly heat the electron emissive coating. The heater coil 42 has a pair of legs 44 which are welded to heater straps 46 which, in turn, are welded to support studs 48 that are embedded in the glass support rods 14.

The cathode-grid subassembly 12, shown in detail in FIGURE 2, includes a ceramic member 50, having an alumina content of about 99%, to which the cathode assemblies 16 and the control grid and screen grid electrodes 18 and 20, respectively, are attached. The ceramic member 50 includes a first major surface 52 and an oppositely-disposed, substantially-parallel second major surface 54. The ceramic member has a thickness of about 1.5 mm (0.060 inch). At least a portion of the first major surface 52 has metallizing patterns 56a and 56b formed thereon, to permit attachment thereto of the electrodes 18 and 20, respectively. A plurality of electrically isolated metallizing patterns (only one of which, 56c, is shown) are provided on the second major surface 54, to permit attachment of the cathode assemblies 16 thereto. The metallizing of a ceramic member is well known in the art and needs no further explanation. The major surfaces 52 and 54 may include lands, as shown in FIGURE 2, which facilitate application of the metallizing patterns thereto. The control grid electrode 18 is essentially a flat plate having two parallel flanges 58 on opposite sides of the three inline, precisely-spaced, beam-defining first apertures 60, only one of which is shown. The screen grid electrode 20 is also essentially a single flat metal plate, having two parallel flanges 62 on opposite sides of three inline, precisely-spaced, beam-defining second apertures

64, only one of which is shown. Alternatively, the screen grid electrode may comprise a composite structure, as described in the above-identified U.S. Patent 4,500,808.

In U.S. Patent 4,500,808 above, and in US-A-4605880 (published on August 12, 1986) and US-A-4607187 (published on August 19, 1986), control and screen grid electrodes and portions of the cathode assemblies are brazed directly to the metallized patterns on the ceramic surfaces. The brazing of a plurality of formed metal parts tends to distort at least some of the parts and introduce stress into the ceramic member. If the stress is sufficiently great, the ceramic member will crack, rendering the cathode-grid subassembly unusable.

In the present structure, the distortion of the formed metal parts, including the control grid 18 and the screen grid 20, is reduced by providing, as shown in FIGURES 2-5, a substantially flat first bimetal transition member 66 which is brazed to the first major surface 52 of the ceramic member 50. A substantially flat second bimetal transition member 68, shown in FIGURES 6 and 7, is brazed to the second major surface 54 of the ceramic member 50.

With reference to FIGURES 2-5, the first bimetal transition member 66 is shown disposed on the first major surface 52 of the ceramic member 50. The transition member 66 includes two layers of metal bonded face-to-face to form a bimetal. The first metal layer 70 is preferably formed from a nickel-iron alloy of 42% nickel and 58% iron, having a thickness of about 0.2 mm (0.008 inch), which is not greater than about 20% of the thickness of the ceramic member 50; and the second metal layer 72 is preferably formed of copper, having a thickness of about 0.025 mm (0.001 inch). The melting point of the copper layer 72 is about 1083°C, and the melting point of the nickel-iron alloy layer 70 is about 1427°C, which is substantially higher than that of the copper. The first transition member is stamped or photo-etched, and thereby configured to conform to the shape of the metallizing patterns 56a and 56b on the first major surface 52 of the ceramic 50. The second metal layer 72 is disposed on the first major surface 52. As shown in FIGURE 3, the first transition member 66 includes first electrode contact portions 74 disposed above and below a trio of large inline apertures 76 in the ceramic member 50, and second electrode contact portions 78 spaced from the first electrode contact portions 74. A pair of oppositely disposed removable frame portions 80 are connected to the electrode contact portions 74 and 78 by weakened bridge regions 82, which comprise oppositely disposed notches 84 formed in the first metal layer 70. A pair of oppositely disposed, arcuately shaped alignment channels 86 are formed

in the bridge regions 82. The alignment channels are aligned, in a manner to be described below, with corresponding alignment apertures 88 in the ceramic member 50, to register the first electrode contact portions 74 and the second electrode contact portions 78 with the first and second major surface metallizing patterns 56a and 56b, respectively.

The second bimetal transition member 68, shown in FIGURES 2, 6 and 7, also includes two layers of metal bonded face-to-face to form a bimetal. The first metal layer 90 is preferably formed of the above-described nickel-iron alloy and has a thickness of about 0.2 mm (0.008 inch), and the second metal layer 92 is preferably formed of copper and has a thickness of about 0.025 mm (0.001 inch). The second transition member 68 is stamped or photo-etched to conform to the shape of the metallizing patterns 56c on the second major surface 54 of the ceramic member 50. During fabrication of the cathode-grid subassembly 12, the second metal layer 92, comprising copper, is disposed on the second major surface 54. The second transition member includes three pairs of cathode assembly contact portions 94, and a pair of removable frame portions 96 which are connected to the cathode assembly contact portions 94 by weakened bridge regions 98. The bridge regions are configured to provide integral cathode contact leads 100 on one side of the cathode assembly contact portions 94. A pair of oppositely disposed, arcuately shaped second transition member alignment channels 102 are formed in the removable frame portions 96, to facilitate alignment of the channels 102 with the alignment apertures 88 in the ceramic member 50, to register the cathode assembly contact portions 94 with the metallizing patterns 56c formed on the second major surface 54 of the ceramic member 50.

With reference to FIGURE 8, a brazing jig 104 comprises lower and upper jig members 106 and 108, respectively. The second bimetal transition member 68 is positioned on the lower jig member 106, with the first metal layer 90, comprising nickel-iron, in contact with the lower jig member. The ceramic member 50 is disposed on the second bimetal transition member 68 so that the second metallized patterns 56c on portions of the second major surface 54 of the ceramic member are in contact with the second metal layer 92 of the cathode assembly contact portions (not shown) of the second bimetal transition member. The first bimetal transition member 66 is disposed on the first major surface 52 of the ceramic member 50 so that the second metal layer 72 of the first and second contact portions 74 and 78 (only 74 being shown) is in contact with the metallizing patterns 56a and 56b, respectively (only pattern 56a being

shown). Brazing alignment pins 110 are fitted in the lower jig member 106 to align the alignment channels 86 and 102 (shown in FIGURES 3 and 6, respectively) in the first and second bimetal transition members 66 and 68, with the alignment apertures 88 in the ceramic member 50. The upper jig member 108 is placed in contact with the first metal layer 70 of the first bimetal transition member 66. A pair of reference apertures 112 in the upper jig member 108 enclose the alignment pins 110.

The jig 104, loaded in the manner described herein, is then heated in a wet hydrogen atmosphere in a BTU three-zone belt furnace (not shown), at temperatures of 1105°C, 1120°C and 1105°C, to melt the copper layers 72 and 92. The belt speed through the furnace is about 100 mm (4 inches) per minute. Since the transition members 66 and 68 comprise substantially flat members having nickel-iron layers 70 and 90, each with a thickness not more than about 20% the thickness of the ceramic member 50, little or no stress is introduced into the ceramic member during the brazing operation.

The fabrication of the cathode-grid subassembly 12 proceeds as follows. After the brazing of the first and second bimetal transition members 66 and 68 to the ceramic member 50, the removable frame portions 80 and 96, respectively, are removed at the weakened bridge regions 82 and 98. The removal of the frame portions 80 from the first transition member 66 electrically isolates the first electrode contact portions 74 from the second electrode contact portions 78. As shown in FIGURE 5, the metallized pattern 56b, underlying the second electrode contact portion 78, terminates at the lower notch 84 of the weakened bridge portion 82. Thus, only the copper layer 72 to the left of the lower notch 84 in FIGURE 5 is brazed to the metallized pattern 56b. Since there is no metallizing to the right of the lower notch 84, the copper layer 72 will not adhere to the ceramic member 50, and the frame portion 80 can be broken away readily. The frame portions 96 of the second bimetal transition member 68 are also broken away, along the weakened bridge regions 98, thereby electrically isolating each of the cathode assembly contact portions 94 attached to the metallized patterns 56c on the second surface 54 of the ceramic member 50. The cathode contact leads 100, extending from selected ones of the portions 94, are bent at about a 90° angle, as shown in FIGURE 2, to facilitate attachment thereto of stem leads (not shown). The cathode eyelets 40 are welded, e.g., by laser welding, to oppositely disposed pairs of the cathode assembly contact portions 94. The control grid electrode 18 is then disposed upon the first electrode contact portions 74 and aligned by

means of secondary apertures (not shown) with the alignment apertures 88 in the ceramic member 50. Such a method of alignment is described in the above-identified U.S.-A-4605880. The flanges 58 of control grid electrode 18 are welded, e.g., by laser welding, to the first electrode contact portions 74. Next, the second apertures 64 of the screen grid electrode 20 are aligned, either directly or indirectly, with the first apertures 60 in the control grid electrode 18. The parallel flanges 62 of the screen grid electrode 20 are welded, e.g., by laser welding, to the second electrode contact portions 78. The cathode sleeves 38 are inserted into the eyelets 40 and welded thereto. The heater coils 42 are located within the sleeves 38, and the heater legs 44 are welded to the heater straps 46. Preferably, the cathode assembly welds also are made by laser welding. Laser welding is preferred since no pressure is applied to physically distort the parts, and the welding parameters can be precisely controlled.

While the cathode-grid subassembly 12 described herein only has the control grid electrode 18 and the screen grid electrode 20 attached to electrical contact portions 74 and 78 of the transition member 66, it should be clear to one skilled in the art that the size of the ceramic member and the transition member brazed thereto can be increased to permit attachment thereto, e.g., of the first focusing electrode. Correspondingly, the transition member brazed to the second surface 54 of the ceramic may also be provided with tabs, in addition to the cathode contact leads 100 to which heater supports for the heater straps 46 are attached.

The fabrication method here is preferable to previous fabrication methods, for the following reasons: precise alignment is not required to braze the transition members 66 and 68 to the metallized patterns; the control grid 18 and the screen grid 20 are laser welded to the electrical contact portions 74 and 78 without the distortion that occurs during high temperature brazing; the grids 18 and 20 can be individually aligned and spaced to provide greater alignment accuracy; the subassembly 12 can be inspected after each step to minimize the expense of manufacturing defective structures; and the use of the transition members with removable frame portions simplifies the manufacturing process, since it is easier to align unitized members than to separately align a plurality of discrete components.

Claims

1. A multibeam electron gun (10) for a cathode-ray tube, comprising a plurality of cathode assemblies (16) and at least two spaced successive electrodes (18,20) having aligned ap-

ertures (60,64) therethrough for passage of a plurality of electron beams, said cathode assemblies and said electrodes being individually held in position from a common ceramic member (50), said ceramic member having a first major surface (52) and an oppositely disposed second major surface (54), with a metallized pattern (56a,56b;56c) formed on at least a portion of each major surface, said electrodes being attached to said first major surface, and said cathode assemblies being attached to said second major surface; characterized in that a first transition member (66) is attached to said metallized pattern (56a,56b) on said first major surface of said ceramic member, said first transition member including stress reducing means (70), and at least one of said electrodes is attached to said transition member.

2. The gun (10) according to Claim 1, characterized in that said first transition member (66) includes at least one electrode contact portion (74,78), to which a removable frame portion (80) was connected by at least one weakened bridge region (82).
3. The gun (10) according to Claim 2, characterized in that said first transition member (66) is disposed between said metallized pattern (56a,56b) on said first major surface (52) and two of said electrodes (18,20), whereby said electrodes are connected to the electrode contact portions (74,78) of said transition member and electrically isolated from one another by the removal of said frame portion (80) at said weakened bridge region (82).
4. The gun (10) according to Claim 1, characterized in that a second transition member (68) is attached to said metallized pattern (56c) on said second major surface (54), said second transition member including stress reducing means (90), said second transition member being disposed between said metallized pattern and said cathode assemblies (16).
5. The gun (10) according to Claim 4, characterized in that said second transition member (68) includes a plurality of cathode assembly contact portions (94), to which a removable frame portion (96) was connected by a plurality of weakened bridge regions (98), said cathode assemblies being connected to different ones of said cathode assembly contact portions and electrically isolated from one another by the removal of said frame portion at said plurality of weakened bridge regions.



means of secondary apertures (not shown) with the alignment apertures 88 in the ceramic member 50. Such a method of alignment is described in the above-identified U.S.-A-4605880. The flanges 58 of control grid electrode 18 are welded, e.g., by laser welding, to the first electrode contact portions 74. Next, the second apertures 64 of the screen grid electrode 20 are aligned, either directly or indirectly, with the first apertures 60 in the control grid electrode 18. The parallel flanges 62 of the screen grid electrode 20 are welded, e.g., by laser welding, to the second electrode contact portions 78. The cathode sleeves 38 are inserted into the eyelets 40 and welded thereto. The heater coils 42 are located within the sleeves 38, and the heater legs 44 are welded to the heater straps 46. Preferably, the cathode assembly welds also are made by laser welding. Laser welding is preferred since no pressure is applied to physically distort the parts, and the welding parameters can be precisely controlled.

While the cathode-grid subassembly 12 described herein only has the control grid electrode 18 and the screen grid electrode 20 attached to electrical contact portions 74 and 78 of the transition member 66, it should be clear to one skilled in the art that the size of the ceramic member and the transition member brazed thereto can be increased to permit attachment thereto, e.g., of the first focusing electrode. Correspondingly, the transition member brazed to the second surface 54 of the ceramic may also be provided with tabs, in addition to the cathode contact leads 100 to which heater supports for the heater straps 46 are attached.

The fabrication method here is preferable to previous fabrication methods, for the following reasons: precise alignment is not required to braze the transition members 66 and 68 to the metallized patterns; the control grid 18 and the screen grid 20 are laser welded to the electrical contact portions 74 and 78 without the distortion that occurs during high temperature brazing; the grids 18 and 20 can be individually aligned and spaced to provide greater alignment accuracy; the subassembly 12 can be inspected after each step to minimize the expense of manufacturing defective structures; and the use of the transition members with removable frame portions simplifies the manufacturing process, since it is easier to align unitized members than to separately align a plurality of discrete components.

Claims

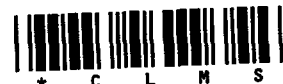
1. A multibeam electron gun (10) for a cathode-ray tube, comprising a plurality of cathode assemblies (16) and at least two spaced successive electrodes (18,20) having aligned ap-

ertures (60,64) therethrough for passage of a plurality of electron beams, said cathode assemblies and said electrodes being individually held in position from a common ceramic member (50), said ceramic member having a first major surface (52) and an oppositely disposed second major surface (54), with a metallized pattern (56a,56b;56c) formed on at least a portion of each major surface, said electrodes being attached to said first major surface, and said cathode assemblies being attached to said second major surface; characterized in that a first transition member (66) is attached to said metallized pattern (56a,56b) on said first major surface of said ceramic member, said first transition member including stress reducing means (70), and at least one of said electrodes is attached to said transition member.

2. The gun (10) according to Claim 1, characterized in that said first transition member (66) includes at least one electrode contact portion (74,78), to which a removable frame portion (80) was connected by at least one weakened bridge region (82).
3. The gun (10) according to Claim 2, characterized in that said first transition member (66) is disposed between said metallized pattern (56a,56b) on said first major surface (52) and two of said electrodes (18,20), whereby said electrodes are connected to the electrode contact portions (74,78) of said transition member and electrically isolated from one another by the removal of said frame portion (80) at said weakened bridge region (82).
4. The gun (10) according to Claim 1, characterized in that a second transition member (68) is attached to said metallized pattern (56c) on said second major surface (54), said second transition member including stress reducing means (90), said second transition member being disposed between said metallized pattern and said cathode assemblies (16).
5. The gun (10) according to Claim 4, characterized in that said second transition member (68) includes a plurality of cathode assembly contact portions (94), to which a removable frame portion (96) was connected by a plurality of weakened bridge regions (98), said cathode assemblies being connected to different ones of said cathode assembly contact portions and electrically isolated from one another by the removal of said frame portion at said plurality of weakened bridge regions.



6. The gun (10) according to Claim 4, characterized in that the stress reducing means for said first transition member (66) and said second transition member (68) comprise substantially flat plates (70;90) configured to conform to the metallized patterns (56a,56b;56c) formed on said first (52) and said second (54) major surfaces. 5
7. The gun (10) according to Claim 6, characterized in that said first transition member (66) and said second transition member (68) comprise two layers (70,72; 90,92) of metal bonded face-to-face to form a bimetal, one layer (72;92) of metal having a melting point lower than the other layer (70;90) of metal. 10
8. The gun (10) according to Claim 7, characterized in that said layer (72;92) of metal having the lower melting point comprises copper. 15
9. The gun (10) according to Claim 8, characterized in that the other layer (70;90) of metal comprises a nickel-iron alloy of 42% nickel and 58% iron. 20
10. The gun (10) according to Claim 9, characterized in that the stress reducing means further comprises the layer (70;90) of nickel-iron alloy having a thickness of not more than about 20% of the thickness of said ceramic member (50). 25
11. A method for assembling a multibeam electron gun (10) for a cathode-ray tube, said gun including a plurality of cathode assemblies (16) and at least one spaced electrode (18,20) held in position from a ceramic member (50) having a metallized pattern (56a,56b;56c) thereon; characterized by the steps of: 30
 - (a) disposing a transition member (66;68) on a major surface (52;54) of said ceramic member, said transition member comprising two metal layers (70,72;90,92) bonded face-to-face, one layer of metal (72;92) having a melting point lower than the other metal layer (70;90), said layer of metal having the lower melting point being adjacent to the major surface; 35
 - (b) aligning said transition member with said metallized pattern; 40
 - (c) heating said ceramic member and said aligned transition member to a temperature sufficient to melt said layer of metal having the lower melting point, to attach said transition member to said major surface of said ceramic member; 45
 - (d) cooling said ceramic member with said transition member attached thereto to room temperature; and 50
 - (e) removing portions of said transition member at weakened bridge regions (82;98), thereby providing a plurality of electrically isolated electrical contact portions (74,78;94). 55
12. A method for assembling a multibeam electron gun (10) for a cathode-ray tube, said gun comprising a plurality of cathode assemblies (16) and at least two spaced successive electrodes (18,20) individually held in position from a common ceramic member (50), each of said cathode assemblies including a cathode eyelet (40), a cathode sleeve (38) disposed within said eyelet, said sleeve being closed at the forward end by a cap, a cathode heater (42) within said cathode sleeve and a pair of heater straps (46) attached to said heater, said electrodes including a control grid (18) and a screen grid (20), each of said grids having a plurality of beam forming apertures (60,64) therethrough, said ceramic member having a first major surface (52) and an oppositely disposed second major surface (54), with a metallized pattern (56a,56b;56c) formed on at least a portion of each major surface; characterized by the steps of: (a) disposing a first transition member (66) configured to conform to said metallized pattern (56a,56b) on said first major surface, said first transition member including a plurality of electrode contact portions (74,78) and a removable frame portion (80) connected to said electrode contact portions by at least one weakened bridge region (82), and disposing a second transition member (68) configured to conform to said metallized pattern (56c) on said second major surface, said second transition member including a plurality of pairs of cathode assembly contact portions (94) and a removable frame portion (96) connected to said cathode assembly contact portions by a plurality of weakened bridge regions (98), said first and second transition members comprising two layers of metal (70,72;90,92) bonded face-to-face to form a bimetal, one layer of metal (72;92) having a melting point lower than the other layer of metal (70;90), and said transition members being disposed so that said layers thereof of metal having the lower melting point are adjacent to their respective major surfaces;
 - (b) aligning said electrode contact portions of said first transition member with said metallized pattern on said first surface;
 - (c) aligning said cathode assembly contact portions of said second transition member with said metallized pattern on said second



major surface;

(d) heating said ceramic member and said aligned first and second transition members to a temperature sufficient to melt said layers of metal having the lower melting point so as to attach said first and second transition members to said first and second major surfaces, respectively, of said ceramic member;

(e) cooling said ceramic member with said first and second transition members attached thereto to room temperature;

(f) removing said frame portions from said first and second transition members at the weakened bridge regions, thereby providing a plurality of electrically isolated electrode contact portions and cathode assembly contact portions;

(g) aligning the cathode eyelet of each of said cathode assemblies with a different pair of said cathode assembly contact portions attached to said second major surface of said ceramic member;

(h) welding each of the cathode eyelets to its respective pair of cathode assembly contact portions;

(i) aligning said control grid with two of said plurality of electrode contact portions attached to said first major surface of ceramic member;

(j) welding said control grid to said electrode contact portions (56a);

(k) aligning the beam forming apertures in said screen grid with the beam forming apertures in said control grid; and

(l) welding said screen grid to two different electrode contact portions (56b) attached to said first surface of said ceramic member so that said screen grid is electrically isolated from said control grid.

13. The method according to Claim 12, characterized in that said welding steps comprise laser welding to prevent distorting said grids (18,20).

Revendications

1. Canon à électrons multifaisceaux (10) pour un tube à rayon cathodique, comprenant une pluralité d'assemblages de cathode (16) et au moins deux électrodes successives espacées (18,20) ayant des ouvertures alignées (60,64) à travers pour un passage d'une pluralité de faisceaux d'électrons, lesdits assemblages de cathode et lesdites électrodes étant individuellement maintenus en position à partir d'un membre de céramique commun (50), ledit membre de céramique ayant une première

grande surface (52) et une seconde grande surface disposée de façon opposée (54), avec un motif métallisé (56a,56b;56c) formé sur au moins une partie de chaque grande surface, lesdites électrodes étant reliées à ladite première grande surface, et lesdits assemblages de cathode étant reliés à ladite seconde grande surface, caractérisé en ce qu'un premier membre de transition (66) est relié audit motif métallisé (56a,56b) sur ladite première grande surface dudit membre de céramique, ledit premier membre de transition incluant un moyen de réduction de charge (70), et au moins une desdites électrodes est reliée audit membre de transition.

2. Canon (10) selon la revendication 1, caractérisé en ce que ledit premier membre de transition (66) inclut au moins une partie de contact d'électrode (74,78), à laquelle a été reliée une partie de structure amovible (80) par au moins une région formant pont affaibli (82).

3. Canon (10) selon la revendication (2), caractérisé en ce que ledit premier membre de transition (66) est disposé entre ledit schéma métallisé (56a,56b) sur ladite première grande surface (52) et deux desdites électrodes (18,20), dans lequel lesdites électrodes sont reliées aux parties de contact d'électrode (74,78) dudit membre de transition et électriquement isolées l'une de l'autre par le retrait de ladite partie de structure (80) à ladite région formant pont affaibli (82).

4. Canon (10) selon la revendication 1, caractérisé en ce qu'un second membre de transition (68) est relié audit schéma métallisé (56c) sur ladite seconde grande surface (54), ledit second membre de transition incluant un moyen de réduction de charge (90), ledit second membre de transition étant disposé entre ledit schéma métallisé et lesdits assemblages de cathode (16).

5. Canon (10) selon la revendication 4, caractérisé en ce que ledit second membre de transition (68) inclut une pluralité de parties de contact d'assemblage de cathode (94), auquel une partie de structure amovible (96) a été reliée par une pluralité de régions formant pont affaiblies (98), lesdits assemblages de cathode étant reliés aux parties différentes de contact d'assemblage de cathode et électriquement isolées l'une de l'autre par le retrait de ladite partie de structure à ladite pluralité de régions formant pont affaiblies.



6. Canon (10) selon la revendication 4, caractérisé en ce que les moyens de réduction de charge pour ledit premier membre de transition (66) et ledit second membre de transition (68) comprennent des plaques sensiblement plates (70;90) configurées pour se conformer aux schémas métallisés (56a,56b;56c) formés sur ladite première (52) et ladite seconde (54) grande surfaces.
7. Canon (10) selon la revendication 6, caractérisé en ce que ledit premier membre de transition (66) et ledit second membre de transition (68) comprennent deux couches (70,72; 90,92) de métal assemblées face-à-face pour former un bi-métal, une couche (72;92) de métal ayant un point de fusion inférieur à l'autre couche (70;90) de métal.
8. Canon (10) selon la revendication 7, caractérisé en ce que ladite couche (72;92) de métal ayant le point de fusion inférieur comprend du cuivre.
9. Canon (10) selon la revendication 8, caractérisé en ce que l'autre couche (70;90) de métal comprend un alliage nickel-fer de 42% de nickel et 58% de fer.
10. Canon selon la revendication 9, caractérisé en ce que le moyen réducteur de charge comprend en outre la couche (70;90) d'alliage nickel-fer ayant une épaisseur de pas plus d'environ 20% de l'épaisseur dudit membre de céramique (50).
11. Méthode pour assembler un canon à électrons multifaisceaux (10) pour un tube à rayon cathodique, ledit canon incluant une pluralité d'assemblages de cathode (16) et au moins une électrode espacée (18,20) maintenue en position à partir d'un membre céramique (50) ayant un schéma métallisé (56a,56b;56c) au-dessus; caractérisée par les étapes consistant à :
- (a) disposer un membre de transition (66;68) sur une grande surface (52;54) dudit membre de céramique, ledit membre de transition comprenant deux couches de métal (70,72;90,92) assemblées face-à-face, une couche de métal (72;92) ayant un point de fusion inférieur à celui de l'autre couche de métal (70;90), ladite couche de métal ayant le point de fusion le plus bas étant au voisinage de la grande surface;
 - (b) aligner ledit membre de transition avec ledit schéma métallisé;
 - (c) chauffer ledit membre de céramique et ledit membre de transition aligné à une température suffisante pour fondre ladite couche de métal ayant le point de fusion le plus bas, pour relier ledit membre de transition à ladite grande surface dudit membre de céramique;
 - (d) refroidir ledit membre de céramique avec ledit membre de transition relié à celui-ci à la température de chambre; et
 - (e) retirer les parties dudit membre de transition à des régions formant pont affaiblies (82;98), de ce fait procurant une pluralité de parties de contact électriques isolées électriquement (74,78;94).
12. Procédé pour assembler un canon à électrons multifaisceaux (10) pour un tube à rayon cathodique, ledit canon comprenant une pluralité d'assemblages de cathode (16) et au moins deux électrodes successives espacées (18,20) individuellement maintenues en position à partir d'un membre de céramique commun (50), chacun desdits assemblages de cathode incluant un oeillet de cathode (40), un manchon de cathode (38) disposé à l'intérieur dudit oeillet, ledit manchon étant fermé à l'extrémité avant par un chapeau, un élément de chauffage de cathode (42) à l'intérieur dudit manchon de cathode et une paire d'attaches d'élément de chauffage (46) reliées audit élément de chauffage, lesdites électrodes incluant une grille de commande (18) et une grille formant écran (20), chacune des grilles ayant une pluralité de d'ouvertures de formation de faisceau (60,64) au travers, ledit membre de céramique ayant une première grande surface (52) et une seconde grande surface disposée de façon opposée (54), avec un schéma métallisé (56a,56b;56c) formé sur au moins une partie de chaque grande surface; caractérisé par les étapes consistant à : (a) disposer un premier membre de transition (66) configuré pour se conformer audit schéma métallisé (56a,56b) sur ladite première grande surface, ledit premier membre de transition incluant une pluralité de parties de contact d'électrode (74,78) et une partie de structure amovible (80) reliée auxdites parties de contact d'électrode par au moins une région formant pont affaiblie (82), et disposer un second membre de transition (68) configuré pour se conformer audit schéma métallisé (56c) sur ladite seconde grande surface, ledit membre de transition incluant une pluralité de paires de parties de contact d'assemblage de cathode (94) et une partie de structure amovible (96) reliée auxdites parties de contact d'assemblage de cathode par une pluralité de régions formant pont affaiblies (98), lesdits pre-



mier et second membres de transition comprenant deux couches de métal (70,72;90,92) assemblées face-à-face pour former un bi-métal, une couche de métal (72;90) ayant un point de fusion inférieur à l'autre couche de métal (70;90), et lesdits membres de transition étant disposés de sorte que leurs couches de métal ayant le point de fusion inférieur soient au voisinage de leurs grandes sur faces respectives;

(b) aligner lesdites parties de contact d'électrode dudit premier membre de transition avec ledit schéma métallisé sur ladite première surface;

(c) aligner lesdites parties de contact d'assemblage de cathode dudit second membre de transition avec ledit schéma métallisé sur ladite seconde grande surface;

(d) chauffer ledit membre de céramique et lesdits premier et second membres de transition alignés à une température suffisante pour fondre lesdites couches de métal ayant le point de fusion inférieur de façon à relier lesdits premier et second membres de transition auxdites première et seconde grandes surfaces, respectivement, dudit membre de céramique;

(e) refroidir ledit membre de céramique avec lesdits premier et second membres de transition reliés à celui-ci à la température de chambre;

(f) retirer lesdites parties de structure desdits premier et second membres de transition aux régions formant pont affaiblies, de ce fait procurant une pluralité de parties de contact d'électrode isolées électriquement et des parties de contact d'assemblage de cathode;

(g) aligner l'élément formant oeillet de cathode de chacun desdits assemblages de cathode avec une paire différente desdites parties de contact d'assemblage de cathode reliées à ladite seconde grande surface dudit membre de céramique;

(h) souder chacun des oeillets de cathode à sa paire respective de parties de contact d'assemblage de cathode;

(i) aligner ladite grille de commande avec deux de ladite pluralité de parties de contact d'électrode reliées à ladite première grande surface du membre en céramique;

(j) souder ladite grille de commande auxdites portions de contact d'électrode (56a);

(k) aligner les ouvertures de formation de faisceau dans ladite grille formant écran avec les ouvertures de formation de faisceau dans ladite grille de commande; et

(l) souder ladite grille d'écran à deux parties

de contact d'électrode différentes (56b) reliées à ladite première surface dudit membre de céramique de sorte que ladite grille formant écran soit électriquement isolée de ladite grille de commande.

13. Procédé selon la revendication 12, caractérisé en ce que lesdites étapes de soudure comprennent la soudure par laser pour empêcher aux grilles (18,20) de se déformer.

Patentansprüche

1. Mehrstrahlelektronenkanone (10) für eine Kathodenstrahlröhre, mit einer Mehrzahl von Kathodenanordnungen (16) und mindestens zwei beabstandeten, aufeinanderfolgenden Elektroden (18, 20), die fluchtende Öffnungen (60, 64) zum Durchtritt einer Mehrzahl von Elektronenstrahlen aufweisen, wobei die Kathodenanordnungen und die Elektroden durch ein gemeinsames Keramikteil (50) individuell in ihrer Position gehalten sind, welches eine erste Hauptfläche (52) und eine entgegengesetzt angeordnete zweite Hauptfläche (54) sowie ein Metallisierungsmuster (56a, 56b; 56c) auf mindestens einem Teil jeder Hauptfläche aufweist und wobei die Elektroden an der ersten Hauptfläche angebracht sind, während die Kathodenanordnungen an der zweiten Hauptfläche befestigt sind, **dadurch gekennzeichnet**, daß am Metallisierungsmuster (56a, 56b) auf der ersten Hauptfläche des Keramikteiles ein erstes Übergangsteil (66) angebracht ist, welches Mittel (70) zur Verringerung von mechanischen Spannungen umfaßt und daß mindestens eine der genannten Elektroden an diesem Übergangsteil angebracht ist.
2. Strahlerzeugungssystem (10) nach Anspruch 1, **dadurch gekennzeichnet**, daß das erste Übergangsteil (66) mindestens einen Elektrodenkontaktteil (74, 78) umfaßt, mit dem ein entfernbarer Rahmenteil (80) durch mindestens einen geschwächten Brückenbereich (82) verbunden war.
3. Strahlerzeugungssystem (10) nach Anspruch 2, **dadurch gekennzeichnet**, daß das erste Übergangsteil (66) zwischen dem Metallisierungsmuster (56a, 56b) auf der ersten Hauptfläche (52) und zwei der genannten Elektroden (18, 20) angeordnet ist, so daß die Elektroden mit den Elektrodenkontaktteilen (74, 78) des Übergangsteiles verbunden und durch die Entfernung des Rahmenteils (80) an dem geschwächten Brückenbereich (82) elektrisch voneinander isoliert sind.



4. Strahlerzeugungssystem (10) nach Anspruch 1, dadurch gekennzeichnet, daß am Metallisierungsmuster (56c) auf der zweiten Hauptfläche (54) ein zweites Übergangsteil (68) befestigt ist, welches Mittel (90) zur Verringerung von mechanischen Spannungen umfaßt und zwischen dem Metallisierungsmuster und den Kathodenanordnungen (16) angeordnet ist. 5
5. Strahlerzeugungssystem (10) nach Anspruch 4, dadurch gekennzeichnet, daß das zweite Übergangsteil (68) eine Mehrzahl von Kathodenanordnungs-Kontaktteilen (94) aufweist, an denen ein entferntbarer Rahmenteil (96) durch eine Mehrzahl von geschwächten Brückenbereichen (98) angebracht war, daß die Kathodenanordnungen an verschiedenen Kathodenanordnungs-Kontaktteilen angebracht und durch die Entfernung des Rahmenteils an einer Mehrzahl von geschwächten Brückenteilen elektrisch voneinander isoliert sind. 10 15 20
6. Strahlerzeugungssystem (10) nach Anspruch 4, dadurch gekennzeichnet, daß die Mittel zur Spannungsverringerng für das erste Übergangsteil (66) und das zweite Übergangsteil (68) im wesentlichen ebene Platten (70; 90) enthalten, die so geformt sind, daß sie mit den auf der ersten (52) und der zweiten (54) Hauptfläche gebildeten Metallisierungsmustern (56a, 56b; 56c) übereinstimmen. 25 30
7. Strahlerzeugungssystem (10) nach Anspruch 6, dadurch gekennzeichnet, daß das erste Übergangsteil (66) und das zweite Übergangsteil (68) zwei Schichten (70, 72; 90, 92) aus Metall enthalten, die Fläche-an-Fläche miteinander verbunden sind, so daß sie ein Bimetall bilden, und daß die eine Metallschicht (72; 92) einen niedrigeren Schmelzpunkt hat als die andere Metallschicht (70; 90). 35 40
8. Strahlerzeugungssystem (10) nach Anspruch 7, dadurch gekennzeichnet, daß die Schicht (72, 92) aus dem Metall mit dem niedrigeren Schmelzpunkt Kupfer enthält. 45
9. Strahlerzeugungssystem (10) nach Anspruch 8, dadurch gekennzeichnet, daß die andere Metallschicht (70, 90) eine Nickel-Eisenlegierung aus 42% Nickel und 58% Eisen enthält. 50
10. Strahlerzeugungssystem (10) nach Anspruch 9, dadurch gekennzeichnet, daß die Schicht (70; 90) aus der Nickel-Eisen-Legierung der Mittel zur Spannungsverringerng eine Dicke von nicht mehr als etwa 20% der Dicke des Keramikteils (50) hat. 55
11. Verfahren zur Montage einer Mehrstrahlelektronenkanone (10) für eine Kathodenstrahlröhre, welche Elektronenkanone eine Mehrzahl von Kathodenanordnungen (16) und mindestens eine beabstandete Elektrode (18, 20) enthält, die durch ein Keramikteil (50) in ihrer Position gehalten sind, auf welchem sich ein Metallisierungsmuster (56a, 56b; 56c) befindet, gekennzeichnet durch die Schritte:
 - a) Anordnen eines Übergangsteiles (66; 68), welches zwei Metallschichten (70, 72; 90, 92), die Fläche-an-Fläche miteinander verbunden sind, enthält, auf einer Hauptfläche (52; 54) des Keramikteils, wobei die eine Metallschicht (72; 92) einen niedrigeren Schmelzpunkt als die andere Metallschicht (70; 90) aufweist und die Metallschicht mit dem niedrigeren Schmelzpunkt sich bei der genannten Hauptfläche befindet;
 - b) Ausrichten des Übergangsteiles bezüglich des Metallisierungsmusters;
 - c) Erhitzen des Keramikteils und des ausgerichteten Übergangsteils auf eine Temperatur, die ausreicht, um die Metallschicht mit dem niedrigeren Schmelzpunkt zu schmelzen, um das Übergangsteil an der genannten Hauptfläche des Keramikteils zu befestigen;
 - d) Abkühlen des Keramikteils mit dem an ihm angebrachten Übergangsteil auf Raumtemperatur; und
 - e) Entfernen von Teilen des Übergangsteils an geschwächten Brückenbereichen (82; 98), so daß eine Mehrzahl von elektrisch isolierten elektrischen Kontaktteilen (74, 78; 94) gebildet werden.
12. Verfahren zur Montage einer Mehrstrahlelektronenkanone (10) für eine Kathodenstrahlröhre, welche Elektronenkanone eine Mehrzahl von Kathodenanordnungen (16) und mindestens zwei beabstandete, aufeinanderfolgende Elektroden (18, 20) aufweist, die durch ein gemeinsames Keramikteil (50) individuell in ihrer Position gehalten werden, wobei jede der Kathodenanordnungen eine Kathodenöse (40), eine in der Öse angeordnete Kathodenhülse (38) enthält, die am vorderen Ende durch eine Kappe geschlossen ist, einen in der Kathodenhülse angeordneten Kathodenheizer (42) und zwei am Heizer angebrachte Heizeranschlußstreifen (46) enthält, wobei die Elektroden ein Steuergitter (18) und ein Schirmgitter (20) umfassen, die jeweils eine Mehrzahl von durchgehenden Strahlformungsöffnungen (60, 64) aufweisen, das Keramikteil eine erste Hauptfläche (52) und eine entgegengesetzt angeordnete zweite Hauptfläche (54) hat und auf mindestens einen



Teil jeder Hauptfläche ein Metallisierungsmuster (56a, 56b; 56c) gebildet ist, **gekennzeichnet durch die Schritte:**

- a) Anordnen eines ersten Übergangsteiles (66), das dem Metallisierungsmuster (56a, 56b) auf der ersten Hauptfläche entsprechend geformt ist und eine Mehrzahl von Elektrodenkontaktteilen (74, 78) sowie einen entfernbaren Rahmenteil (80) hat, der mit den Elektrodenkontaktteilen durch mindestens einen geschwächten Brückenbereich (82) verbunden ist, auf der ersten Hauptfläche und Anordnen eines zweiten Übergangsteiles (68), das entsprechend dem Metallisierungsmuster (56c) auf der zweiten Hauptfläche geformt ist und eine Mehrzahl von Paaren von Kathodenanordnungs-Kontaktteilen (94) sowie einen mit den Kathodenanordnungs-Kontaktteilen durch eine Mehrzahl von geschwächten Brückenbereichen (98) verbundenen entfernbaren Rahmenteil (96) aufweist, auf der zweiten Hauptfläche, wobei das erste und das zweite Übergangsteil zwei Metallschichten (70, 72; 90, 92), die unter Bildung eines Bimetalls Fläche-an-Fläche miteinander verbunden sind, enthalten, die eine Metallschicht (72, 92) einen niedrigeren Schmelzpunkt als die andere Metallschicht (70, 90) hat und die Übergangsteile so angeordnet sind, daß ihre Schichten aus dem Metall mit dem niedrigeren Schmelzpunkt den entsprechenden Hauptflächen benachbart sind;
- b) Ausrichten der Elektrodenkontaktteile des ersten Übergangsteils bezüglich des Metallisierungsmusters auf der ersten Fläche;
- c) Ausrichten der Kathodenanordnungs-Kontaktteile des zweiten Übergangsteils bezüglich des Metallisierungsmusters auf der zweiten Hauptfläche;
- d) Erhitzen des Keramikteiles und der beiden ausgerichteten Übergangsteile auf eine Temperatur, die ausreicht, um die Schichten aus dem Metall mit dem niedrigeren Schmelzpunkt zu schmelzen, um das erste und das zweite Übergangsteil an der ersten bzw. zweiten Hauptfläche des Keramikteiles zu befestigen;
- e) Abkühlen des Keramikteiles mit dem ersten und dem zweiten Übergangsteil, die an ihm angebracht sind, auf Raumtemperatur;
- f) Entfernen der Rahmentteile vom ersten und vom zweiten Übergangsteil an den geschwächten Brückenbereichen, so daß eine Mehrzahl von elektrisch isolierten Elektrodenkontaktteilen und Kathodenanordnungs-Kontaktteilen gebildet wird;
- g) Ausrichten der Kathodenöse jeder der

Kathodenanordnungen bezüglich verschiedener Paare der Kathodenanordnungskontaktteile, die an der zweiten Hauptfläche des Keramikteiles befestigt sind;

h) Anschweißen jeder der Kathodenösen an dem zugehörigen Paar von Kathodenanordnungs-Kontaktteilen;

i) Ausrichten des Steuergitters bezüglich zwei der Mehrzahl von Elektrodenkontaktteilen, die an der ersten Hauptfläche des Keramikteiles angebracht sind;

j) Anschweißen des Steuergitters an den genannten Elektrodenkontaktteil (56a);

k) Ausrichten der Strahlformungsöffnungen im Schirmgitter mit den Strahlformungsöffnungen im Steuergitter; und

l) Anschweißen des Schirmgitters an zwei verschiedenen Elektrodenkontaktteilen (56b), die an der ersten Fläche des Keramikteiles angebracht sind, so daß das Schirmgitter elektrisch vom Steuergitter isoliert ist.

13. Verfahren nach Anspruch 12, dadurch gekennzeichnet, daß die Schweißschritte eine Laserschweißung umfassen, um eine Verformung der Gitter (18, 20) zu verhindern.