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54 **Electron gun electrode and method of manufacturing the same.**

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**GB-A-2 068 163**  
**US-A-4 234 814**

**PATENT ABSTRACTS OF JAPAN, unexamined applications, E section, vol. 6, no. 99, June 8, 1982 THE PATENT OFFICE JAPANESE GOVERNMENT page 138 E 11**

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## Description

This invention relates to methods of manufacturing electron gun electrodes of cathode ray tubes, for example electrodes for in-line electron gun assemblies of color picture cathode ray tubes.

In such electron gun assemblies, end walls of the electrodes must be parallel to a reference plane perpendicular to the axis of the electron gun assembly. When an electrode is prepared by laser welding flanges of first and second electrode portions, the degree of parallelism of the end walls of the two electrode portions with respect to the reference plane influences the precision of the completed electrode and hence of the electron gun assembly.

A conventional in-line convergence electrode is shown in longitudinal section in Figure 1. The convergence electrode is assembled such that a cylindrical upper convergence electrode portion 1 is welded by laser radiation at a plurality of positions with a cylindrical lower convergence electrode portion 2 at out-turned flanges 1a and 2a, respectively. Reference numeral 3 denotes a welded portion. References numerals 1b and 2b denote the end walls of the upper and lower convergence electrode portions 1 and 2, respectively. The end walls 1b and 2b have electron beam apertures 1c and 2c, respectively. An axis I of the apertures 1c and 2c is parallel with the axis of the electron gun assembly.

The upper and lower convergence electrode portions 1 and 2 are prepared by press drawing a stainless steel plate having a thickness of about 0.3 mm, and the resultant structures must be heat-treated in a hydrogen atmosphere at a temperature of 1,000 to 1,100°C so as to perform degassing and to eliminate stress. Under these circumstances, errors in parallelism of the end walls 1b and 2b are caused by the pressing and the heat treatment. In particular, the error in each cylindrical electrode portion along its major axis is larger than that along the minor axis thereof, thereby causing an error h1 in parallelism between the upper and lower surfaces of the electrode portion.

Certain further details and design factors concerning prior art electron gun assemblies are described in GB-A-2068163 and in US-A-4234814.

The prior art describes a method of manufacturing an electron gun electrode of a cathode ray tube, comprising:

providing first and second electrode portions each comprising an end wall having the same number of electron beam apertures, a side wall extending peripherally of said end wall, and an out-turned flange extending peripherally of the free end of said side wall in a plane parallel to the end wall and perpendicular to the axes of each associated pair of said electron beam apertures; and

welding said flanges together to form the electron gun electrode.

The present invention is characterized by:

prior to said welding step, locating each said electrode portion in a polishing machine having

upper and lower parallel reference bases and polishing the surface of said flange remote from the end wall to improve the degree of parallelism of said surface in relation to said end wall.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a conventional electron gun electrode;

Figure 2 is a sectional view showing deformation of a flange of an upper electrode portion so as to explain the degradation of parallelism in an electron gun electrode; and

Figure 3 is a sectional view showing the main part of a polishing machine for carrying out a method according to the present invention.

In order to best understand the present invention, a parallelism error in a conventional upper electrode portion will be described. Fig. 2 is a central sectional view showing an upper convergence electrode portion 1 obtained by drawing in the same manner as in Fig. 1. Part of a flange surface 1a of the portion 1 is deformed by a height h2. In this manner, a parallelism error in the flange surface 1a occurs with respect to a plane A - A' perpendicular to the axis of each electron beam aperture 1c.

In order to correct such an error, the flange surface 1a is polished by a portion corresponding to the height h2, and the flange surface 1a can be precisely parallel to the ideal plane. The flange surface of the lower electrode half can also be polished to obtain a convergence electrode having polished surfaces as the lens formation surfaces.

A method of polishing the surface described above will be described with reference to Fig. 3. Referring to Fig. 3, reference numerals 4 and 5 denote bases of a commercially available polishing machine, respectively. This polishing machine has a mechanism for rotating the upper and lower bases 4 and 5 while the lower and upper surfaces of the upper and lower bases 4 and 5 are kept to be parallel with high precision. The upper base 4 has a mechanism for vertically moving the lower surface of the upper base 4 and the upper surface of the lower base 5 relative to each other while the upper and lower surfaces are kept parallel with high precision. The upper base 4 has a compressing mechanism for compressing an electrode half toward the lower base 5.

The electrode half 1 is held between the upper and lower bases in the polishing machine to polish the flange surface 1a and a bottom surface 1b. In order to stably and precisely polish each surface, a polishing jig 6 is mounted on the lower surface of the upper base 4. The polishing jig 6 has at least two (three in this embodiment) cores 6b extending vertically on a table 6a fixed on the base 4. A diameter of each of the cores 6b is smaller by 0.01 mm than that of the beam aperture 1c. The tolerance of the diameter of the core 6b is 0.01 mm in the same as in the beam aperture 1c.

In operation, the cores 6b of the polishing jig 6 are fitted in the electron beam apertures 1c, respectively. The flange surface 1a deformed as

shown in Fig. 2 is fixed on the base 5. The upper and lower bases 4 and 5 are rotated relative to each other while a pressure of 0.3 to 0.4 kg/cm<sup>2</sup> is applied to the surface to be polished. The polished flange surface 1a becomes precisely parallel to the ideal plane perpendicular to the axis of the electron beam aperture 1c.

Subsequently, the bottom surface 1b is polished using the polished flange surface 1a as a reference surface, thereby obtaining a flat bottom surface 1b which is precisely parallel to the ideal plane.

In the embodiment described above, the flange surface is polished to be perpendicular to the axis of the electron beam aperture, and then the polished flange surface is used to as the reference surface to polish the bottom surface, thereby obtaining the flat flange and bottom surfaces precisely parallel to the ideal plane perpendicular to the axis of the electron beam aperture. However, when recent laser welding is performed, the flange surface often need not have higher precision than that of the bottom surface. It is important to obtain the flat bottom surface precisely parallel to the ideal plane.

As is apparent from the above description, the surface of the flange remote from the end wall and optionally also the outer surface of the end wall are polished to be parallel to the ideal plane perpendicular to the axis of the electron beam aperture, thereby improving the precision of the electron gun using such an electrode. The surfaces to be polished can be easily located using a jig having cores entering the electron beam apertures.

In this manner, when the surfaces are polished to obtain smooth, flat surfaces, the lens characteristics themselves are also improved.

#### Claims

1. A method of manufacturing an electron gun electrode of a cathode ray tube, comprising:

providing first and second electrode portions (1, 2) each comprising an end wall (1b, 2b) having the same number of electron beam apertures (1c, 2c), a side wall extending peripherally of said end wall, and an out-turned flange (1a, 2a) extending peripherally of the free end of said side wall in a plane parallel to the end wall and perpendicular to the axes of each associated pair of said electron beam apertures; and

welding said flanges together to form the electron gun electrode;

characterized by:

prior to said welding step, locating each said electrode portion (1, 2) in a polishing machine having upper and lower parallel reference bases (4, 5) and polishing the surface of said flange (1a, 2a) remote from the end wall (1b, 2b) to improve the degree of parallelism of said surface in relation to said end wall.

2. A method according to Claim 1, characterized by, subsequent to said step of polishing the surface of the flange (1a, 2a), polishing the outer

surface of the end wall (1b, 2b) using the previously polished flange surface (1a, 2a) as a reference surface, to further improve the degree of mutual parallelism of said flange surface and said end wall outer surface of each said electrode portion (1, 2).

3. A method according to Claim 1 or Claim 2, characterized in that said step of locating each said electrode portion (1, 2) in a polishing machine is effected by fitting at least two cores (6b) of a jig through said electron beam apertures (1c, 2c), thereby polishing the surfaces to be polished perpendicular to the longitudinal axes of said electron beam apertures.

4. A method according to Claim 3, characterized in that said electron beam apertures (1c, 2c) are circular and each said core (6b) has a diameter smaller by 0.01 mm. than that of the relevant aperture.

5. A method according to any one of Claims 1 to 4, characterized in that the or each polishing step is effected by relative rotation of said located electrode portion (1, 2) and a polishing member (5) of said polishing machine under an applied pressure of 0.3 to 0.4 kg/cm<sup>2</sup>.

#### Patentansprüche

1. Verfahren zum Herstellen einer Elektrode für eine Elektronenkanone einer Kathodenstrahlröhre, bei dem:

ein erster und ein zweiter Elektrodenabschnitt (1, 2) bereitgestellt werden, die jeweils versehen sind mit einer Stirnwand (1b, 2b), die jeweils dieselbe Anzahl Elektronenstrahlöffnungen (1c, 2c) besitzt, einer Seitenwand, die sich am Umfang der Stirnwand erstreckt, und einem nach außen gedrehten Flansch (1a, 2a), der sich am Umfang des freien Endes der Seitenwand in einer Ebene erstreckt, die parallel zu der Stirnwand und senkrecht zu den Achsen jedes zugehörigen Paares der Elektronenstrahlöffnungen verläuft; und

die Flansche zur Herstellung der Elektrode für die Elektronenkanone miteinander verschweißt werden;

dadurch gekennzeichnet:

daß vor dem Verschweißen jeder Elektrodenabschnitt (1, 2) in einer Poliermaschine mit einer oberen und einer unteren parallelen Bezugsbasis (4, 5) positioniert und die von der Stirnwand (1b, 2b) abgewandte Fläche des Flansches (1a, 2a) poliert wird, um die Parallelität dieser Fläche bezüglich der Stirnwand zu verbessern.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß anschließend an das Polieren der Fläche des Flansches (1a, 2a) die Außenfläche der Stirnwand (1b, 2b) poliert wird, wobei die vorher polierte Flanschfläche (1a, 2a) als Bezugsfläche verwendet wird, um die gegenseitige Parallelität der Flanschfläche und der Außenfläche der Stirnwand jedes Elektrodenabschnittes (1, 2) weiter zu verbessern.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das Positionieren jedes Elektrodenabschnittes (1, 2) in einer Poliermaschine in

der Weise erfolgt, daß mindestens zwei Kerne (6b) einer Schablone in die Elektronenstrahlöffnungen (1c, 2c) eingepaßt werden, wodurch die zu polierenden Flächen senkrecht zu den Längsachsen der Elektronenstrahlöffnungen poliert werden.

4. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß die Elektronenstrahlöffnungen (1c, 2c) kreisförmig sind und jeder Kern (6b) einen Durchmesser hat, der um 0,01 mm kleiner ist als der der betreffenden Öffnung.

5. Verfahren nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß der oder jeder polierschritt durch eine Relativedrehung des positionierten Elektrodenabschnittes (1, 2) und eines Polierkörpers (5) der Poliermaschine unter einem aufgetragenen Druck von 0,3 bis 0,4 kg/cm<sup>2</sup> erfolgt.

#### Revendications

1. Procédé de fabrication d'une électrode pour canon à électrons d'un tube à rayons cathodiques, consistant à:

prévoir des première et seconde portions d'électrode (1, 2), chacune comprenant une paroi extrême (1b, 2b), ayant le même nombre d'ouvertures pour faisceau d'électrons (1c, 2c), une paroi latérale s'étendant périphériquement à ladite paroi extrême, et un rebord tourné vers l'extérieur (1a, 2a) s'étendant périphériquement à l'extrémité libre de ladite paroi latérale dans un plan parallèle à la paroi extrême et perpendiculaire aux axes de chaque paire associée des ouvertures pour faisceaux d'électrons; et

souder ensemble lesdits rebords pour former l'électrode pour canon d'électrons;

caractérisé par,

avant ladite étape de soudage, la localisation de

chaque portion d'électrode (1, 2) dans une machine de polissage ayant des bases supérieure et inférieure parallèles de référence (4, 5) et le polissage de la surface dudit rebord (1a, 2a) qui est éloignée de la paroi extrême (1b, 2b) pour améliorer le degré de parallélisme de ladite surface relativement à ladite paroi extrême.

2. Procédé selon la revendication 1, caractérisé par, subséquemment à ladite étape de polissage de la surface du rebord (1a, 2a), le polissage de la surface externe de la paroi extrême (1b, 2b) en utilisant la surface précédemment polie de rebord (1a, 2a) en tant que surface de référence, pour mieux améliorer le degré de parallélisme mutuel de ladite surface de rebord et de ladite surface externe de la paroi extrême de chaque portion d'électrode (1, 2).

3. Procédé selon la revendication 1 ou la revendication 2, caractérisé en ce que ladite étape de localisation de chaque portion d'électrode (1, 2) dans une machine de polissage est effectuée en adaptant au moins deux pièces (6b) d'un gabarit à travers lesdites ouvertures de faisceau d'électrons (1c, 2c), pour ainsi polir les surfaces à polir perpendiculairement aux axes longitudinaux des ouvertures de faisceau d'électrons.

4. Procédé selon la revendication 3, caractérisé en ce que lesdites ouvertures (1c, 2c) pour faisceau d'électrons sont circulaires et chaque pièce (6b) a un diamètre qui est plus petit de 0,01 mm que celui de l'ouverture en rapport.

5. Procédé selon l'une quelconque des revendications 1 à 4, caractérisé en ce que là ou chaque étape de polissage est effectuée par rotation relative de ladite portion localisée d'électrode (1, 2) et d'un organe de polissage (5) de ladite machine de polissage sous une pression appliquée de 0,3 à 0,4 kg/cm<sup>2</sup>.

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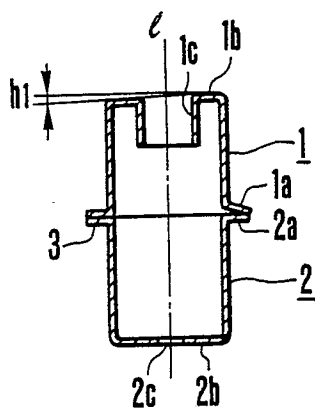


FIG. 1

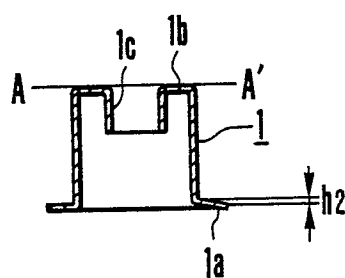


FIG. 2

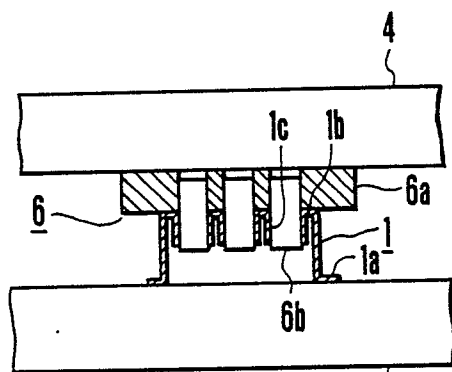


FIG. 3