(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 534 842 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **92402605.7**

(22) Date of filing : **23.09.92**

(51) Int. Cl.[5] : **H01J 1/26**

(30) Priority : **26.09.91 KR 1574491**

(43) Date of publication of application :
31.03.93 Bulletin 93/13

(84) Designated Contracting States :
DE FR NL

(71) Applicant : **GOLDSTAR CO. Ltd.**
20, Yoido-Dong, Youngdungpo-Gu
Seoul (KR)

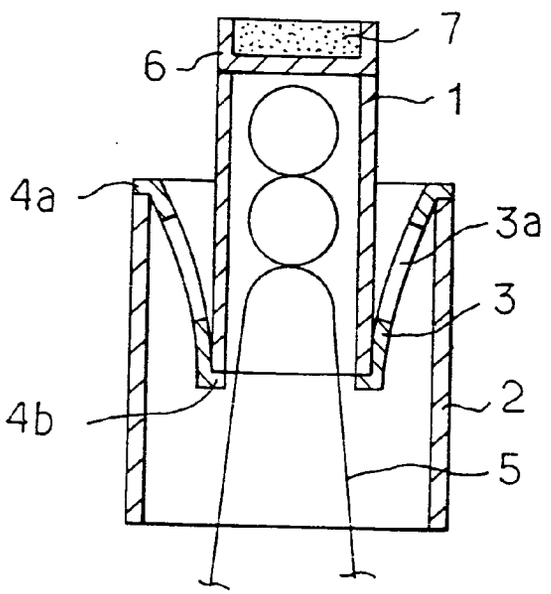
(72) Inventor : **Lee, Gyeong Sang**
Jugong Apt.318-505, 207B3, Hyeonggok-dong
Kumi-si, Kyungsangbuk-do (KR)

(74) Representative : **Chauchard, Robert et al**
c/o Cabinet Malémont 42, avenue du Président Wilson
F-75116 Paris (FR)

(54) Cathode structure for an electron tube.

(57) This invention relates to a cathode structure for an electron gun of an electron tube, comprising a hollow, cylindrical sleeve (1) having a heater (5) mounted therein and a cathode cap (6) disposed at its top to contain an electron emission material (7) ; a hollow, cylindrical cathode holder (2) for supporting the sleeve ; and a unitary, trumpet-shaped support (3) formed in its peripheral wall with a plurality of through-holes (3a) for preventing thermal deformating thereof and attached at one end to the upper end of the cathode holder (4a) and at the other end to the lower end of the sleeve (4b), thereby firmly supporting a cathode body relative to the cathode holder.

F I G. 4



EP 0 534 842 A1

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a cathode structure for an electron tube, and more particularly a cathode body fixing structure for a high current density type electron tube, which is capable of preventing deformation of a cathode body for the electron tube by heat generated by a heater, or burnout of the heater due to electric field concentration.

2. Description of the Prior Art

Recently, electron tubes tend to be made to have a large size and a higher brightness. To this end, there have been actively made the studies of cathodes for high current density type electron tubes. Generally, a cathode body comprises a cathode cap 16 having an electron emission material 17 which includes high temperature, heat resisting metal powder such as tungsten(W) and an oxide such as BaO, CaO, or Al_2O_3, and a hollows sleeve 11 made of high temperature, heat resisting metal powder such as molybdenum (Mo) and having a heater 15 mounted therein, as shown in Figs. 1 and 2 of the accompanying drawings. The cathodes for the high current density type electron tubes require cathode current density of about 10A/cm^2, and there is required to obtain such current density an operating temperature of about 1000°Cb (brightness temperature). In particular, since a very higher activating temperature of about 1200°Cb is required, the cathodes have exhibited certain disadvantages in that the higher activation temperature results in increased power consumption of the heater, structural deformation of cathode body and burnout of the heater.

With a view to overcoming this problem, there has been proposed a cathod body fixing structure as shown in Figs. 1 and 2, which comprises a plurality of spaced-apart methallic fixing pieces or methallic ribbons 13 interconnecting the outer peripheral surface of the lower end of the sleeve 11 and the top of a cathode holder 12. With this construction, when rated voltage is applied to the heater 15 of the cathode body, the temperature of the heat generation section of the heater is raised to a given temperature, and thus the heat is transferred to the electron emission material 17 in the cathode cap 16, so that thermions of predetermined density are emitted from the surface of the electron emissions material, At this time, since the heater 16 rapidly expands with heat toward the electron emission material 17 located at the top of the cathode body, the sleeve 11 of the cathod body also exapands towerd the material 17 with heat transferred thereto. As a result, the metallic fixing pieces 13 connecting the cathode body to the cathode holder 12 to support the cathode body undergoes deformating owing to the heat transferred to them. The reason for this is that the speed of the thermal exapansion of the heater 15 is much greater than those of the sleeve 11 and the metallic fixing pieces 13.

In the prior art cathode body fixing structure, since a plurality of the metallic fixing pieces 13 between the sleeve 11 and the cathode holder 12 are disposed in laterally spaced relation to eath other, the heat transferred from the heater 15 to the sleeve is not readily conducted to the cathode holder, but effectively conducted to the electron emission material 17 generating thermions.
Therefore, the efficiency of the heater is increased, and this somewhat contributes to reduction in power consumption of the heater.

This prior cathode body fixing structure however has a drawback in that since the metallic fixing pieces interconnecting the sleeve and the cathode holder are inherently weak, when the temperature of the cathode body is raised to a higher temperature depending upon heat generation of the heater, the fixing pieces coupled to the sleeve are apt to be easily deformed with thermal expansion of the sleeve by the heat transferred from the heater.

Further, since the joined portions of the lower ends of the fixing pieces to the lower end of the sleeve are discrete to form portruded portions on the outer periphery of the sleeve, electric fields may be concentrated at the protruded portions to cause electric discharge between the sleeve and the heater, thereby resulting in burnout of the heater.

SUMMARY OF THE INVENTION

In view of the aforesaid problem of the prior art, it is an object of the present invention to improve structure for fixing a cathode body to a cathode holder, thereby preventing thermal deformation of the cathode body at a higher cathode temperature and burnout of a heater due to electric field concentration during operation of the heater.

To achieve the above object, there is provided according to one form of the present invention a cathode structure for an electron tube comprising a hollow, cylindrical sleeve having a heater mounted therein and a cathode cap disposed at its top to contain an electron emission material ; a hollow, cylindrical cathod holder for supporting the sleeve; and a unitary support interconnecting the sleeve and the cathode holder and formed in its peripheral wall with a plurality of circumferentially spaced through-holes for preventing thermal deformation thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings :

Fig. 1 is a plan view of a cathode body fixing structure for an electron tube according to the pri-

or art;

Fig. 2 is a cross-sectional view taken along line A-A of Fig.1;

Fig. 3 is a plan view of a cathode body fixing structure for an electron tube according to the present invention ; and

Fig. 4 is a cross-sectional view taken along line B-B of Fig. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention will now be described in detail, by way of example, with reference to Figs. 3 and 4 of the accompanying drawings, in which Fig. 3 is a plan view of the cathode body fixing structure according to the present invention and Fig. 4 is a cross-sectional view taken along line B-B of Fig. 3.

The basic construction of the cathode structure according to the present invention is the same as that of the prior art with the exception of means for fixing a sleeve 1 of a cathode body to a cathode helder 2. According to the present invention, as shown in Figs. 3 and 4, a unitary, trumpet-shaped support 3 having a plurality of circumferentially spaced through-holes 3a formed in its peripheral wall for preventing thermal deformation thereof is used, instead of a plurality of metallic fixing pieces as in the prior art, to interconnect the sleeve 1 and the cathode holder 2. Reference numeral 6 denotes a cathode cap containing an electron emission material 7.

More specifically, the unitary, trumpet-shaped support 3 is disposed between the hollow, cylindrical cathode holder 2 and the hollow, cylindrical sleeve 1 concentrically put in part into the holder, and fixed at one end to the outer periphery of the lower end of the sleeve and at the other end to the top of the cathode holder. The through-holes 3a formed in the peripheral wall of the spport 3 act to radiate heat generated by a heater 5 and transferred to the support during operation of the heater. Each of the through-holes may be of either circular or oblong shape.

According to the preferred embodiment of the present invention, as shown in Fig. 4, the unitary support 3 may be fixed at its both ends to the sleeve 1 and the cathode holder 2 by means of separate, annular securing rings 4a and 4b.

Alternatively, the support 3 may have cylindrical turnover portions formed at its opposite end openings to be attached to the outer peripheral surface of the sleeve 1 and the inner peripheral surface of the holder 2, respectively.

Besides, various modified constructins may be employed to fix the unitary, trumpet-shaped support 3 to the sleeve 1 and the cathode holder 2.

In the cathode structure according to the present invention, since the sleeve 1 is connected to the cathode holder 2 through the trumpet-shaped support 3 fixed to them by means of the securing rings 4, as shown in Fig. 4, and the support has the through-holes 3a formed in its peripheral wall, although during operation of the heater 5 the heat of a high temperature generated by the heater is conducted to the support 3 through-holes 3a of the support. In this manner, since the heat conducted to the support can be effectively dissipated through the through-holes 3a, so that thermal deformation of the cathode body can be greatly reduced.

Further, since the support 3 is attached at both ends to the sleeve 1 and the cathode holder 2 by means of either the annular securing rings 4 or the cylindrical turnover portions formed at the opposite end openings of the support to be attached to the peripheral surfaces of the sleeve and the holder, circumferentially continuous joints are obtained at the opposite ends of the support without forming any protruded portion on the periphery of the sleeve, so that the electric field concentration does not occur during operation of the heater. As a result,electric field concentration may be prevented, whereby burnout of the heater due to the electric dischage may be reduced.

While the invention has been shown and described with particular reference to preferred embodiments thereof, it will be understood that variations and modifications in detail may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

Claims

1. A cathode structure for an electron tube comprising :

   a hollow, cylindrical sleeve having a heater mounted therein and a a cathode cap disposed at its top to contain an electron emission material ;

   a hollow, cylindrical cathode holder for supporting said sleeve ;and

   a unitary support interconnecting said sleeve and said cathode holder and formed in its peripheral wall with a plurality of circumferentially spaced through-holes for preventing thermal deformation thereof.

2. A cathode structure for an electron tube as claimed in Claim 1, wherein said support is of a trumpet shape.

3. A cathode structure for an electron tube as claimed in Claim 1, wherein said support is fixed at the upper and lower ends thereof to the upper end of said cathode holder and the lower end of said sleeve by means of annular securing rings.

4. A cathode structure for an electron tube as

claimed in Claim 1, wherein each of said through-holes is of circular or oblong shape.

FIG. 1
PRIOR ART

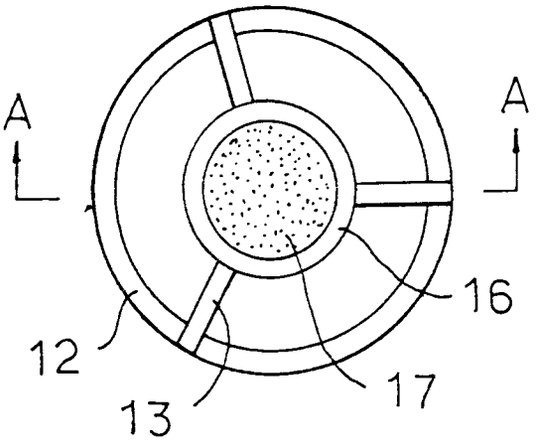


FIG. 2
PRIOR ART

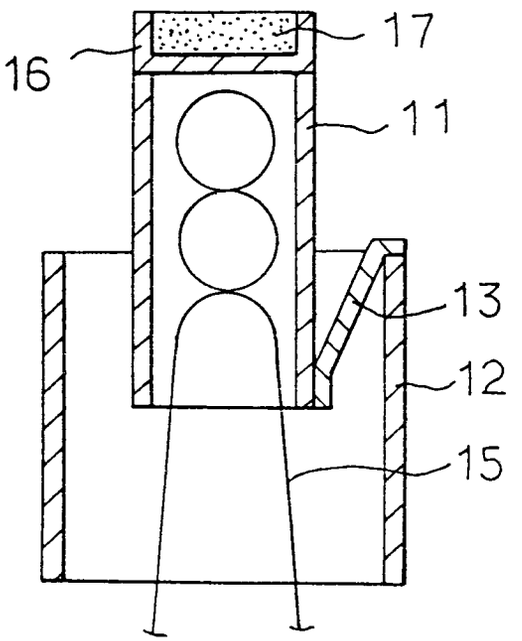


FIG. 3

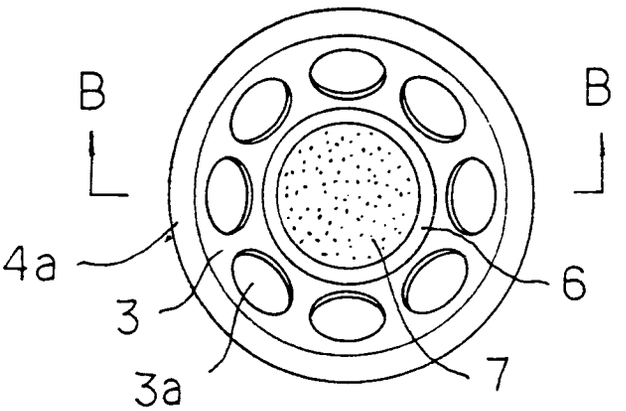
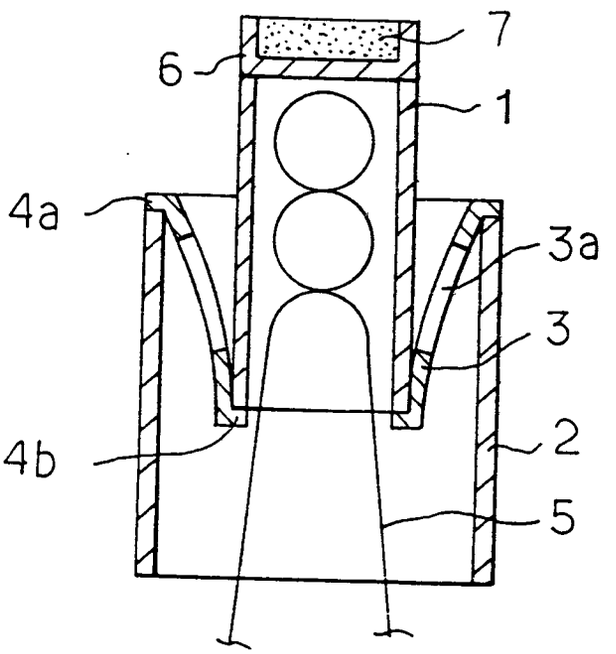


FIG. 4



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 40 2605

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 906 601 (BUESCHER ET AL.) * column 3, line 7 - line 28 * * column 3, line 49 - line 58 * * figures 2-4 *	1	H01J1/26
A	US-A-3 259 783 (NORRIS ET AL.) * column 1, line 43 - line 45; figure *	1	
A	DE-A-1 639 399 (SIEMENS AG.) * page 3, paragraph 2 * * page 5, paragraph 2 * * figures *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H01J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 DECEMBER 1992	COLVIN G.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)