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EUROPEAN PATENT APPLICATION

⑳ Application number: 86200249.0

⑤① Int. Cl.⁴: **H 01 J 29/56**

㉔ Date of filing: 19.02.86

③① Priority: 22.02.85 NL 8500500

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④③ Date of publication of application: 10.09.86
Bulletin 86/37

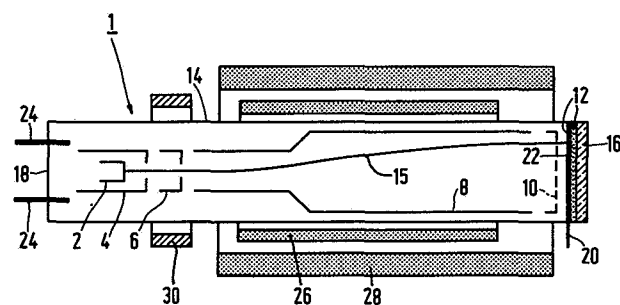
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⑧④ Designated Contracting States: **DE FR GB NL**

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⑤④ **Television camera tube including a stigmator for beam correction.**

⑤⑦ A television camera tube (1) includes a stigmator (30), preferably an eight-pole stigmator, which precorrects the electron beam (15) so that beam defects which occur during deflection, for example, astigmatism and coma, are minimized. The invention can be used notably in a high-resolution television system such as that used, for example, in medical diagnostic X-ray systems.



Television camera tube including a stigmator for beam correction.

The invention relates to a television camera tube comprising an electron gun, an electron-optical system for controlling and modulating an electron beam to be emitted by the electron gun, and a beam scanning system
5 for scanning a target by means of the electron beam.

In known television camera tubes defects or aberrations occur in the electron beam due to the deflection of the beam during scanning, said defects usually increasing as the deflection angle is increased. Such defects are
10 notably beam astigmatism and coma. Due to these defects, an electron spot becomes comparatively large notably at the corners of the target where it exhibits a poorly defined shape. Consequently, for example, the resolution of the tube at the periphery of the screen is considerably
15 inferior to that in the central part thereof. If the spot shape at the centre is such that it does not limit the resolution in that region, a compromise can be accepted as regards the spot dimensions at the centre in order to achieve an improved spot shape at the corners. It will be
20 apparent that this would be a bad compromise which cannot be used in systems requiring a high resolution such as high-definition television systems used for medical diagnostics. This is notably applicable to the television camera tube of such a system.

It is the object of the invention to mitigate these restrictions; to achieve this, a television camera tube of the kind set forth in accordance with the invention is characterized in that a stigmator which dynamically precorrects the electron beam is added to the electron-
30 optical system.

A stigmator for electron beam correction is known per se from Journal Ph. D. Vol. 7, 1974, pp. 805-814. When such a stigmator is used in a television camera tube provided with a beam scanning arrangement, the electron beam
5 can be precorrected in an angle-dependent manner so that an acceptable electron spot is also formed at the periphery of the screen. The resolution across the entire screen is thus substantially increased and is also more uniform; for example, in diagnostic X-ray images the amount of image
10 information is thus substantially increased so that the radiation dose for the patient can also be reduced.

The stigmator of a preferred embodiment consists of an eight-pole whose poles can be controlled in pairs. The stigmator is constructed notably as an electromagnetic
15 eight-pole. When an eight-pole stigmator is used, two pole pairs of the stigmator can also be used for beam alignment.

The precorrection can be automatically performed in a simple manner by measuring the control signals required for optimum correction across the entire screen once and by
20 storing this data in a memory. This is notably applicable in as far as the correction is independent of the local image content, i.e. of the beam current and in this case a correction signal can be formed as a function of, for example, the excitation current for the deflection coils
25 of an electron-optical deflection system. When the correction is dependent on the local beam current, it can again be automatically performed in a simple manner, but in that case it is also necessary to include a signal component derived from the beam current.

30 Some preferred embodiments in accordance with the invention will be described in detail hereinafter with reference to the accompanying drawing.

Figure 1a of the drawing shows a television camera tube and Figure 1b shows an associated stigmator.

35 Figure 1a shows a television camera tube 1 comprising a cathode 2, a control grid 4, an anode 6, a final anode 8, a gauze anode 10 and a target 12. All said components are accommodated in an envelope 14 which comprises an entrance

window 16 and a base 18 and serve to generate, control and modulate an electron beam 15 to be emitted by the cathode. In the envelope there are also provided an electrical connection 20 for a signal electrode 22 and connections 24
5 for power supply and control of the electron gun. Around the tube there are provided deflection means, coils 26, which may alternatively be provided in electrostatic form within the envelope, as well as focussing means, comprising coils 28, for which the same is applicable.

10 In the region between the control grid 4 and the final anode 8 there is provided a stigmator 30 which in this case comprises (see Figure 1b) eight poles or rather four pairs of electromagnetic poles 32. The field distribution and the operation of such a stigmator are
15 described in detail in said article in Journ. Phys. D and will not be elaborated upon herein. Two non-adjacent coil pairs can be used for beam alignment in the tube, so that additional facilities in this respect can be dispensed with. It is an advantage of a stigmator which is arranged
20 around the tube that ~~its~~ angular position can be optimized at a later stage; this benefits notably the beam alignment but may also be advantageous for the precorrection signal, because an optimum and combined positioning of the deflection coils and the stigmator can then be performed. It may
25 then be advantageous, for example to make two coil pairs coincide exactly with the diagonals of an image to be formed on the target. Notably for television systems in which the electron spot in the undeflected position can be made just small enough for it not to be the decisive factor
30 determining the resolution, for example in a high-resolution system with a scanning raster with 1000 lines, a substantially improved image can thus be obtained. It is to be noted that a static precorrection imposed on the central spot, for example by operating in the underfocussing or over-
35 focussing mode, offers only a rather imperfect correction for the deflected beam. The invention can thus also be used to good advantage in systems in which the central spot is not the decisive factor in determining the resolution.

Such systems often utilize television camera tubes having an enlarged target so that, without using the invention, the desired gain in resolution is far from being achievable because of the larger deflection angles. The
5 invention again offers a high-resolution image across the entire screen in such a case.

Even though requirements imposed on the electron spot in television monitors are usually less severe than in a camera tube, considerable spot defects occur at the periphe-
10 ry of the screen due to a combination of larger beam currents and much larger deflection angles. As in the described example, a stigmator can again offer a substantial improvement in such a case.

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1. A television camera tube comprising an electron gun, an electron-optical system for controlling and modulating an electron beam to be emitted by the electron gun, and a beam scanning system for scanning a target by means of the electron beam, characterized in that a stigmator (30) which dynamically precorrects the electron beam (15) is added to the electron-optical system.
2. A television camera tube as claimed in Claim 1, characterized in that the stigmator (30) comprises four electromagnetic pole pairs (32).
3. A television camera tube as claimed in Claim 2, characterized in that the stigmator is mounted so as to be adjustable around the neck portion of the envelope (14) of a television camera tube (1).
4. A television camera tube as claimed in Claim 2 or 3, characterized in that two pole pairs of the stigmator act as a beam alignment system.
5. A television camera tube as claimed in any one of the preceding Claims, characterized in that a signal which is derived from the excitation current of an electromagnetic deflection system of the tube is used as correction signal for the stigmator.
6. A television camera tube as claimed in any one of the preceding Claims, characterized in that a signal which is also derived from the local target beam current is used as a correction signal for the stigmator.
7. A television camera tube as claimed in any one of the preceding Claims, characterized in that there is provided an associated storage element for the storage of precorrection signals.

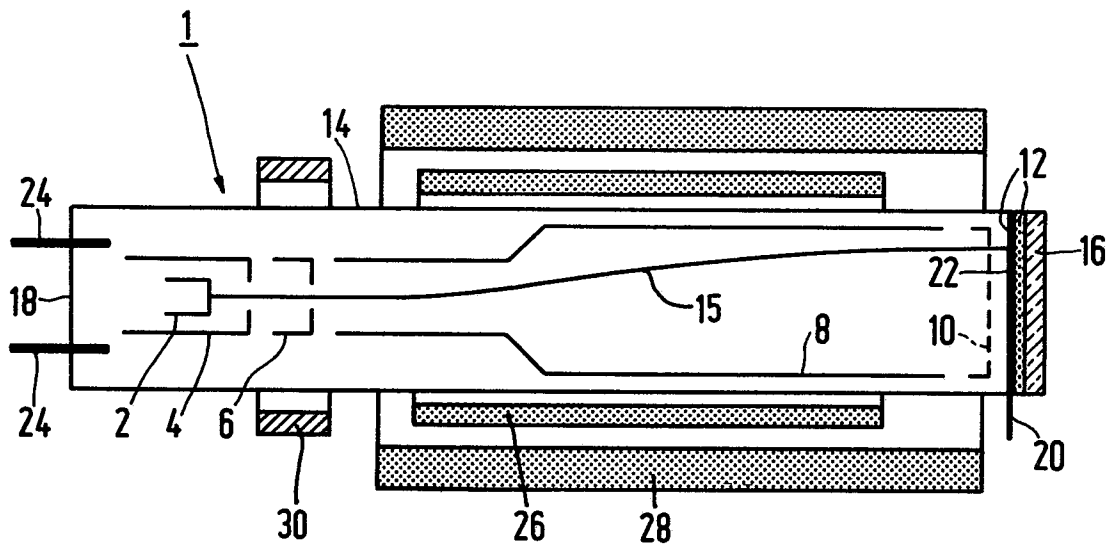


FIG.1a

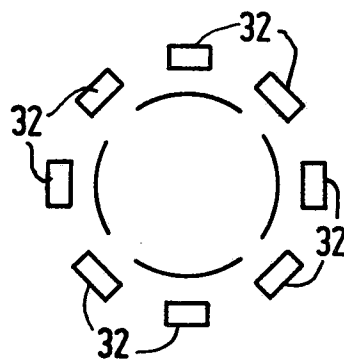


FIG.1b



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.4)
A	IEEE TRANSACTIONS ON ELECTRON DEVICES, vol. ED-12, no. 8, August 1965, pages 478-484, IEEE, New York, US; K. SCHLESINGER et al.: "Correction of deflection-aberrations by analog computer" * Page 478, abstract and right-hand column, paragraph 2; page 479, left-hand column and right-hand column, paragraphs 1,3; page 480, lines 1-10; figures 2,3b *	1,2,5	H 01 J 29/56
A	--- US-A-3 961 223 (RAY et al.) * Column 1, lines 6-12, 31-53; column 2, lines 40-42, 49-60 *	1,2,5	
A	--- JOURNAL OF PHYSICS D: APPLIED PHYSICS, vol. 4, 1971, pages 27-38, Letchworth, GB; S.S. WILLDER: "The correction of deflection astigmatism in microspot cathode ray tubes" * Chapter 2.3; figure 5 *	1,2,5	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 01 J 29 H 04 N 9 H 01 J 3 H 01 J 31
A	--- US-A-3 150 284 (Ch.P. COMEAU) * Column 2, lines 18-32; column 6, lines 65-68; column 7, lines 18-33; figures 1,7 *	1,2	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 02-06-1986	Examiner WITH F.B.
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	



European Patent
Office

EUROPEAN SEARCH REPORT

0193983

Application number

EP 86 20 0249

DOCUMENTS CONSIDERED TO BE RELEVANT			Page 2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	SOVIET INVENTIONS ILLUSTRATED, Week 84 50, abstract: LEEE, T 04, 84-311267/50, 30th January 1985, Derwent Publications Ltd., GB; & SU - A - 1 088 088 (LENGD ELECTROTECH RES) 23-04-1984	1,2	
A	GB-A-1 142 747 (GENERAL ELECTRIC) * Page 1, lines 56,57; page 4, lines 11,12,15-17; page 4, lines 42-129; page 5, left-hand column; figures 1,3-6 *	1,2	
A	FR-A-1 396 287 (PHILIPS)		
A	US-A-2 878 416 (R. THEILE et al.)		
A	US-A-3 872 344 (SHIMIZU et al.)		
A,D	JOURNAL OF PHISICS D: APPLIED PHYISICS, vol. 7, 1974, pages 805-814, Letchworth, GB; N.H. DEKKERS: "A universal deflection unit generating a field of any order and azimuth"		TECHNICAL FIELDS SEARCHED (Int. Cl.4)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 02-06-1986	Examiner WITH F.B.
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			