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

(11) Publication number: **0 442 571 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91200279.7**

(51) Int. Cl.[5]: **H01J 29/62**

(22) Date of filing: **11.02.91**

(30) Priority: **14.02.90 NL 9000349**

(43) Date of publication of application:
21.08.91 Bulletin 91/34

(84) Designated Contracting States:
DE FR GB IT

(71) Applicant: **N.V. Philips' Gloeilampenfabrieken**
Groenewoudseweg 1
NL-5621 BA Eindhoven(NL)

(72) Inventor: **Van Engelshoven, Jeroen**
c/o INT. OCTROOIBUREAU B.V., Prof. Holstlaan 6
NL-5656 AA Eindhoven(NL)
Inventor: **Goorhuis, Ger-Wim Jan**
c/o INT. OCTROOIBUREAU B.V., Prof. Holstlaan 6
NL-5656 AA Eindhoven(NL)
Inventor: **Hellings, Gerardus Jacobus Arcadius**
c/o INT. OCTROOIBUREAU B.V., Prof. Holstlaan 6
NL-5656 AA Eindhoven(NL)
Inventor: **Vrijssen, Gerardus Arnoldus Herman Maria**
c/o INT. OCTROOIBUREAU B.V., Prof. Holstlaan 6
NL-5656 AA Eindhoven(NL)
Inventor: **Spanjer, Tjerk Gerrit**
c/o INT. OCTROOIBUREAU B.V., Prof. Holstlaan 6
NL-5656 AA Eindhoven(NL)

(74) Representative: **Koppen, Jan et al**
INTERNATIONAAL OCTROOIBUREAU B.V.
Prof. Holstlaan 6
NL-5656 AA Eindhoven(NL)

(54) Display tube comprising an electron gun with a focusing lens of the helical type.

(57) Picture display device comprising a display tube with an electron gun having a hollow tubular structure (34) with an inner surface on which a resistance structure (35) of a material having a high electrical resistance is provided, which structure constitutes a focusing lens (33). The resistance structure (35) is connected to at least two axially spaced electric contacts (36,37) for connecting an anode voltage and at least one electric contact (38) located in between for applying a focusing voltage. An electrode means (38) of low-ohmic material for controlling the focusing lens by means of a dynamic correction signal is arranged in the region of the connection for the focusing voltage. Upon energization, the low-ohmic electrode means (38) particularly exercises a non-rotationally symmetrical effect on the electron beam.

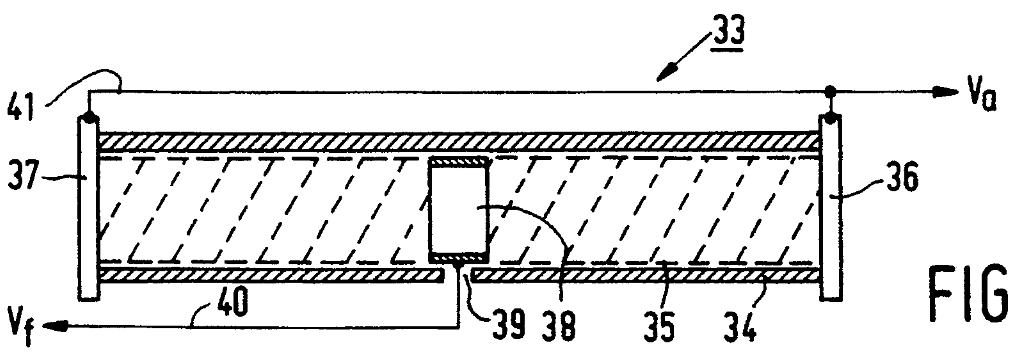

FIG.8

EP 0 442 571 A1

The invention relates to a picture display device comprising a display tube having a display screen and an electron gun arranged opposite said screen, with a cathode centred along an electron-optical axis and a plurality of electrodes which jointly constitute an electron beam-producing part, said gun further comprising a tubular structure having an outer surface and an inner surface on which a resistance structure of a material having a high electrical resistance is provided, which structure constitutes a focusing lens.

Lately, research efforts have been made regarding the use of a main focusing lens constituted by a (particularly helical) high-ohmic resistance structure in display tubes in order to obtain a low spherical aberration. The resistance structure has at least one contact for supplying a static focusing voltage and at least one contact for supplying an anode voltage.

However, when a dynamic correction signal together with the static focusing signal is to be supplied, the desired effect which was to be expected on grounds of previous experiences with conventional focusing tubes does not occur, particularly not at scan frequencies exceeding 16 kHz. (Correction by applying a dynamic focusing voltage may be necessary, for example in the case of large deflection angles so as to keep the electron beam in focus throughout the screen. In the corners a focusing voltage is required which is different from that in the centre of the screen. This means that the dynamic focusing voltage is a signal varying with the scan frequency whose intensity is a function of the position of the electron beam spot on the screen.)

It is an object of the invention to provide a picture display device comprising a display tube with an electrostatic lens, such as a focusing lens, of the helical resistance type, which is particularly suitable for using dynamic correction signals.

To this end a picture display device according to the invention is characterized in that the resistance structure has at least two electric contacts which are axially spaced apart and are adapted to be connected to first voltage-providing means for applying an anode voltage and is electrically connected to a low-ohmic electrode means arranged between said electric contacts, which means is adapted to be connected to second voltage-providing means for applying a static focusing voltage and a dynamic correction voltage. The low-ohmic electrode means may consist of one or more discrete metal components or of an electrically conducting layer.

The invention is based, *inter alia* on the recognition that the high resistance of the (helical) lens structure leads to a long intrinsic RC time of the resistance layer, even at those locations where the layer does not form a helical structure but is homogeneous. In other words, the focusing signal does not propagate or hardly propagates in the resistance structure.

An essential aspect of the invention is that the electrical connection of the high-ohmic resistance structure to the above-described low-ohmic electrode means provides a region having an RC time which is decreased to such an extent that the dynamic correction signal can spread sufficiently far across the main focusing lens in the central part of the focusing lens. As will be described in greater detail, the intermediate electrode means may consist of, for example a coaxial metal ring, one or more transversal metal plates having a beam-passing aperture or of a thin conducting layer provided on the inner wall of the tubular structure and/or on the inner surface of the resistance structure. Vapour deposition, sputtering or painting are examples of suitable techniques for providing the thin conducting layer. It appears that dynamic correction signals (such as, for example dynamic focusing signals) having frequencies up to the MHz range now provide the desired effect.

A construction enabling the low-ohmic intermediate electrode to be provided in a simple manner is characterized in that the tubular structure comprises at least two aligned sub-tubes each having resistance structures which jointly constitute a main focusing lens and in that the low-ohmic electrode means consists of at least one metal plate having a beam-passing aperture, which plate is arranged transversely between the facing ends of the sub-tubes.

An embodiment of this construction is characterized in that the beam-producing part comprises a correction means for correcting possible alignment errors of the sub-tubes.

An alternative construction with which alignment errors are obviated is characterized in that the tubular structure comprises a single tube having a resistance structure provided on its inner surface, which structure constitutes a focusing lens, in that an annular structure of electrically conducting material making electrical contact with the resistance structure is arranged within said tube, which annular structure constitutes the low-ohmic electrode means, and in that the annular structure is connected to an electric contact *via* an aperture in the wall of the tube.

For dynamic focusing the low-ohmic intermediate electrode is constructed to exercise a rotationally symmetrical effect on the electron beam.

For dynamic and astigmatic focusing the low-ohmic intermediate electrode should be constructed to exercise a non-rotationally symmetrical effect.

Some embodiments of a picture display device according to the invention will now be described in greater detail with reference to the drawing in which

Fig. I shows diagrammatically a cross-section of a picture display device comprising a display tube according to the invention;

Fig. 2 is an elevational view of a longitudinal cross-section through a part of a focusing lens of an electron gun suitable for use in the display tube of Fig. 1;

Fig. 3 shows a basic diagram of a first embodiment of a focusing lens which can be used in an electron gun;

Fig. 4 shows a basic diagram of a second embodiment of a focusing lens which can be used in an electron gun;

Figs. 5, 6 and 7 show realisations of the basic diagram of Fig. 3;

Fig. 8 shows an alternative realisation of the basic diagram of Fig. 3;

Fig. 9 is a longitudinal section of a part of a focusing lens having an electrode means which exercises a non-rotationally symmetrical effect; and

Figs. 10, 11 and 12, 13 show alternatives to the construction shown in Fig. 9.

Fig. 14 shows an alternative use of the invention.

The device shown in Fig. 1 comprises a cathode ray tube consisting of, *inter alia* a glass envelope 1 which is composed of a display window 2, a conical portion 3 and a neck 4. This neck accommodates electrode structures 8 and 9 which together with a cathode constitute the beam-producing part 43 of an electron gun. The electron-optical axis 6 of the electron gun is also the axis of the envelope. An electron beam 12 is successively formed and accelerated by the cathode 7 and the electrode structures 8, 9. The reference numeral 10 denotes a tubular structure whose inner surface carries a (particularly helical) structure 11 of a material having a very high electrical resistance which forms a focusing lens focusing the beam on a display screen 14 on the inner side of the display window 2. The resistance structure 11 is electrically connected to a low-ohmic metal input electrode 13a and a low-ohmic metal output electrode 13b. In the case of a so-called unipotential lens suitable voltages to be applied to the electrodes are, for example:

cathode 7	several tens of Volts (for example 50V)
electrode 8	0 V
electrode 9	several hundreds of Volts (for example 400 V)

input and output focusing lens several tens of kilovolts (for example 30 kV) central part focusing lens several kilovolts (for example 5 kV). The electron beam 12 is deflected by means of a system 5 of deflection coils from the axis 6 across the display screen 14. Display screen 14 consists of a phosphor layer which is coated with a thin aluminium film which is electrically connected to the end of electrode 11 *via* a conducting coating on the inner wall of the conical portion 3.

For applying a focusing voltage in the central part of the focusing lens a low-ohmic electrode is required within the scope of the invention. This electrode may be constructed in different manners. Examples will be given with reference to Figs. 5, 6, 7 and 8.

Some details of the construction of a focusing lens of a type suitable for use in an electron gun of the display tube of Fig. 1 will be described with reference to Fig. 2. The type in question comprises a tubular (glass) envelope 15. The inner side of the envelope 15 whose ends are provided with transversal metal electrode plates 17a, 17b having central coaxial apertures 18a, 18b carries a high-ohmic resistance layer 16 in which a helical structure is formed which constitutes a focusing lens 17 when a suitable electric voltage is applied. The patterns of parallel oblique lines diagrammatically represent the locations where the resistance layer 16 has been omitted. The parts of the helical structure are thus always present between two of these lines. The high-ohmic resistance layer 16 may consist of, for example glass enamel having a small amount (for example several % by weight) of metal oxide (particularly ruthenium oxide) particles. The layer 16 may have a thickness of between 1 and 10 νm, for example 3 νm. The resistance per square of such a layer depends on the concentration of metal oxide and the heat treatment to which the layer is subjected. In practice resistances per square varying between 10^4 and 10^8 Ω have been realised. A desired resistance per square can be realised by adjusting the relevant parameters. A resistance per square of the order of 10^6 Ω is very suitable for the relevant application. The total resistance of the helical structure formed in the layer 16 (which structure may comprise a continuous helix as well as a number of separate helixes connected by segments without a helical structure - 6 in the example of Fig. 2) may be of the order of 10 G Ω, which means that a current of several mA will flow across the ends at a voltage difference of 30 kV. In this Figure and in all other Figures the (oblique) line patterns indicate the locations of the resistance layer where the material has been removed from the resistance layer by means of, for example, a rotating cutting tool.

The electron gun of Fig. 1 has a beam-producing part 43 preceding the focusing lens 17, which part generally comprises a cathode 7, a grid electrode 8 and an anode 9. In the case of Fig. 1 the components of the beam-producing part 43 are separately mounted in the display tube, for example, by means of axial glass- ceramic mounting rods. Alternatively, they may be mounted within the tubular envelope 10 of the focusing lens.

It may be necessary to correct occurring picture errors by means of dynamic focusing. The power of the electron lens for focusing the electron beam is adjusted as a function of the deflection to which the electron beam is subjected at that instant. This provides the possibility of causing the main picture plane which is then prevalent to intersect the display screen at the location where the electron beam impinges upon the display screen. This correction mode requires an extra circuit in the control device for generating the correct dynamic focusing voltages on the electrodes of the focusing lens.

Since the material of the helical resistance structure has such a high electrical resistance (for example 10 G Ω), the RC time is long (for example 10 msec). As a result, the effect of a dynamic focusing voltage applied to electrode 18a will hardly reach the helical resistance structure. The invention provides a solution in this respect. The principle of this solution will be elucidated with reference to Figs. 3 and 4 showing two designs of focusing lenses which are suitable for use in an electron gun for a picture display device according to the invention.

Only two electric supply leads are required for the two types of focusing lenses: an anode lead and a focus lead.

Fig. 3 shows diagrammatically a helical focusing lens in which an anode voltage V_a is applied to the ends and a focusing voltage V_f is applied to the central part (so-called unipotential lens). A characteristic feature of a unipotential lens design is that, in contrast to a bipotential lens design, the voltages across the object-sided lens portion and the image-sided lens portion are equal. The resistance structures of these two portions may be symmetrical. Each structure has, for example 5 helical segments.

Fig. 4 shows diagrammatically a helical focusing lens in which an anode voltage V_a is applied to one end and to a first part located between the ends, and a focusing voltage V_f is applied to the other end and to a second part located between the ends (so-called quadripotential lens).

Such a lens may have an object-sided potential at the focusing voltage, followed by a trajectory where the potential increases to the anode voltage and then the potential may decrease to the focusing voltage and increase again to the anode voltage on the last trajectory.

Other types of "multipotential" lenses are also applicable.

The voltages can be applied, for example by making an aperture in the wall of the glass tube at each desired location, which glass tube carries the resistance structure on its inner surface, and by providing an electric contact in this aperture (for example an indium pellet) which makes contact with the resistance layer. Instead of this type of electric contact a metal flange making electrical contact with the resistance layer can be provided at the ends of the glass tube.

However, within the scope of the invention, the electrode for applying a dynamic correction signal should always be a low-ohmic intermediate electrode electrically connected to the resistance layer.

An embodiment of the lens design of Fig. 3 is shown in Fig. 5. The resistance lens construction shown in this Figure comprises a sub-tube 21 and a sub-tube 22. Metal flanges (for example flanges of CrFe) 23, 24 each having a coaxial aperture are sealed to the ends of sub-tube 21 and metal flanges 25, 26 each having a coaxial aperture are sealed to the ends of the sub-tube 22. The flanges 23, 26 serve for applying the anode voltage V_a. In the manner described with reference to Fig. 2 high-ohmic resistance layers 27, 28 having a helical structure are arranged in the sub-tubes 21, 22. The flanges 24, 25, each of which has a beam-passing aperture, are welded together and jointly constitute a low-ohmic intermediate electrode which serves for applying the (static + dynamic) focusing voltage V_f.

Fig. 6 shows a substantially identical structure. However, in this case the facing flanges 24, 25 are not welded together, but arranged in a mutually electrically insulated manner (for example, by mounting on glass or ceramic rods which are not shown). This provides the possibility of applying a static plus a dynamic focusing voltage V_f (stat + dyn) to, for example flange 25 and a static focusing voltage V_f (stat) to flange 24. In the constructions shown in Figs. 5 and 6 the metal flanges 24, 25 having coaxial central apertures 29, 30 function as low-ohmic electrodes. The apertures 29, 30 may have a rotationally symmetrical shape, as in Fig. 5. If the apertures 29, 30 have a non-rotationally symmetrical shape, for example a square or elongate (oval or rectangular) shape, as in Fig. 6, an electric 4-pole field forming an astigmatic lens is formed in between them upon energization. The applied dynamic focusing voltage has a diverging effect on an electron beam passing through the focusing lens, both in the horizontal and in the vertical direction. This diverging effect can be compensated in the horizontal direction and increased in the vertical direction by the astigmatic lens which is formed between the flanges 24, 25 when the dynamic and static focusing voltages are applied. This renders an independent horizontal and vertical focusing possible, which is particularly important in color display tubes. (Here, dynamic astigmatic focusing is concerned).

Fig. 7 shows a structure which is substantially identical to the structure of the focusing lens of Fig. 6. In this case, however, an extra transversal electrode 31 is arranged between the flanges 24 and 25. The required static and dynamic focusing voltages can now be applied to the electrodes 24, 25 and 31.

Fig. 9 shows a part of a focusing lens construction with a low-ohmic electrode means comprising two metal flanges 24' and 25' each having a beam-passing aperture and engaging projections 42, 43, 44 and 45 whereby, upon energization, a 4-pole field is generated between the flanges.

In the cases of Figs. 5, 6, 7 and 9 the focusing lens always comprises at least two sub-tubes having a resistance structure. This could give rise to misalignment of the sub-tubes. Possibly occurring misalignments can be corrected by a correction means particularly arranged in front of the focusing lens. The desired correction is realised, for example, by providing a ring 42 of permanently magnetizable material in the last electrode of the beam-producing part of the electron gun (electrode 9 in Fig. 1) and by magnetizing this ring from the exterior after the electron gun has been mounted in the display tube. It appears from Figs. 5, 6 and 7 that the metal flanges 24, 25 (and 31) are comparatively close to the through-connection wire 32 applying the anode (high) voltage to flange 23. Since the flanges 24, 25 (and 31) convey the (lower) focusing voltage, this may give rise to unwanted field emission ("spraying") of the flanges 24, 25 (and 31) to the through-connection wire 32, particularly when the flanges are rough (or have projections). To prevent this, it should be ensured that the components conveying different voltages do not "see" one another, for example, by insulating the connection wire by oxidizing the material of which it is made or by coating it with an insulating layer. However, an electrically insulating protective coating is preferably provided on the components conveying the lowest voltage (*i.e.* the flanges 24, 25 (and 31)). A thin layer of ceramic material or of glass is suitable for insulation. In the latter case, for example aluminium phosphate glass is a good choice. This may be provided in a thin layer and has a high viscosity already at a relatively low temperature. Consequently, a great degree of freedom with respect to the coefficients of expansion of the metal to be coated and the glass is admissible. Also in the case of the relatively high viscosity and a snall thickness (of the order of microns) of the layer, this layer will easily follow possible irregularities of the surface on which it is provided and thus coat this surface satisfactorily. An alternative example is to manufacture the flanges 24, 25 (and 31) from a chromium-containing material and to subject it to an oxidation treatment.

Another way of preventing the occurrence of unwanted field emission is explained with reference to Fig. 8.

Instead of two (or more) sub-tubes (for example two tubes having a length of 35 mm each) the focusing lens 33 comprises one single tube 34 (having a length of, for example 70 mm) in this case. The inner surface of tube 34 is provided, for example in the manner described hereinbefore with a high-ohmic resistance layer 35 having a helical pattern and its ends may be provided with flanges 36, 37 which are electrically connected thereto and are intended to apply an anode voltage V_a. The tube 34 accommodates a coaxial metal ring 38 (for example of CrNi) which is in (clamping) engagement and in electrical contact with a part of the resistance layer 35 in which no helical pattern has been provided. Focus lead 40 is welded (for example by means of laser welding) to the clamping ring 38 functioning as a focusing electrode *via* an aperture 39 (of, for example 1.5 x 3 mm) in the wall of the tube 34, which aperture is made (for example by means of sandblasting) preferably after the resistance layer 35 is provided. In this construction the wall of the tube 34 shields the focusing electrode 38 from anode through-connection wire 41, thus preventing the above-mentioned field emission problem. The width of the focusing electrode (clamping ring 38 in this case) determines to a considerable extent the region where dynamic focusing takes place. Also the width of the uninterrupted part of the resistance layer 35 located between the helical portions plays a role if this width deviates from the width of the focusing electrode. Static focusing takes place throughout the length of the helical pattern.

To prevent possible high-voltage problems, it is important that the focus lead 40 does not "see" the high-voltage through-connection wire 41. To achieve this, it is useful to provide the aperture 39 in a position which is rotated through an angle of between 120° and 180° with respect to the position of the wire 41.

In its simplest form the coaxial focusing ring 38 is rotationally symmetrical so as to render the use of dynamic focusing possible. Within the scope of the invention rotationally symmetrical rings are not only understood to mean (closed) rings whose circumference exactly follows a circular path, but also (open) substantially circular rings with two ends which slightly overlap or with two ends which are located opposite each other in one plane, either with the inclusion of a small gap or by means of a butt joint.

Instead of a discrete ring (38) a layer or a tape of electrically conducting (low-ohmic) material can be used as a focusing electrode. Such a layer can be provided on the inner wall of the tube 34 before the high-ohmic resistance structure 35 is provided. An alternative method is to provide the high-ohmic resistance structure 35 and to coat it with a layer of electrically conducting material, for example a layer of electrically conductive paint sold under the name of "Leitsilber".

As already noted hereinbefore, the invention can be used for dynamic astigmatic focusing, for which purpose an electric 4-pole field is generated in the focusing lens range. However, it may also be used for generating other dynamic multipole fields in the focusing lens range, for example, a dynamic dipole field (for beam displacement).

The inventive principle of ohmically coupling in a dynamic signal into a resistance lens may be used advantageously in a projection TV tube, but the principle may also be used in color display tubes. Another possibility is its Use in oscilloscope tubes in which the high-frequency deflection could be effected, for example by means of a signal which is ohmically coupled in, similarly as the dynamic focusing signal.

Dynamic astigmatic focusing may be carried out in manners differing from those described hereinbefore, for example, in the manner shown in Fig. 10. In this case the resistance layer 46 of the focusing lens is interrupted over an intermediate area 47 of several millimetres. In this area the inner wall of the tubular structure 50 carries two metal electrodes 48, 49 which have engaging projections of several millimetres' length. Each electrode 48, 49 slightly overlaps the resistance layer 46 so as to establish electrical contact therewith. The electrodes may be made of, for example, a layer of a low-ohmic material provided by way of an electroless or a vapour-deposition process, in which the finger structure is provided by means of etching or by a laser. The support may be a synthetic material foil. Electrodes of the type 24', 25' shown in Fig. 9 are alternatively possible. Fig. 11 shows the area 47 and its direct surroundings in greater detail. A voltage V_f, (stat) is applied to the electrode 48 and a voltage V_f (stat + dyn) is applied to the electrode 49.

Fig. 12 shows a simpler solution. Here the resistance layer 46, in which the helical pattern is formed, is not interrupted over a given (intermediate) area (as in the constructions shown in Figs. 5, 6, 7, 9, 10 and 11), but it continues as in the construction shown in Fig. 8. A finger structure is formed by means of a scratch 51 in the resistance layer 46. (There may be a plurality of parallel scratches so as to reduce the voltage drop per scratch.) An annular structure in the form of two tape-shaped metal electrodes 52, 53 is provided on both sides at a short distance (several mm) from this scratch. These electrodes are energized in the same way as the electrodes shown in Fig. 11. By making the distance between these tape-shaped electrodes and the ends of the fingers sufficiently small, it is possible for the DAF signal to enter into the ends of the fingers. This solution has the advantage that the accuracy is determined by the scratch in the resistance layer and is not determined by the position or the shape of the tape-shaped electrodes.

DAF is possible at the line frequency as well as at the field frequency, when the latter two solutions are employed. Another advantage is that DAF electrodes having a finger structure are very effective.

A further refinement (see Fig. 13) is to replace the rectangular finger (or square-wave) structure by a more gradual profile such as a $\sin 2\phi$ function. Such a scratch 54 is easier to provide and will result in fewer lens errors. Here, too, use is made of tape-shaped electrodes 52' and 53' to which respective voltages V_f (stat) and V_f (stat + dyn) are applied.

The invention is generally based on the recognition that the high resistance of the resistance structure leads to a long intrinsic RC time, even at those locations where the layer does not form a helical structure, so that a H.F. correction signal, such as a dynamic focusing signal, does not enter or hardly enters into the resistance structure. This also holds in the case where a portion of the resistance structure outside the focusing lens portion constitutes a correction element. This may be a correction element of a type described hereinbefore, or a cylindrical element 60 which has a plurality of circumferentially arranged parts (for example, 2, 4 or 8), each of which is adapted to be connected to voltage-providing means for applying a correction voltage and each of which is in contact with a low-ohmic electrode means for decreasing its resistance (see Fig. 14). Each low-ohmic electrode means should at least be in contact with its own correction element part in the area of the voltage contact. If desired, the correction element parts can be electrically connected to the resistance structure portion constituting a focusing lens.

A further aspect of the invention thus is that contacting each individual portion of the high-ohmic correction element with a low-ohmic electrode means provides a region having an RC time which is decreased to such an extent that the dynamic correction signal can spread fast enough across the correction element to be effective. The low-ohmic electrode means may consist of, for example, a thin conducting layer provided on the inner wall of the tubular structure. Vapour deposition, sputtering or painting are examples of suitable techniques for providing the thin conducting layer. It appears that dynamic correction signals (such as, for example dynamic focusing signals) having frequencies up to the MHz range now provide the desired effect.

Claims

1. A picture display device comprising a display tube having a display screen and an electron gun arranged opposite said screen, with a cathode centred along an electron-optical axis and a plurality of electrodes which jointly constitute an electron beam-producing part, said gun further comprising a tubular structure having an outer surface and an inner surface on which a resistance structure of a material having a high electrical resistance is provided, which structure constitutes a focusing lens, characterized in that the resistance structure has at least two electric contacts which are axially spaced apart and are adapted to be connected to first voltage-providing means for applying an anode voltage and is electrically connected to a low-ohmic electrode means arranged between said electric contacts, which means is adapted to be connected to second voltage-providing means for applying a static focusing voltage and a dynamic correction voltage.

2. A display device as claimed in Claim 1, characterized in that the tubular structure comprises at least two aligned sub-tubes each having resistance structures which jointly constitute a focusing lens and in that the low-ohmic electrode means consists of at least one metal plate having a beam-passing aperture, which plate is arranged transversely between the facing ends of the sub-tubes.

3. A display device as claimed in Claim 2, characterized in that the beam-producing part comprises a correction means for correcting possible alignment errors of the sub-tubes.

4. A display device as claimed in Claim 1, characterized in that the tubular structure comprises a single tube having a resistance structure provided on its inner surface, which structure constitutes a focusing lens, in that an annular structure of electrically conducting material making electrical contact with the resistance structure is arranged within said tube, which annular structure constitutes the lowohmic electrode means, and in that the annular structure is connected to an electric contact *via* an aperture in the wall of the tube.

5. A display device as claimed in Claim 1, 2 or 4, characterized in that, upon energization, the low-ohmic electrode means exercises a non-rotationally symmetrical effect on the electron beam.

6. A picture display device comprising a display tube having a display screen and an electron gun arranged opposite said screen, with a cathode centred along an electron-optical axis and a plurality of electrodes which jointly constitute an electron beam-producing part, said gun further comprising a tubular structure having an inner surface on which a resistance structure of a material having a high electrical resistance is provided, characterized in that the resistance structure has at least two circumferentially arranged parts which constitute a correction element, each part being adapted to be connected to voltage-providing means for applying a correction voltage and each being in contact with a low-ohmic electrode means for decreasing its resistance.

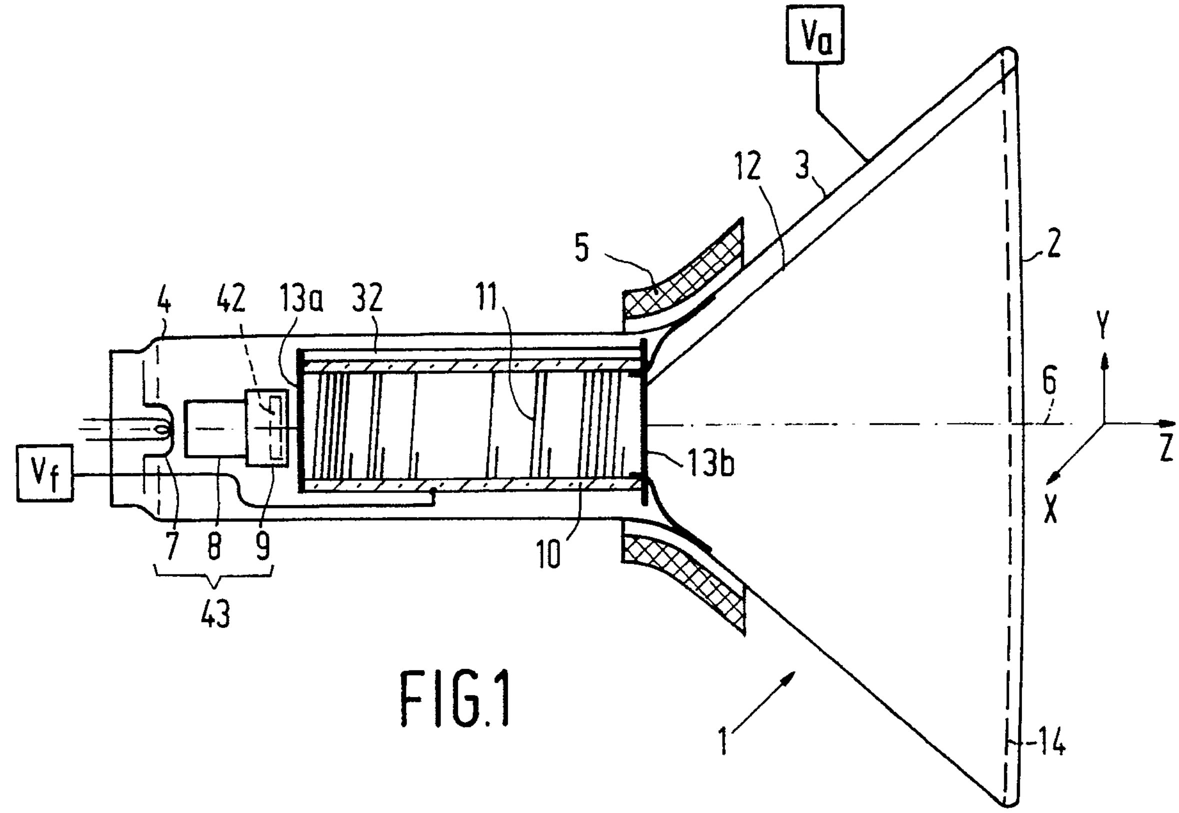
Va
12
3
5
2
4
42
13a
32
11
Y
6
Z
Vf
13b
X
7
8
9
10
43
1
14

FIG.1

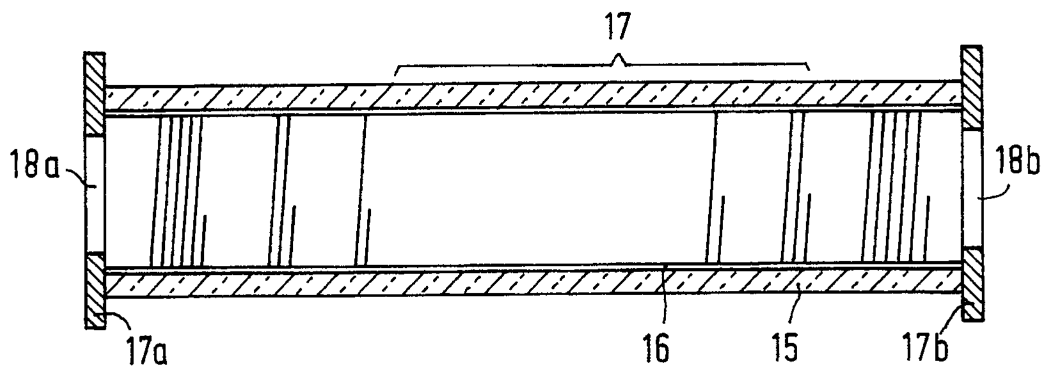
17
18a
18b
17a
16
15
17b

FIG.2

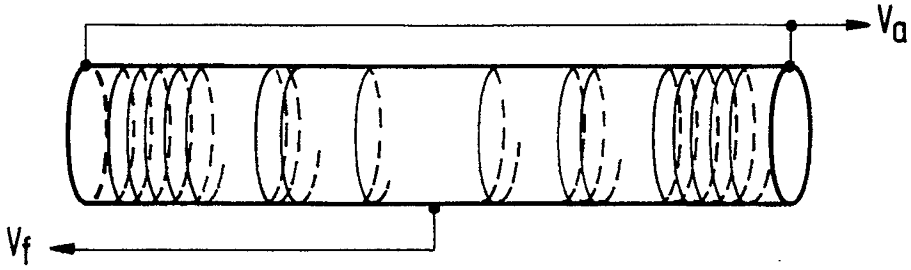

FIG.3

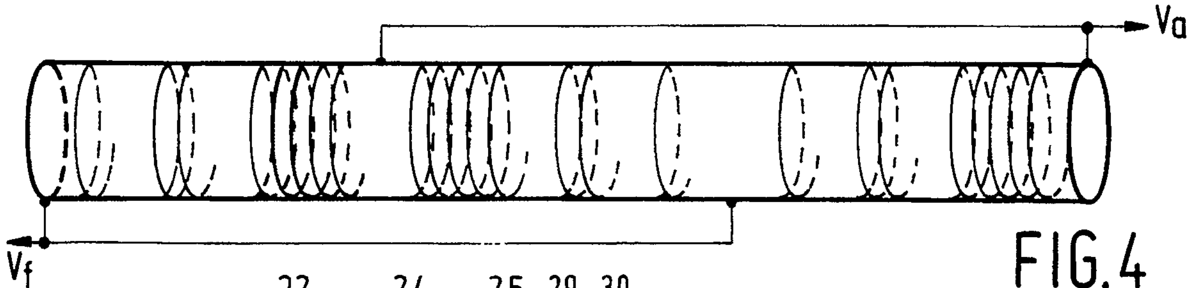

FIG.4

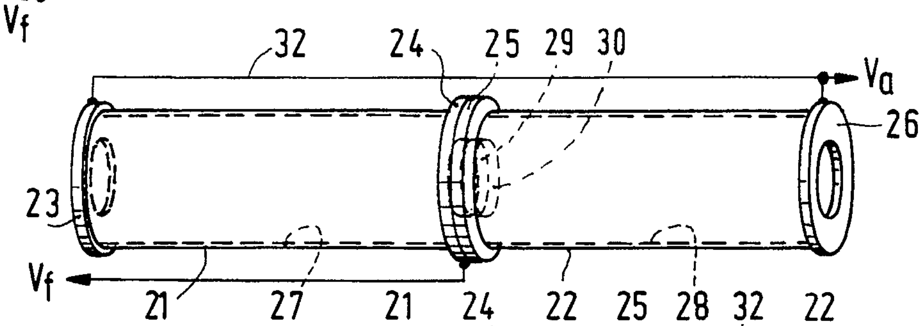

FIG.5

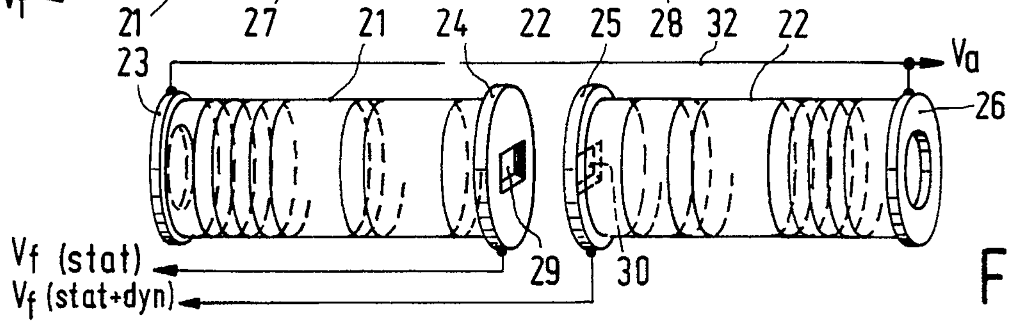

FIG.6

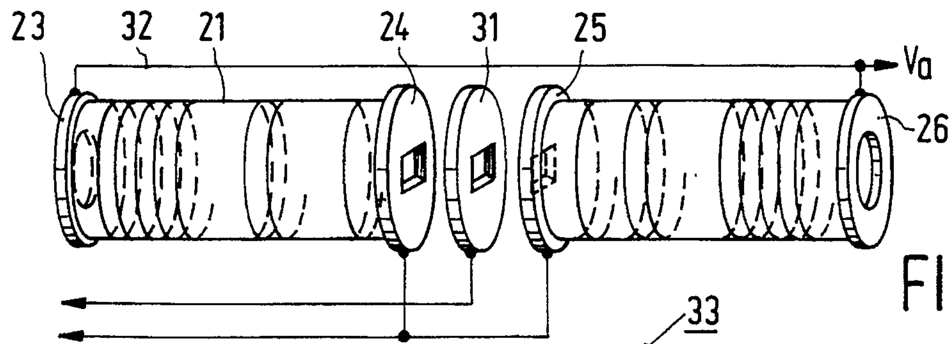

FIG. 7

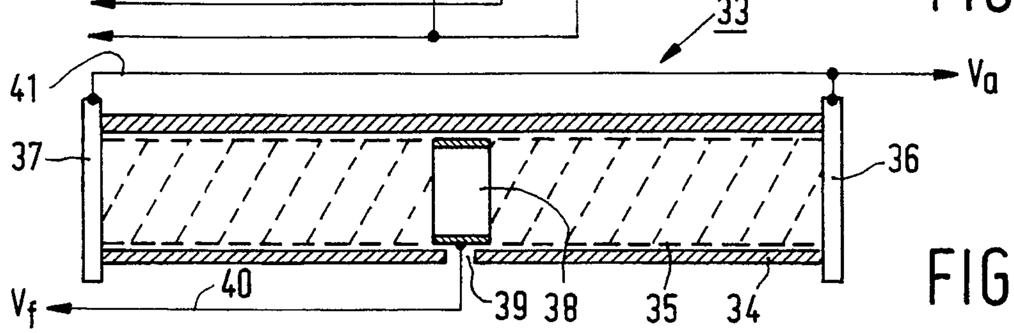

FIG.8

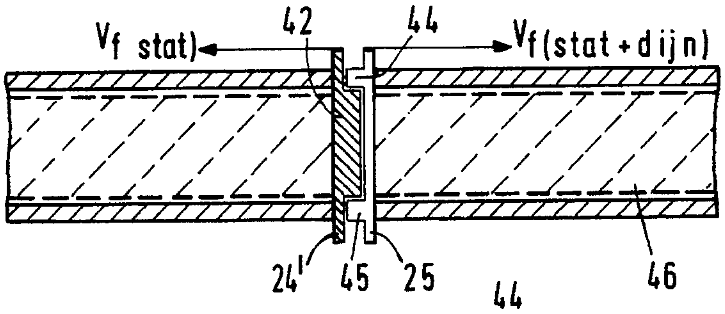

FIG.9

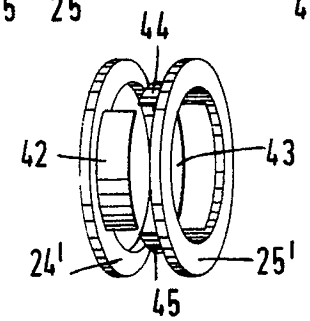

FIG.9a

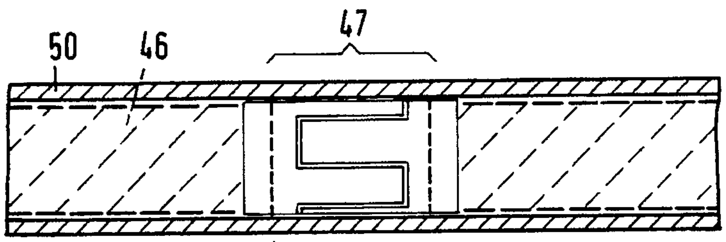

FIG.10

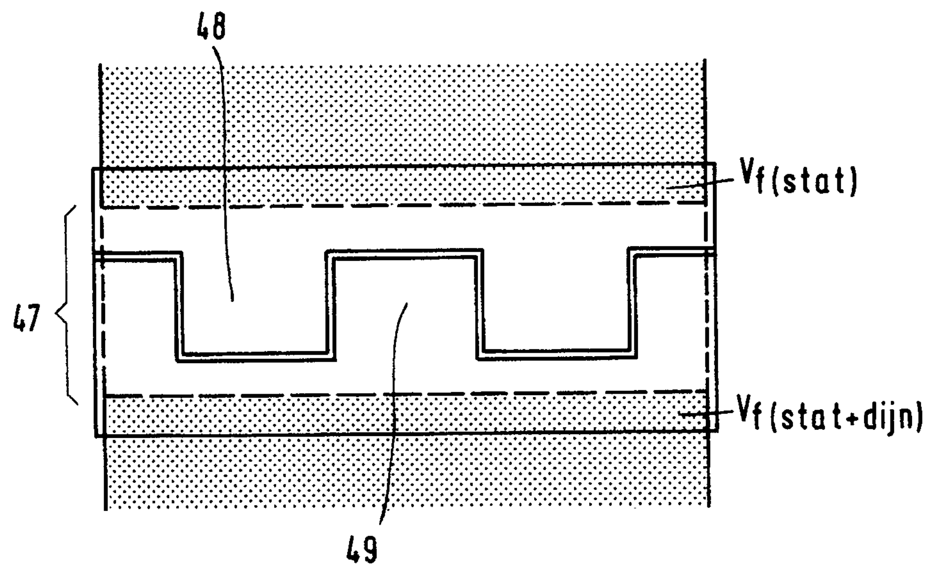

FIG.11

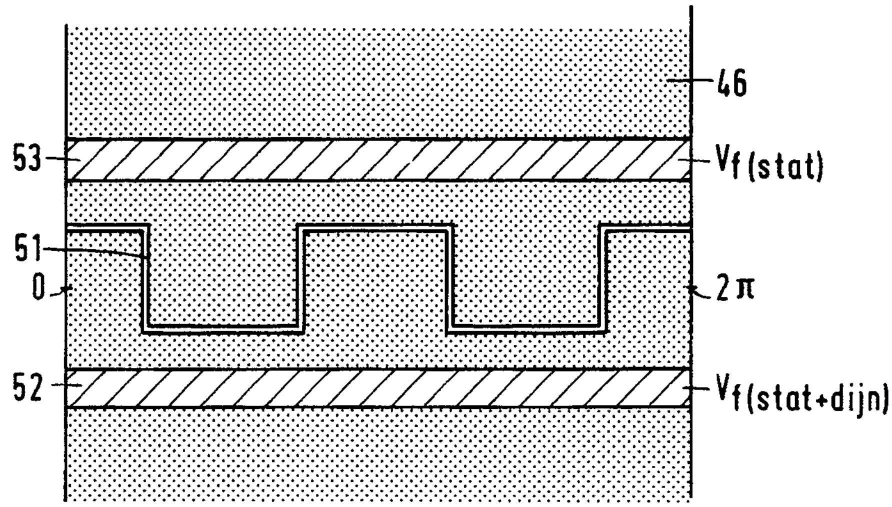

FIG. 12

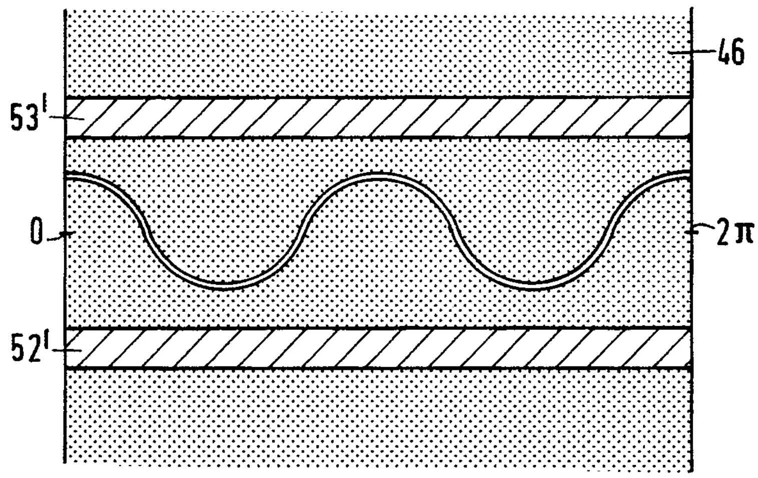

FIG. 13

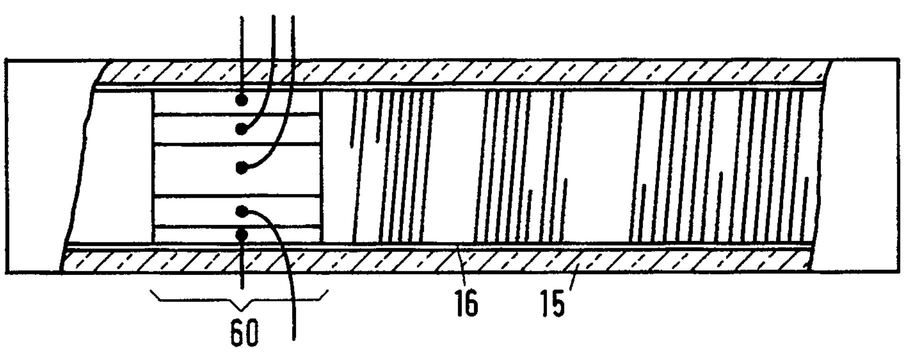

FIG. 14

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 20 0279

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	EP-A-0 342 761 (PHILIPS) * column 3, lines 44 - 47 * * column 4, line 53 - column 5, line 24 @ column 5, line 40 - column 6, line 8; figures 3, 4 * – – –	1-6	H 01 J 29/62
A	FR-A-1 407 985 (THOMSON-HOUSTON) * page 1, lines 51 - 54 * * page 2, lines 49 - 72 * * page 3, lines 52 - 59 * * page 4, lines 47 - 49; figures 1, 3, 6 * – – – – –	1,2,5	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 01 J 29/00

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	22 May 91	ROWLES K.E.G.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
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