

DEFLECTION DEVICE FOR CATHODE RAY TUBE

The invention relates to a system for deflecting the electron beams for a cathode ray tube, also referred to as a deflector, and more particularly to the device ensuring both the support of the deflection coils, the mechanical rigidity of the system, the positioning and the fixing of the deflector on the neck of the cathode ray tube.

Such a deflection system generally consists of a pair of vertical deflection coils, of a pair of horizontal deflection coils and of a substantially frustoconical ring made of a magnetic material intended to concentrate the flux created by the coils. The two pairs of deflection coils are electrically insulated by a separator, generally made of plastic, which furthermore makes it possible to improve the mechanical rigidity of the deflection device, to fix the coils with respect to one another and to fit the assembly to the neck of the tube. The separator consists of a main body, in one or more parts, substantially funnel-shaped, and of a flexible rear part hugging the neck of the tube and intended for fixing the position of the deflection system along the longitudinal axis of said tube; this fixing is generally effected by virtue of a clamping collar disposed above the flexible rear part.

The adjusting of the deflector on the neck of the tube is performed in two steps:

- firstly the adjusting of the deflector along the longitudinal axis of the tube, in such a way as to set into place the centers of deflection of the horizontal and vertical deflection coils,

- next the positioning of the front part of the deflector by rotation or "tilt" of this front part about the horizontal and/or vertical axis, in such a way as to make the axes of the horizontal and vertical deflection fields coincide with the longitudinal axis of the tube.

In order, during the horizontal scanning of the screen of the cathode ray tube, to improve the

transitions between a dark part and a bright part of the image formed on the screen, it is known practice to use a pair of auxiliary coils, the so-called horizontal scan rate modulation coils; these coils will
5 superimpose an auxiliary field on the horizontal deflection field created by the main coils, in such a way as to anticipate the large variations in the luminance signal and to modify the horizontal scan rate accordingly. It is moreover known practice
10 advantageously to dispose these auxiliary coils on the neck of the tube, the horizontal deflection coils of the deflection system sometimes overlapping them partially or totally. It is also known practice to make these auxiliary coils by etching on a support in the
15 form of a rigid or flexible hoop. Examples of such arrangements are described in European Patent Application EP 484 606.

When installing a deflection system comprising auxiliary coils for modulating the scan rate of the
20 electron beams on the neck of the tube, the position of the auxiliary coils with respect to the horizontal deflection coils must be adjusted so as to optimize their effect on the electron beams.

To simplify the procedure for adjusting the
25 deflection system on the neck of the tube, it is possible to lengthen the substantially cylindrical rear part of the separator so as to dispose thereat the auxiliary coils whose positioning with respect to the deflection coils would be performed beforehand.

30 To increase the effect of the auxiliary coils, the latter must be placed as close as possible to the electron beams, this implying, if they are supported by the rear part of the separator, that the cross section of said part be as small as possible.

35 However, the substantially cylindrical rear part of the separator must possess a transverse cross section of minimum thickness so as to allow the separator to be made in a simple manner by injecting plastic into a mold, too small a thickness not

guaranteeing correct filling of the mold during the making of the component.

Moreover, the internal surface of the substantially cylindrical rear part must allow the tilt movements of the front part, thus preventing said internal surface from coming as close as possible to the surface of the tube, and forcing a gap to be left between the internal surface of the separator and the neck of the tube.

The two mechanical constraints mentioned above are generally those taken into account when making the component, the deflection systems according to the prior art comprising auxiliary coils disposed over the periphery of the rear part of the separator, whose large thickness leads to the auxiliary coils being driven with very large currents owing to the low sensitivity of said coils, this low sensitivity stemming from the fact that these coils are situated at too great a distance from the beams.

The deflector according to the invention incorporates a separator which makes it possible to reduce to the maximum the distance between the auxiliary coils and the beams, while being easy to make and ensuring good mechanical durability. To do this, the deflector according to the invention comprises a pair of horizontal deflection coils and a pair of vertical deflection coils, a separator insulating the two pairs from one another and comprising means for supporting said deflector on the surface of the tube, the separator having a flared front part and a rear part in the shape of a substantially cylindrical ring, and extending along a longitudinal axis Z while surrounding the neck of the tube,

wherein the rear part exhibits a zone whose cross section in a plane perpendicular to the Z axis is such that the value of the radius of curvature of the internal periphery exhibits a minimum at at least two points of said internal periphery.

The invention will be better understood with the aid of the description hereinbelow and of the drawings among which:

- Figures 1 represents a cathode ray tube
5 equipped with a deflector according to the prior art,

- Figures 2 is a longitudinal sectional view of the rear part of a cathode ray tube equipped with a deflector according to the prior art,

- Figures 3 represents a transverse section
10 through the rear part of a cathode ray tube equipped with a deflector according to the prior art,

- Figures 4 illustrates a first embodiment of the invention,

- Figures 5 illustrates a second embodiment of
15 the invention,

- Figures 6 represents a sectional view along a vertical plane of the embodiment illustrated by Figures 4.

Figures 1 represents a system 2 for deflecting
20 the electron beams issuing from an electron gun disposed in a conventional manner at the rear of a cathode ray tube 1. Said system, also referred to as a deflector, comprises two pairs of coils 3 intended for the horizontal and vertical deflection of the beams,
25 the two pairs being insulated from one another by a separator 12, generally made of plastic injected into a mold. The separator comprises an annular front part 12, a flared intermediate part 11, and a substantially cylindrical shaped rear part 8 joined to the flared
30 part 10. The deflector, after adjusting its position on the neck 6 of the tube, is held in position with the aid of adjustable feet 13 at the front and of a locking ring 9 at the rear. Conventionally, an auxiliary coil 5, for example intended for modulating the horizontal
35 scan rate, is disposed on the neck of the tube behind the deflector 2. This arrangement has several drawbacks, such as for example the lengthening of the neck of the tube so as to allow the installation of the auxiliary coil as well as the awkward manipulation of

the deflector once this auxiliary coil has been installed.

Preferred thereto is the arrangement represented in Figures 2 in longitudinal section, in which the deflection coils are not represented, and in transverse section in Figures 3. The auxiliary coil 5 is here disposed on the external surface of the rear part of the separator 12 which is substantially cylindrical 8 and of constant thickness 21. This arrangement makes it possible to associate the auxiliary coils and the main deflection coils before installation on the neck of the tube but it impairs the sensitivity of the auxiliary coil 5 owing to its increased distance from the electron beam or beams on which it is intended to act. This distance is increased by the value of the thickness 21 of the rear part 8 of the separator, plus the space 20 which must be provided between the part 8 of the separator and the neck 6 of the tube so as to allow the "tilt" movements of the front 7 of the separator when adjusting the deflector on the neck of the tube. The value of the thickness 21 is chosen in such a way as to allow the rear part 8 of the separator to be made easily by vacuum injection of plastic.

Figures 4 and 5 represent a first embodiment of the invention. In this case the final adjustment of the deflector on the neck of the tube requires a tilting movement of the front 7 of the deflector according to just one axis, for example about the horizontal axis X. The rear part 8 of the separator is divided into two zones 30 and 31. The zone 30 is the zone to which the collar 9 will be clamped on the neck of the tube. The zone 31 supports the auxiliary coils 5 and terminates at 10 at the spot where the separator tends to be flared. Since the zone 30 is clamped on the neck of the tube, the tilting movements of the front part of the separator affect only the zone 31 of the rear part 8.

Starting from a thickness 21 required to ensure good mechanical durability of the separator, the thickness of the part 8 is reduced in favored directions. In this case, the directions of the intersections of the separator with the vertical plane YZ allow the tilting movements about the horizontal axis. As illustrated by Figures 4, it follows that the thickness 21 along the horizontal axis is smaller than the thickness 22 along the direction of the vertical axis.

Illustrated in Figures 4 are the relative positions of the separator and of the neck of the tube, said neck being represented in its extreme positions 23 and 24 in a transverse sectional view at the level of the zone 10 of joining with the flared part 10 of said separator. The point O represents the center of the neck of the tube when the deflection system undergoes no tilting movement of the front part 7, the points O' and O'' represent the relative positions of the center of the neck of the tube in the separator in the extreme positions of tilting of the front part 7. Referring to Figures 6, it may be seen that the value of the offset Δ , relative to the center of the neck of the tube at the level of the join 10, is calculated by taking into account the maximum allowable angle of tilt and the length of the part 31. It follows that the thickness 22 decreases as one proceeds away from the zone 30 supporting the collar, toward the zone 10 of joining to the flared part of the separator. The external surface 26 of the separator in the rear zone remains, in a transverse cross-sectional plane, substantially circular while its internal surface has a variable radius of curvature, with a minimum value, at the level of the two zones of minimum thickness, corresponding to the points of intersection with the YZ plane, and a maximum value, at the level of the two zones of maximum thickness, corresponding to the points of intersection with the XZ plane.

In the case where the tilt is adjusted merely by tilting the front part about a vertical axis, the resulting structure of the zone 31 would be identical to that described earlier, the zones of maximum and minimum thickness being simply radially offset by 90° about the longitudinal axis Z.

The second embodiment illustrated by Figures 5 results from a further constraint relating to the tilting movements of the front part, which, here, must be performed both about a vertical axis and about a horizontal axis. In this case, in the transverse sectional view of Figures 5 depicted at the level of the join zone 10, the extreme positions which may be occupied by the center of the external circular surface 40 of the neck of the tube are displaced according to the points O1 to O8. In these extreme positions, the neck of the tube comes into contact with the internal surface 25 of the separator. The gaps of value Δ , representing the relative displacement of the center of the circular surface 40 with respect to the internal surface 25 of the separator along the horizontal and vertical directions, are calculated as before on the basis of the length of the part 31 and of the maximum angle of tilt.

In this case, this results in an internal surface 25 of the cylindrical part 31 defined by a variable radius of curvature, this radius of curvature having, at four points A, B, C, D symmetrically disposed with respect to the X and Y axes, a smaller value than at four points E, F, G, H. The corresponding external surface 26 being circular so as to receive the auxiliary coils, the thickness of the rear part 31 of the separator exhibits in a transverse cross section four zones at the level of the points A, B, C, D of lesser thickness than the thickness of the other four zones at the level of the points E, F, G, H.

For example, to define the profile of the bore of the rear part of a separator according to the invention comprising as constraint a maximum value of

tilt along the X and Y axes of $\pm 0.5^\circ$, with a length of the part 31 fixed at 30 mm, the relative movement of the center of the neck of the tube in the bore is calculated firstly as:

5 $\Delta = 30 \times \tan(0.5^\circ) = 0.26 \text{ mm.}$

Based on this value and on the value of the external diameter of the neck, one defines the internal surface area. Thus, for a tube with neck diameter equal to 29.7 mm, the points A, B, C, D are situated a distance equal to:

10 $OA = (29.7/2) + 0.26 \times \sqrt{2} = 15.22 \text{ mm}$
from the center O.

The points E, F, G, H are situated a distance equal to:

15 $OE = (29.7/2) + 0.26 = 15.11 \text{ mm}$
from the center O.

The diameter of the outside surface 26 is chosen at a minimum so as to satisfy the mechanical strength constraints and plastic injection molding constraints. In the prior art where the internal surface is conical, the minimum thickness to obtain good injection of plastic into the mold leads to the choice of a thickness of around 0.9 mm in the join zone 10.

25 The advantage of the invention is that it makes it possible to choose a smaller outside diameter than in the prior art where the thickness was constant: this is because, within the framework of the invention, choosing a very small thickness about the points A, B, C, D does not compromise the injection of plastic into these zones since the plastic can penetrate laterally through the zones of greater thickness, at E, F, G, H for example. Thus, the minimum thickness which can be obtained in the join zone can drop here and there to 35 0.79 mm, i.e. a thickness reduction of around 12%.



CLAIMS

1. A device for deflecting the electron beam or beams for a cathode ray tube (1) comprising a pair of horizontal deflection coils and a pair of vertical deflection coils, a separator (12) insulating the two pairs from one another and comprising means (9, 13) for supporting said device on the surface of the tube, the separator having a flared front part (11) and a rear part in the shape of a substantially cylindrical ring (8), and extending along a longitudinal axis Z while surrounding the neck (6) of the tube,

wherein the rear part exhibits a zone (31) whose cross section in a plane perpendicular to the Z axis is such that the value of the radius of curvature of the internal periphery (25) exhibits a minimum at at least two points of said internal periphery.

2. The deflection device as claimed in claim 1, wherein the value of the radius of curvature of the internal periphery exhibits a minimum of four points (A, B, C, D) of said internal periphery disposed symmetrically with respect to the horizontal axis X and to the vertical axis Y.

3. A device for deflecting the electron beam or beams for cathode ray tube (1) comprising a pair of horizontal deflection coils and a pair of vertical deflection coils, a separator (12) insulating the two pairs from one another and comprising means (9, 13) for supporting said device on the surface of the tube, the separator having a flared front part (11) and a rear part in the shape of a substantially cylindrical ring (8), and extending along a longitudinal axis Z while surrounding the neck of the tube,

wherein the rear part exhibits a zone whose cross section, in a plane perpendicular to the Z axis, is such that it exhibits a variable thickness.

4. The device (10) for deflecting the electron beam or beams for cathode ray tube (1) as claimed in the previous claim, wherein the variable thickness of

the cross section of the cylindrical rear part exhibits a minimum value at at least two points of said cross section.

5. The device as claimed in the preceding claim, wherein the minimum value of the thickness decreases from the rear toward the front of the cylindrical ring.

6. A cathode ray tube comprising a device for deflecting the electron beam or beams in accordance with any one of the preceding claims.

