

The invention relates to a method for winding for a non radial winding of a deflector for a cathode ray tube.

Trichromatic cathode ray tubes with aligned gun are actually equipped with deflectors which realize themselves the self-convergence of the electron beams and the corrections of the geometry of the image. The line field, created by saddle shaped coils, is called "with positive astigmatism", while the frame field is called "with negative medium astigmatism" to provide the convergences and "with positive front astigmatism" to provide the correction of geometry.

In the field of public television, various methods are used to realize a frame winding in accordance with said requirements : either a saddle shaped coil, or a toroid can be used. The toroid can be realized either with a radial frame cooperating with field shaping devices (ferromagnetic parts mounted on the deflector), or by using a technique with an inclined winding with a posterior angle which is bigger than the anterior angle, whereby such a winding can also be associated to magnetic correction means. This last solution, widely used, generally calls on one of the three following techniques to realize the winding :

- parts made of plastic material and provided with notches which are fixed at the front and at the back of the ferrite are used, whereby these notches determine the inclination of the wire of the winding. This method enables to obtain strong inclinations of the wire but is expensive because it requires the use of special parts and additional handling of these parts, which increases the manufacturing time.
- the wire is wound on the bare ferrite, which is eventually notched, but the inclination of the wire is then very limited (approximately 15° at the maximum) because the wire tends to slip in an asymmetrical way.

- or at last, to avoid the slipping of the wire, adhesive elements, which are deposited on the ferrite in the anterior and posterior planes are used, whereby these elements can be adhesive tapes, glues, waxes etc. Such a method is expensive, difficult to automatize and does not allow to obtain inclinations of the wire which are higher than approximately 20° .

The realization of a toroidal deflecting coil, presented in the Japanese patent 58-133744, describes a toroid in which the slipping of a first layer is unlikely because it has a small winding angle, followed by a subsequent layer which has a big winding angle and which depends on the precedent layer to avoid the slipping.

The method according to the invention consists in realizing a first winding layer at least approximately radially with a big coil pitch, then in depositing the following non radial layers by using at least one part of the wires of the first layer so as to avoid the slipping of the following layers.

The invention shall be better understood when reading the description of an embodiment which is a non restrictive example and which is illustrated on the annexed drawings.

Figures 1 to 4 are different views of a frame winding of the prior art using plastic notches.

Figures 5 and 6 are front and side views of a frame winding of the prior art using adhesive agents for the retention of the wire.

Figure 7 is a partial top view of a classical winding machine during the realization of the first layer of the winding according to the present invention.

Figure 8 is a side view of a half ferrite wound according to the invention during the winding of the non radial layers.

Figures 9 and 10 are back and side views of a frame winding with several layers according to the invention.

Figures 1 and 2 are front and back exploded views of two half ferrites 1, 2, each of which consists respectively of a half frame winding 3, 4. The wires of the half windings 3, 4 are not placed radially, i.e. they are not parallel to the generating lines of the conical surface formed by the half ferrites 1, 2. These wires form a variable inclination angle, relatively to these generating lines, depending on the position of the strands of the wires in the winding and on the angular position of the notches. To maintain all the turns of both half windings, plastic parts with notches 5, 6 and 7, 8 respectively are fixed on the front anterior and posterior faces of each half ferrite 1, 2. The successive turns of the half windings 3, 4 are maintained by these notches so that they can be wound with a high angle of inclination.

Two side views, considered at 180° the one relatively to the other, of a deflector which is finished and which has been realized from elements of fig. 1 and 2, are represented on figures 3 and 4.

Another embodiment of a deflector of the prior art has been represented on figures 5 and 6. For this embodiment, eight segments made of adhesive material 9 to 16, for example, double-faced adhesive tape or an adhesive paste, are deposited on the front anterior and posterior faces of the two half ferrites or near these front faces at the periphery of these half ferrites. These segments are deposited at the ends of the half windings 17, 18 of the deflector 19 in the sense of the periphery and slightly project outwards. Because it is generally sufficient to immobilize the

extreme turns of the first layer to prevent the turns of the following layers from slipping.

The method of the invention shall now be described with reference to the figures 7 to 10. The machine for winding, partially represented on figure 7, principally consists of a device 20 for maintaining and rotating the half ferrites 21 and of a rotative wire guide 22 (more known under the english designation "flyer"), the axis of rotation 23 of which is perpendicular to the axis B of the half ferrites 21 in radial winding position.

On figure 7, a half ferrite 21 has been represented on which the wire guide 22 is depositing the radial winding layer 24 with great pitch. Since the turns of this first layer are substantially radial (i.e. effectively radial or inclined at a few degrees), they have a constant positioning relatively to the conical ring portion formed by the half ferrite, the generating line of which is also radial. It is difficult to move these turns when depositing the following non radial layers (or at least for the second layer which guides the following ones) for which they act as catch notches. Of course, the radial winding and the non radial winding are made out of the same wire, continuously.

According to a first embodiment of the invention, the pitch (angle of rotation of the ferrite or of the "flyer" around the axis B for one turn) of this first layer 24 is constant and equal to approximately 2 to 5 times the pitch of a winding with contiguous turns made of the same wire.

According to a second embodiment of the invention, this pitch is variable : it has a first value P1 at the ends of the layer and a second value P2, higher than P1, at the middle of the layer. Preferably, P1 is equal to approximately 2 to 5 times said coil

pitch with contiguous turns and P2 is equal to approximately 2 to 3 times P1. As it can be seen on figures 8 to 10, the layer 24 must be wide enough particularly at the posterior part of the ferrite and slightly protrudes at the front part (with 2 to 5 turns approximately) of the following layers so as to be sure that the extreme turns of the non radial winding will always be maintained by those of the layer 24 without being necessary to position with a high precision the first turn of the non radial winding respectively to the layer 24.

To realize the non radial windings according to the invention, the half ferrite 21 is inclined around an axis contained in the rupture plane P (breakage plane between two half ferrites formed by rupture of an entire ferrite). On figure 8, we see the trace T of this axis (which is perpendicular to the plane of the drawing). Let B be the axis of the machine (axis around which the machine rotates the half ferrites to realize the radial windings). The angle I formed by B and P is the angle of inclination of the ferrite. The angles of inclination of the different turns of the non radial winding 25 depend on the angle I and on the angular position of these turns in the winding.

The angular distribution of the different turns of the resulting winding (24 + 25) is the composition of the distribution of the different layers, the effect of the first being weak as far as its number of turns is small.

The middle inclination of a half ferrite which carries a non radial winding according to this invention is equal to that obtained with an inclined ferrite for all turns, reduced because the first layer is not inclined. If the total winding (24 + 25) has N turns and the first layer n turns, the equivalent inclination I_{eq} of the half ferrite 21 will be :

$$I_{eq} = I (N - n) / N$$

whereby l is the angle of inclination of the half ferrites (figure 8).

As an example, a winding of 440 turns in four layers with a pitch of 1° , which occupies an angle at center of 110° on a ferrite inclined with an angle $l = 20^\circ$ and made according to a method of the prior art, is equivalent to a winding according to the invention by winding a first radial layer of 40 turns with a pitch of $3,4^\circ$ (then occupying an angle at center of approximately 136°) on which four non radial layers of 100 turns each are wound with a pitch of $1,1^\circ$ on a ferrite inclined of $l' = 22^\circ$.

Moreover, it is advantageous that the pitch of coil of the non radial layers is higher than it would have been without the first radial layer so as to allow the wires of this first layer to be placed between the turns of the following layers of the winding without disturbing too much their arrangement.

The method of this invention can be implemented when a winding with an anterior angle of coverage (angle at center formed by the two extreme turns of the winding in a plane PA perpendicular to the axis of the ferrite) which is bigger than the posterior angle of coverage (i.e. for a plane PA through the anterior or posterior front face, respectively of the ferrite), and this with a first radial layer (like said layer 24). After having wound the first layer, the half ferrite is inclined in a direction opposite to that represented on figure 8. This type of winding is useful, particularly to realize a self-convergent deflector which gives an image with a very uniform definition.



CLAIMS

1. Method for winding for the non radial winding of wires to form a coil for a deflector for a cathode ray tube, according to which the deflector for the cathode ray tube has at least a first half core (21), according to which at least the first half core has a radius center, said method comprising following steps :
a first layer (24) of the coil is wound which is approximately radial up to the center with a pitch which is bigger in the middle of the first layer than at the ends of said layer and
a second layer (25) which is non radial is wound on the first layer (24) so that at least one part of the wires of the first layer avoid the slipping of the second layer.
2. Method for winding according to claim 1, according which the method for winding comprises following steps :
a first layer (24) of the coil is wound approximately radially to the center ;
a second non radial layer (25) of the coil is wound on the first layer (24) by using at least one part of the wires of the first layer (24) to avoid the slipping of the second layer (25), whereby the winding of the second layer (25) is stopped 2 to 5 turns before the end of the first layer (24).
3. Deflector for a cathode ray tube comprising :
a toroid on a core (21), said toroid winding having a first layer (24) wound approximately radially on said core (21) and a second layer (25) wound on the first layer (24), this second layer (25) being non radial, said first layer (24) having a bigger pitch in the middle of the layer than at the ends.



4. Deflector for a cathode ray tube according to claim 3, according to which the first layer (24) projects from the second layer (25) with 2 to 5 turns.