

DEVICE FOR APPLICATION OF GRAPHITE IN THE NECK OF CATHODE RAY TUBES

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BACKGROUND OF THE INVENTION

The invention relates to a device used to apply graphite to the inner surface of the neck of the cone of cathode ray tubes (CRT).

10 The purpose of this graphiting operation is to make this inside surface of the neck of the tube conducting to bring it to the same potential (25 KV) as that of the grid that is in contact with the top shield cup.

 This operation is delicate since, for reasons concerning the operation of the tube, the maximum length of the graphiting in the neck is a critical
15 parameter. What is more, the thickness of the graphite layer must be uniform.

 For these reasons, and since the graphiting operation is unreliable when performed manually, this graphiting operation is today increasingly carried out using automatic machines. These machines must be adjustable
20 so as to vary the length of the graphited section in the neck of the CRT, which depends on the angle of deviation of the CRT (from 90° to 110°).

SUMMARY OF THE INVENTION

25 The purpose of the present invention is to respond to these requirements and resolve all the common problems of graphiting the neck of a CRT. The device according to the invention is equipped with means enabling it to be adapted to all types of CRT, whatever their angle of deviation, these means cooperating with the actual graphite application
30 system of the device such that the application of graphite within the neck of the CRT is controlled both in thickness and length.

 A device and a method according to the present invention are described respectively in Claims 1 and 10 of Patent Abstracts of Japan, Vol. 10, N.79 (E-391), (2186), 28.03.86 and JP-A-60 225 330 describes a machine and a

method for applying a layer of graphite on the inner surface of the neck of a cone of a CRT. The machine comprises a table to support the base of the cone and means of determining the type of tube, these means including a measuring device that measure the size of the tube and a sensor that
5 measures the overall length of the cone. To apply the graphite to the inner surface of the neck, a brush is inserted in the cone via the bottom of the supporting table, the brush then making back-and-forth movements inside the neck.

The present invention is a device for application of a layer of graphite
10 on the inner surface of the neck of a cathode ray tube over a given area located between a limiting plane and a reference plane, characterized in that it includes, first, two brackets free to pivot about vertical axes, each fitted with a collar that is designed to fit closely about the neck of the cone of the CRT, two brackets being provided so as to be able to handle two different types of
15 cones of different angles of deviation, said collar having a bearing face that defines said reference plane that is perpendicular to the axis of the cone and serves as a stop for the neck of the cone; secondly, a table used to support the base of the cone and fitted with means of centering the base of the cone, this table being able to be raised to bring the cone against said reference
20 plane; and finally, a graphite applicator system which can be brought into contact with the inner surface of the neck of the CRT at said limiting plane and which can be displaced so as to apply a layer of graphite inside the neck from said limiting plane to at least said reference plane.

25 BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and other advantages and characteristics will become clear on reading the following description making reference to the appended figures, of which:

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- Figure 1 is a diagram of a device according to the invention;
 - Figure 2 is a diagram showing detail of part of the device of figure 1;
 - Figure 3 is a plan view of the device in the direction of the arrow F of figure 1;

- Figures 4a and 4b show sections of the collars used for centering the necks of cones of 110° and 90° ;
- Figure 5 is a drawing of a CRT whose neck has been coated with graphite by means of the device according to the invention.

5 For clarity, the same parts in the various figures carry the same reference.

The figures illustrating the device according to the invention show that it is composed essentially of:

- a frame 110;
- 10 - a sub-assembly 2 comprising a supporting table 4 on which the cone 1 of the CRT is placed, this supporting table 4 being fitted with a system of centering stops to center the cone on the table 4. The table 4 can be moved in a vertical direction;
- two pivoting brackets 7a and 7b each fitted with a collar, respectively 15 9a and 9b, having bearing faces against which the cone presses when the table 4 is raised, this bearing face then delimiting a reference plane L_r ;
- a graphite applicator assembly 77 whose movement is linked to the movement of the vertical movement of the table 4 and is guided by means of a throat 25 whose shape and position guide the graphiting brush 21 to the 20 plane L_g that defines the upper limit of the area of the neck to be graphited;
- a set of thrustors (servo-cylinders), motors, springs, etc., attached to the frame 110 which between them control the various parts of the device.

The operation and description of the device according to the invention will now be described with reference to figures 1 and 2.

25 A frame 110 supports all the parts of the device, in particular the table 4 that supports the cone 1 whose inner surface is to be graphited.

This supporting table 4 is fitted, according to a characteristic of the invention, with a series of stops, for example six, known as centering stops, whose structure and operation are illustrated by figure 2.

30 We see that each of these stops $5_1, 5_2, 5_3, 5_4, 5_5$ and 5_6 is mounted on separate supports S_1, S_2, S_3, S_4, S_5 and S_6 each having a point of rotation p_1, p_2, p_3, p_4, p_5 and p_6 each of which is independent and attached to the table 4.

The linkages between these supports are by means of four tie-rods T_1, T_2, T_3 and T_4 each of a different, fixed length, associated with the supports

S_1, S_2, S_3, S_4, S_5 and S_6 such that, under the action of two thrusters C_1 and C_2 , the six stops $5_1, 5_2, 5_3, 5_4, 5_5$ and 5_6 can be brought into contact with the base of the cone 1 (shown by a dot-dash line in figure 2).

Note that the thruster C_1 controls the support S_1 and the thruster C_2 controls the support S_6 . Each independent thruster C_1 and C_2 can activate respectively the tie-rods T_1, T_2 and T_3 and the tie-rod T_4 to bring the stops into contact with the cone 1 by a pentographic action at six points a, b, c, d, e and f around its perimeter and thus center it perfectly on a vertical axis xx coinciding with the axis of the neck 3 of the cone 1.

Figure 1 shows the graphite applicator assembly 77. It also shows the cone 1 (solid line) when it has just been placed and centered on the table 4 by the six stops 5_1 to 5_6 , of which only one, labelled arbitrarily 5 , is shown in this figure for reasons of clarity.

The cone 1 is therefore centered in a horizontal plane on the table 4 which is in its lower position. In figure 1 we can see two other cones (hatched lines) also mounted on the table 4 which, in this case, is in its upper position. In effect, the table 4 can move up and down, as will be explained later. These two cones in the upper position correspond to two different CRTs with deviation angles of 90° and 110° .

According to a characteristic of the invention, two brackets 7a and 7b are attached to the frame 110; these are both shown in figure 3, whereas figure 1 shows only one of them (7a), for reasons of clarity.

These brackets, rotating about axes yy and zz , are fitted with collars 9a and 9b adapted to the external shape of the necks 3 which depends on the angle of deviation of the cone 1. The sectional diagrams in figures 4a and 4b show that the machined shapes of the bearing faces of the collars are such that the collars 9a and 9b are suitable for cones of 110° and 90° deviation, respectively.

These figures show that the machining angles of each of the collars are different so as to adapt to the different cones. These machining angles form a horizontal line defining a reference plane Lr with which the cone 1 will come into contact.

Before the table 4 is raised, the bracket 7a or 7b adapted to the CRT to be processed is oriented by rotation about its axis yy or zz by means of a

thruster 8a or 8b such that the axis xx of the collar 9a or 9b coincides with the axis xx of the neck 3. The table 4 is then moved upwards until the cone comes into contact with the reference plane Lr of the collar. In this position, the neck 3 is automatically centered and positioned in its upper position; this operation is repeatable and precise. The upward movement of the table 4 is described below.

The collar 9a or 9b being in the axis xx, the withdrawal of the rod 11 of the cylinder V raises a support 230 that is guided by a column 231 and supports both the arm 23 bearing the graphite applicator assembly 77 and the table 4. The raising of the table 4 is assisted by a counterweight 10 placed at the end of an arm 80 whose other end is in the form of a yoke tending to push the table 4 upwards. This arm 80 pivots about an axis 100 until the top of the cone 1 comes into contact with the reference plane Lr of the collar concerned (9a or 9b).

The raising of the table 4 is accompanied by the raising of the graphite applicator assembly 77 which moves upwards until the support 230 reaches the stop 44.

The graphite applicator assembly 77 comprises a brush and its support 21 that are mounted eccentrically on the drive shaft of a motor 22.

The brush/motor assembly 21/22 is attached to a lever 24 which can pivot about an axis 240 mounted on the arm 23.

In its rest position, the brush/motor assembly 21/22 is in horizontal position. When the rod 11 of the cylinder V is drawn upwards, the arm 23 moves upward causing upward rotation of the motor support 24 and the brush 21 attached to it about the axis 240.

According to a characteristic of the invention, the lever 24 follows a throat 25 during this upward movement, which at the end of the travel assures that the brush 21 is in a vertical position; the axis of the motor 22 coincides with the axis xx of the neck 3 and the brush is parallel to this axis, the axis of the brush being offset from the axis of the motor. In this way the combination of the shape and positioning of the throat 25, the fixed position of the collar 9a or 9b mounted on the bracket 7a or 7b, and the position of the stop 44 control precisely and reliably the uppermost position of the

graphiting brush 21 and thus the position of the upper limit Lg of the graphited section.

If the motor 22 is then started, it rotates the brush 21 which, owing to its eccentric mounting, applies graphite 3 previously picked up from the container 33 to the inside of the neck. During the application of graphite it is nevertheless necessary to provide a vertical movement to the brush in order to assure the joining of the graphite in the neck 3 with that in the cone 1 (figure 5). This vertical movement of the brush is achieved by the mechanism described below.

The arm 23 supporting the lever 24 is fitted on its lower section with a roller 26 that rides on a cam 28 driven by a motor 27.

In the operating position of the device, with the brush 21 in its uppermost position, the position of the cam 28 of the motor 27 is such that the roller 26 attached to the arm 23 is in its upper position, as shown in figure 1.

Thus, when the motor 27 is started and the cam 28 rotates, the arm 23 is forced downwards. The brush follows it while continuing to rotate. The downward travel of the brush is determined by the size of the cam 28. It is important to note that during this downward movement of the brush 21 due to the action of the cam 28 on the roller 26, the contact between the cam 28 and roller 26 is assured by the compression of a spring 30 fitted about a rod 29, which maintains upward pressure on the arm 23. This spring mounting of the arm 23 enables the table 4 to remain in its upper position during this downward movement of the brush.

One of the important characteristics of this mechanism is that the combination of the profile and the speed of rotation of the cam 28 enable a large range of possibilities of vertical scanning of the brush 21, with rapid, slow or even variable vertical movement of the brush, which will determine the thickness and distribution of the graphite applied.

When the graphiting operation is complete, the operations described above are reversed: the rod 11 of the cylinder V is pushed downwards; the arm 23 and the brush 21 move downwards drawing with them the lever 80 with the counterweight 10. The table 4 also moves downwards with the cone 1, its neck 3 now graphited.

The thrusters C_1 and C_2 are then activated to release the centering stops 5_1 , 5_2 , 5_3 , 5_4 , 5_5 and 5_6 . The thruster 8a (or 8b) activates to move the bracket 7a (or 7b) along with its collar 9a (or 9b) to one side.

The graphited cone 1 is then removed manually or automatically to
5 enable loading of another cone.

As shown in figure 5, the combination of means used in the device according to the invention enable a section of length l to be graphited between the reference plane L_r and the plane L_g , the latter corresponding to the maximum height attained by the graphiting brush 21.

10 In addition, by adapting the shape of the cam 28 driving the roller 26, this graphited section can be extended below the reference plane L_r so as to overlap the graphite previously deposited inside the cone before the cone was mounted on the device according to the invention. The overlap area A is shown in figure 5 as a cross-hatched area. The position of the anode contact
15 Ba is included as a reminder.

Automatic systems of loading and unloading the cones can be associated with this device. It can also be loaded manually, in which case the automation concerns only the device itself during the stages of movement described above.

20 The device according to the invention has many advantages. In particular it accepts two types of cone (deviations of 90° or 110°). It assures a very precise upper limit of the graphited section in the neck 3 thanks to the graphite applicator assembly 77 using the rotating brush 21 which is positioned automatically and precisely at an upper limit L_g . It provides for
25 regulation of the speed of rotation of the brush 21 and also its speed of descent during the graphiting stage. The device is fitted with centering and guiding devices which are necessary to assure a constant thickness of graphite over a precisely delimited area in an automatic and repeatable manner.

30 The invention is applicable in particular to the fabrication of cathode ray tubes.

**WHAT IS CLAIMED IS**

1. Device for application of a layer of graphite on the inner surface of the neck of a cathode ray tube over a given area located between a limiting plane and a reference plane, characterized in that it includes, first, two brackets free to pivot about vertical axes, each fitted with a collar that is designed to fit closely about the neck of the cone of the CRT, two brackets being provided so as to be able to handle two different types of cones of different angles of deviation, said collar having a bearing face that defines said reference plane that is perpendicular to the axis of the cone and serves as a stop for the neck of the cone; secondly, a table used to support the base of the cone and fitted with means of centering the base of the cone, this table being able to be raised to bring the cone against said reference plane; and finally, a graphite applicator system which can be brought into contact with the inner surface of the neck of the CRT in said limiting plane and which can be displaced so as to apply a layer of graphite inside the neck from said limiting plane to at least said reference plane.
2. Device according to claim 1, wherein the vertical movement is assured by means of a push-pull cylinder whose rod is attached to a support guided by a column, this support being attached to both an arm bearing said graphite applicator system and said table supporting the base of the cone.
3. Device according to claim 2, wherein the vertical movement of said supporting table is assisted by a counterweight mounted on the end of an arm pivoting about an axis.
4. Device according to any of the preceding claims, wherein said graphite applicator system is constituted by a brush and its support mounted eccentrically on the drive shaft of a motor, the brush/motor assembly being attached to a lever which can pivot about an axis mounted on



said arm bearing the graphite applicator system such that in its rest position the brush/motor assembly is in a horizontal position.

5. Device according to claim 4, wherein said graphite applicator system also includes a throat whose purpose is to guide the movement of said lever such that during the upward movement of the rod of said push-pull cylinder said arm bearing the graphite applicator system is lifted causing rotation of said lever about an axis, the brush moving into a vertical position parallel to the axis of the neck of the cone.
6. Device according to claim 5, wherein the uppermost position of the brush coincides with said limiting plane.
7. Device according to claim 6, wherein when the brush is in its uppermost position said motor rotates the brush which, being eccentrically mounted, applies graphite picked up previously from a container when said brush/motor assembly was in its rest position to the neck of the cone.
8. Device according to any of the preceding claims, characterized in that it also includes a motor-driven cam that drives a roller attached to said arm bearing the graphite applicator system, the shape of the cam being such that its rotation causes the arm to be pushed downwards thus bringing the brush to its lower limiting position in said reference plane, this downward movement being associated with the compression of a spring, which enables said supporting table to remain in its upper position.
9. Device according to claim 8, wherein the combination of the shape and speed of rotation of said motor-driven cam enable the speed of descent of said brush to be regulated during the phase of application of graphite.



10. Method of application of a layer of graphite on the inner surface of the neck of the cone of cathode ray tubes over a given area located between a limiting plane and a reference plane, that includes the following steps:

- 5 - position the base of the cone of the cathode ray tube on a supporting table of a graphiting device;
- orient one of two collars mounted on pivoting brackets so that it engages the neck of said cone, each of these collars having a bearing face that defines said reference plane perpendicular to the
- 10 axis of the cone and provides a stop for the neck of the cone;
- center said cone in a horizontal plane on said supporting table such that the vertical axis of said collar coincides with the vertical axis of the neck of the cone;
- raise said supporting table bearing said cone to a position in which
- 15 the cone comes into contact with said stopping reference plane;
- raise a graphite applicator assembly constituted by an arm on which is mounted an axis about which a brush/motor assembly can pivot, this brush/motor assembly rotating from a horizontal position to a vertical position when the arm is raised, such that the brush of the
- 20 brush/motor assembly is located at the position of said limiting plane in the neck of the cone, parallel to and offset from the axis of the neck;
- activate the brush/motor assembly to rotate the brush so as to apply a uniform layer of graphite to the neck;
- 25 - lower the brush while it is rotating to move it down from said limiting plane to at least said reference plane, while holding the supporting table in its upper position, the lowering of the brush being produced by a second motor driving a cam in contact with a roller attached to said arm supporting the brush/motor assembly, the cam pushing the
- 30 arm downwards to a predefined lowermost position.