

The present invention relates to a device for the implantation of cathodes in guns of cathode ray tubes, particularly for the simultaneous implantation of the three cathodes of a trichromatic tube.

A method for fixing cathodes of electron guns of cathode ray tubes consists in utilizing "lugs" having approximately the form of muffs widening on one side, the flared part ending in a flange, this flange being fixed on a bearing electrode placed just in the rear of the first grid of the gun. The cathode is introduced into this lug and can move freely therein, this cathode being held up at the end of a hollow rod connected to a vacuum tapping, this rod being generally called "implantation electrode". When the distance between the active face of the cathode and the first or second grid is adjusted at the wanted value, the cathode is welded into the lug, generally spot or laser welded, in three or four spots.

However, in spite of all the care taken to the fixing of the lugs, it often happens that the lugs have position defects such as translation offset or inclination in relation to the theoretical axis. Such defects are detrimental to the good positioning of the cathodes and to their adjustment and might damage them when inserting them into the lugs or when removing the inserting instruments.

The object of the present invention is a device enabling, during the automatic insertion of the cathodes into the lugs, the elimination of the position and alignment defects of the three cathode lugs of an electron gun. This device should also allow the forward-backward motion of the cathode in the lug to perform the adjustment of the distance between the cathode and the

first grid of the gun, practically without clearance between the cathode and its lug, even when implanting simultaneously the three cathodes of a trichromatic tube.

The implantation device according to the invention consists of at least one cylindrical, hollow "implantation electrode", an end of which is intended to accommodate the cathode to be implanted which is maintained in position on this end by aspiration and the other end of which is maintained by the same aspiration and is connected to a support which is movable parallel to the axis of the gun in the lug of which a cathode is to be implanted and is characterized in that the outer diameter of the front end of the electrode, from the front face of this end, is approximately equal, on a short length, to the inner diameter of the body of the cathode and then, on a length which is at least equal to the length of the cathode, less than said inner diameter. Advantageously, the transition between these two parts of the implantation electrode with different diameters is conical with an angle at center of approximately 20° at the maximum.

According to another characteristic of the invention, the end of the implantation electrode which is connected to a movable support is articulated in relation thereto in the manner of a ball joint.

The present invention will better be understood by reading the detailed description of an embodiment which is taken as a non-restrictive example and illustrated on the annexed figures.

Fig. 1 is a simplified cutaway view of a device for implantation of cathodes according to the invention.

Fig. 2 is a view of the device of fig. 1 during the insertion of a cathode into its lug.

Fig. 3 is a view of the device of fig. 1 during its removal.

The device for implantation of cathodes represented on the drawing essentially consists of a tubular implantation electrode 1 connected to a support 2 which is movable through a motor 4 in a direction parallel to the axis of the gun in the lug of which the device must implant a cathode 3 (of course when the gun is in implantation position). In the fig. 1, the electrode 1 is represented at rest, i.e. its longitudinal axis 5 is parallel to the displacement direction of the gun 13. This position of "rest" is maintained by aspiration or for example by springs (which are not represented).

The electrode 1 has the general form of a hollow cylinder with circular section. Its free end 6 (that which is not connected to the support 2) has, on a short length from its front face 7, for example on a length of approximately 0,5 to 1 mm, an outer diameter which is practically equal to the minimal tolerated inner diameter of the cathodes, which is for example 1,96 mm, so that the cathodes can be passed onto the electrode 1 with a smooth friction in the most defavourable case. The body 8 of the electrode 1 has an outer diameter (for example 1,72 mm) which is less than that of the end 6 (for the same example: 1,96 mm). The transition 9 between the end 6 and the body 8 is conical with an angle at center A of approximately 20° or less. The

length of the body 8 is at least equal to approximately the length of the cathodes 3.

The body 8 of the electrode 1 ends in a device 10 which forms a ball joint articulated in the support 2. This articulation works with a very smooth friction so that the electrode 1 can be removed from a cathode practically without effort when this cathode is welded in a lug, even if the lug is offset (as explained hereunder in a more detailed manner).

The support 2 also has the general form of a hollow cylinder and is connected to a vacuum pump (which is not represented). The drilled hole 11 of the body 2 communicates with the axial bore 12 of the electrode 1. This bore 12 ends on the front face 7 so that, when a cathode 3 is passed on the electrode 1, its bottom wall is firmly maintained against the face 7 of the electrode 1 as long as the vacuum pump communicates with the support 2. Of course, the aspiration of this pump compensates widely the leaks which could take place at the level of the ball joint 10.

The operation of the device described above is as follows. When this device is in the backward position, a gun (partially visible on figures 2 and 3) is set without cathodes. An automatic handling device (which is not represented) passes a cathode onto the electrode 1, the vacuum pump communicating continuously with the support 2. The cathode 3 is then firmly maintained on the electrode 1 (figure 1).

The gun 13 is moved forward towards the support 2, the electrode 1 still being in said position of "rest". We presume that, as represented in figs. 2 and 3, the axis

14A of the lug 14 into which the cathode 3 must be fixed does not merge with the axis 15 of the gun because it is difficult to keep very severe tolerances when welding the lug 14 onto its support 14'. When the electrode 1 is in the position of "rest", its axis merges with the axis 15. Since the outer diameter of the front part 16 of the cathode 3 is less than the diameter of the aperture 17 of the lug 14, this front part can penetrate into the lug. Of course, we presume that the distance tolerated between the axes 15 and 14A is less than the difference between the inner radius of the aperture 17 and the outer radius of the part 16 and that the distances which are greater than this difference lead to the refuse of the gun.

After introduction of the lug on the cathode and at a distance cathode-grid 1 which is greater than the desired distance, the motor 4 controls the forward motion of the support 2 until the distance between the emissive face 1 of the cathode 3 and the first grid (G1) of the gun reaches the desired value (this distance between the cathode and G1 can eventually be determined indirectly by measuring, in a manner known in itself, the distance between the cathode and the second grid).

The cathode 3 comprises a back part 19, the outer diameter of which is greater than the outer diameter of its front part 16. The transition 20 between the parts 16 and 19 of the cathode 3 has a conical form. The outer diameter of the part 19 is slightly less than the inner diameter of the aperture 17 of the lug 14.

During the motion of the gun 13 towards the cathode 3, its transition 20 rubs on the aperture 17 so that the cathode swings (arrow 21) in a rotation around the end 6

of the electrode 1 :since the length of this end 6 is very short (approximately 0,5 mm as specified above), it can be compared to a ball joint. Of course, the aspiration or the springs or the similar device which maintains the electrode 1 in a position of "rest" does not exert a too important strength on the electrode so that it can be easily overcome by a slight friction between the end 6 and the inner face of the cathode. Thus, when the cathode 3 is in a position in the lug 14, the median circumference 22 of its back part 19 is approximately concentric to the aperture 17. The welding of the cathode into the lug at the level of this median circumference 22 can be done by laser in two to four regularly spaced spots (spots 23 and 24 of fig. 3).

After this welding, the gun 13 is removed, the vacuum pump still being connected. Since the axis 3A of the cathode 3 welded in the lug 14 forms a certain angle B with the axis 15, the electrode 1 can be removed without being damaged only when it swings (arrow 25), which is possible thanks to the joint device 10 and to the fact that the end 6 of the electrode has a short length and can therefore easily be guided by the inner walls of the cathode. When the electrode 1 comes out of the cathode 3 under the effect of aspiration or of springs, it raises up and comes back into its position of "rest".

It should be noted that the center of the emissive face 18 of the cathode 3 is practically on the axis 15 because the electrode 1 does not swing when the cathode is being inserted, so that the axis of the electrode still merges with the axis 15 until the welding operation is finished (23, 24).

Since the support 2 may have small dimensions and since the length of the electrode 1 may be any as long as it is greater than the length of a cathode and is sufficiently rigid, three devices such as the one described above may be arranged the one near the other to implant simultaneously the three cathodes of a triple gun of a trichromatic tube. Of course, the driving motors (such as the motor 4) of the three electrodes are then driven independantly the one from the other.

C L A I M S

1. A device for the implantation of cathodes in guns of cathode ray tubes, particularly for the simultaneous implantation of the three cathodes of a trichromatic tube, consisting of at least one cylindrical, hollow "implantation electrode" (1), one end of which is intended to accomodate the cathode (3) to be implanted which is maintained in position on this end by aspiration and the other end of which is connected to a support (2) movable parallel to the axis (15) of the gun in the lug of which a cathode is to be implanted, characterized in that the outer diameter of the front end (6) of the electrode, from the front face (7) of this end, is approximately equal, on a short length, to the inner diameter of the body of the cathode, and then on a length which is at least equal to the length of the cathode, less that said inner diameter.
2. A device for implantation according to claim 1, characterized in that said short length is about 0,5 to 1 mm.
3. A device according to one of the claims 1 or 2, characterized in that the transition between the two parts of the electrode with different diameters is conical with an angle at center of approximately 20° at the maximum.
4. A device according to any of the preceding claims, characterized in that the end of the implantation electrode which is connected to a movable support is articulated in relation to the support in the manner of a ball joint (10).

