

1

The present invention has as an object a device for the simultaneous automatic control of the spacing between cathodes and second grid of an electron gun in a three-colour cathode ray tube.

The knowledge of the spacing between the emissive surface of each of the three cathodes and of the first grid (G1) of an electron gun in a three-colour cathode ray tube is very important in the manufacture of an electron gun in a cathode ray tube to ensure, on large scale manufacture, that the focussing qualities of the grids of the gun are constant. The measurement of this spacing can not be carried out directly, owing to the shape and dimensions of the gun.

According to the current state of the art, this spacing is determined indirectly by measuring the spacing between each cathode and the second grid (G2), access to this second grid being possible through the other grids, the spacing between G1 and G2 being estimated. However, the devices which are generally used for this purpose are cumbersome and do not permit the simultaneous measurement for the three cathodes, and their use in an automated measuring process does not guarantee against any risk of impact on the cathode or on the grid G2.

From the document R.C.A. TECHNICAL NOTES, No. 1322, December 1982, pages 1,2, Princeton, New Jersey (US); R.E.SCHLACK et al. : "G1-G2 Compensating Cathode Inserter" a device is known for measuring the spacing K-G2 comprising a sleeve, coming to rest on G2, in which a sensing pin moves, coming to rest on K, the movements of each of these two members being determined by a respective mechanical displacement measurer.

The present invention has as an object a device permitting the simultaneous automatic control of the spacing of each of the three cathodes to the grid G2, this device ensuring that

2

the measuring members are brought very gently into contact with the cathodes and G2, whilst carrying out a very rapid and accurate control.

In accordance with the present invention, the device for the simultaneous automatic control of the spacing between cathodes and the second grid of an electron gun in a three-colour cathode ray tube, of the type having a control member comprising a sleeve coming into contact with the second grid, within which moves a sensing pin which comes into contact with the cathode, the device comprising three control elements fixed on a common frame and each comprising a hollow cylindrical guide enclosing a coaxial sleeve capable of moving with a minimum of friction in the guide, a sensing pin moving with a minimum of friction in the sleeve, and being integral with the core of an electronic displacement measurer, whose body is integral with the sleeve.

The present invention will be better understood on reading the detailed description of a form of embodiment, taken as a non-restrictive example, and illustrated by the attached drawing, in which:

- figure 1 is a view, partially in section, of a control device according to the invention,
- figure 2 is a simplified diagram of a variant of the device of figure 1, showing in particular the connections with the electronic sensors, and
- figure 3 is a view in section of another variant of the device of figure 1.

The invention is explained hereinbelow with reference to an electronic gun in a three-colour tube comprising six prefocussing and focussing grids bearing the references G1 to G6, but it is to be understood that the invention is not

3

limited to such a gun, nor to such a number of grids.

The device of the invention is termed a control device, because it serves in general to check whether the spacings between cathodes and grid G2 of each gun in a series of guns which have just been assembled are comprised within determined limits, the spacings outside the limits leading to the guns being scrapped. However, this device can also serve to measure the individual absolute values of these spacings, for example to follow the development or statistical distribution of a manufacturing series.

The device of the invention comprises a frame 1 on which are fixed three identical control members 2, 3 and 4 which allow controls to be carried out of the cathode-G2 spacing for the cathodes 5, 6, 7 respectively (not shown in detail) of an electron gun, these cathodes producing electronic beams relating to the colours red, green and blue respectively. These three cathodes may, or may not, be aligned. In the present case, which is the most usual, these cathodes are aligned, i.e. their longitudinal axes are parallel and coplanar. The part of the control device which is directed towards the cathodes will be termed the anterior part, and the part enclosed in the frame 1 will be termed the posterior part.

The axes of the elements 2 to 4 are arranged in the same manner as those of the cathodes 5 to 7. The inter-axes of the elements 2 to 4 are equal to those of the cathodes 5 to 7. As the elements 2 to 4 are identical only element 2 will be described in detail hereinbelow.

The element 2, of a general tubular cylindrical shape, comprises a hollow cylindrical exterior guide 8, the posterior part 9 of which, which has a greater diameter than the anterior part, is fixed in a corresponding facing of the frame 1. This posterior part 9 of the guide 8 rests on

4

the base of the facing in which it is fixed. The anterior part 10 of the element 2, which projects from the frame 1, has a slightly smaller external diameter than the diameter of the orifices formed in grids G3 to G6 for the passage of the electronic beam. The length of the part 10 is such that when the frame 1 is in contact with, or very close to G6, the free end of this part 10 arrives substantially flush with G3, beside G2.

Inside the guide 8, a floating sleeve 11 is arranged, likewise of general hollow circular cylindrical shape. This sleeve 11 can move axially practically without friction inside the guide 8, due to two ball bearing housings 12, 13 respectively, arranged coaxially in the posterior part 9 and in the anterior part 10 of the guide 8, between the internal face of the guide and the external face of the sleeve.

The sleeve 11 projects from the anterior frontal face of the guide 8 at greater length than the maximum possible distance between the faces opposite G2 and G3. The sleeve 11 comprises a posterior part 14, which is also tubular and cylindrical, of greater interior diameter than the anterior part, this part 14 freely passing through an opening 15 arranged in the base of the lining in which is fixed the posterior part 9 of the guide 8. This posterior part is in the form of a cylindrical tube, closed at its end, with the exception of a small opening 14 A. The sleeve 11 comprises on its exterior surface an annular flange 16, the exterior diameter of which is slightly smaller than the interior diameter of the part 9 of the guide, this flange being situated between the ball bearing housing 12 and the base of the lining in which the part 9 is fixed; to allow the arrangement of a helicoidal spring 17 between this flange and the base of the lining, with this spring urging the sleeve 11 towards the front (towards the cathode 5, the device being in control position), without the flange 16, however, coming into abutment against the ball bearing

housing 12 in control position.

A sensing pin 18 is housed in the sleeve 11. The diameter of this pin is slightly smaller than the interior diameter of the anterior part of the sleeve, so as to be able to slide freely therein. A ball bearing housing 19, arranged in the posterior part of the sleeve, close to the junction with the anterior part, allows the pin 18 to move coaxially with the minimum of friction against the sleeve.

The pin 18, close to its posterior end, approximately at the level of the centre of the part 14, comprises a flange 20 forming a piston in the cylinder formed by the part 14, without this piston, however, rubbing the walls of the cylinder. Slightly beyond the piston 20, the end of the pin 20 is connected at the end to the cylindrical core 21 of a displacement measurer 22, arranged in the axis of the element 2, the body 23 of which is fixed to the interior of the sleeve 14. The core 21 is connected at its posterior end to a short pin 24, ending in a plate, with a spring 25 resting on the one hand against this plate and on the other hand against the posterior closed frontal face of the sleeve 14, this spring urging towards the front the assembly of pin 18, core 21 and pin 24.

An inlet for compressed air 26 is fixed to the wall of the part 14 of the sleeve 11, before the piston 20 (sufficiently before for the piston not to pass beyond it in the extended position of the pin 18), this inlet opening out into the cylinder formed by the part 14 and being connected to a source of compressed air (not shown). The pressure exerted by the compressed air coming from this source must be able to overcome the contrary pressure of the spring 25 and urge the pin 18 towards the rear, despite the leaks occurring at the level of the piston 20 and at the outlet of the anterior part of the sleeve 11, means for sealing off these leaks being prohibited, given that, as specified above, the pin 18

must be able to move with the minimum of friction inside the sleeve 11.

According to a variant, which is not shown, this system of pneumatic actuation can be replaced by an electro-magnet, urging the pin 18 towards the rear.

The frame 1 comprises an arm 27 in excrescence, extending parallel to the axes of the elements 2 to 5, towards the front, substantially up to the level of the anterior frontal faces of the guides of these elements. At the end of the arm 27, a precision contactor 28 is fixed, the sensor 29 of which extends, substantially perpendicularly to the axes of the elements 2 to 4, in the direction of these elements, so as to come into contact with the grid G2, beside G3, when the frame of the control device is in place, i.e. when the elements 2 to 4 have been introduced into the corresponding orifices of the grids G6 to G3, the frontal faces of the guides of these elements arriving flush with the face of G3, which is opposite G2. The anterior frontal faces of the three sleeves then rest on the face of G2, which is opposite G3, and the three sensing pins are held in retracted position in the corresponding sleeves, which they do not pass beyond, under the effect of the pressure exerted by the compressed air on the three pistons (the piston 20 and the homologous pistons of the elements 3 and 4) of the sensing pins. As soon as the sensor 29 comes into contact with G2, a device (not shown) stops the delivery of the compressed air, and the three sensing pins, under the action of their springs (spring 25 and homologous springs), gently come into contact with the active faces of the cathodes 5 to 7.

According to a variant, diagrammatically represented in figure 2, the sleeve of the central element 3 forms a single piece with its guide, i.e. it is fixed with respect to the frame 1, with the contactor 28 releasing itself when the anterior frontal face of the sleeve of this central element

comes into contact with G2. Of course, for this variant, the elements permitting the axial mobility of the sleeve are omitted, i.e. the corresponding ball bearing housings and spring.

In figure 2, there have been shown in a simplified manner, apart from the grids and the cathodes of the gun which is subjected to control, the sleeves 11, 30 and 31 of the three control members 2, 3 4 respectively, their sensing pins 18, 32, 33 respectively, and their displacement measurers 22, 34 and 35 respectively, and also the spring 17 of the sleeve 11 and the spring 36 of the sleeve 31, the sleeve 30 not requiring a spring for this variant. It is to be understood that the reasoning is valid if the element 3 is identical to the elements 2 and 4, provided that it is taken into account that the sleeve of this member is then mobile.

When the control device is put into position, the sleeve 30 comes into contact with G2, the sleeves 11 and 31 being likewise applied, under the action of their respective springs 17 and 36, to G2. These springs allow their sleeves to be applied, whilst ensuring a good contact even if G2 has a flatness defect or is not perpendicular to the axes of the control members 2 to 4.

With the bodies of the sensors 22, 34 and 35 being integral with the sleeves 11, 30 and 31 respectively, and the sensing pins 18, 32 and 33 being integral with the cores of the measurers 22, 34 and 35 respectively, each measurer provides the absolute value of the corresponding cathode-G2 spacing (or, more simply, allows it to be determined, by an all or nothing response, whether this spacing is in fact in a determine fork or not). These measurements or controls are carried out simultaneously, when the ends of the sensing pins 18, 32, 33 are in fact in contact with the corresponding cathodes. These measurements or controls can be triggered by the closure of the contactor 28, after a

slight delay period, necessary to allow the sensing pins to leave their sleeves and come into contact with the cathodes. One can thus automate the measurement or the control easily and with certainty, with the sensing pins only leaving their sleeves when the control device is in fact in place with respect to the gun.

In figure 3, an advantageous variant of the control device according to the invention has been shown, for which variant the assembly of the measurement sensor, i.e. the sensing pin with its floating sleeve, is moved, instead of only moving the pin (pin 18 of figure 1), which brings about additional advantages which are clarified hereinbelow.

The control device of figure 3 essentially comprises three identical measuring elements 36, 37, 38. Only one of these elements, element 36, will be described in detail. This element 36 comprises an exterior sleeve 39, the exterior diameter of which is smaller than the diameter of the orifices of the grids G3 and G6. A floating sleeve 40 can move axially practically without friction inside the sleeve 39 due to two ball bearing housings 40, 42 arranged coaxially inside the posterior end (the end opposite the grid G1 in measuring position) by a part 43 of greater interior and exterior diameters than those of its body.

A sensor 44 in the form of a pin moves axially with very gentle friction inside the sleeve 40. The sensor 44 has approximately the same length as the sleeve 40 (including its end 43). On the sensor 44 there is fixed a disc 45, moving inside the end 43. The placement of the disc 45 with respect to the sensor 44 is determined such that when the disc is in abutment against the base 46 of the end 43, the sensor passes beyond the anterior end of the sleeve 40 by a length l greater by approximately 1 to 2 mm than the maximum possible value of the distance d between a cathode K and the face of G2 beside G3. A spring 47 is arranged

between the disc 45 and a ring 48 fixed inside the end 43, this spring bearing on the face of the disk opposite the base 46. The ring 48 extends up to the tip of the end 43. Inside the ring 48 there is fixed a displacement measuring device 49, inside the axial hole of which moves the posterior end 50 of the sensor 44, serving as a core for this measurer. A hood 51 closes off the end 43. The frame 52 supporting the three elements of the control device has been shown very diagrammatically in the drawing, so as to be able to represent different positions of this device in the same figure. Three of these positions are illustrated for each of the elements 36 to 38.

The element 36 illustrates the position of the control device when the three measuring elements have been introduced into the gun and when the anterior face of the sleeve 40 comes into abutment against G2 by being urged by the action of springs such as the spring 53 represented for the element 38 (the spring 53 in the present case is a traction spring arranged between a part 54 of the frame 52 and a collar 55 fixed around the end 43). The corresponding cathode has not been shown, so as to see better the extreme extended position of the sensor 44. The disc 45 is then bearing on the face 46 of the tubular end 43. When the sensor 44 is bearing on the cathode (cathode K opposite the element 37), this sensor returns very gently (approximately a few tenths of a millimetre, and a maximum of 1 to 2 mm) into the sleeve 40, which means that the disc 45 moves away by the same extent from the face 46. The spring 47 then applies the sensor against the cathode, as shown for the element 37.

When the measuring is completed (see element 38), a "fork" 56, which is actuated by a jack 57 fixed to the frame 52, and is arranged around the bodies of the three sleeves 40 of the elements 36 to 38, at the level of the junction with the ends 43, simultaneously pushes the ends 43 of these three

elements in the opposite direction to the cathodes, until, as shown for the element 38, the sensor 44 has completely returned inside the protective sleeve 39. Then the frame is moved so as to release the three elements of the gun.

The device comprising the sensors 28, 29 and triggering the extension of the sensing pins in the device of figure 1 can be adapted to the device of figure 3. In this case, it repels the fork 56 and therefore causes the simultaneous displacement of the sensors 44 and of their sleeves 40 towards the cathodes as soon as the sleeves 39 are in place with respect to the gun (as shown in figure 3).

The device described above, owing to the fact that on putting into measuring position and on retraction, the assembly of sensor 44 + sleeve 40 is moved, instead of moving solely the sensor (as was the case for the forms of embodiment of figures 1 and 2), presents the following advantages:

- the small stroke of the sensor with respect to the sleeve allows a precision micro-displacement measurer to be used
- as the displacements of great amplitude do not affect the measurer, elements of this measurer are therefore less subject to wear, and practically do not risk seizing
- the actual measuring system (sensor + interior sleeve + measurer) is easily removable, can be calibrated independently of its support (exterior sleeve, frame) and is therefore interchangeable quickly and without adjustment.

11
CLAIMS



1. A device for the simultaneous automatic control of the spacing between cathodes and second grid of an electron gun in a three-colour cathode ray tube, of the type having a control member comprising a sleeve coming into contact with the second grid, within which moves a sensing pin which comes into contact with the cathode, the device comprising three control elements (2, 3, 4) fixed on a common frame (1, 52) and each comprising a hollow cylindrical guide (8, 39) enclosing a coaxial sleeve (11, 40) capable of moving with a minimum of friction in the guide, a sensing pin (18, 44) moving with a minimum of friction in the sleeve and being integral with the core (21) of an electronic displacement measurer (22, 49), whose body is integral with the sleeve.
2. A device according to claim 1, characterized in that the sensing pin (44) and the inner sleeve (40) together are retracted by means of a fork (56).
3. A device according to claim 1, characterized in that each sensing pin is retracted into its sleeve by means of a pneumatic device (26), and is extended, into the control position, by means of a spring (25) urging it against the respective cathode (5).
4. A device according to claim 1, characterized by the fact that each pin is retracted into its sleeve by means of a pneumatic device and is extended, into the control position, by means of a second pneumatic device.
5. A device according to claim 1, characterized in that each pin is retracted into its sleeve by means of an electromagnet device and is extended, into the control position, by means of a spring urging it against the respective cathode.



6. A device according to ¹²any one of the preceding claims, characterized in that the sleeves and/or the pins move within ball bearing housings (12, 13, 19, 41, 42).
7. A device according to anyone of the preceding claims, characterized in that it comprises a sensing device (28, 29) triggering, by contact with the second grid of the electron gun (G2) when the device is put into position for the purpose of control, the extension of the sensing pins and the start of measuring.
8. A device according to claim 1, characterized in that within the central control member(s) the sleeve (30) is fixed relative to its guide, the sleeves (11, 31) of the other control elements being movable in the longitudinal direction.
9. A device according to anyone of claims 1 to 7, characterized by the fact that the sleeves in the three control members are movable longitudinally (Figure 1).