

The invention relates to a method and a device with a permanent magnet for the adjustment of the static convergence and/or the purity of a colour television tube.

A tube for colour television (or display) usually comprises three electron guns intended for exciting luminophores placed against the internal side of the envelope or front part of the tube. These luminophores are arranged in groups of three points (triads) or three strips and in each group, a point or a strip is intended for emitting, when it is excited, a light of a determined colour, generally red, green or blue.

In a tube which is usually used, a perforated mask is placed in front of the screen so that each luminophore is only excited by the electron gun intended for exciting the corresponding colour.

The sweep of the electron beams on the screen is obtained by two deflectors, the one for the horizontal deflection and the other for the vertical deflection ; each deflector consists of a coil supplied with current ; both coils are generally mounted on the same support around the neck and the flared part of the television tube.

To obtain a faithful reproduction of the contours of the images (without colour fringes), it is necessary that the three electron beams converge to form the same virtual light spot (because blacked out by the mask) on the screen. This is obtained by the so-called adjustment of convergence during the manufacture of the tube.

The three electron guns must also have precise positions relative to the screen, the gun corresponding to a colour having to reach only the luminophores generating this colour. Otherwise, the colours are not pure. To this end, a so-called adjustment of purity is performed during the manufacture of the tube.

The adjustments which require the sweep, i.e. the action of the deflectors, are called dynamic adjustments. They consist in the precise positioning of the deflector in relation to the rest of the tube.

The adjustments which do not require the sweep are called static adjustments. The adjustments of purity and static convergence are of that type. They are performed either by the displacement of magnets, or by the modulation of the induction of the poles of a magnetizable ring arranged around the neck of a cathode ray tube. In the application EP-A-123 611 of the applicant, a method is described for the adjustment of the purity and of the static convergence of a tube which comprises a magnetized ring arranged around the neck in which eight poles are generated, poles which are uniformly distributed around the axis with the aid of magnetization coils on the external surface of the ring so that a current of a determined intensity in a coil generates a magnet pole having a determined induction. The magnetization method is, for example, that described in the French patent n° 2 545 265 of the applicant which consists in the strong magnetization of the magnetic material and then in the reduction of the magnetization by reversing it, until the induction allowing the adjustment of the static convergence and/or of the purity is obtained.

It has been noted that the precision of the adjustment obtained with the method in which the end of a coil is put against the external face of a magnetizable ring is not satisfactory. It has been discovered that this lack of precision has the following origin : each coil produces outside its turns a field with a direction which is opposite to that generated inside the turns ; the effective field is that generated inside the turns ; on the other hand, the field with the opposite direction generates around each pole a pole with an opposite direction which is at the origin of the inaccuracy observed. This inaccuracy is all the bigger since the number of poles is high.

The invention remedies those inconveniences. The method according to the invention is characterized as indicated in claim 1.

According to this method, each magnetizable element is disturbed only by the field outside the coil. Thus, the precision of the adjustment can be increased.

It is known in itself from the patent US-A-4 211 960 (figs. 8, 9a, 9b and 9c) to fix magnetizable elements on a supporting ring and to magnetize each element with a coil in a support in form of a clamp.

To perform the magnetization of each element so as to obtain the adjustment of purity and/or static convergence, a device to measure the purity and static convergence errors is used and, since the relation between each error and the current to supply to each coil is known by a preliminary calibration, calculation means are used so that each coil receives the quantity of energy which is necessary to perform correction.

The device described in the French patent n°2480032 may be used for the measurement of the static convergence errors and the device described in the US patent n° 4 001 877 may be used for the measurement of the purity errors.

The magnetizable elements consist, for example, of "plastroferrite", i.e. in a ferrite (for example a barium ferrite) embedded in a plastic material.

The outline of each magnetizable element is preferably rectangular with sides parallel to the axis of the tube. With the same space requirement, this form allows a correction which is more effective than with other forms such as circular or elliptic forms.

In the preferred embodiment of the invention, the magnetizable elements are fixed on the support of the deflector. Therefore, it is not necessary to provide special supports for these elements ; moreover, these magnetizable elements can be mounted on the support of the deflector before the deflector is mounted on the tube itself so that there is no mechanical operation, such as a displacement of the magnetizable elements or a bonding, to perform for the adjustments of purity and static convergence.

It should be noted that the invention allows to use a quantity of magnetizable material which is less than that used with a continuous ring.

Other characteristics and advantages of the invention will be revealed by the description of some embodiments of the invention with reference to the appended drawings in which :

Fig. 1 is a schema of a deflector of a colour television tube with, according to the invention, magnetizable elements mounted on the support of the deflector.

Fig. 2 represents the magnetizable elements of fig. 1 in the process of being magnetized.

Fig. 3 represents a coil and a magnetizable element.

In the example represented in the figures, the windings 10 of the deflector of a colour television tube are mounted on a tapered part of a support 11 made of a plastic material, between two shoulders, a front one 12 and a rear one 13 which extend in a plane which is perpendicular to the axis 14 of the tube (merged with the axis of the support). At the back of the shoulder 12, the support 11 comprises a cylindrical protrusion 15, the axis of which merges with the axis 14 of the tube and which is intended to receive a clamp fitting 16 of the support on the tube.

The magnetizable elements of the invention are fixed, for example by bonding, on the external side 17 of this cylindrical protrusion 15, in the example between the shoulder 13 and the clamp fitting 16.

There are 8 such magnetizable elements 18₁, 18₂... 18₈. They are arranged regularly around the axis 14. All the elements have the same form and the same dimensions and are made of the same material, namely of a "plasto-ferrite" consisting of a barium ferrite embedded in a die made of a plastic material. Each element 18 consists of a right-angled plate, preferably square, with two sides 19 and 20 parallel to the axis 14.

The plates are distributed so that the axis 21 connecting the centers of the plates 18₄ and 18₈ is parallel to the horizontal axis of the screen; the axis 22 connecting the centers of the plates 18₂ and 18₆ is parallel to the vertical axis of the screen and the axes connecting the other diametrical plates 18₃ and 18₇, and 18₁ and 18₅ are at 45° in relation to the axes 21 and 22.

For the magnetization of the eight plates 18₁...18₈, a device is provided which comprises eight magnetization coils 23₁...23₈. Each coil is wound on a core 24₁... with a square section, the side of which is slightly longer than the side of the square of the corresponding plate 18. For magnetization, the end 25 of the core 24 is put against the external side of the plate 18.

Since the section of the coil 23 is more important than the section of the plate 18, the latter is only subject to the internal field of the coil; this field has only one direction. In the simplest embodiment, the last turn of the coil 23 is practically in the plane of the end 25 of the core 24. In another embodiment, with which better results could be achieved, turns of the coil are beyond the end face 25 of the core 24 so that these turns cover completely the plate 18.

Each element 18 is in a uniform field area. No part of the magnetic material is in the vicinity of the periphery of the coils which is a field reversal area with strong variations of the field. Thus, the magnetization may be optimal and very uniform. Moreover, there is no interaction of the poles.

For the manufacturing of each tube, the coils 23 are moved radially by electrical motors and means to convert the rotation into a translation or by electromagnets to put these coils onto the plates and then to remove them thereof.

These sliding coils are preferably fixed to the platform usually used to support the deflector and to position it on the tube, which is favourable to the correct positioning of each coil 23 in relation to the corresponding magnetic element 18, because each coil 23 has then a position which is well determined (by the platform) in relation to the deflector and therefore to the associated element 18. The platform is, for example, that described in the French patent 2 545 266 in the name of the applicant.

For the calibrations, we can easily determine, for example empirically, the displacement of each electron beam depending on the amplitude of the current of the corresponding magnetization coil. The relation between the current pulses and the resulting displacements can be made linear with a simple algebraic transformation.

Thus, the effect of the coil on the electron beams may be expressed by the following matrix relation :

$$(1) \quad D = K.B$$

In this formula, D is a vector with 6 components (two for each beam) which represent the displacements of the points of impact of the electron beams on the screen ; B represents the 8 current values applied to the adjustment coils and K is the matrix of the calibration factors with 8 lines and 8 columns.

In practise, the inverse relation is used :

$$(2) \quad B = C.A$$

In this formula, B is the vector of the 8 amplitudes of the adjustment pulses and A the vector of the 6 necessary movements (displacements), the measuring of these displacements resulting of the determination of the static convergence and purity errors ; C is the matrix of 8 lines and 6 columns of the calculated adjustment factors which is calculated from the matrix K above.

The adjustments of static convergence and purity are performed as follows :

The tube, on which a deflector is mounted, is arranged on a machine for adjustment, for example on the above mentioned platform. Then, the magnetization coils 23 are put, with the end faces 25 of their cores 24, against the corresponding plates 18. We note the convergence and purity errors at the center of the screen and calculate, for example with a microprocessor, the pulses B to correct the errors which have been observed, with the formula (2) above. This microprocessor is also used to control the magnetization sequence which is performed with two pulses of inverse directions, as described in the French patent 2 545 265.

One measuring cycle for the convergence and purity errors and for the calculation errors of the magnetization pulses is generally not sufficient so that the errors are less than a predetermined limit. Usually 3 to 4 cycles are necessary so that the convergence errors are at most 0,1 mm and the purity errors at the most 10 μ m approximately. This is not a problem if we use the

magnetization method described in the French patent 2 545 265 because with this method the total adjustment time is less than 10 seconds.

After the static adjustment, we perform the dynamic adjustments : positioning and fixing of the deflector. The static adjustments can be corrected after having performed the dynamic adjustments. 2 or 3 cycles of static and dynamic adjustment will be sufficient to obtain satisfactory results.

In the embodiment described above, the mean lines of all the plates 18, which are perpendicular to the axis 14, are in a same plane. In an alternative embodiment, other magnets are provided, the mean lines of which are in another (or in several other) plane(s) perpendicular to the axis 14. These additional magnets may be used, for example, for the horizontal centering of the image or to compensate for a misalignment of the guns in relation to the screen.

The elements 18 are preferably automatically mounted on the support of the deflector before the deflector is mounted on the tube itself.

However, in an alternative embodiment, the plates 18 are placed directly on the neck of the tube and not on the support of the deflector.



CLAIMS

1. A method for the adjustment of the static convergence and/or the purity of a colour television tube with permanent magnets, characterized in that magnetizable elements are fixed around the tube, these elements being regularly distributed around the axis (14) of the tube, and in that, for the correction of the static convergence and/or purity errors, each element (18₁-18_n) is magnetized with a coil (23) with corresponding position and with such dimensions that the element (18) is subject only to the single field inside the turns of the coil.
2. Method according to claim 1, characterized in that each magnetizable element (18) has the general shape of a rectangular or square plate with sides parallel to the axis (14) of the tube.
3. Method according to claim 1 or 2, characterized in that the plates have identical forms and dimensions.
4. Method according to claim 2, characterized in that the mean lines of the plates (18), which are perpendicular to the axis (14) of the tube, are in a same plane.
5. Method according to any of the preceding claims, characterized in that the magnetizable elements (18) are fixed to the support (11) of the deflector.
6. Method according to claim 5, in which a support for a deflector is used which comprises a tapered part, which is limited by a front shoulder (12) and a rear shoulder (13), as well as a rear cylindrical part (15), characterized in that the magnetizable elements are fixed on



said cylindrical part.

7. Method according to claim 5 or 6, characterized in that the magnetizable elements are fixed on the support of the deflector before the deflector is mounted on the tube.
8. Method according to any of the preceding claims, characterized in that each magnetization coil of a magnetizable element is wound on a core (24) and in that the end turn of this coil is in the same plane than the end side (25) of the core.
9. Method according to any of the claims 1 to 7, characterized in that the end of the magnetization coil covers, during magnetization, the corresponding magnetization element.
10. Method according to any of the preceding claims, characterized in that the magnetization coils of the magnetizable elements are mounted on a platform which supports the deflector and also comprises positioning means for this deflector.
11. Colour television tube comprising a deflector (10) with a support (11) mounted around the tube itself as well as means for the adjustment of static convergence and purity of the type with permanent magnets, characterized in that the means for the adjustment of static convergence and/or purity consist of separate permanent magnets (18) arranged regularly around the axis (14) of the tube and fixed on the support (11) of the deflector.
12. Tube according to claim 11, characterized in that each magnet has the form of a plate.



13. Tube according to claim 12, characterized in that each plate has a rectangular or square section with sides (19, 20) parallel to the axis (14) of the tube.