

The invention relates to a process and a device for imparting to a magnet the induction necessary to perform an adjustment of static convergence and/or of purity in a colour television tube.

It is known that the reproduction of television pictures is achieved by the displacement of a spot of light on the screen of a tube along some lines from left to right and from top to bottom. At each moment, the intensity and the colour of the spot of light correspond to the intensity and the colour of the corresponding point of the image to be reproduced. To this end, the screen is covered with phosphors the purpose of which is to emit, when they are hit by a beam of electrons, a light of given colour; the screen is therefore covered with phosphors of three types, each type emitting a primary colour. Triads of the primary colours, in general red, green, and blue are formed; each of the triads corresponds to a point to be reproduced, the eye reconstituting a colour from the three elements constituting this triad. Three electron guns, one for each colour, are located inside the tube. Each gun produces a beam of electrons reaching only the luminophores of the corresponding colour; to this end, the beams produced by these three guns have different directions and a perforated mask is arranged in front of the screen inside the tube. It is thus the relative positions of the perforations, of the triads on the screen and of the directions of the electron beams which enable the required end to be achieved, namely that each gun hits only the luminophores of a given colour.

The scanning, i.e. the displacement of the spot of light on the screen, is achieved by means of a variable magnetic field produced by some coils termed deviators supplied with currents of variable intensity.

To obtain a faithful reproduction of the edges (without coloured fringes) of the pictures, it is necessary for the three beams of electrons to converge so as to form a virtually single (since cut off by the mask) spot of light on the screen. This result is obtained by an adjustment, termed convergence adjustment, during the manufacture of the tube.

It will also be easily understood that the three beams of electrons must have precise positions in relation to the screen: the gun allocated to one colour must hit only the luminophores producing this colour. Otherwise the colours are not "pure". To this end, during manufacture of the tube, an adjustment, termed purity adjustment, is made.

The adjustments which bring the scanning into play, i.e. the deviators, are termed dynamic adjustments. They consist of precisely positioning the deviators in relation to the rest of the tube.

The adjustments which do not call upon the scanning are termed static adjustments. The purity and static convergence adjustments are of this type. They are performed either by displacement of magnets, or by modulation of the induction of the poles of a magnetisable ring arranged around the neck of the cathode ray tube. In other words, in the latter case, some magnetic poles are produced each of which has such an induction and such a position that they perform the static convergence and purity adjustments.

Hitherto, to perform this adjustment, the magnet or magnets is or are demagnetised by means of an alternating current of continuously decreasing amplitude and then the magnet is remagnetised until the remanent induction value is reached providing the static adjustment. It has also been proposed (patent GB-A-20 01 803) to magnetise the magnet by means of a pulse of current which imparts to the remanent induction a value greater than that which is required to deviate and correct the electron beams in order to achieve the said static convergence and/or purity adjustment, and then gradually to demagnetise it.

In the known processes the demagnetisation is an operation lasting several seconds per operation and consuming power.

The invention enables the duration of the adjustment and the power consumed to be considerably reduced.

It results from the findings, on the one hand, that a complete, or practically complete, demagnetisation is not essential, and, on the other hand, that a gradual demagnetisation is not essential either.

The process according to the invention is characterised in that the magnetic material is strongly magnetised, then in that the magnetisation is reduced by reversing it until the induction is reached which permits the static convergence and/or purity adjustment. To magnetise strongly, it is sufficient to cause a high intensity current to flow in a magnetisation coil and, to partially demagnetise, a single pulse (therefore of short duration) of current flows through this same coil in the opposite direction.

In one example, the duration of a magnetisation-demagnetisation cycle is of the order of 60 milliseconds which leads to a total duration of implementation of the process of the order of one half-second whereas with the conventional process - each cycle of demagnetisation (complete or almost complete)-magnetisation having a duration of the order of several seconds - the total duration is of about one minute. Similarly when gradual demagnetisation is performed the total duration is of the order of one minute. Furthermore, as will be seen below, the circuit enabling the magnetisation to be performed according to the process of the invention may be particularly simple.

When the relationship between the intensity of the current supplied to the coil and the induction of the magnet is invariable, for example when the magnetisation coil is in contact, with no air-gap, with the material to be magnetised, a given intensity of current in the magnetisation coil will produce an induction of given value, i.e. a known magnetisation. Consequently, in this case, the adjustment may easily be performed automatically; in fact, when a prior calibration operation has made it possible to determine the curve of variation of the magnetisation to be produced (or the intensity of the current in the magnetisation coil) to correct the errors of static convergence and of purity in terms of the values of these errors, a device for measurement of these errors is provided which supplies a signal to a means, such as a programmed computer, which delivers a signal representing the intensity of the current to be supplied to the magnetisation coil to obtain the desired correction.

The invention also relates therefore to an appliance for adjusting the static convergence and/or the purity of a colour television tube, particularly of the type having a perforated mask and three electron guns, comprising at least one coil to apply to a magnetic material an induction of sufficient value to deviate and to correct the beams of electrons in order to obtain the said adjustment, and a generator to produce to a pulse of current applied to the terminals of the coil in order to impart a remanent induction B_R having a value greater than that which is required to deviate and to correct the beam of electrons and to obtain the said adjustment. This appliance is characterised in that it comprises a device for measurement of the errors of static convergence and/or of purity on the screen of the cathode ray tube and a converter to convert these values into values of pulses of current applied to the coil to obtain an induction B_0 permitting a desired adjustment, this pulse of current being of opposite polarity to the pulse imparting the first remanent induction, so as to cause a partial demagnetisation. This second pulse of current is single for implementation of the process defined above which is characterised in that it comprises a device for measurement of the errors of static convergence and/or of purity on the screen of the cathode ray tube and a converter to convert these error values into values of pulses of current applied to the coil to obtain the induction enabling the adjustment, i.e. the correction of the errors, to be performed.

The adjustment may also be performed automatically, even if the relationship between the intensity of the current in the magnetisation coil and the induction obtained in the magnetic material is not determined, the relative positions of the coil and of the magnet being for example variable. In this case, use is made of a regulation circuit: the errors of static convergence and of purity measured on the screen deliver an input signal to a converter the output signal from which energises the magnetisation coil, the converters being such that the signal delivered tends to reduce the errors measured.

- figure 2 is an electrical circuit diagram of the appliance of figure 1; and
 - figures 3 and 4 are diagrams illustrating the process of the invention.
 A colour television tube 1 comprises a glass shell having at its anterior end a plate 2, the inner face of which has a layer 3 of alternately green, red and blue cathodo-luminescent substances, in front of which is situated a perforated mark 4.

For measurement of the static convergence errors, use is made, for example, of the device described in application EP-A 0,037,766 corresponding to FR-A-2,480,032, and for measurement of the errors of purity a device may be used of the type of that described in patent US-A-4,001,877.

Other characteristics and advantages of the invention will appear with the description of certain of its methods of construction, this being given with reference to the attached drawings in which:

- figure 1 is a diagram of an appliance implementing the process of the invention;

The rear of the tube 1 has the shape of a cylinder 5 termed neck inside which are located the three electron guns (not shown). It is around the neck 5 and the flared part 6 connecting the neck to the plate 2 that is installed the deviator enabling the scanning to be performed. For simplification, this deviator has not been shown in the diagram of figure 1.

Around the neck 5 is also arranged a ring-shaped permanent magnet 7. The latter is formed of a mixture of plastic material and ferrite termed "plastoferrite".

The arrangement of the poles in this ring 7 and also the intensity of magnetisation provide the static convergence and purity adjustments.

To magnetise the ring 7, eight coils 8 are pressed against the periphery of this ring and each coil is energised so that after it is moved away, the desired adjustment is obtained, i.e. the tube has neither any static convergence defect nor any purity defect.

Firstly, to the terminals of each coil 8 is applied a pulse of current (or voltage) 9 (figure 4) of a given polarity which, in the ring 7 magnetisation diagram (figure 3), permits a rise from the origin 0 to the point 10 which corresponds with a strong magnetisation, i.e. with a high remanent induction B_R (induction in the absence of exciting magnetic field H).

The intensity of the pulse 9 is of a sufficient value so that, in all cases, the magnetisation which it imparts - i.e. the value B_R of the remanent induction, is greater than the magnetisation necessary to achieve the static convergence and purity adjustments.

In these conditions, to perform the adjustment, it is afterwards necessary to demagnetise the ring 7. To this end, a pulse 11 of amplitude lower than that of the pulse 9 and of opposite direction is applied to the terminals of each coil 8. There is thus a movement from point 10 of the hysteresis cycle 12 (figure 3) to point 13 for which $H = 0$, then to point 14. When the pulse 11 has disappeared, the state of magnetisation of the ring 7 is represented by the point 15 with a remanent induction B_0 . In this example the remanent induction B_0 is positive. It may happen that it is necessary to impart a negative remanent induction. In this case a pulse 11 is applied of greater amplitude but still lower than that of the pulse 9 and of opposite direction; there is thus movement from the point 16 and when the pulse 11 has disappeared, the point 17 is ultimately reached with a remanent induction B'_0 .

To determine the values of the inductions B_0 necessary to obtain the corrections, the errors of static convergence and of purity are measured by means of a device 16 (figure 1) arranged against the front face of the plate 2 which delivers a signal to a computer 17 programmed to convert the error signal into a signal representing the amplitudes of the pulses 11 which have to be applied to the coils 8 to obtain the correction of these errors by the resultant action of all the poles produced in the ring 7.

The program of the computer 17 is established from a calibration beforehand; that is to say that for the development of this program, it is determined by some measurements what relationship exists between the amplitude of the errors and the amplitude of the currents to be injected into the coils 8 to obtain the desired correction.

In the place of a programmed computer 17, use may equally be made of a simple converter.

Figure 2 represents a circuit enabling the pulses 9 and 11 to be generated.

A d.c. voltage source 20 charges a condenser 21 via a controlled switch 22 such as a field effect power transistor.

The charge of the condenser 21 determines the amplitude of the pulse 9 or 11 which will be applied to the coil 8. It is therefore the conduction duration of the switch 22 which determines the amplitude of the pulse.

The discharge circuit of the condenser 21 comprises, on the one hand, the primary 23 of a pulse transformer 24 and, on the other hand, in series, another controlled switch 25 such as a thyristor.

The mid-point 26 of the secondary winding 27 of the transformer 24 is connected to a terminal, to the earth, of the coil 8. The second terminal of the coil 8 is connected to the cathode of a thyristor 28 the anode of which is connected to a first end 29 of the secondary winding 27. This second terminal of the coil 8 is also connected to the anode of another thyristor 30 the cathode of which is connected to the second end 31 of the secondary winding 27.

The operation is as follows:

When the charge of the condenser 21 has reached the desired value - value which is determined by the computer 17 and which corresponds to the intensity of the pulse 11 or 9 - the switch 22 is opened and the switch 25 is closed as well as one of the two switches 28 or 30. The switch 28 is closed when the positive pulse 9 has to be applied whereas it is the switch 30 which is closed when the negative pulse 11 has to be applied.

The conduction order to the switches 22, 25, 28 and 30 may be given from the computer 17.

In the example, where the number of poles to be created in the ring 7 is eight, eight coils 8 are provided and a pair of thyristors 28, 30 is associated with each coil whereas the rest of the circuit is single. For this purpose the end 29 is connected to the eight anodes of the thyristors 28 and the end 31 is connected to the eight cathodes of the thyristors 30. The eight poles are thus created or modified in turn using the same circuit. The creation of each pole 8 has an average duration of approximately 60 milliseconds; the whole of the adjustment therefore lasts approximately 0.5 second.

In addition to its short duration, the process of the invention has the advantage of requiring a circuit of particular simplicity such as that of figure 2 whereas with the earlier known process, it is necessary to make use of a relatively complex circuit to perform the complete demagnetisation.

CLAIMS

1. Process of adjustment of the static convergence and/or of the purity of a colour television tube, particularly of the type having a perforated mask and three electron guns, consisting of applying, by means of at least one coil (8), to a magnetic material an induction of sufficient value to deviate and to correct the beams of electrons so as to obtain the said adjustment, a current pulse (9) being applied to the terminals of the coil (8) to impart a remanent induction (B_R) having a value greater than that which is required to deviate and to correct the beam of electrons and to obtain the said adjustment, characterised in that it consists of applying after the said current pulse (9) a single current pulse (11) of opposite polarity causing a partial demagnetisation so that the remanent induction (B_0) permits the desired adjustment.

2. Process according to claim 1, characterised in that the time between the start of the first pulse (9) and the end of the second pulse (11) is of the order of 60 milliseconds.

3. Process according to claim 1 or 2, characterised in that during the magnetisation, the coil (8) is pressed against the periphery of the magnetic material which is formed of a ring (7) around the neck (5) of the tube (1).

4. Process according to any of claims 1 to 3, characterised in that the magnetic material consists of a ring surrounding the neck of the tube and in that several coils (8) are provided to form several poles in the ring, the number of poles formed in this ring being preferably equal to eight.

5. Appliance for adjustment of the static convergence and/or of the purity of a colour television tube, particularly of the type having a perforated mask with three electron guns, comprising at least one coil (8) to apply to a magnetic material an induction of sufficient value to deviate and to correct the beams of electrons in order to obtain the said adjustment, this appliance comprising a generator to apply a current pulse (9) to the terminals of the coil (8) to impart a remanent induction having a value greater than that



which is required to deviate and to correct the beam of electrons and to obtain the said adjustment, characterised in that it comprises a device (16) for measurement of the errors of static convergence and/or of purity on the screen of the cathode ray tube and a converter (17) to convert these error values into values of current pulses (11) applied to the coil (8), so that after the current pulse (9) imparting the remanent induction of value greater than that which is required to deviate and to correct the beam of electrons, there is applied one single pulse of the said current pulses (11) produced by the converter (17), of opposite polarity and causing a partial demagnetisation.

6. Appliance according to claim 5, characterised in that it comprises a pulse generator having a condenser (21) charged to a value representing the amplitude of the pulse to be applied and in that the coil (8) is arranged in the secondary circuit of a pulse transformer (24) the primary winding (23) of which receives the discharge current of the said condenser (21), this secondary winding circuit (27) comprising two controlled switches (28 and 30) mounted and controlled so that if the first is conductive, the electric current passes in one direction in the coil (8) and if the second is conductive, the electric current passes in the other direction.

7. Appliance according to claim 6 for implementation of the process of claim 4, characterised in that a pair of controlled switches (28, 30) is associated with each coil (8) whereas the rest of the supply circuit is common, the control being such that the poles are created or modified in turn.

