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Equipment for correcting the Raster in a Television
Apparatus

The invention is based on an equipment in accordance with the first part of claim 1. An equipment of this type serves for correcting the convergence in a projection television apparatus for example.

It is known to define a plurality of picture elements by means of a grid pattern consisting of horizontal and vertical lines on the screen, to determine correcting values for these picture elements, to place them into a store and to supply them one after the other, for the individual picture elements, to a correcting coil during the reproduction process. The correcting coil may be the deflection coil itself. Preferably however, a separate correcting coil is used since the inductance of the deflection coil is generally too great for the rapid correcting processes.

The correcting current flowing in the coil is delayed vis a vis the applied correcting voltage due to the inductance of the correcting coil. Hence, if it is intended that a correcting current should flow at its nominal value upon the occurrence of a particular picture element K_n , then the correcting voltage for causing the correcting current must be applied to the correcting coil correspondingly earlier. Thus, it is known to start the correcting process for a picture element K_n , i.e. to apply the correcting voltage to the coil, during the picture element K_{n-1} which precedes it along the line. One can thereby achieve the effect that the



correcting current for the picture element K_n attains its nominal value, which was determined for this picture element, when this picture element occurs.

It has nevertheless transpired, that deviations in the position of the nominal value of the correcting current relative to the associated picture element occur, in that the nominal value is only attained after the associated picture element, i.e. the correcting current has not yet reached its nominal value at the time of the picture element itself.

The object of the invention is to remove deviations of this type between the picture element and the nominal value of the associated correcting current.

This object is achieved by the invention defined in claim 1. Advantageous developments of the invention are specified in the appendant claims.

The invention is based on the following consideration. The amplifier and various other components in the correcting signal path inevitably have a delay or dead time. This means, that, between the application of the correcting voltage and the beginning of the climb in the correcting current which is slowed by virtue of the inductance, there elapses a certain amount of time which causes an additional time displacement between the attainment of the nominal value of the correcting current and the associated picture element. This time is brought into the calculation in the case of the invention, in that the starting point for the application of the correcting voltage is brought forward correspondingly. In this way, one can achieve an exact coincidence between the picture element that is to be corrected and the nominal value of the correcting current. It is possible in particular, to provide an individual matching to the particular amplifier being used in the correcting signal path for each apparatus by means of an



appropriate adjustment. Other factors, which cause a displacement of the nominal value relative to the picture element that is to be corrected, can be compensated by virtue of the invention. The invention requires practically no greater outlay since it is only the commands for the read out of the values from the store that have to be correspondingly altered.

The invention will be explained hereinafter by means of the drawing. Therein

Fig. 1 shows a screen including the grid pattern,

Fig. 2 curves for explaining the invention and

Fig. 3 the principle of the correcting circuit.

In Fig. 1, a plurality of picture elements K , which are formed by the respective crossing points of the lines, are defined on the screen 1 by means of the horizontal lines SH and the vertical lines SV . One picture element K_n and the picture element K_{n-1} preceding it along the line are illustrated. In practice, the number of thus defined picture elements is substantially greater.

Fig. 2a shows the ideal case that is being strived for. The correcting current i_k for the picture element K_n is started at the occurrence of the picture element K_{n-1} . The correcting current i_k climbs up due to the effect of the inductance of the correcting coil and attains its nominal value i_N , which is necessary for the correction of the picture element K_n , exactly at the time this picture element K_n occurs.

Fig. 2b shows that the beginning of the climb of the correcting current i_k is delayed due to a transit time or dead time T_0 in the correcting signal path. The correcting current i_k only attains its nominal value i_N after the



associated picture element K_n . This means that, at the time of occurrence of the picture element K_n , for which the correcting current i_k is intended, the correcting current only has the lower value i_N' , i.e. it deviates from the correct value i_N .

In accordance with Fig. 2c, the starting point SP for the beginning of the correcting process is brought forward by the time T_0 . The correcting voltage which gives rise to the correcting current is preferably applied to the correcting equipment correspondingly earlier. The correcting current i_k now again attains its nominal value i_N exactly at the time of occurrence of the associated picture element K_n for which this correcting current is intended. A perfect correction of the currently effective parameters for the picture element K_n , by means of the nominal value i_N that has been determined, is thus ensured. Following the picture element K_n , the correcting current i_k passes on to the value for the succeeding picture element K_{n+1} by virtue of an appropriate extrapolation, for example, by a process of integration.

The equipment in accordance with the invention is illustrated symbolically in Fig. 3. A vertical deflection coil 11 and a horizontal deflection coil 12 are associated with a picture tube 10. A signal v_A from the output of a vertical amplifier 13 is fed to the vertical deflection coil 11, a vertical deflection signal v_S being supplied to its input.

In analogous manner, the horizontal deflection coil 12 receives a signal h_A from the output of a horizontal amplifier 14 to the input of which a horizontal signal h_S is supplied. The signals h_S and v_S originating from a not-illustrated picture generator are themselves known and there is no need to go into them any further at this point.

Furthermore, there is associated with the picture tube a correcting coil 15 which is connected to the output of a

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correcting amplifier 16. The input thereof is connected to the output of a digital/analogue converter (D/A) 17 which receives at its input signals from a first store 18 in which the nominal values i_N of the correcting current for the individual picture elements K are stored.

The control input of the first store 18 is connected to a clock control means 19 to which the output signal v_A of the vertical amplifier 13 is supplied via a first input and the output signal h_A of the horizontal amplifier 14 is supplied via a second input.

Furthermore, a third input of the clock control means 19 is connected to a second store 20 in which the values relating to the dead time T_0 are stored.

A first output of the clock control means 19 is connected to the control input of the first store 18 and a second output of the clock control means 19 leads to the control input of the picture tube 10 by means of which the brightness of the picture elements can be controlled.

The operation of the equipment in accordance with the invention will be explained hereinafter with the help of Fig. 2.

The previously determined values of the dead time T_0 are read from the second store 20 into the clock control means 19 which is controlled by the two signals v_A and h_A .

The input signals v_S and h_S or some other signals coupled to these signals may also be used for controlling the clock control means 19 instead of the output signals v_A and h_A .

In dependence on the signals, the clock control means 19 firstly controls the picture tube 10 in such a way that a grid pattern is produced as shown in Fig. 2.



Furthermore, the clock control means 19 controls the first store 18 which thereupon reads out the nominal values i_N of the correcting current i_K , as described in connection with Fig. 2, and emits correcting signals to the input of the D/A converter 17.

The values of the correcting voltage U_K determined in this manner are amplified by the correcting amplifier 16 so that there occurs a voltage at its output which gives rise to a correcting current i_K through the correcting coil 15. The correction process is thereby carried out as has been described.

The determination of the dead time T_0 can be effected in various manners. If, for the sake of simplicity, it is assumed that it merely depends on the components being used, such as for example, the correcting amplifier 16, the D/A converter 17, the correcting coil 15 etc, then it can be determined from timed measurements of the signal waveform and thereafter read into the second store 20 as a value.

However, it has transpired, that in the case of some television apparatus, the dead time T_0 also depends on the position of the picture element K .

In this case, a second embodiment is used in which dead time values $T_0(K)$, which are dependent on the picture elements, were stored in the second store 20 and effected by virtue of an appropriate control of the second store 20 by means of signals which are coupled to the vertical signal v_S and the horizontal signal h_S . The control process may, for example, be effected by the clock control means 19, to which end there is provided an appropriate connection between this and the second store 20.

In the case of further versions, the dead time T_0 or the starting point SP may be determined by an adaptive process



that is inherently known to the skilled man and it can be taken into account thereafter.

A variant of the two quoted embodiments provides for the correction of the picture element K being carried out by means of the horizontal coil 12 and, if necessary, the components connected thereto.

One may thereby dispense with the correcting coil 15 and possibly in addition, with the correcting amplifier 16. In this case, the signal from the D/A converter 17 is supplied to the input of the horizontal amplifier 14 or to an amplifier stage being used in its place.

It now remains to be mentioned, that, for the sake of clarity, only the correcting coil for the horizontal deflection has been described. Usually however, a correcting coil for the vertical deflection is also required.

The correcting process in accordance with the equipment according to the invention preferably occurs, in the case of a projection television apparatus, for the three picture tubes for the basic colours R, G, B, namely, in each case, for the convergence in the horizontal direction and in the vertical direction. Then, in toto, six correcting coils 15, which are controlled in this manner, are associated with the three picture tubes.

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Claims

1. Equipment for correcting the raster in a television apparatus in which, for each of the picture elements (K) that are defined by a grid pattern, a respective correcting current (i_k) is supplied to a coil which affects the deflection and the respective correcting current for a picture element K_n is started in the vicinity of the picture element K_{n-1} which precedes it horizontally, characterised in that the starting point (SP) lies before the picture element K_{n-1} by such an amount (T_0) that transit times in the correcting signal path are compensated and the nominal value (i_N) of the correcting current (i_k) associated with the picture element K_n is attained at the picture element K_n .
2. Equipment in accordance with Claim 1, characterised in that, the position in time of the starting point (SP) can be adjusted.
3. Equipment in accordance with Claim 1 or 2, characterised in that, the value of the dead time ($T_0(K)$) is determined in dependence on the position of the picture element and is taken into account during the correction process.
4. Equipment in accordance with any of the Claims 1 to 3, characterised in that, the value for the dead time (T_0 or $T_0(K)$) is determined in an adaptive manner.



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