

- [54] CATHODE RAY TUBE CIRCUIT
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Funk

Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 129,824, March 31,
1971, abandoned.
[52] U.S. Cl. 315/276 D, 315/24
[51] Int. Cl. H01j 29/70
[58] Field of Search..... 315/276 D, 27 R, 18, 22,
315/24, 29

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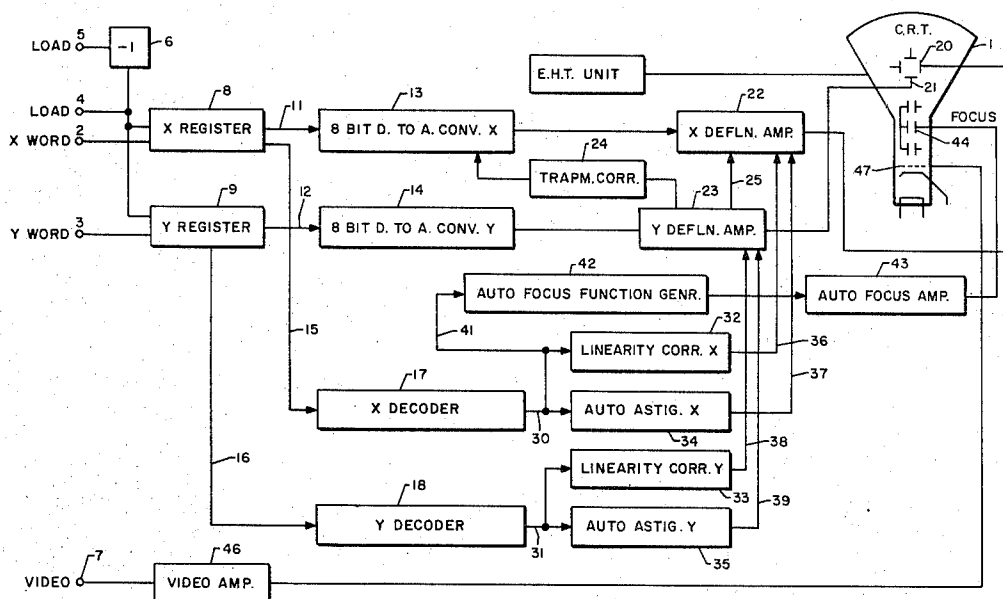
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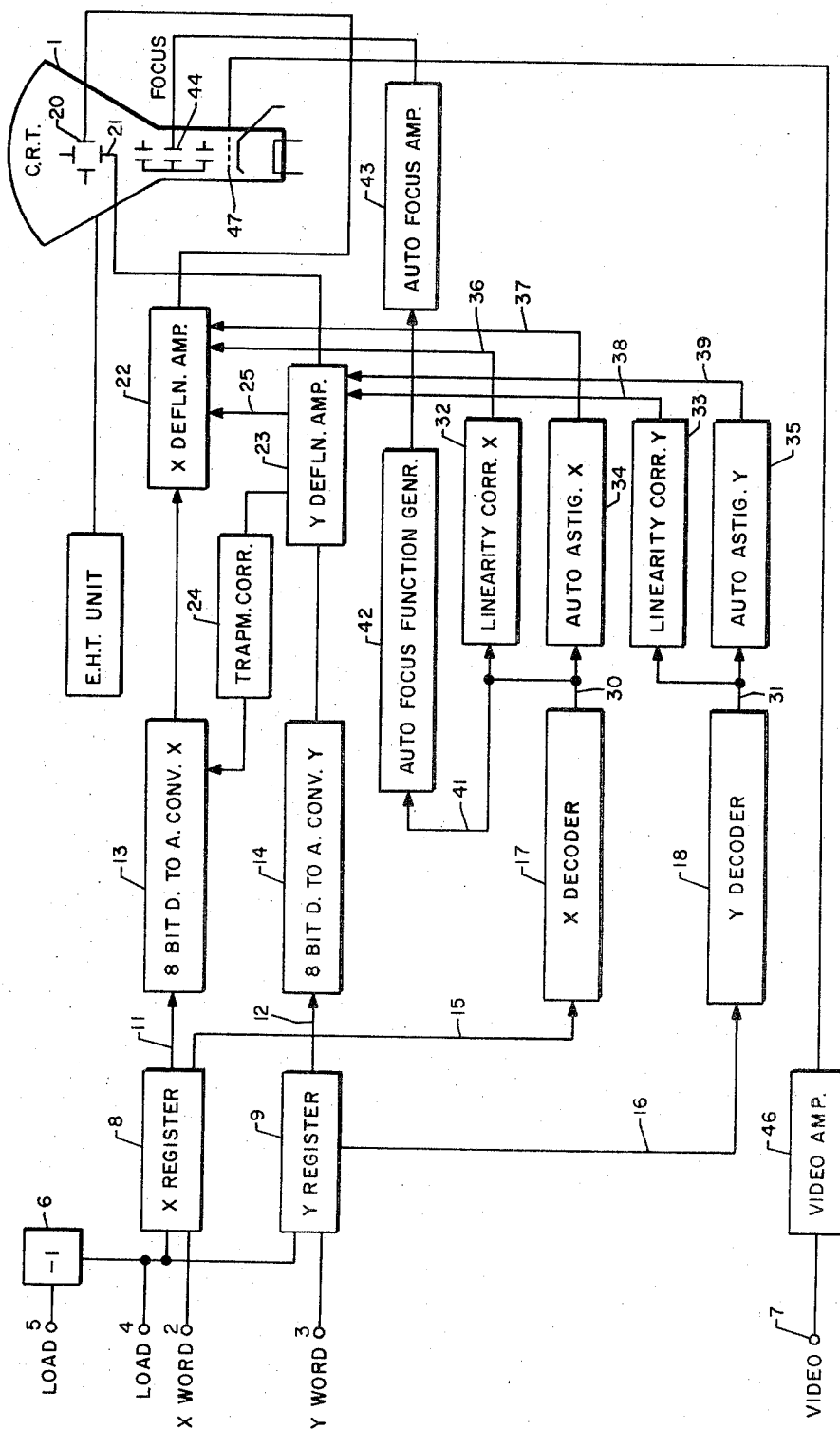
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ABSTRACT

A cathode ray tube circuit arrangement having digi-
tally operated control circuits for controlling beam de-
flection signals, a decoder which identifies predeter-
mined beam positions and a function generator which
provides a signal for modifying a beam control signal
according to an identified position of the beam.

7 Claims, 11 Drawing Figures





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FIG. 5

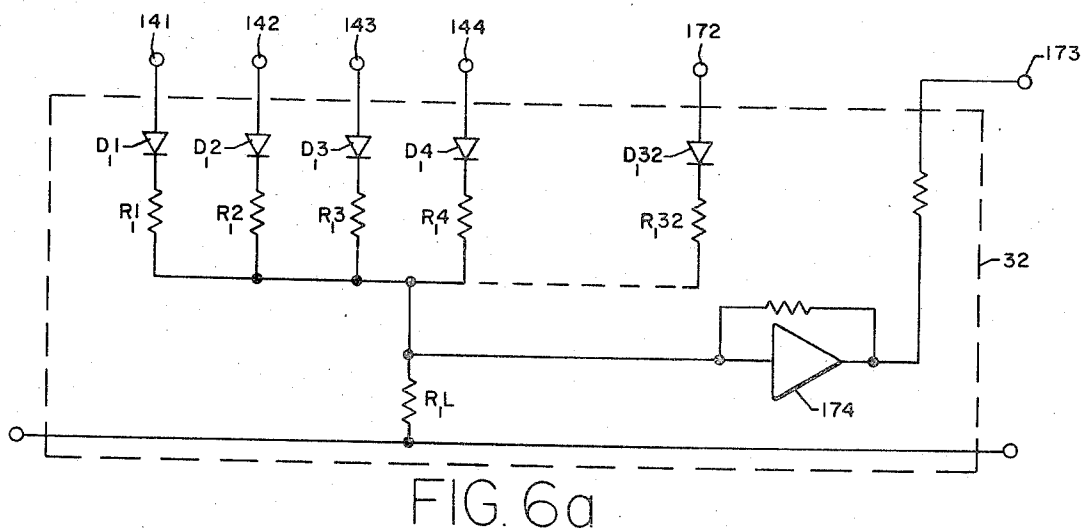
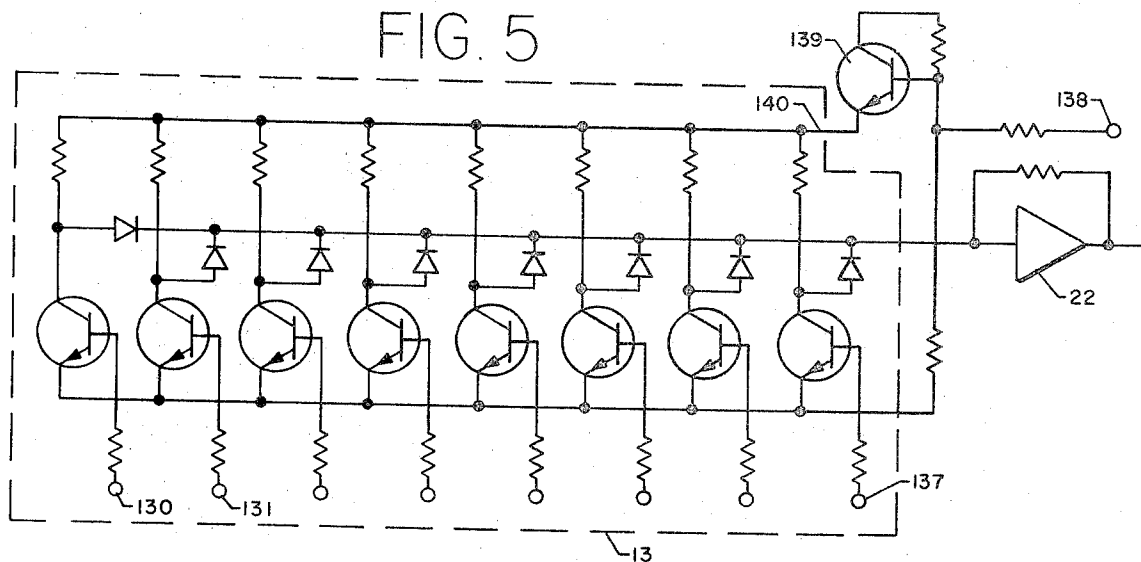


FIG. 6a

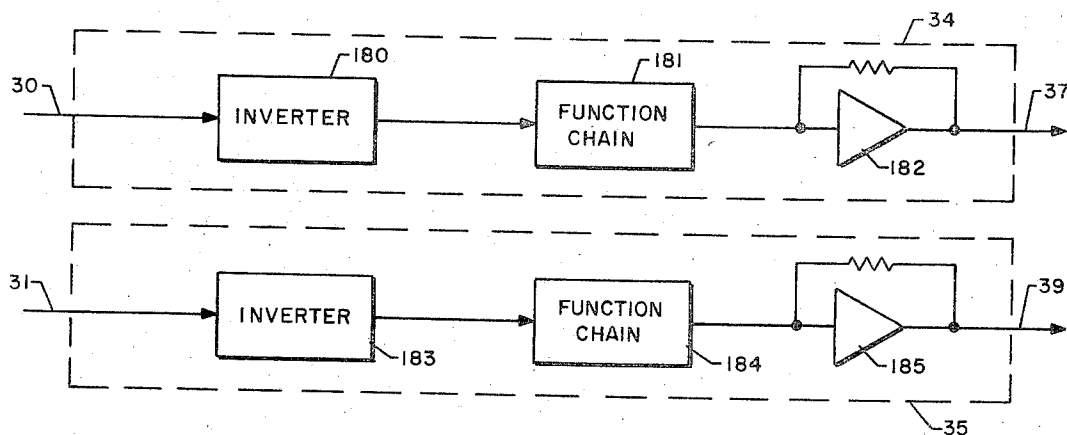


FIG. 7a

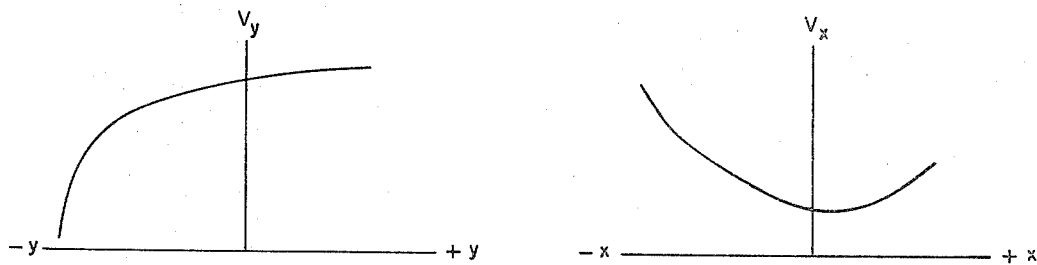


FIG. 7b

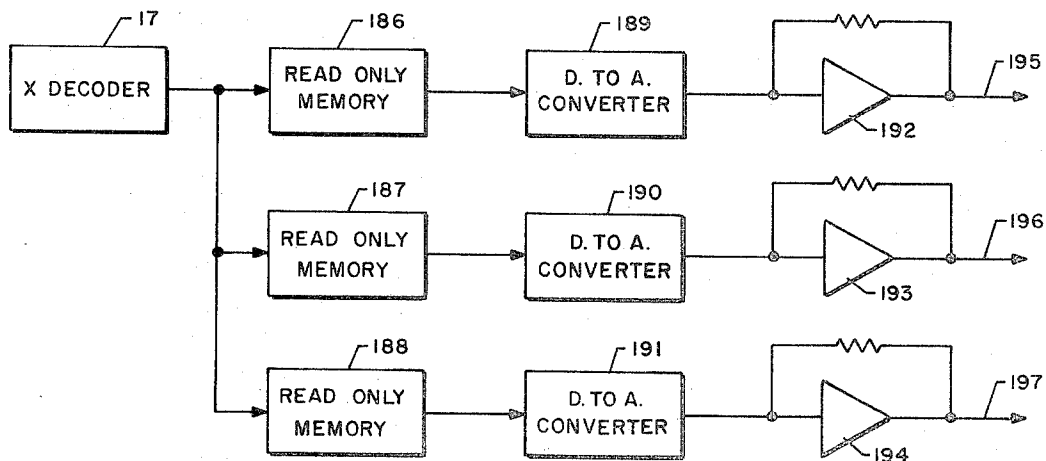


FIG. 8

CATHODE RAY TUBE CIRCUIT

BACKGROUND OF THE INVENTION

This invention relates to a cathode ray tube circuit and it has particular, though not exclusive, application to the cathode ray tube described in our continuation in part co-pending patent application, Ser. No. 129,824, filed Mar. 31, 1971 now abandoned for "Cathode Ray Tube Apparatus."

SUMMARY OF THE INVENTION

According to the present invention, there is provided a cathode ray tube circuit having first and second means for generating beam deflection signals, first and second digitally operated control means connected for controlling the said first and second beam deflection signal generating means respectively, a decoder having an input connected to the output from one of the control means and a function generator having an input connected to the output from the decoder and an output providing a signal for modifying a control signal for a cathode ray tube beam. The digital signals operating the control means may be coded, for example in binary form, or be groups of pulses arranged to convey the required information.

In one embodiment of the invention, the first and second beam deflection signal generating means provide deflection signals for controlling the scanning of the beam in the x and y orthogonal directions respectively, and two decoders are provided, each having its input connected to the output of a respective one of the control means, there being at least one function generator providing a signal for modifying a control signal for the cathode ray tube beam connected to the output of each decoder.

The use of digitally operated control means for controlling the deflection of the beam, enables the instant in time when the beam impinges on each of a number of discrete positions on the face of a cathode ray tube to be positively identified and a control signal, which is developed according to a known law for any one of a number of parameters of the beam, to be applied to a beam control element at the precise instant necessary to correct an unwanted deflection or aberration of the beam.

In the preferred embodiment of the invention the beam scans the face of the cathode ray tube in a raster, in the manner commonly employed in television reproduction, through a plurality of discrete positions identified by their x and y co-ordinates. However, other types of scanning, for example the use of a spiral trace on the screen, and other methods of identifying the position of the beam, for example the specification of the γ $\perp$ θ position of the spot on the screen, may be used.

The digitally operated control means is, in one embodiment of the invention, a pair of registers which are under the control of a computer associated with a source of video signals. The computer enters a code, identifying a required co-ordinate position of the cathode ray tube beam, into the registers in synchronism with the video signal so that the beam is correctly positioned on the screen in accordance with the video signal.

In another embodiment, the control means is a pair of interconnected counters which are triggered by pulses obtained from a clock under the control of the synchronizing pulses of a video signal.

The parameters which can be controlled include the linearity of the deflection signals, the focussing of the beam and the astigmatism of the beam.

According to a further feature of the invention means is provided for controlling the deflection of the beam in such a way that correction of any trapezium distortion of the scanning of the screen area is obtained.

In addition to enabling controls to be applied to the scanning beam of a cathode ray tube during the reproduction of a picture it is possible, by means of a circuit according to the invention, to control the deflection on the beam in such a way that it writes or traces symbols of the face of a cathode ray tube. Furthermore, the control of the beam may be such that a character is reproduced on one area of the screen by writing, and a picture or character is reproduced on another area by raster scanning.

It has been found, in one particular embodiment of a cathode ray tube, that the beam only requires focus correction according to the same law for each line of scanning in the x direction. Furthermore in this particular embodiment the law is symmetrical about the midpoint of each of scan in the x direction. Of course, focus correction in accordance with the scanning of the beam in the y direction may be provided where necessary.

The invention therefore also provides a circuit from which a correction signal is obtained for application to a cathode ray tube focus control electrode according to position of the cathode ray tube beam on the screen.

One focus control circuit for use with the particular embodiment of cathode ray tube referred to above is addressed by a series of outputs from the appropriate decoder to provide the appropriate focus correction signal according to the scanning position of the beam, as determined by the digitally operated control means.

The focus control circuit can be a resistor network, graded according to the law of the required correction signal and connected on the one hand to provide a signal output and on the other hand to a voltage or current source through a series of switches operated by the output from the associated decoder in such a way that the voltage or current at the signal output is varied according to both the correction law and the scanning position of the beam.

Circuits in accordance with the present invention can be arranged to provide voltage or current outputs and are applicable either to electrostatically or electromagnetically deflected cathode ray tubes.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a block schematic circuit diagram of a control circuit,

FIG. 2A is a schematic diagram of an electrical circuit for producing a focus control signal,

FIG. 2B is a curve illustration of the focus correction law,

FIG. 3 is a diagrammatic front view of a cathode ray tube of utility in the practice of the present invention,

FIG. 4 is a section on the line N—N of FIG. 3,

FIG. 5 is a schematic circuit diagram of the eight bit x digital to analogue converter of FIG. 1 illustrating trapezium distortion correction,

FIG. 6A is a schematic diagram of an electrical circuit for producing a linearity correction control signal,

FIG. 6B is a graph illustrating the theory of linearity correction,

FIG. 7A is a schematic block diagram of an electrical circuit for producing an automatic astigmatism correction control signal,

FIG. 7B are curves illustrating the laws of astigmatism correction, and

FIG. 8 is a block diagram of another embodiment for providing focus, astigmatism and linearity correction.

DESCRIPTION OF PREFERRED EMBODIMENTS

The circuit of FIG. 1 controls the deflection of the electron beam of a cathode ray tube 1 and corrects the deflection signals for trapezium distortion, linearity and astigmatism. Automatic control of the focussing of the beam as it moves over the face of the cathode ray tube is also provided.

The operation of the circuit of FIG. 1 is controlled by the digital output from a computer (not shown) applied to registers in synchronism with a video signal. However, it is equally possible for the circuit of FIG. 1 to be controlled by some other means, for example by a generator of clock pulses synchronized with the line and frame synchronization pulses of a video signal. In such an arrangement, the registers can be counters coupled to the clock pulse generator and to one another to provide the pulse outputs to digital to analogue converters to generate step function x and y deflection waveform signals.

The signals for the control of the circuit of FIG. 1 consists of a series of pairs of eight bit words, each pair corresponding to an x and y co-ordinate position of the beam on the cathode ray tube screen, and a load instruction consisting of one bit.

An input terminal for the eight bit x co-ordinate word is provided at 2 and an input terminal for the eight bit y co-ordinate word is provided at 3. The load instruction, which precedes the x and y words and prepares the circuit for the next words may be either a logical 0 or a logical 1 and be applied respectively either directly to the circuit via an input terminal 4, or via an input terminal 5 and a negater 6.

An input terminal 7 is provided for the video signal which is synchronized with the input signals applied to the terminals 2 to 5.

The input terminals 2 and 3 are connected to respective inputs to x and y registers 8 and 9 and the input terminals 4 and 5 are also connected to inputs to these registers 8 and 9.

Each of the eight bit registers 8 and 9 can be set to one of 256 different code combinations and a parallel output from the registers on each of the lines 11 and 12 couples a code in the registers directly into eight bit x and y digital to analogue converters 13 and 14 respectively.

A part of the eight bit code in each of the registers 8 and 9 is coupled via five line parallel connections indicated at 15 and 16 respectively directly to the inputs of x and y decoders 17 and 18.

The code combinations are fed to the registers 8 and 9 in a natural binary sequence and the coupling connections 15 and 16 couple the last five digits stored in the registers to the decoders with the result that the code addressed to the decoders changes at every eighth change of the code combination in the registers, thereby resulting in 32 changes of code fed to the decoders 17 and 18 for every 256 changes of code applied to the digital to analogue converters 13 and 14.

The digital to analogue converters 13 and 14 convert the 256 code combinations applied thereto into scanning waveforms having a generally saw-tooth configuration with trace defining portions formed of 256 discrete steps, the level of each step corresponding to a respective one of the 256 different code combinations. The saw-tooth waveform outputs from the digital to analogue converters 13 and 14 are applied to the x and y deflection plates of the cathode ray tube 1, as indicated at 20 and 21, via x and y deflection amplifiers 22 and 23 respectively. It is thus possible to identify 256 discrete deflection positions of the cathode ray tube beam in both the x and y directions, and thus to identify 65,536 positions to which the beam can be deflected on the screen.

The x and y deflection signals cause the beam to scan from a co-ordinate position of $x=0$ and $y=0$ in the lower left hand corner of the screen, as seen by the viewer, from the left to the right and from the bottom to the top of the screen.

In the particular embodiment described, the circuit is used with the cathode ray tube described in our previously mentioned co-pending patent application, in which the normal axis of the electron beam issuing from the electron gun source is either parallel to or at a small angle to the plane of the screen, and the x scan near to the top of the screen remote from the gun is longer than the scan near to the bottom of the screen, for the same angular deflection of the beam, resulting in trapezium distortion of the area scanned. A coupling circuit 24 is therefore provided to couple a portion of the y deflection amplifier circuit 23 output to the converter 13 in order to modulate the analogue signal output from the converter 13 and provide correction of any trapezium distortion that might otherwise occur in the deflection of the beam over the cathode ray tube screen. The signal coupled from the y deflection amplifier 23 via the circuit 24 to the converter 13 causes the x deflection signal to decrease in amplitude as the y deflection signal increases in amplitude, with the result that the x deflecting or line scanning field causes a smaller angular sweep of the beam when it scans near to the top of the screen than when it scans near to the bottom of the screen. This modulation of the x deflection field by an output from the y deflection amplifier to reduce the scanning angle as the beam moves in the y direction from the bottom of the screen, i.e., from the edge nearest to the beam source, to the top of the screen, compensates for the increased length of the scan in the x direction as the beam lengthens during deflection in the y direction. Since the present circuit is d.c. coupled it is necessary also to apply an "off-set" potential on a line 25 between the y deflection amplifier 23 and the x deflection amplifier 22 in order to correct what otherwise would be a parallelogram type scan into a rectangular scan. If an a.c. coupled circuit is used this "off-set" potential is not required.

A typical eight bit x digital to analogue converter with trapezium distortion correction is illustrated in FIG. 5. The parallel outputs from x register 8 are applied to the eight inputs 130-137 of the digital to analogue converter 13. As mentioned above, an output from the y deflection amplifier circuit 23 is applied to converter 13 to modulate the analogue signal output therefrom. This signal is applied along a line 138 by way of a transistor 139. The y axis converter produces a constant amplitude staircase which is used to modulate the x axis staircase. The output from converter 13 is coupled to the x deflection amplifier 23.

The y axis converter 14 is similar to x axis converter 13 with the exception that the reference voltage at point 140 is constant.

In order to develop other correction signals, output from the x and y registers 8 and 9 are applied to the x and y decoders 17 and 18 respectively on the lines 15 and 16. In the particular embodiment described the last five bits of the coded signals in the registers 8 and 9 are applied in parallel on the lines 15 and 16 to the decoders 17 and 18. The coded signals in the registers 8 and 9 change in a natural binary sequence and since only the last five digits are applied to the decoders 17 and 18, the codes on the lines 15 and 16 are changed on the occurrence of every eighth change in the code in the registers 8 and 9. Thus for every 256 changes of code in the registers 8 and 9 there are 32 changes of code applied to the decoders 17 and 18. The decoders 17 and 18 each provide an output on one of 32 different output lines, only one of which is shown at 30 and 31, to respective x and y linearity correction circuits 32 and 33 are respective x and y automatic astigmatism correction circuits 34 and 35. The outputs from the x correction circuits 32 and 34 are applied on lines 36 and 37 respectively to the x deflection amplifier 22 and the outputs from the y correction circuits 33 and 35 are applied on lines 38 and 39 to the y deflection amplifier 23. It is thus possible, with 32 discrete deflection positions of the beam along the x and y axes respectively, which provide one thousand and twenty four discrete and identifiable co-ordinate positions of the beam over the whole screen, to effect correction of the x and y deflection fields for both linearity and astigmatism at each of these co-ordinate positions.

In the particular cathode ray tube employed, deflection of the beam is achieved electrostatically and the automatic astigmatism correction circuits 34 and 35 operate to control the mean voltages between the respective x and y deflection plates 20 and 21 during scanning in the x and y directions.

It has been found, with the particular cathode ray tube employed, that it is not necessary to change the automatic focus correction of the beam as it is scanned in the y direction and that the correction necessary for each x scan is the same for corresponding positions in each scan.

The outputs from the x decoder are thus coupled, as indicated via lines 30 and 41, to an automatic focus function generator 42, whose output is applied, via an automatic focus amplifier 43, to the focus electrodes 44 of the cathode ray tube 1. Thus for each of 32 discrete positions of the cathode ray tube beam as it is scanned in the x direction it is possible to apply 32 distinct control signals to control the beam focus in accordance with the known parameters of the tube.

The video signal applied on the terminal 7 passes via a video amplifier 46 to the control grid electrode 47 of the cathode ray tube.

A simple form of automatic focus control signal generator is shown diagrammatically in FIG. 2 in which the generator 42 is indicated within dotted lines 49. The output signals from the x decoder 17 are applied via the lines 30 and 41 and an inverter 198 consecutively to respective ones of 32 input terminals 51 to 82 across a resistance chain comprising a load resistor R_L and a respective one of a plurality of resistors R_1 to R_{32} via a respective diode rectifier D_1 to D_{32} . The output across the resistor R_L is obtained on the line 83 for application to the amplifier 43. The resistors R_1 to R_{32} are each of a value such that the output signal across the resistor R_L , at each instant corresponding to a respective output signal from the decoder 17, modifies the focus signal on the electrode 44 as required by the corresponding position of the electron beam in accordance with the focus law illustrated in FIG. 2B.

In an alternative circuit the load resistor R_L is connected in series with a resistor chain and respective points in the chain are addressed consecutively via individual diode rectifiers by the 32 outputs from decoder 17 to provide the required succession of output signals across the load resistor according to the combination of resistors in the part of the chain addressed.

It may thus be seen that, in the embodiment of FIG. 1, 256 binary digit codes fed into the x and y registers 8 and 9 in numerical sequence and in synchronism with a video signal on the terminal y can be used to generate x and y deflection fields which cause the electron beam of the cathode ray tube 1 to scan through 65,536 identifiable positions on the screen. The electron beam may, of course, be moved through any required sequence of these points according to the order in which the codes are fed to the registers, and the signal applied on the terminal 7 can be used to brighten or darken the trace on the screen, as required. The digital to analogue converters 13 and 14 providing the saw-tooth deflection signals may be of any known type. The trapezium distortion correction coupling circuit 24 may comprise a suitably proportioned matching circuit including an amplifier, and together with the d.c. "off-set" potential coupling line 25 may be omitted with cathode ray tubes which do not exhibit this form of distortion.

The use of the x and y decoders 17 and 18 to provide 32 separate outputs, during each x and y scan, as indicated at 30 and 31, enables 32 regularly spaced signals to be provided during each x scan of the beam to the linearity correction circuit 32, the automatic astigmatism correction circuit 34 and the automatic focus function generator 42, and during each y scan of the beam to the linearity correction circuit 33 and the automatic astigmatism correction circuit 35. Thus the automatic focus function generator 42 is addressed by signals on the lines 41 32 times during each x scan and corrected signals are applied to the focus electrodes 44 in accordance with each of the 32 outputs per x scan from the generator 42 and the law suitably built into the generator 42. Of course, where required, the focus correction may also be applied in accordance with the y scanning of the beam or where it is not necessary it may be dispensed with. In the embodiment described there are thus 8,192 corrections of the focussing of the beam throughout a complete scan.

Correction signals are also applied to the x deflection amplifier 22 32 times during each line scan in respect of linearity and astigmatism correction signals from the circuits 32 and 34 as a result of the inputs to them on the lines 30 from the decoder 17.

Thirty-two times during each y scan, or at every eighth line, correction signals in respect of linearity and astigmatism are applied from the correction circuits 33 and 35 to the y deflection amplifier 23 as a result of the inputs to them on the lines 31. There are thus corrections for these two parameters of the beam at 1,024 co-ordinate positions throughout the frame scan.

The linearity and astigmatism correction circuits may be in the form of known networks, for example matrices giving a required predetermined output when a particular line is addressed.

One form of x axis linearity correction circuitry is shown in FIG. 6A, in which the correction circuit is indicated within dotted lines 32. This circuit generates a correction function which is equal and opposite to the function generated by the particular cathode ray tube employed in order to provide linear deflection.

The outputs from x decoder 17 are applied to respective ones of thirty-two input terminals 141 to 172 across a resistance chain comprising a load resistor R_{1L} and a respective one of a plurality of resistors R_{11} to R_{32} via a respective diode rectifier D_{11} to D_{32} . The output across resistor R_{1L} is coupled via an amplifier 174 to a terminal 173 for application to the x deflection amplifier 22.

Referring to FIG. 6B, it is apparent that if the uncorrected deflection law is shown by curve 176 the necessary correction shown by curve 177 must be generated to achieve the desired deflection law shown by curve 176.

A like arrangement is employed to provide y axis correction by linearity correction circuitry 33.

Astigmatism correction of the electron beam spot is made in one embodiment by charging the mean d.c. potential of the x and y deflection plates according to the laws graphically illustrated in FIG. 7B. The laws are generated by the circuits shown in FIG. A. The upper circuit block chain provides x correction and the lower chain provides y correction. The 32 output lines of x decoder 17 are applied via line 30 to an inverter at the 32 outputs therefrom are coupled to a function chain 181 which is a resistor network of the same form shown in FIG. 2. The single line output of the network 181 is coupled via an amplifier 182 and line 37 to the x deflection amplifier 22.

In like fashion, the y correction law is generated by inverter 183, function chain 184 and amplifier 185 and coupled via line 39 to y deflection amplifier 23.

The resistor networks described above for providing the various correction laws may be eliminated and the system shown in FIG. 8 substituted therefor. In this system read only memories may be employed.

To provide x axis correction, the 32 output lines of x decoder 17 are coupled to read only memories 186, 187 and 188 which are constituted according to the focus law, astigmatism law and linearity law, respectively. The eight outputs from these read only memories are coupled to corresponding digital to analogue converters 189, 190 and 191. The correction signals from amplifiers 192-194 are applied via lines 195-197 in the manner described hereinbefore.

Y axis correction would be provided in like fashion.

Other combinations of co-ordinate positions of the beam at which corrections may be applied may be chosen according to the particular characteristics of the cathode ray tube employed, and as has been explained above, the circuit has particular application to the cathode ray tube described in our co-pending patent application. A suitable cathode ray tube will now be described with reference to FIGS. 3 and 4 of the accompanying drawings.

In FIGS. 3 and 4 there is shown a cathode ray tube having an envelope 101 through which there is visible a planar transparent support screen 102. On the inner face of the support screen there is an electroluminescent screen 103 which comprises a transparent conducting layer and a coating of material which luminesces when bombarded by electrons. Directly behind and spaced from the screen 102 there is a beam-directing electrode 104 which is in the form of a single sheet, though it may be made from a plurality of electrically interconnected sheets. The support screen 102 upon which the luminescent material is provided may alternatively be the transparent face of the envelope 101. In a further modification, the beam directing electrode is made of a transparent material and the screen may be viewed from either or both sides of the envelope. The beam directing electrode 104 is of greater height in the normal direction of the beam than the screen 102 and along the edges of the electrode 4 extending beyond the area of the screen 102 there are, as shown in FIG. 3, strips of electrically conducting material 105 and 106. Terminals 107 and 108 on the envelope 101 are electrically connected to the strips 105 and 106. A uniform resistive layer is applied to the electrode 104 between the strips 105 and 106. The conducting layer of the electroluminescent screen 103 is electrically connected to a terminal 109 on the envelope 101.

The envelope 101 has a neck 110 which houses an electron gun 111 and orthogonally operating electrostatic deflecting electrode systems 112 and 113. An electromagnetic collimator lens structure 114 is positioned around the flared part of the envelope. Other correcting lens systems may be provided as required. An electron beam, indicated in two positions by solid and dotted lines 115 and 116 respectively, is shown impinging upon the screen at points distant from and near to the beam source 111.

In operation, biasing potentials, with respect to the E. H. T. potential applied to the electroluminescent screen 103 via the terminal 109, are applied between the terminals 107 and 108 and connected across the electrode 104 between the strips 105 and 106. The biasing potential on the strip 105 is of a higher value than that on the strip 106 and an electric field is produced in the space 121 (FIG. 4) between the beam-directing electrode 104 and the screen 103 having an intensity which is greatest in the part of the region of the space 121 furthest from the electron gun 111. The uniform layer of resistive material between the strips 105 and 106 causes the beam-directing biasing potential to be so distributed over the electrode 104 that the field in the space 121, though static, is non-uniform and varies in intensity substantially linearly throughout the space 121 in the direction from the strip 106 to the strip 105, reaching a maximum value in the region of the space 121 extending between the edges of the

screen 103 remote from the source 107 and the strip 105.

Deflection potential are applied to the deflecting electrode systems 112 and 113 in a known manner to cause the electron beam emitted by the gun 111 to be deflected in two orthogonal directions and to set up a raster or other selected pattern before it enters the space 121. When the electron beam is given a lateral component of movement from its undeflected path before it enters the beam directing field space 121 between the screen 103 and the electrode 104, its direction of entry into the space changes and the distribution of the beam directing field in that space is such that the beam is caused to be directed, as it passes through the space 121, towards a given position on the screen 103 according to the angle through which it is moved laterally from its undeflected path before it enters the space 121, or in other words according to its direction of entry into the space 121. The electron beam may initially be directed towards the electrode 104 as it enters the space 121 in order eventually to impinge upon certain positions on the screen 103. The actual position in which the beam impinges upon the screen 103 is determined by the angle through which it is deflected before it enters the beam-directing field, the velocity of the beam and the distributed intensity of the field in the part of the space 121 through which it passes.

The deflection fields set up by the systems 112 and 113 determines the angle at which the beam enters the region 121 and by suitably shaping these fields, the shape of the area of the screen 103 scanned by the beam may be controlled. The collimator lens structure 110 is designed to correct for the form of distortion commonly known as "keystone" distortion in which the width of a display nearer to the source 111 would otherwise be less than the width of the display further from the source 107. However, as has been indicated above, keystone distortion may alternatively be corrected by suitably shaping the deflection fields, for example by interchanging the electrode systems 112 and 113 and shaping the electrodes of the system 112 to provide the required correcting field.

A scanning raster may be set up by the electrode systems 112 and 113 in such a way that the scanning lines developed on the screen 103 are either in planes substantially at right angles to the axis of the electron beam emerging from the gun 111 or parallel to this axis.

Instead of setting up a raster pattern the beam may be deflected by the systems 112 and 113 to write alphanumeric information directly on the screen. This latter form of display is particularly suitable for use in displaying quantitative information, for example when monitoring information on an aircraft control panel. It is necessary in modern aircraft to monitor a large number of different sources of information and, since these sources can be scanned electrically comparatively easily, information exceeding given limits from any of the sources may be selected and written on the separate parts of the display simultaneously, in order to highlight the fact that a limit has been exceeded.

Modifications and variations may be made within the

scope of the present invention, for example by reducing or increasing the number of parameters which are corrected or by employing other means than binary coded digital signals to control the circuit operation.

What is claimed is:

1. A cathode ray tube circuit having first and second means for generating x and y beam deflection signals, respectively, to provide a raster scan, a connection for coupling a signal proportional to the y deflection signal to the x deflection signal generating means to modify the x deflection signal according to the y deflection signal thereby to provide a correction for the trapezium distortion of an image on the screen that might otherwise occur, first and second digitally operated control means connected for controlling the said first and second beam deflection signal generating means respectively, a decoder having an input connected to the output from one of the control means and a function generator having an input connected to the output from the decoder and an output providing a signal for modifying a control signal for a cathode ray tube beam.

2. A cathode ray tube circuit as claimed in claim 1 wherein the input to the decoder from the control means comprises a series of digital signals fed at a rate which is proportional to and less than the rate at which signals are fed from the control means to the means for generating beam deflection signals.

3. A cathode ray tube circuit as claimed in claim 1 wherein each of the first and second control means is constituted by a counter, including means for coupling to the counters a series of pulses obtained from a clock under the control of the synchronizing pulses of a video signal, whereby scanning of the face of the cathode ray tube in synchronism with an image to be displayed is obtained.

4. A cathode ray tube circuit as claimed in claim 1 including a function generator having its input connected to the output of the first decoder and its output connected to a focus control electrode, whereby a correction signal can be applied to the focus control electrode according both to the deflection of the beam by signals generated by the first beam generating means and to the output of the said function generator.

5. A cathode ray tube circuit as claimed in claim 1 wherein the function generator comprises a circuit which includes a load resistor across which the output signal for modifying a control signal can be obtained, a plurality of function determining resistors each in series with the load resistor, a diode connected to each function determining resistor, and means for connecting a signal to each diode in turn whereby a plurality of output signals each corresponding to a predetermined beam position can be provided.

6. A circuit as claimed in claim 5 wherein the function determining resistors are connected in series with one another.

7. A circuit arrangement as claimed in claim 1 wherein the control means are operated by digital signals in the binary form.

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