

Description

This invention relates to electron beam landing correction for cathode ray tubes and, in particular, to vertical convergence correction using digital sample interpolation techniques.

A digital color television system samples an analog video signal at a predetermined rate, for example, 14.32 MHz; which, for NTSC color signals, is four times the color subcarrier frequency. The signal amplitude of each sample is converted to a digital value by an analog-to-digital converter (ADC). The digitized video signal is processed to form red, green and blue drive signals, which after conversion back to the analog domain by a digital-to-analog converter (DAC), are applied to the cathodes of the color cathode ray tube.

Both digital and analog television receivers are subject to raster distortion and convergence errors. Horizontal convergence errors and raster distortion, such as side pincushion distortion, may be corrected by selectively delaying one or more of the individual color signals in a given horizontal scan line in order to converge the three colors on the cathode ray tube display screen. In a digital system, this delay may be accomplished by clocking the digital samples into a storage device, such as a random access memory (RAM) and clocking the samples out of the RAM after a predetermined number of clock pulses.

In order to provide accurate correction of misconvergence or raster distortion, it may be necessary to provide digital sample delays of less than whole clock pulses. One way such fractional clock pulse delays may be accomplished is by controlling the phase of the sample read clock with respect to the write clock, as is disclosed in U.S. Patent Application Serial No. 480,907, filed March 31, 1983, in the name of T. V. Bolger and entitled "Digital Video Processing System With Raster Distortion Correction", corresponding to UK Published Application No. 2137849A, published 10 October 1984. Another way of providing fractional sample delay is by a sample interpolation arrangement, such as is described in EP-A-176240.

Vertical misconvergence or vertical raster distortion, such as top and bottom pincushion distortion, requires a somewhat different correction approach than the previously described technique of horizontal error correction by sample delay. Whereas horizontal error correction requires processing of video information pixels in only a single horizontal scan line at a given time, vertical error correction requires simultaneous processing of pixels in more than one horizontal line, thereby increasing the complexity of the correction circuitry. Top and bottom pincushion distortion, for example, may result in information from one video line being displayed in several scan lines separated by a vertical distance on the picture tube display screen of as much as 1.2 cm. For standard interlaced scan raster, this corresponds to a vertical distance of as many as eight

horizontal scan lines. This means that for a severely distorted region of the raster, video information from as many as eight video lines must be stored and retrieved in order to display one corrected picture line. It may also be necessary to be able to effect apparent displacement of video pixel information through distance less than the separation between scan lines, in order to provide accurate error correction to closely specified tolerances.

In accordance with the present invention, there is provided means for correcting vertical beam landing position errors in a video display apparatus comprising circuitry for digitally sampling a first line of video information to form a plurality of pixel samples, and circuitry for digitally sampling at least another line of video information to form another plurality of pixel samples. Circuit means combines respective pixel samples from the first and other line(s) of video information in accordance with the vertical beam landing position errors to form a resultant pixel sample having an apparent vertical offset position between the first and the other pixel samples that provides correction for the beam landing position errors.

In the accompanying drawing:

Figure 1 is a schematic and block diagram of a vertical beam landing correction circuit in accordance with an NTSC embodiment of the present invention; and

Figure 2 shows a portion of a scanned raster, useful in understanding the circuit shown in Figure 1.

Referring to Figure 1, an analog composite video signal, from a source of video signals (not shown), is applied to an analog-to-digital converter (ADC) 10. ADC 10 generates digital samples representative of pixels at a sample rate determined by the clock signal frequency of a clock generator 11. The circuit of Figure 1 illustratively uses a sampling frequency of 14.32 MHz, which is equal to four times the color subcarrier frequency for NTSC color signals. ADC 10 is illustratively shown as providing an 8-bit digital sample, thereby generating samples having $2^8=256$ possible quantizing steps. The digitized video signal is applied to a synchronizing signal separator circuit 12, where it is processed to remove the horizontal and vertical synchronizing information. The video signal is also applied to a digital comb filter 13, which separates the luminance and chrominance information into separate channels.

The luminance information is applied to luminance processing circuitry 14 which provides a luminance signal on a conductor designated Y to a digital matrix 15. Chrominance information is applied to chrominance processing circuitry 16, which generates the I and Q color signals in response to the properly phased I and Q clock signals, provided on conductors designated ICK and QCK from clock generator 11. The I and Q color signals, on conductors I and Q, are applied to digital matrix 15, which combines the luminance signal Y and the I and Q color signals to

produce the digital red, green and blue color signals on conductors DR, DG and DB, respectively.

In accordance with an aspect of the present invention, each of the digital red, green and blue color signals is applied to a digital delay circuit. Figure 1 shows, in detail, a digital delay circuit 20 which acts on the digital blue color signal on conductor DB. Similar delay circuits 21 and 22 for the digital red and digital green color signals are illustrated in block diagram form, for simplicity.

Digital matrix 15 generates pixel representative digital color samples illustratively comprising 8 bits. These samples are applied to an odd/even line multiplex circuit 23, which controls whether the digital color samples for a given horizontal scan line are stored in the odd-line memory 24 or the even-line memory 25. Memories 24 and 25, for example random access memories or RAM's, are provided so that pixel representative samples in successive video lines can be stored in different memories, thereby providing easy access to adjacent video line pixel information, in order to simplify sample processing. Multiplex circuit 23 receives a signal from a counter logic circuit such as flip-flop 26 that determines to which of memories 24 or 25 the video information pixel samples from digital matrix 15 are applied. Flip-flop 26 is responsive to horizontal synchronizing information and produces a signal which acts to switch the operation of multiplex circuit 23 for each horizontal video line in order to effectively direct the pixel data alternately into the odd line memory 24 and the even line memory 25. Flip-flop 26 is reset by vertical synchronising information at the beginning of each field.

Write/read address generator 27 is reset by horizontal and vertical rate signals from sync separator 12 and incremented by clock generator 11. Write/read address generator 27 determines the pixel sample location in memories 24 and 25 into which pixel sample information is written or from which pixel sample information is read. Since vertical error correction requires processing pixel samples in adjacent video lines at the same horizontal raster position, the horizontal address provided by write/read address generator 27 will be the same at any given time for either a reading or writing function. A write/read multiplexer circuit 30 determines which of the memories 24 or 25 will be reading data and which of the memories 24 or 25 will be writing data during a particular horizontal line interval. Pixel sample data being read from odd line memory 24 is processed by shift and add circuit 31, while data being read from even line memory 25 is processed by shift and add circuit 32. Shift and add circuits 31 and 32 perform coefficient multiplication as part of a sample interpolation function.

Referring to Figure 2, the means by which vertical beam landing position errors are corrected will be described. Figure 2 illustrates a number of representative horizontal scan lines near the top of the scanned raster. The scan lines display information from corresponding video

lines. The scan lines illustratively exhibit north-south pincushion distortion.

As can be seen in Figure 2, most of the first raster scan line SL_1 , and corresponding video line VL_1 , occurs above the top of the viewable display area, identified as picture line PL_1 . Picture line PL_1 represents the location where scan line SL_1 would occur if no pincushion distortion existed. Due to the pincushion distortion of scan line SL_1 , the only part of video line VL_1 that is viewable occurs near the center of the line. The first video line that is completely viewable in Figure 2 is video line VL_8 , displayed by scan line SL_8 . Scan line SL_8 comprises one line of video information. However, due to the north-south pincushion raster distortion, scan line SL_8 traverses a vertical distance that includes picture lines PL_1 — PL_8 . For simplicity, only picture lines PL_1 and PL_8 are shown in Figure 2. In accordance with an aspect of the present invention, in order to provide an apparent correction of the north-south pincushion distortion, the video line information displayed by a given scan line is controlled so that the video information displayed at a given horizontal pixel location represents the information that would be displayed at the corresponding vertical picture line location of the beam, as if no pincushion distortion existed. For example, as scan line SL_8 traverses a vertical distance through picture lines PL_1 to PL_8 from the left side of the raster to the center (sample locations S_1 — S_4), the video information displayed by the beam will correspond to video information derived from video lines VL_1 through VL_8 , so that the resultant display appears to place the video line information at the desired picture line location.

In Figure 1, read address offset circuitry 33 provides write/read multiplex circuit 30 with the initial coarse vertical offset for correcting a given horizontal scan line, i.e., the integer number of horizontal line intervals that are delayed between writing and reading of video data in order to place the video line information of a given scan line at the desired picture line location. For picture line PL_8 in Figure 2, for example, the initial vertical offset at location S_1 provided by read address offset circuit 33 would be eight lines. This means that video information from video line VL_1 would be read and displayed at the beginning (left side of picture) of the scanning of scan line SL_8 . As described previously, this will place the display of video information from the beginning of the first horizontal video line VL_1 at its desired location at the beginning of the first picture line PL_1 . The initial offset needed during a given scan line is provided to read address offset circuit 33 from a read only memory (ROM) 34.

As scan line SL_8 progresses across the screen from sample locations S_1 to S_8 in Figure 2, the video information needed to display a corrected raster at the appropriate picture line location must be derived from video lines VL_1 through VL_8 . The vertical separation between horizontal picture lines provide beam landing correction in step amounts that are large compared to the incre-

mental amount of distortion or beam landing error that must be corrected. Satisfactory distortion correction cannot be made, therefore, by only controlling the vertical offset position in integer units of horizontal video lines. Accurate beam landing position correction requires that video samples be derived that represent video information occurring between vertically adjacent pixel samples of adjacent video lines.

A horizontal beam landing correction arrangement utilizing a sample interpolation technique is disclosed in the aforementioned EP—A—176240.

In an aspect of the present invention, a sample interpolation arrangement similar to that disclosed in EP—A—176240 is used to provide derived pixel sample having a digital sample value interpolation between the sample values of pixels occurring in adjacent video lines.

As previously described, the initial integer line delay or offset for a given horizontal scan line necessary to place scan line video information at the proper picture line location is provided to read address offset circuit 33 by ROM 34 via the initial line offset conductor 40. The initial fractional line delay or offset is applied to coefficient control counter circuitry 35 by ROM 34 via the initial fractional offset conductor 41. The fractional line offset is combined with the integer line offset to provide accurate beam landing correction to the desired tolerances. The coarse integer and the fine fractional line delay or offset information provided by ROM 34 is determined during manufacture and alignment of the cathode ray tube and deflection yoke. A sensing arrangement, for example, a video camera or a number of photodiodes, determines the amount of correction required for each of the red, green and blue beams at different locations on the cathode ray tube display screen. This information is stored in ROM 34.

The fractional line delay information is provided in the form of coefficients that indicate the relative fractional amplitude of each of the two digital pixel samples from adjacent video lines that are used to form the resultant interpolated sample. The coefficients illustratively form unity fractional complements, that is, the sum of the coefficients will be one, or unity.

The formation of these unity fractional complements is simplified in a digital sampling system. The sample derived from the previously described sample interpolation technique has an apparent position located between the two original samples. The proximity of the interpolation sample to either of the two original samples is determined by the value of the coefficients. If the two interpolating coefficients are each chosen to be one-half, for example, the resultant derived sample will have an apparent position located halfway between the two real samples. If the two coefficients are chosen to be one-eighth and seven-eighths, for example, the resultant sample will have an apparent position located one-eighth of the distance between the samples measured from the sample on which the seven-eighth coefficient operates.

As previously described, the digital pixel samples from odd and even line memories 24 and 25 are applied to shift and add circuits 31 and 32, respectively, in response to signals from write/read multiplexer circuit 30. Write/read address generator 27 determines which pixel location in a given video line is being read from the memories. The two samples stored in shift and add circuits 31 and 32 will be from the same horizontal pixel location in adjacent lines, thereby forming vertically adjacent pixel samples.

The operation of shift and add circuits 31 and 32 is controlled by the fractional coefficients applied by coefficient control counter 35. A coefficient value is illustratively applied to shift and add circuit 32. An inverter 36 illustratively forms the unity fractional complement of the coefficient which in turn is applied to shift and add circuit 31. The coefficients control the number of bit shifts of the pixel sample information, thereby effectively multiplying the sample value by the coefficient. The resultant bit-shifted samples are applied to a summing circuit 37, which sums the samples and provides an interpolated sample at its output. The interpolated sample for the blue video signal may be illustratively applied to a horizontal error correction circuit 45, such as is described in the aforementioned EP—A—176240, or in an article entitled "Digital System for Horizontal Geometry and Convergen Correction", by R. Deubert, published in the *IEEE Transactions on Consumer Electronics*, Vol. CE-30, No. 3, August, 1984, which describe a sample interpolation technique which corrects for horizontal beam landing position errors. Alternative techniques for horizontal beam landing error correction are described in the aforementioned U.K. Published Application 2137849A, and in U.S. Patent No. 3,893,174, issued July 1, 1975, in the names of Sano et al. The red and green video signals are illustratively applied to red horizontal correction circuit 46 and green horizontal correction circuit 47, respectively. The respective red, green and blue corrected digital signals are applied to digital to analog converters 50, 51, and 52, respectively, which convert the signals back into the analog domain. The red, green and blue analog signals are then illustratively applied to their respective kine driver circuits.

As the electron beams traverse the screen along a given horizontal scan line, ROM 34 will provide information that determines when the fractional coefficients should be incremented or decremented to maintain proper display of the correct video information at the proper picture line locations. The signal which indicates a coefficient change occurrence is provided to coefficient control counter circuitry 35 via coefficient change clock conductor 42. The coefficient change direction is provided to coefficient control counter circuitry 35 via coefficient change direction conductor 43. A signal from coefficient control counter circuitry 35 to read address offset circuitry 33 causes the selected video lines to be advanced or retarded when the coefficients are respectively

incremented or decremented through unity.

Since the delay circuits 20, 21, and 22 operate independently on the red, green and blue designated electron beams, it is possible to correct any vertical beam landing error, such as convergence, coma, vertical height, and top and bottom pin-cushion distortion, for example.

For a normal N.T.S.C. interlaced scan at a standard horizontal frequency of 15.75 KHz, a vertical error of +0.5 inch (12 mm) on a 25V cathode ray tube could be corrected using eight-line (8H) memories for memories 24 and 25. In progressive scan system operating at a horizontal deflection frequency of 31.5 KHz, a similar amount of correction would require a sixteen-line (16H) memory, since the vertical distance between adjacent scan and picture lines would be halved.

Alternately, if a field or frame store progressive scanning system were to be used, odd and even line memories 24 and 25 would be incorporated into the field or frame store architecture.

Similarly, if sample interpolation techniques were to be used to correct horizontal beam landing errors, a common memory and addressing system could be provided.

Claims

1. Apparatus for countering the effect of vertical beam landing position errors for a cathode ray tube electron beam, characterized by:

means (23, 24) for digitally sampling a first line of video information to form a plurality of pixel samples;

means (23, 25) for digitally sampling at least one other line of video information to form another plurality of pixel samples; and

means (34, 35, 37) for combining respective pixel samples from said first and said other line of video information in accordance with said vertical beam landing position errors to form a resultant pixel sample having an apparent vertical offset position between said first and said another line that provides correction for said beam landing position errors.

2. Apparatus according to claim 1, characterized in that said combining means (35) provides first and second sample interpolating coefficients, said first and second sample coefficients summing to unity.

3. Apparatus according to claim 1, characterized in that said means (23, 24) for digitally sampling a first line of video information and said means (23, 25) for digitally sampling at least one other line of video information sample, respectively, alternate lines of video information.

4. Apparatus according to claim 1, characterized in that said respective pixel samples and said resultant pixel sample have the same horizontal position within the respective lines of video information.

5. Apparatus for countering the effect of vertical beam landing position error in a cathode ray tube for a video information pixel, characterized by:

means (34) for establishing the correct raster location for said video information pixel;

means (30, 33) responsive to said location establishing means (34) for providing a first amount of vertical beam landing position error correction for said video information pixel equal to the number of integer lines of correction required;

means (15, 23, 24, 25) for digitally sampling first and second lines of video information to provide a plurality of pixel samples from each of said first and second lines of video information; and

means (31, 32, 35) responsive to said location establishing means (34) for combining pixel samples from said first and said second lines of video information to provide a second amount of vertical beam landing position error correction for said video information pixel equal to fractional line amount of correction required.

6. Apparatus according to claim 5, characterized in that said means for providing the correct raster location for said video information pixel comprises a preprogrammed memory (34).

7. Apparatus according to claim 5, characterized in that said means (30, 31, 32) for providing a first amount of beam landing position error correction comprises means (31, 32) for delaying the display of said video information pixel sample for a period equal to a predetermined number of lines of video information.

8. Apparatus according to Claim 5 characterized by:

means (45) responsive to said location establishing means (34) for providing horizontal electron beam landing raster distortion correction for said line of vertically corrected digital information pixel samples.

9. Apparatus according to claim 8, characterized in that said means (45, 46, 47) for providing horizontal electron beam landing raster distortion correction comprises means for combining digital video information pixel samples from said line of vertically corrected digital video information pixels.

10. In combination with a cathode ray tube producing three electron beam and exhibiting vertical beam landing errors of said electron beams on the display screen of said cathode ray tube apparatus for countering the effect of beam landing errors provided for each of said three electron beams in accordance with any preceding claim.

Patentansprüche

1. Anordnung zum Ausgleichen des Effekts von vertikalen Strahlaufreffpunktfehler für den Elektronenstrahl einer Kathodenstrahlröhre, gekennzeichnet durch:

eine Einrichtung (23, 24) zum digitalen Abtasten einer ersten Zeile einer Videoinformation um eine Anzahl von Bildpunktabtastwerten zu bilden;

eine Einrichtung (23, 25) zum digitalen Abtasten mindestens einer anderen Zeile der Videoinformation um eine weitere Anzahl von Bildelement-

incremented or decremented through unity.

Since the delay circuits 20, 21, and 22 operate independently on the red, green and blue designated electron beams, it is possible to correct any vertical beam landing error, such as convergence, coma, vertical height, and top and bottom pin-cushion distortion, for example.

For a normal N.T.S.C. interlaced scan at a standard horizontal frequency of 15.75 KHz, a vertical error of +0.5 inch (12 mm) on a 25V cathode ray tube could be corrected using eight-line (8H) memories for memories 24 and 25. In progressive scan system operating at a horizontal deflection frequency of 31.5 KHz, a similar amount of correction would require a sixteen-line (16H) memory, since the vertical distance between adjacent scan and picture lines would be halved.

Alternately, if a field or frame store progressive scanning system were to be used, odd and even line memories 24 and 25 would be incorporated into the field or frame store architecture. Similarly, if sample interpolation techniques were to be used to correct horizontal beam landing errors, a common memory and addressing system could be provided.

Claims

1. Apparatus for countering the effect of vertical beam landing position errors for a cathode ray tube electron beam, characterized by:

means (23, 24) for digitally sampling a first line of video information to form a plurality of pixel samples;

means (23, 25) for digitally sampling at least one other line of video information to form another plurality of pixel samples; and

means (34, 35, 37) for combining respective pixel samples from said first and said other line of video information in accordance with said vertical beam landing position errors to form a resultant pixel sample having an apparent vertical offset position between said first and said another line that provides correction for said beam landing position errors.

2. Apparatus according to claim 1, characterized in that said combining means (35) provides first and second sample interpolating coefficients, said first and second sample coefficients summing to unity.

3. Apparatus according to claim 1, characterized in that said means (23, 24) for digitally sampling a first line of video information and said means (23, 25) for digitally sampling at least one other line of video information sample, respectively, alternate lines of video information.

4. Apparatus according to claim 1, characterized in that said respective pixel samples and said resultant pixel sample have the same horizontal position within the irrespective lines of video information.

5. Apparatus for countering the effect of vertical beam landing position error in a cathode ray tube for a video information pixel, characterized by:

means (34) for establishing the correct raster location for said video information pixel;

means (30, 33) responsive to said location establishing means (34) for providing a first amount of vertical beam landing position error correction for said video information pixel equal to the number of integer lines of correction required;

means (15, 23, 24, 25) for digitally sampling first and second lines of video information to provide a plurality of pixel samples from each of said first and second lines of video information; and

means (31, 32, 35) responsive to said location establishing means (34) for combining pixel samples from said first and said second lines of video information to provide a second amount of vertical beam landing position error correction for said video information pixel equal to fractional line amount of correction required.

6. Apparatus according to claim 5, characterized in that said means for providing the correct raster location for said video information pixel comprises a preprogrammed memory (34).

7. Apparatus according to claim 5, characterized in that said means (30, 31, 32) for providing a first amount of beam landing position error correction comprises means (31, 32) for delaying the display of said video information pixel sample for a period equal to a predetermined number of lines of video information.

8. Apparatus according to Claim 5 characterized by:

means (45) responsive to said location establishing means (34) for providing horizontal electron beam landing raster distortion correction for said line of vertically corrected digital information pixel samples.

9. Apparatus according to claim 8, characterized in that said means (45, 46, 47) for providing horizontal electron beam landing raster distortion correction comprises means for combining digital video information pixel samples from said line of vertically corrected digital video information pixels.

10. In combination with a cathode ray tube producing three electron beam and exhibiting vertical beam landing errors of said electron beams on the display screen of said cathode ray tube apparatus for countering the effect of beam landing errors provided for each of said three electron beams in accordance with any preceding claim.

Patentansprüche

1. Anordnung zum Ausgleichen des Effekts von vertikalen Strahlauftreffpunktfehler für den Elektronenstrahl einer Kathodenstrahlröhre, gekennzeichnet durch:

eine Einrichtung (23, 24) zum digitalen Abtasten einer ersten Zeile einer Videoinformation um eine Anzahl von Bildpunktabtastwerten zu bilden;

eine Einrichtung (23, 25) zum digitalen Abtasten mindestens einer anderen Zeile der Videoinformation um eine weitere Anzahl von Bildelement-



Abtastwerten zu bilden; und

eine Einrichtung (34, 35, 37) zum Kombinieren jeweiliger Bildpunktabtastwerte aus der ersten und der anderen Zeile der Videoinformation entsprechend den vertikalen Strahlauftreffpunktfehlern, um einen resultierenden Bildpunktabtastwert zu bilden, der eine scheinbare, vertikal verschobene Lage zwischen der ersten und der weiteren Zeile aufweist, die eine Korrektur der Strahlauftreffpunktfehler bewirkt.

2. Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Einrichtung (35) zum Kombinieren erste und zweite die Abtastwerte interpolierende Koeffizienten erzeugt, wobei sich die ersten und zweiten Abtastwert koeffizienten zu Eins ergänzen.

3. Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß die Einrichtung (23, 24) zum digitalen Abtasten einer ersten Zeile der Videoinformation und die Einrichtung (23, 25) zum digitalen Abtasten mindestens einer weiteren Zeile der Videoinformation jeweils abwechselnde Zeilen der Videoinformation abtasten.

4. Anordnung nach Anspruch 1, dadurch gekennzeichnet, daß die jeweiligen Bildelement-Abtastwerte und der resultierende Bildelement-Abtastwert in ihren jeweiligen Zeilen der Videoinformation die gleiche horizontale Lage haben.

5. Einrichtung zum Ausgleichen des Effekts eines vertikalen Strahlauftreffpunktfehlers in einer Kathodenstrahlröhre für ein Videoinformationsbildelement, gekennzeichnet durch:

eine Einrichtung (34) zum Festlegen der richtigen Rasterlage für das Videoinformations-Bildelement;

eine auf die Einrichtung (34) zum Festlegen der richtigen Lage ansprechende Einrichtung (30, 33) zum Erzeugen eines ersten Betrages einer Vertikalkorrektur des Strahlauftreffpunktfehlers für das Videoinformationsbildelement, der gleich ist der Anzahl der ganzen Zeilen der notwendigen Korrektur,

eine Einrichtung (15, 23, 24, 25) zum digitalen Abtasten erster und zweiter Zeilen der Videoinformation, um eine Anzahl von Bildelementabtastwerten von jeder der ersten und zweiten Zeilen der Videoinformation zu erzeugen; und

eine auf die Einrichtung (34) zum Festlegen der Lage ansprechende Einrichtung (31, 32, 35) zum Kombinieren der Bildelementabtastwerte aus den ersten und zweiten Zeilen der Videoinformation, um einen zweiten Betrag zur Vertikalkorrektur des Strahlauftreffpunktfehlers für das Videoinformationsbildelement zu erzeugen, der dem einem Bruchteil einer Zeile entsprechenden Betrag der benötigten Korrektur gleich ist.

6. Anordnung nach Anspruch 5, dadurch gekennzeichnet, daß die Einrichtung zum Festlegen der richtigen Rasterlage für das Videoinformationsbildelement einen vorprogrammierten Speicher (34) enthält.

7. Anordnung nach Anspruch 5, dadurch gekennzeichnet, daß die Einrichtung (30, 31, 32) zum Erzeugen eines ersten Betrages der Strahlauftreffpunktfehlerkorrektur eine Einrichtung (31,

32) enthält, um die Anzeige des Abtastwertes des Videoinformationsbildelementes für eine Zeitdauer zu verzögern, die einer vorgegebenen Anzahl von Zeilen der Videoinformation gleich ist.

8. Anordnung nach Anspruch 5, gekennzeichnet durch eine auf die Einrichtung (34) zum Festlegen der Lage ansprechende Einrichtung (45), um eine Horizontalkorrektur einer Rasterverzeichnung des Elektronenstrahlauftreffpunktes für die Zeile der vertikal korrigierten digitalen Abtastwerte der Informationsbildelemente zu bewirken.

9. Anordnung nach Anspruch 8, dadurch gekennzeichnet, daß die Einrichtung (45, 46, 47) zum Bewirken der Horizontalkorrektur einer Rasterverzeichnung des Elektronenstrahlauftreffpunktes eine Einrichtung enthält, um die digitalen Abtastwerte der Videoinformationsbildelemente aus der Zeile der vertikal korrigierten digitalen Videoinformationsbildelemente zu kombinieren.

10. Kombination einer Kathodenstrahlröhre, die drei Elektronenstrahl erzeugt und vertikale Strahlauftreffpunktfehler der Elektronenstrahlen auf dem Anzeigeschirm der Kathodenstrahlröhre aufweist, mit einer Anordnung zum Ausgleichen des Effekts der Strahlauftreffpunktfehler, die nach einem der vorhergehenden Ansprüche für jeden der drei Elektronenstrahlen vorgesehen ist.

Revendications

1. Dispositif pour contrer l'effet d'erreur de position verticale d'atterrissage de faisceau pour un faisceau d'électrons d'un tube à rayon cathodique, caractérisé par:

un moyen (23, 24) pour échantillonner numériquement une première ligne d'information vidéo pour former une pluralité d'échantillons d'éléments d'image;

un moyen (23, 25) pour échantillonner numériquement au moins une autre ligne d'information vidéo pour former une autre pluralité d'échantillons d'éléments d'image; et

un moyen (34, 35, 37) pour combiner des échantillons d'éléments d'image respectifs de la première et de l'autre ligne d'information vidéo suivant les erreurs de position verticale d'atterrissage du faisceau pour former un échantillon d'éléments d'image résultant ayant une position décalée verticale apparente entre la première et l'autre ligne qui produit une correction pour les erreurs de position d'atterrissage du faisceau.

2. Dispositif selon la revendication 1, caractérisé en ce que le moyen de combinaison précité (35) produit des premier et second coefficients d'interpolation d'échantillons, les premier et second coefficients d'échantillons s'additionnant pour former une unité.

3. Dispositif selon la revendication 1, caractérisé en ce que le moyen précité (23, 24) pour échantillonner numériquement une première ligne d'information vidéo et le moyen précité (23, 25) pour échantillonner numériquement au moins une autre ligne d'information vidéo échantillonnent respectivement des lignes alternées d'information vidéo.





Dispositif selon la revendication 1, caractérisé en ce que les échantillons d'éléments d'image respectifs précités et l'échantillon d'élément d'image résultant précité ont la même position horizontale dans leurs lignes respectives d'information vidéo.

5. Dispositif pour contrer l'effet d'erreur de position verticale d'atterrissage de faisceau dans un tube à rayon cathodique pour un élément d'image d'information vidéo, caractérisé par:

un moyen (34) pour établir l'emplacement de trame correct pour l'élément d'image d'information vidéo;

un moyen (30, 33) répondant auxdits moyen d'établissement d'emplacement (34) pour produire une première quantité de correction d'erreurs de position verticale d'atterrissage du faisceau pour l'élément d'image d'information vidéo égale au nombre de lignes entières de correction exigée;

un moyen (15, 23, 24, 25) pour échantillonner numériquement des première et seconde lignes d'information vidéo pour produire une pluralité d'échantillons d'éléments d'image à partir de chacune desdites première et seconde lignes d'information vidéo; et

un moyen (31, 32, 35) répondant audit moyen d'établissement d'emplacements (34) pour combiner des échantillons d'éléments d'image à partir desdites première et seconde lignes d'information vidéo pour produire une seconde quantité de correction d'erreur de position verticale d'atterrissage du faisceau audit élément d'image d'information vidéo égale à la quantité de lignes fractionnelle de correction exigée.

6. Dispositif selon la revendication 5, caractérisé en ce que le moyen précité pour produire l'emplacement de trame correct à l'élément

d'image d'information vidéo précité comprend une mémoire préprogrammée (34).

7. Dispositif selon la revendication 5, caractérisé en ce que le moyen précité (30, 31, 32) pour produire une première quantité de correction d'erreur de position d'atterrissage du faisceau comprend un moyen (31, 32) pour retarder la visualisation de l'échantillon précité d'éléments d'image d'information vidéo pour une période égale à un nombre prédéterminé de lignes d'information vidéo.

8. Dispositif selon la revendication 5, caractérisé par un moyen (45) répondant au moyen d'établissement d'emplacements précité (34) pour produire une correction de déformation de trame horizontale d'atterrissage du faisceau d'électrons pour la ligne précitée d'échantillons d'éléments d'image d'information numérique corrigés verticalement.

9. Dispositif selon la revendication 8, caractérisé en ce que le moyen précité (45, 46, 47) pour produire une correction de déformation de trame horizontale d'atterrissage du faisceau d'électrons comprend un moyen pour combiner les échantillons d'éléments d'image d'information vidéo numérique de la ligne précitée d'éléments d'image d'information vidéo numérique corrigée verticalement.

10. En combinaison avec un tube à rayon cathodique produisant trois faisceau d'électrons et présentant des erreurs verticales d'atterrissage du faisceau desdits faisceau d'électrons sur l'écran de visualisation dudit tube à rayon cathodique, un dispositif pour contrer l'effet d'erreurs d'atterrissage du faisceau prévu pour chacun des trois faisceaux d'électrons selon l'une des revendications précédentes.

40

45

50

55

60

65

7