

Description

The present invention relates generally to control systems for the luminance/chrominance signal processing circuits of a color television receiver, and particularly to control systems suitable for use in receivers of the type incorporating automatic control of color kinescope biasing.

An illustrative arrangement for automatic control of color kinescope biasing in a color television receiver is that described in U.S. Patent US-A-4,263,622 - Hinn. In the Hinn arrangement, a control period, occupying a period of several successive line intervals within each vertical blanking interval, is set aside for monitoring a black level current produced by an electron gun under reference signal conditions. During this control period, departures from a desired current level are detected and the gun bias readjusted to oppose the undesired departures. During a portion of the control period, the color kinescope grid receives a conduction-enhancing pulse. Bias control is based upon information derived as indicative of the change in cathode current level introduced by the grid pulsing. An advantageous system for utilization of the above-described Hinn approach in maintenance of an appropriate bias relationship among the color kinescope's gun trio (in the face of aging and other parameter variations) is described in U.S. Patent US-A-448 4228 (Serial No. 434,314) of R.P. Parker.

For successful use of automatic kinescope bias (AKB) control in the manner exemplified by the structures of the aforementioned Hinn US patent 4263622 and Parker US Patent, US-A-448 4228 it is recognized herein that the luminance/chrominance signal processing circuits require some suitable form of manipulation during the bias control periods to avoid undesirable disturbance or contamination of the current monitoring and bias adjustment functions. These signal processing circuits process signal information for delivery to the color kinescope during the time periods intervening the periodically recurring bias control periods.

In an illustrative embodiment of the present invention, protection of the integrity of the AKB control operations is afforded by keying actions which suitably change the operation of: luminance/chrominance gain control apparatus; brightness control apparatus; and a control loop serving to control the DC level of the receiver's luminance channel output. The keying of the gain control apparatus is such that gains of respective luminance and chrominance signal amplifiers are rendered responsive to an adjustable gain control voltage during all field interval portions with the exception of the kinescope bias control intervals.

During the bias control intervals, the respective amplifiers are effectively disabled. The keying of the brightness control apparatus renders the DC level of each color signal supplied to the color kinescope responsive to an adjustable brightness control voltage during the presence of image-representative signal components, but independent of the adjustable brightness control voltage throughout the kinescope bias control intervals. The control loop for controlling the DC level of the receiver's luminance channel output includes a keyed comparator, serving to compare the voltage attained by one of the color signals with a reference voltage throughout each kinescope bias control interval, and means for applying the comparator output to the luminance channel to oppose departures of said attained color signal voltage from substantial equality with the reference voltage.

Where the color TV receiver includes a retrace blanking circuit for normally supplying a beam cut-off bias to the color kinescope during periods of beam retrace in the tracing of a display raster, the control system desirably includes additional keying control for preventing such cut-off bias application during beam retrace periods falling within the kinescope bias control intervals. Additionally, where the color TV receiver includes an on-screen display (OSD) system for supplying auxiliary color signals to the color kinescope (e.g., for channel number display, time display, etc.), the control system desirably includes additional keying control for disabling the auxiliary color signal supplying means during the kinescope bias control intervals.

In the accompanying drawings,

FIGURES 1 and 1a illustrate, partially schematically and partially by block representation, cooperating portions of a color television receiver incorporating a control system in accordance with an embodiment of the present invention;

FIGURE 2 illustrates, primarily schematically, circuits for implementing functions of selected elements of the FIGURE 1 system; and

FIGURE 3 illustrates graphically waveforms of aid in explaining the operation of the FIGURE 1 system.

In FIGURE 1, luminance signals appearing at terminal L are applied via a capacitor 10 to the input of a luminance signal processor 11. Illustratively, the luminance signals appearing at terminal L may comprise the luminance signal output of comb filter apparatus (of the type shown in U.S. Patent US-A-4,096,516 - Pritchard, for example), employed in a color television receiver to separate the luminance and chrominance components of a received composite signal. Processed luminance signals appearing at an output terminal PL of the processor 11 are supplied to the signal input terminal of a gain controlled luminance amplifier 13. The

gain controlled luminance signal output of amplifier 13 is applied to a luminance signal translator 15, which supplies a luminance signal input to each of a trio of signal combiners 30,31 and 32.

Chrominance signals appearing at terminal C are applied to the input of a chrominance signal processor 20. Illustratively, the chrominance signals appearing at terminal C may comprise the chrominance signal output of the receiver's comb filter apparatus referred to above. The chrominance signal processor 20 illustratively includes a gain controlled chrominance signal amplifier, a color synchronizing burst separator, a burst synchronized color reference oscillator, and synchronous detectors responsive to outputs of the color reference oscillator for recovering a pair of color-difference signals from the output of the gain controlled chrominance signal amplifier. Keying pulses for control of the burst separating function are supplied to processor 20 from output terminals KP and KN of a sandcastle pulse decoder 50 (to be subsequently explained). Illustratively, the color-difference signal outputs of processor 20 comprise I color-difference signals appearing at terminal I, and Q color-difference signals appearing at terminal Q.

The respective color-difference signal outputs of processor 20 are subject to suitable filtering in respective filters (I filter 21, and Q filter 22) and thereafter applied as signal inputs to respective differential amplifiers 23,24. Matrix circuits 27, illustratively of the general form disclosed in U.S. Patent US-A-4,272,778 - Harwood, et al., receive as inputs push-pull versions of the I color-difference signal from differential amplifier 23 and push-pull versions of the Q color-difference signal from differential amplifier 24, and provide appropriate combinations of input signals to develop a trio of different color-difference signal outputs. An R-Y color-difference signal, appearing at matrix output terminal R-Y, is supplied to signal combiner 30 for combination with a luminance signal output of translator 15 to form a red color signal. A B-Y color-difference signal, appearing at matrix output terminal B-Y, is supplied to signal combiner 31 for combination with a luminance signal output of translator 15 to form a blue color signal. A G-Y color-difference signal, appearing at matrix output terminal G-Y, is supplied to signal combiner 32 for combination with a luminance signal output of translator 15 to form a green color signal.

The red color signal output of signal combiner 30 is processed by red signal translator 33 for delivery to the red signal output terminal R. Similarly, the blue color signal output of signal combiner 31 is processed by blue signal translator 34 for delivery to the blue signal output terminal B, and the green color signal output of signal combiner 32 is processed by green signal translator 35

for delivery to the green signal output terminal G.

Before consideration of the various control system elements of the FIGURE 1 arrangement which are associated with the above-described signal processing circuits, attention is directed to the FIGURE 1a showing of circuitry for utilizing the respective color signal outputs developed at terminals R,B and G. As shown in FIGURE 1a, a trio of kinescope drivers 73,74,75 are provided, responsive respectively to the red color signal appearing at terminal R, the blue color signal appearing at terminal B, and the green color signal appearing at terminal G.

Display of color images in response to the trio of color signals is produced on the viewing screen of a color kinescope 77. Kinescope 77 incorporates an electron gun assembly comprising individually energized cathode electrodes 78R,78B and 78G and a commonly energized control grid structure 79. The red content of the displayed color image is determined by control of the intensity of an electron beam emanating from cathode 78R, which is driven by an output of kinescope driver 73. The blue content of the displayed color image is determined by control of the intensity of an electron beam emanating from cathode 78B, which is driven by an output of kinescope driver 74. The green content of the displayed color image is determined by control of the intensity of an electron beam emanating from cathode 78G, which is driven by an output of kinescope driver 75.

The FIGURE 1a apparatus also includes automatic kinescope bias control circuits 76, which desirably operate in the manner described in the aforementioned Parker US patent US-A-448 4228. Thus, the bias control circuits 76 include means for supplying a beam conduction-enhancing pulse to the kinescope control grid 79 during a predetermined portion of the bias control interval (That interval, illustratively, occupies a seven line (7H)-period during a post-sync portion of each vertical blanking interval of the received signal as shown in Fig. 3). The bias control circuits 76 are responsive to inputs derived from the respective drivers (73,74,75) for sensing beam current changes induced by the grid pulsing, and develop therefrom respective DC outputs for application to the respective drivers (73,74,75) to suitably control the biases of the respective kinescope cathodes (78R,78B,78G), to which the driver outputs are DC coupled.

For proper operation of the kinescope bias control system, it is important that the signals appearing at terminals R,B and G should be maintained at a reference level throughout each bias control interval. To appreciate how this goal is met, consideration will now be given to the various control system elements which are associated with the signal processing circuits of FIGURE 1.

Associated with the luminance amplifier 13 of FIGURE 1 is a keyed gain control circuit 55, serving to concomitantly control the gain of luminance amplifier 13 and a chrominance signal amplifier element of chrominance signal processor 20. Illustratively, the gain control circuit 55 is a keyed version of the gain control arrangement described in United States Patent US-A-4,426,625 of L. A. Harwood et al., issued on January 17, 1984.

The gain control circuit 55 receives an adjustable DC control voltage input and a keying wave input, and supplies gain control outputs to amplifier 13 and processor 20. Only single connectors are shown coupling gain control circuit 55 to amplifier 13 and processor 20. However, these may represent cables including a plurality of conductors. A potentiometer 53, with fixed end terminals respectively connected to the positive (+V) and negative (ground) terminals of a DC voltage supply, is provided with an adjustable tap from which the control voltage input for gain control circuit 55 is derived. Potentiometer 53 serves the function of a viewer-adjustable "picture control" for the color television receiver. It permits viewer adjustment of contrast of the reproduced image via luminance signal gain control, with concomitant chrominance signal gain control. This assures that the contrast change is not accompanied by an undesired variation of the saturation of the image colors.

The keying wave input for gain control circuit 55 is derived from terminal P of sandcastle pulse decoder 50, and, as shown by waveform "p" of FIGURE 3, comprises a train of positive-going pulses which recur at a field rate, and each of which is timed to coincide with one of the aforementioned bias control intervals (of a 7 line interval duration). Keying wave "p" affects the operation of gain control circuit 55 in such manner that, (a) during each keying pulse appearance, the luminance and chrominance signal gains are rendered independent of the setting of the picture control potentiometer 53, and set instead at a minimum (desirably disabling) level; whereas, (b) during the periods intervening successive keying pulse appearances, the luminance and chrominance signal gains are rendered dependent upon the setting of potentiometer 53. An illustrative apparatus for implementing such keyed operation of gain control circuit 55 will be discussed subsequently in the explanation of the circuitry of FIGURE 2.

The source of keying wave "p", sandcastle pulse decoder 50, derives keying wave "p" (and other keying waves previously considered, and to be subsequently considered) from trilevel "sandcastle" pulses, of a general form shown by waveform "sc" of FIGURE 3, which are delivered to the decoder's input terminal SC. The sandcastle pulses of waveform "sc" are of a tri-level character,

inclusive of composite blanking pulse components at a first level (V_{RB}) more positive than the base level (V_B), kinescope bias control interval timing pulse components at a second level (V_{AK}) more positive than the first level, and burst gating pulse components at a third level (V_{BG}) more positive than the second level.

Illustratively, sandcastle pulse decoder 50 comprises circuits of a form described in the co-filed European Patent Application EP-A-0 148 606 (RCA 76343) corresponding to United States Patent Application Serial No. 561,331 of L.A. Harwood et al., entitled "Tri-level Sandcastle Pulse Decoder". Illustrative circuits for use in the sandcastle wave "sc" are disclosed in the co-filed European Patent Application EP-A-0147981 corresponding to United States Patent Application Serial No. 561,333 of J. Hettiger, entitled "Tri-level Sandcastle Pulse Encoder". The sandcastle pulse utilization is of advantage in terminal saving when the various luminance and chrominance signal processing circuits and accompanying control systems shown in FIGURE 1 are realized in integrated circuit form on a common, monolithic integrated circuit.

The DC component of the received luminance signal, subject to loss in traversal of coupling capacitor 10, is subject to restoration, in the receiver arrangement illustrated in FIGURE 1, by use of a feedback clamp technique. That is, the output of a keyed voltage comparator 61 is employed to suitably adjust a charge on the input coupling capacitor 10. Comparator 61 develops an output representative of the difference, if any, existing between (1) a signal input derived from luminance amplifier 13, and (2) a reference input derived from a reference voltage terminal VR , during a keying period established by a keying wave derived from terminal KP of sandcastle pulse decoder 50. The keying wave derived from terminal KP corresponds to an inverted version of the keying wave "kn" shown in FIGURE 3, and comprises a train of positive-going pulses, recurring at a line rate and timed to coincide with a "back-porch" portion of horizontal blanking intervals of the received signal, but subject to disappearance during the aforementioned kinescope bias control intervals. The sense of the output of comparator 61 is such as to alter the charge on capacitor 10, when necessary, in a direction tending to reduce the difference between the comparator inputs.

As explained more fully in U.S. Patent US-A-4,376,288 - Shanley, et al., by suitable selection of the points of derivation for the respective signal and reference inputs to comparator 61, the operation of the described feedback clamp circuit may additionally serve to enhance a DC compensation aspect of a gain control arrangement of the aforementioned co-filed European Patent Application

EP-A-0 148 606 (RCA 76343) corresponding to the Harwood et al. U.S. Application Serial No. 561,331. In such an arrangement, undesired DC output level variations for the luminance signal output of amplifier 13 do not accompany gain adjustments effected by operation of the picture control.

The control system of FIGURE 1 includes an additional trio of keyed voltage comparators 63,65,67, which are employed to stabilize the DC levels of the output color signals appearing at terminals R,B and G, in a manner described in detail in the co-filed European Patent Application EP-A-0 146 344 (RCA 78941) corresponding to the U.S. Patent Application Serial No. 561,281 of R. Shanley, entitled "DC Stabilization System".

Comparator 65 develops a DC output potential representative of the difference, if any, existing between (1) a signal input derived from the red signal translator 33, and (2) a reference input derived from a reference voltage terminal VR, during the aforementioned "backporch" keying periods established in response to the keying wave appearing at terminal KP. The output of comparator 65 is supplied as an input to differential amplifier 23, to modify the DC level of the I color-difference signal input to matrix circuits 27 in a direction tending to reduce the difference between the comparator 65 inputs.

Comparator 67 develops a DC output potential representative of the difference, if any, existing between (1) a signal input derived from the green signal translator 35, and (2) a reference input derived from the aforementioned reference voltage terminal VR, during the aforementioned "backporch" keying periods established in response to the keying wave appearing at terminal KP. The output of comparator 67 is supplied as an input to differential amplifier 24, to modify the DC level of the Q color-difference signal input to matrix circuits 27 in a direction tending to reduce the difference between the comparator 67 inputs.

As shown in FIGURE 1, the keying of the third voltage comparator (63) of the trio employed for output DC stabilization purposes differs from that of the above-described comparators 65,67, in that comparator 63 is responsive to the keying wave "p" from decoder terminal P, as well as the keying wave appearing at decoder terminal KP. Thus, comparison of inputs takes place in comparator 63 not only during the aforementioned "backporch" keying periods, but also throughout each kinescope bias control interval. The DC output potential of comparator 63 is representative of the difference, if any, existing between (1) a signal input derived from the blue signal translator 34, and (2) a reference input derived from the aforementioned reference voltage terminal VR, during the above-discussed keying intervals. This output potential is

supplied as an input to the luminance signal translator 15, to modify the DC level of the luminance signal input to signal combiners 30,31,32 in a direction tending to reduce the difference between the comparator 63 inputs.

The receiver arrangement of FIGURE 1 additionally includes a retrace blanking circuit 51, which responds to a keying wave appearing at terminal RB of the sandcastle pulse decoder 50, with a waveform as shown by curve "rb" of FIGURE 3. The keying wave "rb" comprises a train of positive-going pulses, inclusive of wide pulse components recurring at a field rate and timed to encompass each period of vertical retrace for the electron beams of color kinescope 77 but terminating upon initiation of said kinescope bias control intervals, and narrower pulse components recurring at a line rate and timed to encompass each period of horizontal beam retrace (outside the vertical retrace period), with the notable exception of those periods of horizontal beam retrace that lie within each of the aforementioned kinescope bias control intervals. Thus, keying wave "rb" is devoid of pulse component appearances during the period of pulse appearance in the previously discussed keying wave "p". Retrace blanking circuit 51 delivers respective outputs to the red, blue and green signal translators 33,34,35, during appearances of the pulse components of keying wave "rb", which drive the respective electron guns of color kinescope 77 beyond cutoff.

The receiver arrangement of FIGURE 1 additionally includes a keyed brightness control circuit 71, which is desirably of the general form disclosed in United States Patent US-A-4,404,593 of R. Shanley et al., issued on September 13, 1983.

The brightness control circuit 71 receives an adjustable DC control voltage input and a pair of keying wave inputs, and develops a DC output potential at terminal BC which is supplied to the respective signal combiners 30,31,32. A potentiometer 70, with fixed end terminals respectively connected to the positive (+V) and negative (ground) terminals of a DC voltage supply, is provided with an adjustable tap from which the control voltage input for brightness control circuit 71 is derived. Potentiometer 70 serves the function of a viewer-adjustable brightness control for the color television receiver, permitting viewer adjustment of the brightness of the reproduced image via concomitant control of the DC levels of the color signal outputs of the signal combiners 30,31,32.

The pair of keying wave inputs for brightness control circuit 71 are derived from terminals BRP and BRN of the sandcastle pulse decoder 50. The keying waves appearing at terminal BRP are inverted versions of the keying waves appearing at terminal BRN, the latter being illustrated by

waveform "brn" of FIGURE 3 as comprising a train of negative-going pulses. The pulse components of keying wave "brn" include wide, field rate pulse components coinciding in timing with the wide, field rate pulse components of the above-discussed keying wave "rb", and narrower, line rate pulse components coinciding in timing with the narrower, line rate pulse components of keying wave "rb". However, in contrast with the keying wave "rb", which is devoid of pulse appearances during each kinescope bias control interval, the keying wave "brn" also includes additional, relatively wide, pulse components, recurring at a field rate and coinciding with the successive bias control intervals.

The nature of the keyed operation of brightness control circuit 71 is such that (a) during periods intervening the keying pulse component appearances, the level of the DC potential at output terminal BC is dependent upon the setting of the tap on brightness control potentiometer 70, whereas (b) during each keying pulse component appearance a fixed reference DC level, independent of the brightness control setting, appears at terminal BC.

The receiver arrangement of FIGURE 1 also includes a keyed on-screen display control circuit 80, which is illustratively of the form described in United States Patent US-A-4,435,729 of L. Harwood et al., issued on March 6, 1984. The on-screen display control circuit 80 accepts a trio of auxiliary color signal inputs from terminals "r", "g", and "b", and a pair of keying wave inputs from terminals BRP and BRN of the sandcastle pulse decoder 50. Illustratively, the auxiliary color signals may comprise outputs of a character generator under the control of a suitable character signal source (e.g., apparatus developing a binary coded digital signal representative of the number of the channel to which the receiver is tuned). Within the period selected for display of the auxiliary information, the color signal translators (33,34,35) respond to respective outputs of the display control circuit 80, to the exclusion of the normal outputs of combiners 30,31,32. However, during the appearances of the pulse components of the keying waves from terminals BRP and BRN, the display control circuit 80 is disabled. With such keying waves including pulses encompassing each kinescope bias control interval, disturbance of the cathode current monitoring operation by spurious outputs of the display control circuit 80 is prevented.

In FIGURE 2, illustrative circuits for implementing the functions of selected elements of the FIGURE 1 system are shown. Circuits contributing to the development of the blue color signal are chosen for illustration purposes, with schematic details shown for the gain controlled luminance amplifier 13, luminance signal translator 15, signal combiner

31, and blue signal translator 34. Circuit details are also shown for several of the control system elements: keyed gain control circuit 55, keyed voltage comparator 63, and the retrace blanking circuit 51.

The gain controlled luminance amplifier 13 includes an NPN transistor 81 disposed as a grounded-emitter amplifier stage, with its base electrode connected to receive signals from terminal PL (the output terminal of the luminance signal processor 11 of FIGURE 1), and with its emitter electrode returned to ground via an emitter resistor 81R. The collector electrode of transistor 81 is directly connected to the joined emitter electrodes of a pair of NPN transistors 82,83. The collector electrode of transistor 82 is directly connected to the positive terminal ($+V_{cc}$) of an operating potential supply, while the collector electrode of transistor 83 is connected to the $+V_{cc}$ terminal via a load resistor 84. The base electrodes of transistors 82 and 83 receive respective gain control voltage outputs of the keyed gain control circuit 55.

The keyed gain control circuit 55 includes an NPN transistor 85 disposed as an emitter-follower, with its collector electrode directly connected to the $+V_{cc}$ terminal, with its base electrode connected to the adjustable tap of the (picture control) potentiometer 53, and with its emitter electrode connected via resistors 85R and 86 to the anode of diode 87 (the cathode of which is grounded). The series combination of resistor 86 and diode 87 is shunted by the collector-emitter path of an NPN transistor 88, disposed with its collector electrode connected to the emitter electrode of emitter-follower transistor 85 via resistor 85R, with its emitter electrode grounded, and with its base electrode connected via resistor 89 to terminal P (an output terminal of the sandcastle pulse decoder 50 of FIGURE 1).

The voltage appearing across the series combination of resistor 86 and diode 87 is supplied as an input to a gain control voltage translator 56. The translator 56 (not shown in schematic detail) translates the single-ended control voltage input to push-pull outputs for application to the base electrodes of transistors 82,83 of the luminance amplifier 13. Desirably, translator 56 is of the advantageous form described in detail in the previously mentioned U.S. Patent US-A-4426625 Serial No. 296,865 of L. A. Harwood, et al., whereby the difference between the push-pull outputs varies non-linearly with tap adjustment in a manner compensating for non-linearity of the characteristics of amplifier 13. When realized in this advantageous form, translator 56 supplies, as an additional output, a compensating unidirectional current to the load resistor (84) of amplifier 13, serving to substantially prevent an undesired variation of the quiescent DC output potential of amplifier 13 from

accompanying a gain control adjustment. To aid this desired result, the voltage developed across resistor 81R desirably constitutes the signal voltage supplied for use as the signal input to comparator 61 of the FIGURE 1 system, with a voltage derived from the translator 56 supplied to terminal VR' as the reference input to comparator 61, as explained more fully in the aforementioned U.S. Patent 4,376,288 - Shanley, et al.

The luminance signal translator 15 of FIGURE 2 comprises a level shift circuit including an NPN transistor 90 disposed as an emitter-follower responding to the output of amplifier 13. The collector electrode of emitter-follower transistor 90 is directly connected to the $+V_{cc}$ terminal, while the base electrode of transistor 90 is directly connected to the collector electrode of the output transistor (83) of amplifier 13. The emitter electrode of transistor 90 is connected to the output terminal Y of translator 15 via a dropping resistor 91. The quiescent DC voltage drop across resistor 91 is controlled by an NPN current source transistor 92 disposed with its collector electrode directly connected to terminal Y, and with its emitter electrode returned to ground via an emitter resistor 93. The current drawn through resistor 91 by transistor 92 is controlled by an output of the keyed voltage comparator apparatus 63 (to be subsequently described in detail) which is applied to the base of transistor 92.

Signal combiner 31, as shown in FIGURE 2, includes a differential amplifier 100 incorporating a pair of NPN transistors 101, 102 with emitter electrodes interconnected via the series combination of resistor 103 and resistor 104. A current source for the differential amplifier 100 is formed by an NPN transistor 105, disposed with its collector electrode connected to the junction of resistors 103 and 104, with its emitter electrode returned to ground via emitter resistor 106, and with its base electrode connected to the positive terminal ($+V_b$) of a bias potential supply.

Delivery of luminance signals to one input of the differential amplifier 100 is effected by an emitter-follower formed by transistor 108, disposed with its base electrode directly connected to the output terminal Y of translator 15, with its emitter electrode directly connected to the base electrode of amplifier transistor 101, and with its collector electrode directly connected to the $+V_{cc}$ supply terminal. A current source for the emitter-follower transistor 108 is formed by an NPN transistor 109, disposed with its collector electrode directly connected to the emitter electrode of transistor 108, with its emitter electrode returned to ground via emitter resistor 110, and with its base electrode connected to the $+V_b$ bias supply terminal.

A B-Y color-difference signal is delivered to

another input of the differential amplifier 100 by an emitter-follower formed by an NPN transistor 111, disposed with its base electrode directly connected to terminal B-Y (an output terminal of the matrix circuits 27 of the FIGURE 1 system), with its emitter electrode directly connected to the base electrode of transistor 102, and with its collector electrode connected to the $+V_{cc}$ supply terminal. A current source for the emitter-follower transistor 111 is formed by an NPN transistor 112, disposed with its collector electrode directly connected to the emitter electrode of transistor 111, with its emitter electrode returned to ground via emitter resistor 113, and with its base electrode connected to the $+V_b$ bias supply terminal.

The collector electrode of amplifier transistor 101 is directly connected to terminal BC (output terminal of the keyed brightness control circuit 71 of the FIGURE 1 system), while the collector electrode of amplifier transistor 102 is connected thereto via a load resistor 107. A blue color signal, formed as a combination of the respective luminance and color-difference signal inputs, appears across the load resistor 107. The DC level of the color signal thus formed is affected by the DC potential appearing at terminal BC. Illustratively, with use of a brightness control circuit of the form disclosed in the aforementioned Shanley et al. U.S. Patent No. 4,404,593, terminal BC is returned to the $+V_{cc}$ supply terminal via the shunted emitter-collector paths of a pair of NPN transistors. During the appearances of the pulse components of keying waves "brp" and "brn", a first one of the shunted transistors is cut off, while the base electrode of the second one of the shunted transistors receives a fixed DC reference voltage. During all other intervals, the second transistor is cut off while the base electrode of the first transistor receives a DC voltage of a magnitude dependent upon the adjustment of the brightness control potentiometer (70, FIGURE 1).

The blue signal translator 34 includes, in cascade, a trio of emitter-followers employing, respectively, NPN transistor 116, PNP transistor 117, and NPN transistor 119. Transistor 116 is disposed with its base electrode directly connected to the collector electrode of transistor 102 of signal combiner 31, with its emitter electrode directly connected to the base electrode of emitter-follower transistor 117, and with its collector electrode connected to the $+V_{cc}$ supply terminal. A current source for the emitter-follower transistor 116 is formed by an NPN transistor 116T, disposed with its collector electrode directly connected to the emitter electrode of transistor 116, with its emitter electrode returned to ground via emitter resistor 116R, and with its base electrode connected to the $+V_b$ bias supply terminal. The collector electrode of emitter-follower tran-

sistor 117 is grounded, while the emitter electrode thereof is returned to the $+V_{cc}$ supply terminal via resistor 118. Transistor 119 is disposed with its base electrode directly connected to the emitter electrode of emitter-follower transistor 117, with its collector electrode connected to the $+V_{cc}$ supply terminal, and with its emitter electrode directly connected to the blue signal output terminal B, and returned to ground via resistor 120.

As shown in FIGURE 2, respective connections to the on-screen display (OSD) control circuit 80 of the FIGURE 1 system are provided from the base and emitter electrodes of emitter-follower transistor 117. Illustratively, with use of a display control circuit of the form disclosed in the aforementioned Harwood, et al. US patent US-A- 4435729 (Serial No. 352,884), these connections are such that, during character display intervals, transistor 117 is cut off to decouple the blue color signal output of combiner 31 from the blue signal output terminal B, with a drive from control circuit 80 applied to the base electrode of the output emitter-follower transistor 119 in substitution therefor.

Retrace blanking circuit 51 is shown in FIGURE 2 as comprising an NPN transistor 122, disposed with its emitter electrode grounded, with its collector electrode connected to the base electrode of the output emitter-follower transistor 119 via a resistor 123, and with its base electrode connected via resistor 121 to terminal RB (an output terminal of the sandcastle pulse decoder 50 of the FIGURE 1 system) so as to receive keying wave "rb". During the appearances of the pulse components of keying wave "rb", transistor 122 is rendered conducting to pull down the potential at the base electrode of the output emitter-follower transistor 119 to a sufficient degree to assure cut-off of the blue electron gun of the image reproducing color kinescope (77, FIGURE 1a).

The keyed voltage comparator 63, as shown in FIGURE 2, is responsive to the blue color signal appearing at the emitter electrode of transistor 116 of the blue signal translator 34. A first control loop utilizing this signal input comprises a voltage comparator employing a differential amplifier 140. Differential amplifier 140 is formed by a pair of NPN transistors 141, 142 with emitter electrodes interconnected via the series combination of resistors 143 and 144. A current source for differential amplifier 140 is formed by an NPN transistor 145, disposed with its collector electrode connected to the junction of resistors 143 and 144, and with its emitter electrode grounded. The base-emitter path of transistor 145 is shunted by a diode 146, with its anode connected to the base electrode of transistor 145 and with its cathode grounded.

An NPN transistor 147 is disposed as an emitter-follower for supplying the keying wave "p"

to the base electrode of the current source transistor 145. The emitter electrode of transistor 147 is connected via a resistor 148 to the base electrode of current source transistor 145, while the collector electrode of transistor 147 is connected to the $+V_{cc}$ supply terminal. The base electrode of the emitter-follower transistor 147 is connected to terminal P (output terminal of the sandcastle pulse decoder 50 of the FIGURE 1 system). During the appearances of the pulse components of keying wave "p", current source transistor 145 is rendered conducting to enable the differential amplifier 140, which is disabled during all other intervals.

The differential amplifier 140 is provided with an active load circuit employing a trio of PNP transistors 150, 152, 154, with the collector electrode of amplifier transistor 141 directly connected to the collector electrode of load transistor 150, and with the collector electrode of amplifier transistor 142 linked to the collector electrode of load transistor 154 via a forward-biased diode 156 (disposed with its anode connected to the collector electrode of transistor 154, and with its cathode connected to the collector electrode of transistor 142). The emitter electrodes of load transistors 150 and 154 are returned to the $+V_{cc}$ supply terminal via respective emitter resistors 151 and 155. The remaining PNP transistor 152 is disposed with its collector electrode grounded, with its base electrode directly connected to the joined collector electrodes of transistors 141 and 150, with its emitter electrode returned via an emitter resistor 153 to the $+V_{cc}$ supply terminal, and directly connected to the base electrodes of the load transistors 150 and 154.

The above-described disposition of transistors 150, 152 and 154 forms a current mirror arrangement, whereby the collector current of load transistor 154 mirrors the collector current of amplifier transistor 141. An output lead directly links the collector electrode of load transistor 154 with the base electrode of the emitter-follower transistor 90 of the luminance signal translator 15.

If the potentials at the base electrodes of amplifier transistors 141, 142 are balanced during a period of enablement of differential amplifier 140, the collector current demand of transistor 142 is matched in magnitude with the current supplied via the collector electrode of load transistor 154, and the comparator 63 output provides no disturbance of the potential at the base electrode of transistor 90. If, however, an imbalance exists such that the potential at the base electrode of transistor 141 is elevated relative to the potential at the base electrode of transistor 142 during an enablement period, the magnitude of the current supplied via the collector electrode of load transistor 154 exceeds the collector current demand of transistor 142, with the excess supplied via the output lead to result in

elevation of the potential at the base electrode of transistor 90. Conversely, if a base potential imbalance of the opposite sense exists during an enablement period, the collector current demand of transistor 142 exceeds the magnitude of current supplied via the collector electrode of load transistor 154, with the consequence that the deficit is supplied from the output lead, resulting in a depression of the potential at the base electrode of transistor 90.

A reference voltage is supplied to one input of the differential amplifier 140 via the direct connection of the base electrode of amplifier transistor 141 to the reference voltage supply terminal VR. A signal voltage is supplied to the other input of the differential amplifier 140 by means of the connection of the base electrode of transistor 142 through series resistor 137 to the emitter electrode of the emitter-follower transistor 116 of the blue signal translator 34. The series combination of a resistor 138 and a capacitor 139 is connected between the base electrode of transistor 142 and ground, and cooperates with series resistor 137 to form a low pass filter. Filter 137-138-139 provides the first control loop with a stability-assuring loop filter, but desirably has a sufficiently wide bandwidth to permit significant loop response at the frequencies within the luminance signal pass band.

As shown by waveform "p", enablement of the first control loop occurs only during each kine-scope bias control interval. During the periods intervening such intervals, the first control loop has no effect on the DC level of the luminance signal contribution to the blue signal output. The keyed voltage comparator apparatus 63, however, contains additional components which form a second control loop.

The second control loop includes a voltage comparator 130, accepting a signal input directly from the emitter electrode of the emitter-follower transistor 116 of the blue signal translator 34, and a reference input from the reference voltage supply terminal VR. Comparator 130 also receives keying waves from terminal KP (an output terminal of the sandcastle pulse decoder 50 of the system of FIGURE 1). For the sake of drawing simplification, the schematic details of comparator 130 are not shown in FIGURE 2. However, the structure of comparator 130 may desirably correspond with that shown for differential amplifier 140, with the exception of a transposition of inputs such that the reference input is delivered to the counterpart of transistor 142, and the signal input is delivered to the counterpart of transistor 141. The output lead of comparator 130 is connected to one side of a storage capacitor 131, the other side of which is grounded.

During periods of comparator 130 enablement,

under conditions of balance between the signal and reference inputs to comparator 130, a positive DC potential of a predetermined intermediate value is developed across storage capacitor 131, and is held during the intervening periods of disablement of comparator 130. If the signal input should rise above the reference input level, a charging current is supplied via the comparator output lead (during enablement periods) to elevate the potential stored across capacitor 131. Conversely, if the signal input should drop below the reference input, a discharging current is drawn via the comparator output lead (during enablement periods) to depress the stored potential.

The stored output of comparator 130 is applied to a pair of cascaded emitter-followers formed by NPN transistors 132 and 133. Transistor 132 is disposed with its base electrode directly connected to the ungrounded side of storage capacitor 131, and its emitter electrode directly connected to the base electrode of transistor 133. The collector electrodes of the emitter-follower transistors 132 and 133 are connected to the $+V_{cc}$ supply terminal. A pair of resistors 134 and 136 are serially-connected between the emitter electrode of transistor 133 and ground. An attenuated version of the stored comparator output, appearing at the junction of resistors 134 and 136, is directly applied to the base electrode of the current source transistor 92 of the luminance signal translator 15. The output of comparator 130 accordingly controls the current drawn by current source transistor 92 through resistor 91, and is thus determinative of the luminance signal level shift introduced by the DC voltage drop across resistor 91.

Circuitry identical to that shown in use for signal combiner 31 in FIGURE 2 may advantageously be employed for the respective signal combiners 30 and 32 of the red and green signal channels of the FIGURE 1 system, with each subject to control by an output of the keyed brightness control circuit in the manner described previously for signal combiner 31. Likewise, circuitry identical to that shown in use for the blue signal translator 34 in FIGURE 2 may advantageously be employed for the red signal translator 33 and the green signal translator 35, respectively, of the FIGURE 1 system, with each subject to retrace blanking control and on screen character display control in the manner described previously for the blue signal translator 34.

Each of the respective keyed voltage comparators 65,67 of the FIGURE 1 system desirably employs structure similar to that described above for the second control loop (130,131, etc.) of the comparator 63. However, in contrast with the described use of the output of that second control loop in adjusting the DC level of the luminance signal input

to the respective signal combiners, the stored output voltage of comparator 65 is supplied to a differential input of amplifier 23 to adjust the DC level of the I color-difference signal inputs to matrix circuits 27, while the stored output voltage of comparator 67 is supplied to a differential input of amplifier 24 to adjust the DC level of the Q color-difference signal inputs to matrix circuits 27.

In operation of the FIGURE 1 system, implemented in the manner shown in FIGURE 2 and described above, a plurality of safeguards ensure the integrity of the current monitoring and bias adjustment operations undertaken by the AKB control circuits 76 (FIGURE 1a) during each kinescope bias control interval. To appreciate the nature of these safeguards, it is appropriate to reconsider the status of each of the keyed control system elements during such control intervals, as summarized below.

Throughout each kinescope bias control interval:

- (1) Transistor 88 is keyed on to establish a minimum (desirably zero) value of gain for the luminance signal amplifier 13 (as well as for the chrominance signal amplifier of the chrominance signal processor 20), which gain value is independent of the setting of the picture control potentiometer 53.
- (2) The comparator formed by differential amplifier 140 is enabled, closing the first control loop described above for comparator 63, whereas the second control loop's voltage comparator 130, and its counterparts in comparator structures 65 and 67, are disabled.
- (3) Signal combiners 30,31,32 receive from the keyed brightness control circuit 71 a fixed reference voltage, of a magnitude independent of the adjustment of the brightness control potentiometer 70.
- (4) The blanking transistor 122 for the blue signal channel, and its counterparts for the red and green signal channels, are maintained in a non-conductive state, to prevent driving of the kinescope electron guns beyond cut-off.
- (5) The on-screen display control circuit 80 is disabled.

Safeguard (1), above, prevents the picture control adjustment from affecting the operation of the AKB circuits, and provides a first degree of protection against disturbance of the AKB circuit operation by components of the received signals. In the instance of leak-through of luminance signal components (such as VITS signal components) during the kinescope bias control intervals, despite the gain reduction of amplifier 13, a second degree of protection against disturbance of the AKB circuit operation by signal components is obtained via safeguard (2), above. This affords significant de-

generation of any leaked-through luminance signal components by virtue of the wideband negative feedback path closed by the enabled amplifier 140. Safeguard (2) also provides enhanced protection against residual effects of DC drift in the luminance signal channel, and prevents any DC shift consequence of the gated gain reduction of amplifier 13 from adversely affecting the AKB circuit operations. Safeguard (3), above, prevents adjustment of the brightness control potentiometer 70 from affecting AKB circuit operations, while safeguard (4), above, protects against undesired cathode current interruptions during the kinescope bias control intervals. Safeguard (5), above, avoids disturbance of the AKB circuit operations by spurious outputs of the OSD control circuit 80.

In one desirable arrangement for utilizing the present invention, means are incorporated for preventing the keying of comparators 63, 65 and 67 during at least a portion of the received signal's vertical sync interval, for error reduction purposes, as explained in the coiled European Patent Application EP-A-0 145 490 (RCA 79620) corresponding to US Patent Application Serial No. 561,280 of R. Shanley et al., entitled "Keyed DC Stabilization System With Protection From Error Introduction During Vertical Sync Interval".

It is proposed therein, to ensure such keying prevention, that the trilevel sandcastle pulses which are delivered to terminal SC should be freed of at least some of its burst gating pulse components during the vertical sync interval. A desirable technique for achieving such selective elimination of burst gating pulse components is disclosed in the coiled European Patent Application EP-A-0 145 491(RCA 80279) corresponding to U.S. Patent Application Serial No. 561,332 of T Yost, entitled "Backporch Gating Pulse Generator Subject to Disabling During Vertical Sync Interval". When the said technique of the aforesaid Yost patent application is employed in sandcastle pulse encoding, the resultant trilevel sandcastle pulse train appearing at terminal SC will conform to a version of the waveform "sc" in which excursions to the V_{BQ} level are absent throughout at least a major portion of the vertical sync interval.

In embodiments disclosed herein, of the present invention, a control system is provided for the luminance/chrominance signal processing circuits of a color television receiver which, through use of relatively simply implemented keying techniques, modifies conventional functions of such circuits during the recurring bias control periods in a manner ensuring the integrity of the AKB control operations.

Claims

1. A color television receiver for displaying color images in response to composite video signals inclusive of respective image-representative luminance and chrominance components, said image-representative components being absent during horizontal blanking portions of successive line intervals within periodic field intervals, and also absent during the vertical blanking portion of each field interval, said receiver including: a color kinescope (77) having a plurality of beam intensity control electrodes (78R,78B,78G) for controlling the intensity of a plurality of electron beams tracing a raster of scanning lines upon a viewing screen; means (76) for automatically controlling the bias on the respective control electrodes during periodic bias control intervals encompassing a plurality of successive line intervals (7H) within each of said vertical blanking portions; a luminance signal channel (11) for processing said luminance component and including a gain controlled luminance signal amplifier (13), and a luminance signal translator (15) responsive to an output of said luminance signal amplifier; a chrominance signal channel (20) for processing said chrominance component, and including means (21-24,27) responsive to said processed chrominance signal component for developing a plurality of color-difference signal outputs; a first signal combiner (31) responsive to one of said color-difference signal outputs and to an output of said luminance signal translator for forming a first color signal; and means (74) for applying said first color signal to one (78B) of said kinescope electrodes; and further including control apparatus comprising:

an adjustable gain control voltage source (53);

keyed gain control means (55) responsive to an output of said gain control voltage source for

(A) rendering the gains of said luminance signal amplifier (13) and said chrominance signal processor (20) responsive to said adjustable gain control voltage during all field interval portions with the exception of said bias control intervals (7H) and

(B) substantially disabling said luminance signal amplifier (13) and said chrominance signal processor (20) during said bias control intervals;

a control loop for controlling the DC level of said output of said luminance signal translator, said control loop including first keyed comparator means (140) for comparing the

voltage attained by said first color signal throughout said bias control intervals with a reference voltage (VR), said luminance signal translator being coupled and responsive to the output of said keyed comparator means, so as to oppose departures of said attained color signal voltage from substantial equality with said reference voltage;

an adjustable brightness control voltage source (70); and

keyed brightness control means (71) for rendering the DC level of said signal combiner output responsive to said adjustable brightness control voltage during the presence of said image-representative signal components but independent of said adjustable brightness control voltage throughout said bias control intervals.

2. A receiver in accordance with Claim 1,

wherein said color-difference signal output developing means includes a pair of color demodulators (23,24) for recovering first (I) and second (Q) color-difference signals from said processed chrominance component and supplying said first and second color-difference signals as inputs to a matrix circuit (27) which forms said plurality of color-difference signal outputs (R-Y,B-Y,G-Y) therefrom; said receiver also includes a second signal combiner (30), responsive to a second color-difference signal output (R-Y) of said matrix circuit and to said output of said luminance signal translator (15), for forming a second color signal (R), a third signal combiner (32), responsive to a third color-difference signal output (G-Y) output of said matrix circuit and to said output of said luminance signal translator, for forming a third color signal (G); and respective means (73,75) for applying said second (R) and third (G) color signals to respective additional ones of said beam intensity control electrodes; and

said control apparatus also includes

a second control loop for controlling the DC level of said first (I) color-difference signal input to said matrix circuit, said second control loop including second keyed comparator means (85) for comparing said reference voltage (VR) with the voltage attained by said second color signal (R) during gating intervals occurring within horizontal blanking portions of line intervals which lie outside of said bias control intervals; and means (23) for modifying said first color-difference signal input to said matrix circuit, in response to the output of said second keyed comparator means, so as to oppose departures of said attained second color signal voltage from substantial equality with



said reference voltage, and

a third control loop for controlling the DC level of said second (Q) color-difference signal input to said matrix circuit, said third control loop including third keyed comparator means (67) for comparing said reference voltage with the voltage attained by said third color signal (G) during said gating intervals; and means (24) for modifying said second color-difference signal input to said matrix circuit, in response to the output of said third keyed comparator means, so as to oppose departures of said attained third color signal voltage from substantial equality with said reference voltage; and

wherein said keyed brightness control means additionally renders the DC levels of the color signal outputs of said second and third signal combiners responsive to said adjustable brightness control voltage during the presence of said image-representative signal components but independent of said adjustable brightness control voltage throughout said bias control intervals.

3. A receiver in accordance with Claim 2,

wherein said first keyed comparator means (140) includes: a voltage comparator, having a first input terminal (BASE OF 141) coupled to receive said reference voltage (VR) and a second input terminal (BASE OF 142) coupled to receive said first color signal, said voltage comparator being keyed into operation only during said bias control intervals; and said apparatus also includes a fourth control loop for controlling the DC level of said luminance signal input to said first signal combiner (31), said fourth control loop including a fourth keyed comparator means (130) for comparing said reference voltage with the voltage attained by said first color signal during said gating intervals, and means (131) for modifying said luminance signal input to said first signal combiner, in response to the output of said fourth keyed comparator means, so as to oppose departures of said attained first color signal voltage from substantial equality with said reference voltage.

4. A receiver in accordance with Claim 2 or 3,

wherein said keyed brightness control means (71) additionally renders the DC levels of said signal combiner outputs (30,31,32) independent of said adjustable brightness control voltage during said gating intervals.

5. A receiver in accordance with Claim 2,3 or 4 further comprising a retrace blanking circuit

(51) for supplying a beam cut-off bias to said electrodes during periods of beam retrace in the tracing of said raster not including beam retrace periods falling within said bias control intervals.

6. A receiver in accordance with Claim 5, comprising

means (50) for developing: (1) a first train of pulses (p) recurring at a field rate and timed to substantially coincide with said bias control intervals,

(2) a second train of pulses (kn) recurring at a line rate, but subject to interruption during said bias control intervals, each of the pulses of said second train timed to substantially coincide with a backporch segment of the horizontal blanking portion of a line interval,

(3) a third train of pulses (rb) inclusive of (a) recurring field rate pulses timed to substantially encompass vertical retrace periods for said beams but terminating upon initiation of said bias control intervals, and (b) recurring line rate pulses, subject to interruption during said vertical retrace periods and during said bias control intervals, and timed to substantially encompass horizontal retrace periods for said beams,

(4) a fourth train of pulses (brn) corresponding to the sum of said first and third trains of pulses,

means (TERMINAL P OF 50) for supplying said first train of pulses (p) as a keying input to said keyed gain control means (55), and to said first keyed comparator means (140);

means (TERMINAL KP OF 50) for supplying said second train of pulses (kn) as a keying input to said second (65), third (67) and fourth (130) keyed comparator means,

means (RB TERMINAL OF 50) for controlling said retrace blanking circuit with said third train of pulses (rb); and

means (BRP AND BRN TERMINAL OF 50) for supplying said fourth train of pulses as a keying input to said keyed brightness control means.

7. A receiver in accordance with Claim 6,

wherein said receiver also includes respective means (80) for supplying auxiliary color signals (r,b,g) to respective ones of said beam intensity control electrodes and said control apparatus also includes means (BRP AND BRN TERMINAL OF 50) for disabling said auxiliary color signal supplying means in response to the pulses of said fourth train.



Revendications

1. Un récepteur de télévision couleur pour visualiser des images couleur en réponse à des signaux vidéo composés comprenant des composantes de luminance et de chrominance respectives de représentation de l'image, lesdites composantes de représentation de l'image étant absentes pendant des portions de suppression horizontale d'intervalles de lignes successives dans des intervalles de trame périodiques et également absentes pendant la portion de suppression verticale de chaque intervalle de trame, ledit récepteur comprenant : un tube image couleur (77) ayant un certain nombre d'électrodes de commande d'intensité de faisceaux (78R, 78B, 78G) pour contrôler l'intensité d'un certain nombre de faisceaux d'électrons traçant une image de ligne de balayage sur un écran de visualisation ; un moyen (76) pour contrôler automatiquement la polarisation des électrodes de commande respectives pendant des intervalles de contrôle de polarisation périodiques englobant un certain nombre d'intervalles de lignes successives (7H) dans chacune des portions de suppression verticales ; un canal de signal de luminance (11) pour traiter la composante de luminance et comprenant un amplificateur de signal de luminance à gain contrôlé (13) et un translateur de signal de luminance (15) répondant à une sortie de l'amplificateur du signal de luminance ; un canal de signal de chrominance (20) pour traiter la composante de chrominance et comprenant des moyens (21-24, 27) répondant à la composante du signal de chrominance traité pour produire un certain nombre de sorties de signaux de différence de couleur ; un premier combineur de signaux (31) répondant à l'une des sorties de signaux de différence de couleur et à une sortie du translateur de signal de luminance pour former un premier signal de couleur ; et un moyen (74) pour appliquer le premier signal de couleur à l'une (78B) des électrodes du tube image et comprenant également un dispositif de contrôle comprenant :

une source de tension de contrôle de gain réglable (53) ;

un moyen (55) de contrôle de gain verrouillé répondant à une sortie de la source de tension de contrôle de gain pour

(A) rendre les gains de l'amplificateur du signal de luminance (13) et du processeur de signal de chrominance (20) sensibles à la tension de contrôle de gain réglable pendant toutes les portions d'intervalles de trame à l'exception des intervalles de contrôle de polarisation

(7H) et

(B) sensiblement désactiver l'amplificateur du signal de luminance (13) et le processeur du signal de chrominance (20) pendant les intervalles de contrôle de polarisation ;

une boucle de contrôle pour contrôler le niveau continu de la sortie du translateur du signal de luminance, ladite boucle de contrôle comprenant un premier moyen comparateur verrouillé (140) pour comparer la tension atteinte par le premier signal de couleur tout le long des intervalles de réglage de polarisation à une tension de référence (VR), le translateur du signal de luminance étant couplé et répondant à la sortie du moyen comparateur verrouillé afin de s'opposer à des écarts de la tension du signal de couleur atteinte de l'égalité substantielle avec la tension de référence ;

une source de tension de contrôle de luminosité réglable (70) ; et

un moyen de contrôle de luminosité verrouillé (71) pour rendre le niveau continu de la sortie du combineur de signaux sensible à la tension de contrôle de luminosité réglable pendant la présence des composantes du signal représentatif de l'image mais indépendant de la tension de contrôle de luminosité réglable tout le long des intervalles de contrôle de polarisation.

2. Un récepteur selon la revendication 1,

où le moyen de production de sortie des signaux de différence précités comprend une paire de démodulateurs de couleur (23, 24) pour retrouver les premier (I) et second (Q) signaux de différence de couleur à partir de la composante de chrominance traitée et appliquer les premier et second signaux de différence de couleur comme entrées à un circuit de matrice (27) qui forme la pluralité de sorties de signaux de différence de couleur (R-Y, B-Y, G-Y) de celui-ci ; ledit récepteur comprenant également un second combineur de signaux (30), répondant à une seconde sortie de signaux de différence de couleur (R-Y) du circuit de matrice et à la sortie du translateur de signal de luminance (15) pour former un second signal de couleur (R), un troisième combineur de signaux (32) répondant à une troisième sortie de signaux de différence de couleur (G-Y) provenant du circuit de matrice et à la sortie du translateur du signal de luminance pour former un troisième signal de couleur (G) ; et des moyens respectifs (73, 75) pour appliquer les second (R) et troisième (G) signaux de couleur aux électrodes additionnelles respectives de contrôle d'intensité du faisceau ;

le dispositif de contrôle comprend égale-



ment

une seconde boucle de contrôle pour contrôler le niveau continu du premier signal de différence de couleur (I) appliqué au circuit de matrice, la seconde boucle de contrôle comprenant un second moyen comparateur verrouillé (65) pour comparer la tension de référence (VR) à la tension atteinte par le second signal de couleur (R) pendant des intervalles de déclenchement se produisant dans les portions de suppression horizontales d'intervalles de lignes qui s'étendent à l'extérieur des intervalles de contrôle de polarisation ; et un moyen (23) pour modifier le premier signal de différence de couleur appliqué au circuit de matrice en réponse à la sortie du second moyen comparateur verrouillé afin de s'opposer à des écarts de la tension du second signal de couleur de l'égalité substantielle avec la tension de référence,

une troisième boucle de contrôle pour contrôler le niveau continu du second signal de différence de couleur (Q) appliqué au circuit de matrice, la troisième boucle de contrôle comprenant un troisième moyen comparateur verrouillé (65) pour comparer la tension de référence à la tension atteinte par le troisième signal de couleur (G) pendant les intervalles de déclenchement ; et un moyen (24) pour modifier le second signal de différence de couleur appliqué au circuit de matrice en réponse à la sortie du troisième moyen comparateur verrouillé afin de s'opposer à des écarts de la tension du troisième signal de couleur atteinte de l'égalité substantielle avec la tension de référence ;

où le moyen de contrôle de luminosité verrouillé rend additionnellement les niveaux continus des sorties des signaux de couleur des second et troisième combineurs de signaux sensibles à la tension de contrôle de luminosité réglable pendant la présence des composantes du signal représentatives de l'image mais indépendants de la tension de contrôle de luminosité réglable tout le long des intervalles de contrôle de polarisation.

3. Un récepteur selon la revendication 2,

où le premier moyen comparateur verrouillé (140) comprend : un comparateur de tensions ayant une première borne d'entrée (BASE DE 141) couplée pour recevoir la tension de référence précitée (VR) et une seconde borne d'entrée (BASE DE 142) couplée pour recevoir le premier signal de couleur précité, le comparateur de tensions étant verrouillé en fonctionnement seulement pendant les intervalles de contrôle de polarisation ; et le

dispositif précité comprend également une quatrième boucle de contrôle pour contrôler le niveau continu du signal de luminance appliqué au premier combineur de signaux (31), la quatrième boucle de contrôle comprenant un quatrième moyen comparateur verrouillé (130) pour comparer la tension de référence à la tension atteinte par le premier signal de couleur pendant les intervalles de déclenchement, et un moyen (131) pour modifier le signal de luminance appliqué au premier combineur de signaux en réponse à la sortie du quatrième moyen comparateur verrouillé afin de s'opposer à des écarts de la tension du premier signal de couleur atteinte de l'égalité substantielle avec la tension de référence.

4. Un récepteur selon la revendication 2 ou 3,

où le moyen de réglage de luminosité verrouillé précité (71) rend additionnellement les niveaux continus des sorties des combineurs de signaux (30, 31, 32) indépendants de la tension de contrôle de luminosité ajustable précitée pendant les intervalles de déclenchement précités.

5. Un récepteur selon la revendication 2, 3 ou 4 comprenant de plus un circuit de suppression de retour (51) pour appliquer une polarisation de coupure du faisceau aux électrodes précitées pendant les périodes de retour de faisceau dans le tracé de l'image précitée ne comprenant pas les périodes de retour du faisceau tombant dans les intervalles de contrôle de polarisation précités.

6. Un récepteur selon la revendication 5, comprenant

un moyen (50) pour produire : (1) un premier train d'impulsions (p) récurrentes à une fréquence de trame et synchronisées pour coïncider sensiblement avec les intervalles de contrôle de polarisation précités,

(2) un second train d'impulsions (kn) récurrentes à une fréquence de lignes, mais sujettes à interruption pendant les intervalles de contrôle de polarisation, chacune des impulsions dudit second train étant synchronisée pour coïncider sensiblement avec un segment de paller du noir de la portion de suppression horizontale d'un intervalle de lignes,

(3) un troisième train d'impulsions (rb) comprenant (a) des impulsions récurrentes de fréquence de trame synchronisées pour sensiblement englober des périodes de retour vertical pour lesdits faisceaux mais se terminant à l'initialisation des intervalles de contrôle de polarisation, et (b) des impulsions récurrentes



de fréquence de ligne, sujettes à interruption pendant les périodes de retour vertical et pendant les intervalles de contrôle de polarisation, et synchronisées pour sensiblement englober des périodes de retour horizontal pour lesdits faisceaux,

(4) un quatrième train d'impulsions (bm) correspondant à la somme des premier et troisième trains d'impulsions,

un moyen (BORNE P DE 50) pour appliquer le premier train d'impulsions (p) comme entrée de verrouillage au moyen de contrôle de gain verrouillé (55) et au premier moyen comparateur verrouillé (140);

un moyen (BORNE KP DE 50) pour appliquer le second train d'impulsions (kn) comme entrée de verrouillage aux second (65), troisième (67) et quatrième (130) moyens comparateurs verrouillés,

un moyen (BORNE RB DE 50) pour contrôler le circuit de suppression de retour par le troisième train d'impulsions (rb); et

un moyen (BORNES BRP ET BRN DE 50) pour appliquer le quatrième train d'impulsions comme entrée de verrouillage au moyen de contrôle de luminosité verrouillé.

7. Un récepteur selon la revendication 6,

où ledit récepteur comprend également des moyens respectifs (80) pour appliquer des signaux de couleur auxiliaires (r, b, g) aux électrodes respectives de contrôle d'intensité de faisceaux et le dispositif de contrôle précité comprend également des moyens (BORNES BRP ET BRN DE 50) pour désactiver le moyen d'application du signal de couleur auxiliaire en réponse aux impulsions du quatrième train précité.

Ansprüche

1. Farbfernsehempfänger zur Wiedergabe von Farbbildern als Reaktion auf ein Videosignalgemisch, welches entsprechende bildrepräsentative Leuchtdichte- und Farbarteile enthält, die während Horizontalaustastteilen aufeinanderfolgender Zeilenintervalle innerhalb periodischer Teilbildintervalle und außerdem während des Vertikalaustastteiles jedes Teilbildintervalles fehlen, mit: Einer Farbbildröhre (77), die eine Mehrzahl von Strahlintensität-Steuerelektroden (78R, 78B, 78G) zum Steuern der Intensität einer Mehrzahl von Elektronenstrahlen enthält, die ein Raster aus Abtastzellen auf einem Bildschirm abtasten; einer Anordnung (76) zum automatischen Steuern der Vorspannung an den jeweiligen Steuerelektroden wäh-

rend periodischer Vorspannungssteuerintervalle, welche eine Mehrzahl von aufeinanderfolgenden Zeilenintervallen (7H) innerhalb jedes der Vertikalaustastteile umfassen; einem zum Verarbeiten des Leuchtdichteanteiles dienenden Leuchtdichtesignalkanal (11), welcher einen verstärkungsgeregelten Leuchtdichtesignalverstärker (13) sowie einen Leuchtdichtesignalumssetzer (15), der auf ein Ausgangssignal des Leuchtdichtesignalverstärkers anspricht, enthält; einem zum Verarbeiten des Farbanteiles dienenden Farbsignalkanal (20), der eine auf den verarbeiteten Farbsignalelemente entsprechende Anordnung (21-24, 27) enthält, um eine Mehrzahl von Farbdifferenz-Ausgangssignalen zu erzeugen; einem ersten Signalkombinierer (31), der auf eines der Farbdifferenz-Ausgangssignale und auf ein Ausgangssignal des Leuchtdichtesignalumssetzers anspricht um ein erstes Farbsignal zu erzeugen; und einer Anordnung (74) zum Anlegen des ersten Farbsignals an eine (78b) der Bildröhrenelektroden,

weiterhin mit einer Steuereinrichtung welche eine Quelle (53) für eine einstellbare Verstärkungssteuerspannung enthält; ferner eine getastete Verstärkungssteueranordnung (55), welche auf ein Ausgangssignal der Verstärkungssteuerspannungsquelle anspricht um

(A) die Verstärkungsfaktoren des Leuchtdichtesignalverstärkers (13) und der Farbsignalverarbeitungseinrichtung (20) während aller Teilbildintervallteile mit Ausnahme der erwähnten Vorspannungssteuerintervalle (7H) auf die einstellbare Verstärkungssteuerspannung ansprechbar zu machen, und

(B) den Leuchtdichtesignalverstärker (13) und die Farbsignalverarbeitungseinrichtung (20) während der Verstärkungssteuerintervalle im wesentlichen abzuschalten;

eine zum Steuern des Gleichstromwertes des Ausgangssignales des Leuchtdichtesignalumssetzers dienende Regelschleife, welche eine erste getastete Vergleichsanordnung (140) zum Vergleichen der Spannung, die das erste Farbsignal während der Verstärkungsregelintervalle angenommen hat, mit einer Referenzspannung (VR), wobei der Leuchtdichtesignalumssetzer mit dem Ausgang der getasteten Vergleichsanordnung gekoppelt ist und auf diese anspricht, um Abweichungen der vom Farbsignal angenommenen Spannung von einer wenigstens annähernden Übereinstimmung mit der Referenzspannung entgegenzuwirken;

eine Quelle (70) für eine einstellbare Helligkeitssteuerspannung; und

eine getastete Helligkeitssteueranordnung



(71) zum Ansprechbereitmachen des Gleichspannungswertes des Ausgangssignales des erwähnten Signalkombinierers auf die einstellbare Helligkeitssteuerspannung während des Vorhandenseins der bildrepräsentativen Signalanteile jedoch unabhängig von der einstellbaren Helligkeitssteuerspannung während der Vorspannungssteuerintervalle.

2. Empfänger nach Anspruch 1, bei welchem die das Farbdifferenz Ausgangssignal erzeugende Anordnung zwei Farbdemodulatoren (23, 24) zur Wiedergewinnung eines ersten (I) und eines zweiten (Q) Farbdifferenzsignals aus dem verarbeiteten Farbartanteil und zum Zuführen des ersten und des zweiten Farbdifferenzsignals als Eingangssignale an eine Matrixschaltung (27), welche die Mehrzahl von Farbdifferenz Ausgangssignalen (R-Y, B-Y, G-Y) hieraus erzeugt, enthält; daß der Empfänger außerdem einen zweiten Signalkombinierer (30), der auf ein zweites Farbdifferenz Ausgangssignal (R-Y) der Matrixschaltung und auf das Ausgangssignal des Leuchtdichtesignalumsetzers (15) anspricht um ein zweites Farbsignal (R) zu erzeugen, einen dritten Signalkombinierer (32), der auf ein drittes Farbdifferenz Ausgangssignal (G-Y) der Matrixschaltung und auf das Ausgangssignal des Leuchtdichtesignalumsetzers anspricht, um ein drittes Farbsignal (G) zu erzeugen, und eine entsprechende Anordnung (73, 75) zum Anlegen des zweiten (R) und des dritten (G) Farbsignals an entsprechende weitere Strahlintensitätssteuerelektroden enthält, und daß die Steuereinrichtung außerdem enthält
 - eine zur Steuerung des Gleichstromwertes des ersten Farbdifferenzeingangssignales (I) der Matrixschaltung dienende zweite Regelschleife mit einer zweiten getasteten Vergleichsanordnung (65) zum Vergleichen der Referenzspannung (VR) mit der Spannung, welche das zweite Farbsignal (R) während der Tastintervalle angenommen hat, die innerhalb der Zeilenaustastteile der Zeilenintervalle auftreten, welche außerhalb der Vorspannungssteuerintervalle liegen; und einer Anordnung (23) zur Modifizierung des ersten Farbdifferenzeingangssignales der Matrixschaltung in Ansprache auf das Ausgangssignal der zweiten getasteten Vergleichsanordnung derart, daß Abweichungen der Spannung, die das zweite Farbsignal angenommen hat, von einer wenigstens annähernden Übereinstimmung mit der Referenzspannung entgegengewirkt wird, und
 - eine zur Regelung des Gleichstromwertes des zweiten Farbdifferenzeingangssignales (Q) der Matrixschaltung dienende dritte Regelsch-

leife mit einer dritten getasteten Vergleichsanordnung (67) zum Vergleichen der Referenzspannung mit der Spannung, die das dritte Farbsignal (G) während der Tastintervalle angenommen hat, und einer Anordnung (24) zur Modifizierung des zweiten Farbdifferenzeingangssignales der Matrixschaltung in Ansprache auf das Ausgangssignal der dritten getasteten Vergleichsanordnung, um Abweichungen der Spannung, die das dritte Farbsignal angenommen hat, von einer im wesentlichen annähernden Übereinstimmung der Referenzspannung entgegenzuwirken;

wobei die getastete Helligkeitsregelanordnung zusätzlich die Gleichstromwerte der Farbausgangssignale des zweiten und des dritten Signalkombinierers während des Vorhandenseins der bildrepräsentativen Signalanteile, jedoch unabhängig von der einstellbaren Helligkeitssteuerspannung während der Vorspannungssteuerintervalle auf die einstellbare Helligkeitssteuerspannung ansprechbereit macht.

3. Empfänger nach Anspruch 2, bei welchem die erste getastete Vergleichsanordnung (40) enthält: Einen Spannungsvergleicher mit einem ersten Eingangsanschluß (BASIS von 141), der für einen Empfang der Referenzspannung (VR) geschaltet ist, und einen zweiten Eingangsanschluß (BASIS von 142), der für einen Empfang des ersten Farbsignals geschaltet ist, enthält und nur während der Vorspannungssteuerintervalle in den Betriebszustand getastet wird, und daß die Einrichtung außerdem eine zur Steuerung des Gleichstromwertes des Leuchtdichteingangssignales des ersten Signalkombinierers (319) dienende vierte Regelschleife, welche eine vierte getastete Vergleichsanordnung (130) zum Vergleichen der Referenzspannung mit der Spannung, die das erste Farbsignal während der Tastintervalle angenommen hat, und eine Anordnung (131) zur Modifizierung des Leuchtdichteingangssignales des ersten Signalkombinierers in Ansprache auf das Ausgangssignal der vierten getasteten Vergleichsanordnung enthält, um Abweichungen der Spannung, die das erste Farbsignal angenommen hat, von einer wenigstens annähernden Übereinstimmung mit der Referenzspannung entgegenzuwirken.
4. Empfänger nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß die getastete Helligkeitssteueranordnung (71) außerdem die Gleichspannungswerte der Ausgangssignale der Signalkombinierer (30, 31, 32) unabhängig von der einstellbaren Helligkeitssteuerspannung während der Tastintervalle macht.



5. Empfänger nach Anspruch 2, 3 oder 4 der weiterhin eine Rücklauf-Austastschaltung (51) enthält, welche eine Strahlsperrevorspannung an die Elektroden während Strahlrücklaufperioden bei der Abtastung des Rasters ausschließlich Strahlrücklaufperioden, die in die Vorspannungssteuerintervalle fallen, liefert. 5
6. Empfänger nach Anspruch 5 mit einer Anordnung (50) zum Erzeugen: 10
- (1) eines ersten Zuges von Impulsen (p) die mit der Teilbildfrequenz wiederkehren und zeitlich im wesentlichen mit den Vorspannungssteuerintervallen zusammenfallen, 15
- (2) eines zweiten Zuges von Impulsen (kn) die mit einer Zeilenfrequenz wiederkehren, jedoch während der Vorspannungssteuerintervalle unterbrochen werden, wobei die Pulse des zweiten Zuges zeitlich im wesentlichen mit einem Rückschulterabschnitt des Horizontalaustastteiles eines Zeilenintervalles zusammenfallen, 20
- (3) eines dritten Zuges von Impulsen (rb) einschließlich (a) wiederkehrender teilbildfrequenter Impulse, die zeitlich so liegen, daß sie im wesentlichen Vertikalrücklaufperioden für die Strahlen einschließen, jedoch bei Beginn der Vorspannungssteuerintervalle enden und (b) wiederkehrende zeilenfrequente Impulse, welche während der Vertikalrücklaufperioden sowie während der Vorspannungssteuerintervalle einer Unterbrechung unterliegen und zeitlich so gelegt sind, daß sie im wesentlichen die Zeilenrücklaufperioden der Strahlen umfassen, 25 30 35
- (4) eines vierten Zuges von Impulsen (bm), der der Summe des ersten und des zweiten Zuges von Impulsen entspricht, 35
- einer Anordnung (ANSCHLUSS P VON 50) zur Lieferung des ersten Zuges von Impulsen (p) als Tasteingangssignal an die getastete Verstärkungsregelanordnung (55) und die erste getastete Vergleichieranordnung (140); 40
- einer Anordnung (ANSCHLUSS KP VON 50) zur Lieferung des zweiten Zuges von Impulsen (kn) als Tasteingangssignal an die zweite (65), die dritte (67) und die vierte (130) getastete Vergleichieranordnung, 45
- einer Anordnung (ANSCHLUSS RB VON 50) zum Steuern der Rücklaufaustastschaltung mit dem dritten Zug von Impulsen (rb); und 50
- einer Anordnung (ANSCHLÜSSE BRP UND BRN VON 50) zum Liefern des vierten Zuges von Impulsen als Tasteingangssignal an die getastete Helligkeitssteueranordnung. 55
7. Empfänger nach Anspruch 6, dadurch gekennzeichnet, daß der Empfänger außerdem

eine entsprechende Anordnung (80) zum Liefern von Hilfsfarbsignalen (r, b, g) an entsprechende der Strahlintensitätssteuerelektroden enthält und daß die Steuereinrichtung außerdem eine Anordnung (ANSCHLÜSSE BRP UND BRN VON 50) zum Abschalten der das Hilfsfarbsignal liefernden Anordnung in Ansprache auf die Pulse des vierten Zuges enthält.

