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Automatic bias control apparatus for an electron gun in an image reproducer

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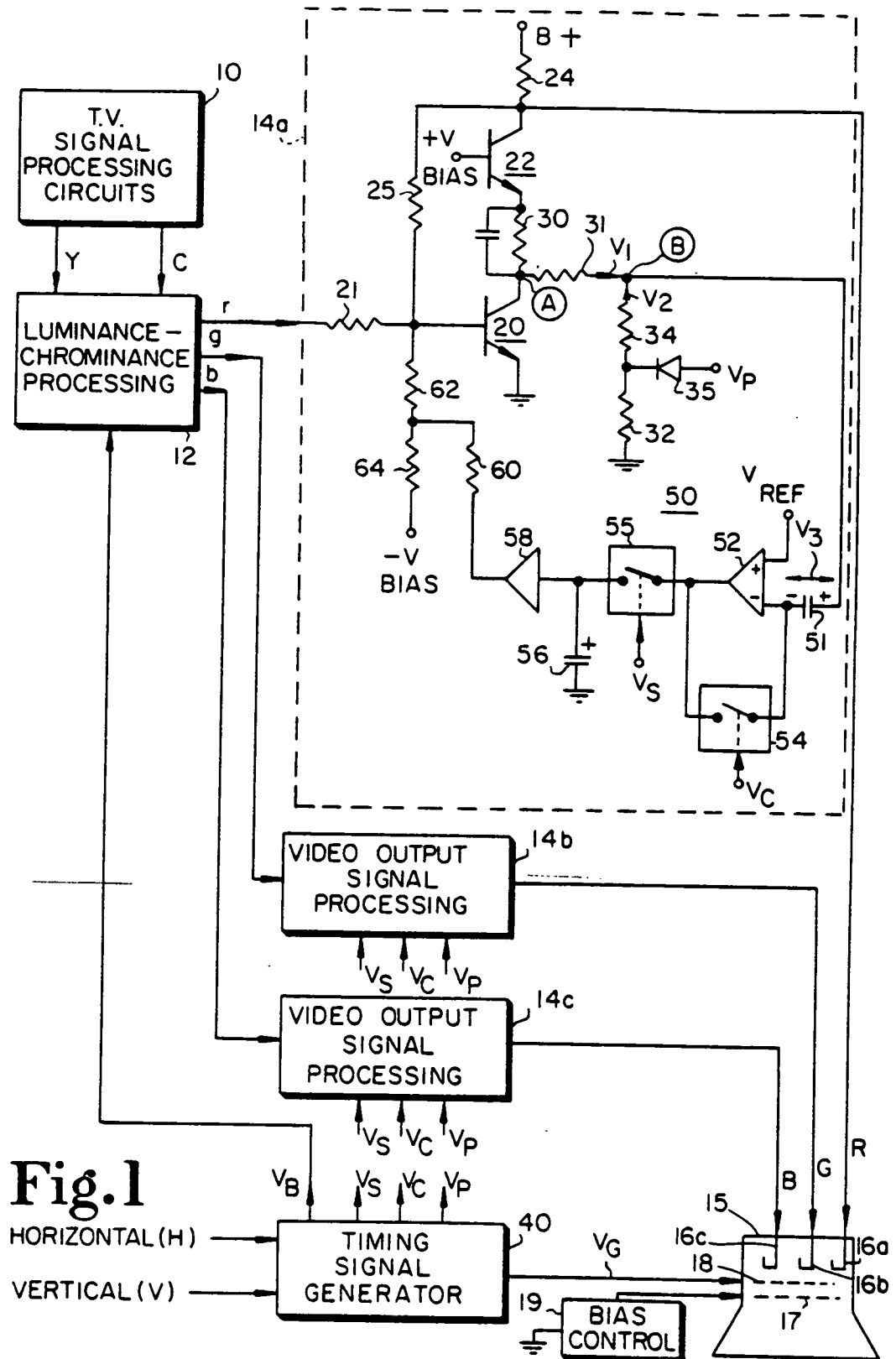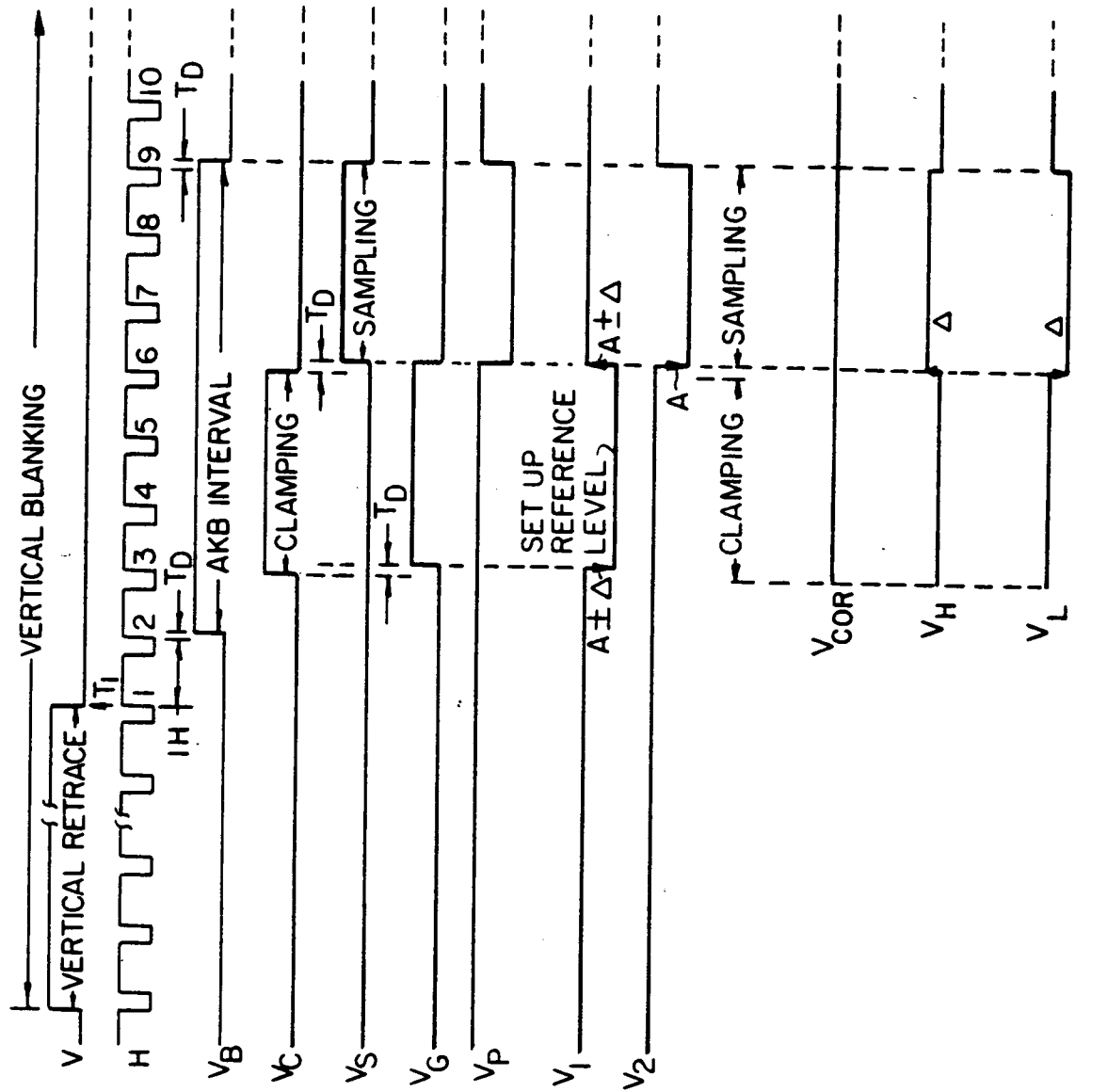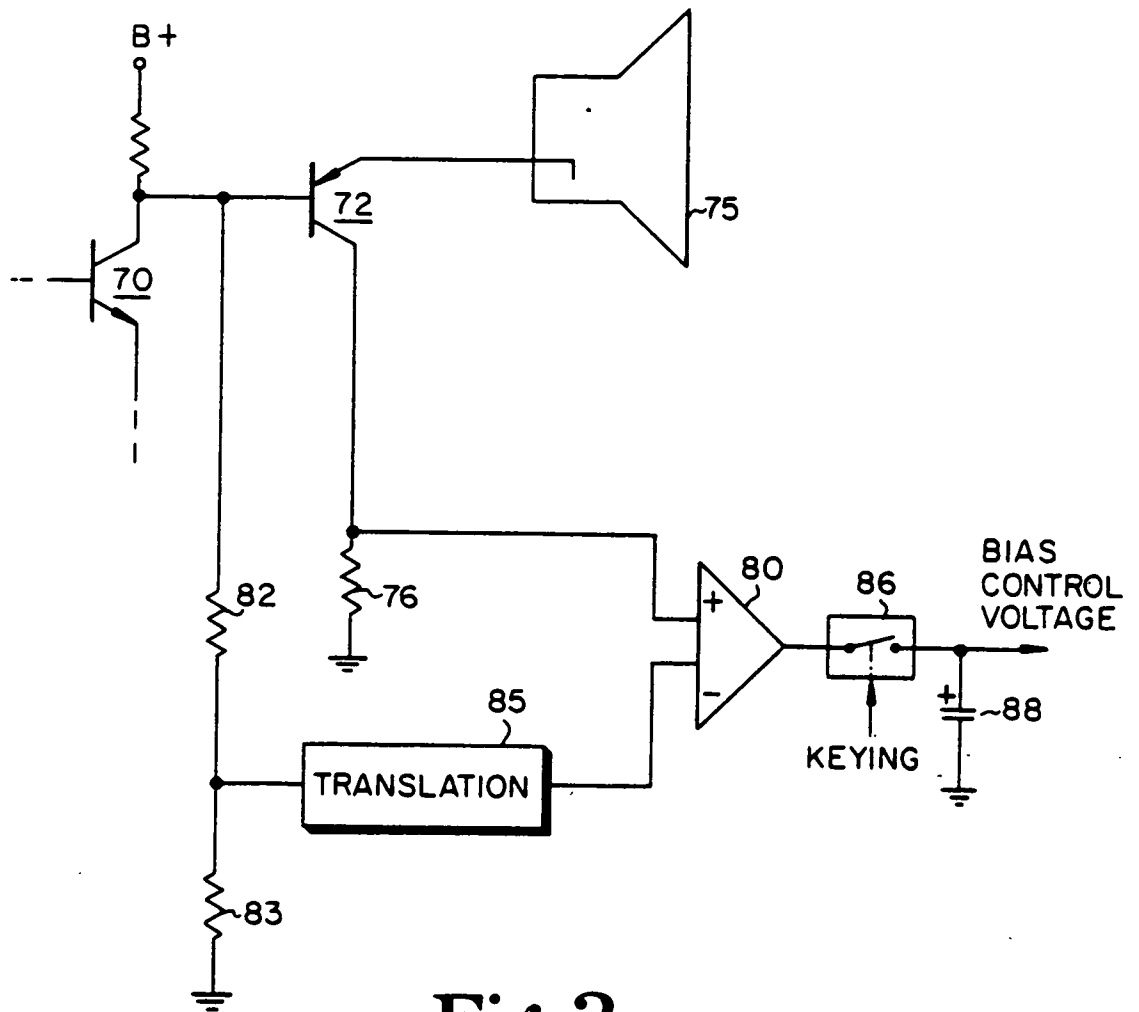
Fig.1

HORIZONTAL (H)

VERTICAL (V)

Fig.2

Fig.3

AUTOMATIC   BIAS CONTROL APPARATUS
FOR   AN   ELECTRON GUN IN AN IMAGE REPRODUCER

This invention concerns apparatus such as may be employed in a video signal processing system for automatically controlling the bias of   an   image reproducing device including an   electron gun . One aspect of the invention concerns such apparatus wherein compensation is automatically provided for mutually different conduction characteristics of plural   electron guns.

One aspect of the invention is set forth in claim 1.

Color television receivers sometimes employ an automatic kinoscope bias (AKB) control system for automatically establishing proper black image representative current levels for each of several electron guns of a color kinoscope associated with the receiver. As a result of this operation, pictures reproduced by the kinescope are prevented from being adversely affected by variations of kinescope operating parameters (e.g., due to aging and temperature effects). One type of AKB system is disclosed in U. S. patent 4,263,622 of Werner Hinn, titled "Automatic Kinescope Biasing System".

An AKB system typically operates during image blanking intervals, at which time each electron gun of the kinescope conducts a small black image representative blanking current in response to a reference voltage representative of black video signal information. This current is monitored by the AKB system to generate a signal which is representative of the currents conducted during the blanking interval, and which is used to maintain a desired black current level.

In an AKB system of the type described in the aforementioned Hinn patent, control circuits respond to a periodically derived pulse signal with a magnitude representative of the cathode black current level. The derived signal exhibits a level other than zero when the black current level is correct, and different levels (e.g., more or less positive) when the black current level is too high or too low. The derived signal is processed by control circuits including clamping and sampling

networks for developing a kinescope bias correction signal
which increases or decreases in magnitude and is coupled
to the kinescope for maintaining a correct black current
level.

5   If the electron guns of the kinescope are
identical whereby they exhibit the same conduction
characteristics (e.g., signal gain), they will conduct
equal black level currents and will exhibit equal cut-off
voltages (i.e., grid-to-cathode voltages) for correct
10   black current conditions. As a practical matter, however,
the electron guns often exhibit mutually different
conduction characteristics due to manufacturing
tolerances, for example. Thus when a receiver is
initially aligned during receiver manufacture to produce a
15   correct black image display condition, the electron guns
can conduct currents which, although different in
magnitude, nevertheless correspond to correct black image
currents. Associated with such different black currents
are electron gun cut-off voltages which, although mutually
20   different in magnitude, correspond to correct cut-off
voltages.

It is herein recognised, in accordance with another aspect
of the invention, that an AKB system, employed in conjunction with a
kinescope having plural electron guns which exhibit dissimilar electron
25   gun conduction characteristics, should maintain the black current levels
and associated cut-off voltages which correspond to a correct black image
current condition, even though such black current levels and
associated cut-off voltages are mutually different from
one electron gun to another. Such black current level and
30   associated cut-off voltage relationship's should be
maintained automatically. The AKB system should operate
to properly correct kinescope bias, however, when the
initially established black level electron gun currents
change due to a change in the operating parameters of the
35   kinescope because of aging or temperature effects. These
objectives are satisfied by the AKB system disclosed
herein.

According to another aspect of the invention there is provided a video signal processing system including a color image reproducing device with plural electron guns each having a cathode intensity control electrode and an associated

5   control grid electrode energized in common with respect to the plural cathodes. The electron guns are subject to exhibiting mutually dissimilar conduction characteristics. The system also includes means for establishing initial correct black current levels for the electron guns, with

10   corresponding initial cathode potentials, the initial correct cathode black current levels and the corresponding cathode potentials being subject to exhibiting mutual dissimilarities. The biasing of the reproducing device is controlled automatically by means of a signal deriving network and a

15   control network. The signal deriving network derives signals respectively representative of electron gun black current variations produced in accordance with changes in the operating parameters of the reproducing device. The control network responds to the magnitudes of both respective

20   derived signals and initial cathode potentials for providing respective bias control signals to respective electron guns of the kinescope, to maintain correct black current levels conducted by the electron guns in substantially the same mutual relationship as exhibited by

25   the conduction characteristics of the electron guns.

        In accordance with an embodiment of the invention, auxiliary control signals are provided with a magnitude proportional to the bias of an electron gun during image blanking bias control intervals. The auxiliary signal

30   exhibits a magnitude and sense for negating the response of the control network to the magnitude of the derived signal when the derived signal is representative of a correct black current level.

        In the drawing:

35   FIGURE 1 shows a portion of a color television receiver including an AKB system and associated apparatus according to the present invention;

FIGURE 2 illustrates signal waveforms associated with the operation of the system of FIGURE 1; and

FIGURE 3 shows an alternative embodiment of apparatus according to the present invention.

In FIGURE 1, television signal processing circuits 10 provide separated luminance (Y) and chrominance (C) components of a composite color television signal to a luminance-chrominance signal processing network 12. Processor 12 includes luminance and chrominance gain control circuits, DC level setting circuits (e.g., comprising keyed black level clamping circuits), color demodulators for developing r-y, g-y and b-y color difference signals, and matrix amplifiers for combining the latter signals with processed luminance signals to provide low level color image representative signals r, g and b. These signals are amplified and otherwise processed by circuits within video output signal processing networks 14a, 14b and 14c, respectively, which supply high level amplified color image signals R, G and B to respective cathode intensity control electrodes 16a, 16b and 16c of a color kinescope 15. Networks 14a, 14b and 14c also perform functions related to the AKB operation, as will be discussed. Kinescope 15 is of the self-converging in-line gun type with a commonly energized control grid 18 associated with each of the electron guns comprising cathode electrodes 16a, 16b and 16c, and a common screen grid 17 also associated with each of the three electron guns. Bias for screen grid 17 is provided by means of an adjustable bias control network 19.

Since output signal processors 14a, 14b and 14c are similar in this embodiment, the following discussion of the operation of processor 14a also applies to processors 14b and 14c.

Processor 14a includes a kinescope driver stage comprising an input common emitter transistor 20 which receives video signal R from processor 12 via an input resistor 21, and an output high voltage common base transistor 22 which together with transistor 20 forms a

cascode video driver amplifier. High level video signal
R, suitable for driving kinescope cathode 16a, is
developed across a load resistor 24 (e.g., 12 kilohms) in
the collector output circuit of transistor 22. An
operating supply voltage for amplifier 20,22 is provided
by a source of high DC voltage B+ (e.g., +230 volts).
Direct current negative feedback for driver 20, 22 is
provided by means of a resistor 25 (e.g., 130 kilohms).
The signal gain of cascode amplifier 20, 22 is primarily
determined by the ratio of the value of feedback resistor
25 to the value of input resistor 21. The feedback
network provides a suitably low amplifier output
impedance, and assists to stabilize the DC operating level
at the amplifier output.

A sensing resistor 30 DC coupled in series with
and between the collector-emitter paths of transistors 20,
22 serves to develop a voltage, at a relatively low
voltage sensing node A, representing the level of
kinescope cathode black current conducted during kinescope
blanking intervals. Resistor 30 functions in conjunction
with the AKB system of the receiver, which will now be
described.

A timing signal generator 40 containing logic
control circuits responds to periodic horizontal
synchronizing rate signals (H) and to periodic vertical
synchronizing rate signals (V), both derived from
deflection circuits of the receiver, for generating timing
signals V_B, V_S, V_C, V_P and V_G which control the operation
of the AKB function during periodic AKB intervals. Each
AKB interval begins shortly after the end of the vertical
retrace interval within the vertical blanking interval,
and encompasses several horizontal line intervals also
within the vertical blanking interval and during which
video signal image information is absent. These timing
signals are illustrated by the waveforms in FIGURE 2.

Referring to FIGURE 2 for the moment, timing
signal V_B, a video blanking signal, comprises a positive
pulse generated soon after the vertical retrace interval

ends at time T_1, as indicated by reference to signal waveform V. Blanking signal V_B exists for the duration of the AKB interval and is applied to a blanking control input terminal of luminance-chrominance processor 12 for

5 causing the r, g and b outputs of processor 12 to exhibit a black image representative DC reference level corresponding to the absence of video signals. This can be accomplished by reducing the signal gain of processor 12 to substantially zero via the gain control circuits of

10 processor 12 in response to signal V_B, and by modifying the DC level of the video signal processing path via the DC level control circuits of procesor 12 to produce a black image representative reference level at the signal outputs of processor 12. Timing signal V_G, a positive

15 grid drive pulse, encompasses three horizontal line intervals within the vertical blanking interval. Timing signal V_C controls the operation of a clamping circuit associated with the signal sampling function of the AKB system. Timing signal V_S, a sampling control signal,

20 occurs after signal V_C and serves to time the operation of a sample and hold circuit which develops a DC bias control signal for controlling the kinescope cathode black current level. Signal V_S encompasses a sampling interval the beginning of which is slightly delayed relative to the end

25 of the clamping interval encompassed by signal V_C, and the end of which substantially coincides with the end of the AKB interval. A negative-going auxiliary pulse V_P coincides with the sampling interval. Signal timing delays T_D indicated in FIGURE 2 are on the order of 200

30 nanoseconds.

Referring again to FIGURE 1, during the AKB interval positive pulse V_G (e.g., on the order of +10 volts) forward biases grid 18 of the kinescope, thereby causing the electron gun comprising cathode 16a and grid

35 18 to increase conduction. At times other than the AKB intervals, signal V_G provides the normal, less positive, bias for grid 18. In response to positive grid pulse V_G, a similarly phased, positive current pulse appears at

cathode 16a during the grid pulse interval. The amplitude of the cathode output current pulse so developed is proportional to the level of cathode black current conduction (typically a few microamperes).

5   The induced positive cathode output pulse appears at the collector of transistor 22, and is coupled to the base input of transistor 20 via resistor 25, causing the current conduction of transistor 20 to increase proportionally while the cathode pulse is

10   present. The increased current conducted by transistor 20 causes a voltage to be developed across sensing resistor 30. This voltage is in the form of a negative-going voltage change which appears at sensing node A and which is proportional in magnitude to the magnitude of the black

15   current representative cathode output pulse. The magnitude of the voltage change at node A is determined by the product of the value of resistor 30 (e.g., 560 ohms) times the magnitude of the incremental current flowing through resistor 30.

20   The voltage change at node A is coupled via a small resistor 31 to a node B at which a voltage change V_1, essentially corresponding to the voltage change at node A, is developed. Node B is coupled to a bias control voltage processing network 50. Network 50 includes an

25   input coupling capacitor 51, an input clamping and sampling operational amplifier 52 (e.g., an operational transconductance amplifier) with an associated feedback switch 54 responsive to clamping timing signal V_c, and an average responding charge storage capacitor 56 with an

30   associated switch 55 responsive to sampling timing signal V_s. The voltage developed on capacitor 56 is used to supply a kinescope bias correction signal via network 58 and resistor network 60, 62, 64 to the kinescope driver via a bias control input at the base of transistor 20.

35   Network 58 includes signal translating and buffer circuits for supplying the bias control voltage at a suitable level and low impedance in accordance with the bias control input requirements of transistor 20.

The operation of the system of FIGURE 1 will now be discussed with specific reference to the waveforms of FIGURE 2. Auxiliary signal V_p is applied to circuit node B in FIGURE 1 via a diode 35 and a voltage translating
5   impedance network comprising resistors 32 and 34, e.g., with values of 220 kilohms and 270 kilohms, respectively. Signal V_p exhibits a positive DC level of approximately +8.0 volts at all times except during the AKB sampling interval, for maintaining diode 35 conductive so that a
10   normal DC bias voltage is developed at node B. When the positive DC component of signal V_p is present, the junction of resistors 32 and 34 is clamped to a voltage equal to the positive DC component of signal V_p, minus the voltage drop across diode 35. Signal V_p manifests a
15   negative-going, less positive fixed amplitude pulse component during the AKB sampling interval. Diode 35 is rendered non-conductive in response to negative pulse V_p, causing both resistors 32 and 34 to be coupled between node B and ground. Resistor 31 causes insignificant
20   attenuation of the voltage change developed at node A relative to the corresponding voltage change (V_1) developed at node B since the value of resistor 31 (on the order of 200 ohms) is small relative to the values of resistors 32 and 34.

25   Prior to the clamping interval, but during the AKB interval, the pre-existing nominal DC voltage (V_{DC}) appearing at node B charges the positive terminal of capacitor 51. During the clamping interval when grid drive pulse V_G is developed, the voltage at node A
30   decreases in response to pulse V_G by an amount representative of the black current level. This causes the voltage at node B to decrease to a level substantially equal to $V_{DC} - V_1$. Also during the clamping interval, timing signal V_C causes clamping switch 54 to close (i.e.,
35   conduct) whereby the inverting (-) signal input of amplifier 52 is coupled to its output, thereby configuring amplifier 52 as a unity gain follower amplifier. As a result, a source of fixed DC reference voltage V_{REF} (e.g.,

+5 volts) applied to a non-inverting input (+) of amplifier 52 is coupled by feedback action to the inverting signal input of amplifier 52 via the output of amplifier 52 and conductive switch 54. Thus during the clamping interval the voltage V_3 across capacitor 51 is a function of a reference set-up voltage determined by voltage V_{REF} at the negative terminal of capacitor 51, and a voltage at the positive terminal of capacitor 51 corresponding to the difference between the described pre-existing nominal DC level (V_{DC}) at node B and voltage change V_1 developed at node B during the clamping interval. Thus voltage V_3 across capacitor 51 during the clamping reference interval is a function of the level of black current representative voltage change V_1, which may vary. Voltage V_3 can be expressed as ($V_{DC} - V_1$) - V_{REF}.

During the immediately following sampling interval, positive grid drive pulse V_G is absent, causing the voltage at node B to increase positively to the pre-existing nominal DC level V_{DC} that appeared prior to the clamping interval. Simultaneously, negative pulse V_P appears, reverse biasing diode 35 and perturbing (i.e., momentarily changing) the normal voltage translating and coupling action of resistors 32,34 such that the voltage at node B is reduced by an amount V_2 as indicated in FIGURE 2. At the same time, clamping switch 54 is rendered non-conductive and sampling switch 55 closes (conducts) in response to signal V_S whereby charge storage capacitor 56 is coupled to the output of amplifier 52.

Thus during the sampling interval the input voltage applied to the inverting signal input (-) of amplifier 52 is equal to the difference between the voltage at node B and voltage V_3 across input capacitor 51. The input voltage applied to amplifier 52 is a function of the magnitude of voltage change V_1, which can vary with changes in the kinescope black current level.

The voltage on output storage capacitor 56 remains unchanged during the sampling interval when the magnitude of voltage change V_1 developed during the

clamping interval equals the magnitude of voltage change V_2 developed during the sampling interval, indicating a correct kinescope black current level. This results because during the sampling interval, voltage change V_1 at
5   node B increases in a positive direction (from the clamping set-up reference level) when the grid drive pulse is removed, and voltage change V_2 causes a simultaneous negative-going voltage perturbation at node B. When kinescope bias is correct, positive-going voltage change
10   V_1 and negative-going voltage change V_2 exhibit equal magnitudes whereby these voltage changes mutually cancel during the sampling interval, leaving the voltage at node B unchanged.

When the magnitude of voltage change V_1 is less
15   than the magnitude of voltage change V_2, amplifier 52 proportionally charges storage capacitor 56 in a direction for increasing cathode black current conduction. Conversely, amplifier 52 proportionally discharges storage capacitor 56 for causing decreased cathode black current
20   conduction when the magnitude of voltage change V_1 is greater than the magnitude of voltage change V_2.

As more specifically shown by the waveforms of FIGURE 2, the amplitude "A" of voltage change V_1 is assumed to be approximately three millivolts when the
25   cathode black current level is correct, and varies over a range of a few millivolts ($^+_-\Delta$) as the cathode black current level increases and decreases relative to the correct level as the operating characteristics of the kinescope change. Thus the clamping interval set-up
30   reference voltage V_3 across capacitor 51 varies with changes in the magnitude of voltage V_1 as the cathode black current level changes. Voltage change V_2 at node B exhibits an amplitude "A" of approximately three millivolts, which corresponds to amplitude "A" associated
35   with voltage change V_1 when the black current level is correct.

As indicated by waveform V_{COR} in FIGURE 2, the voltage at the inverting input of amplifier 52 remains

unchanged during the sampling interval when voltages V_1 and V_2 are both of amplitude "A". However, as indicated by waveform V_H, the input voltage of amplifier 52 increases by an amount Δ when voltage change V_1 exhibits

5   amplitude "A + Δ", corresponding to a high black current level. In this event amplifier 52 discharges output storage capacitor 56, so that the bias control voltage applied to the base of transistor 20 causes the collector voltage of transistor 22 to increase, whereby the cathode

10   black current decreases toward the correct level.

Conversely, and as indicated by waveform V_L, the input voltage of amplifier 52 decreases by an amount Δ during the sampling interval when voltage change V_1 exhibits amplitude "A - Δ", corresponding to a low black

15   current level. In this case amplifier 52 charges output storage capacitor 56, causing the collector voltage of transistor 22 to decrease whereby the cathode black current increases toward the correct level. In either case, several sampling intervals may be required to

20   achieve the correct black current level.

In some AKB systems it may be desirable to develop black current representative voltage change V_1 during the sampling interval, rather than during the preceding clamping interval as described previously. In

25   such an alternative system grid drive pulse V_G would be timed to occur during the sampling interval, coincident with a positive auxiliary pulse V_p. The negative-going voltage change V_1 and the positive-going voltage change V_2 developed in response to auxiliary signal V_p then occur

30   simultaneously and combine directly at node B such that they mutually cancel when the black current level is correct (i.e., no voltage change is produced at node B).

The described combined-pulse sampling technique is discussed in greater detail in U. S. patent application

35   Serial No. 434,314 titled "Signal Processing Network For An Automatic Kinescope Bias Control System", corresponding to copending British Application (RCA 76583/78456). This application also discloses additional information concerning the arrangement

including auxiliary control signal V_p, as well as disclosing a suitable arrangement for timing signal generator 40 and circuit details of sampling amplifier 52.

The voltage developed at node B during the AKB clamping and sampling intervals is a function of the values of resistors 31, 32 and 34, and the value of an output impedance Z_0 (approximately 30 to 50 ohms) appearing at node A. When signal V_p manifests the positive DC level (+8 volts) such as during the clamping interval, the junction of resistors 32 and 34 is voltage clamped and a current conducted by resistor 31 from node A to node B is a function of the values of Z_0, resistor 31 and resistor 34. During the subsequent sampling interval when the negative-going pulse component of signal V_p is present, diode 35 is non-conductive and the junction of resistors 32 and 34 is unclamped. At this time a different current is conducted by resistor 31 from node A to node B as a function of the value of resistor 32, in addition to the values of Z_0 and resistors 31, 34. Voltage change V_2 developed at node B in response to the negative-going pulse component of signal V_p is proportional to the difference between these currents.

The described AKB system, when employed with a kinescope displaying dissimilar electron gun conduction characteristics, advantageously automatically maintains the black current levels corresponding to a correct black image current condition even though such black current levels are mutually different from one electron gun of the kinescope to another due to manufacturing tolerances, for example. This feature of the disclosed AKB system will now be discussed.

As noted previously, kinescope 15 is of the self-converging type with a single control grid 18 and a single screen grid 17 both common to each of the three kinescope electron guns. The correct black current conduction of the kinescope can be established during receiver manufacture alignment by adjusting the bias of screen grid 17 by means of bias control network 19 (e.g.,

comprising a manually adjustable potentiometer) until one or more of the kinescope cathodes exhibits a desired voltage.

When the kinescope electron guns are identical whereby they exhibit the same conduction response, they will conduct equal black currents and exhibit equal cut-off voltages (i.e., grid-to-cathode voltages) as a result of the black current alignment process. As a practical matter, however, the electron guns can exhibit mutually different conduction characteristics. Thus the electron guns can conduct currents which, although different in magnitude, nevertheless correspond to correct black image currents. The different cathode cut-off voltages respectively associated with the different currents likewise correspond to correct cut-off voltages.

The described electron gun conduction relationship for correct black image current conditions is preserved because the magnitude of voltage change V_2 is related to the DC voltage component appearing at sensing node A during AKB operating intervals (neglecting the effect of the induced cathode output current pulse developed in response to positive grid drive pulse V_G). This DC voltage component is proportional to the cathode cut-off bias voltage as manifested by the DC voltage component at the output of driver transistor 22, to which the kinescope cathode is connected.

This relationship is defined by the expression

$$V_2 = R_0 \frac{R_{32}}{R_{34} (R_{32} + R_{34})} V_{DC} - \frac{R_0}{R_{34}} (V_P - V_D)$$

where

V_2 is the magnitude of voltage change V_2,

R_0 is the sum of the values of resistor 31 and impedance Z_0 at node A,

R_{32} is the value of resistor 32,

R_{34} is the value of resistor 34,

V_{DC} is the value of the DC component at node A,

on the order of +7 to +10 volts,

V_p is the fixed positive DC component of
auxiliary signal V_p, on the order of
+8 volts, and

V_D is the substantially constant DC offset
voltage of diode 35, approximately
+0.6 volts.

Voltage change V_2 exhibits a magnitude of approximately
-3.4 millivolts when V_{DC} is +8.0 volts, for example.

Thus if the three kinescope electron guns
exhibit mutually different currents and associated cut-off
voltages corresponding to initial black current set-up
conditions, voltage changes V_2 respectively associated
with signal processors 14a, 14b and 14c each exhibit
different magnitudes, even though each is derived from a
common signal V_p. The different magnitudes of voltage
changes V_2 are a function of the different cut-off
voltages as manifested by the DC components of different
magnitudes developed at nodes A. The different magnitudes
of voltage changes V_2 are such that, for the associated
AKB control loop, the voltage developed at node B does not
change when voltage changes V_1 and V_2 are combined.
Accordingly, each AKB control loop remains quiescent.

The AKB control loops will remain quiescent
until the initially established black currents change due
to a change in the operating parameters of the kinescope
because of kinescope aging or temperature effects, for
example. In this regard assume that the kinescope
operating parameters change such that the red electron gun
conduction decreases whereby the associated cathode black
current is too low. The cathode output current pulse
induced in response to positive grid drive pulse V_G will
then correspondingly decrease in magnitude, the voltage at
node B will change in response to voltage changes V_1 and
V_2, and the voltage on output storage capacitor 56 will
change with a sense for reducing the cathode bias voltage
developed at the collector of transistor 22 to thereby
return (i.e., increase) the cathode black current to the

correct level. At this time the magnitude of voltage change V_2 will exhibit a new level associated with the newly developed (corrected) cathode bias voltage, such that the voltage at node B remains unchanged in response to voltage changes V_1 and V_2 (i.e., the AKB control loop is again quiescent).

As indicated by the arrangement of FIGURE 3 the principles of the present invention are applicable to systems which do not employ the pulsed grid, combined-pulse sampling technique of FIGURE 1.

In FIGURE 3, the collector output of a video signal amplifier transistor 70 is coupled via a high voltage PNP follower transistor 72 to a cathode of a kinescope 75. During AKB intervals, follower transistor 72 acts as a current sensor for directly sensing the level of the cathode black current, which corresponds to the emitter-collector current of transistor 72. A voltage developed across a resistor 76 is directly proportional to the collector current of transistor 72, which corresponds to the cathode black current. A voltage divider comprising resistors 82, 83 is coupled to the collector output of transistor 70, for developing a voltage at the junction of resistors 82, 83 proportional to the cathode cut-off bias voltage associated with the correct black current level established during receiver alignment.

The black current representative voltage developed across resistor 76 is applied to one input of a differential input amplifier 80. The cut-off voltage representative voltage developed across resistor 83 is coupled via a voltage translation network 85 (e.g., including level shifting circuits) to another input of differential amplifier 80. A sampling switch 86 closes (conducts) in response to KEYING signals during AKB sampling signals for coupling the output of amplifier 80 to a charge storage capacitor 88. A bias correction voltage developed on capacitor 88 is a function of the voltages across resistors 76 and 83, and is applied to the kinescope (e.g., via transistor 70) for maintaining a

correct kinescope black current level. Here, the
"reference" input to amplifier 80, as developed from the
voltage across resistor 83, is proportional to the cathode
black level cut-off bias voltage.

1 CLAIMS:

1. In a video signal processing system including an image reproducing device having an electron gun comprising an intensity control electrode, automatic
5 bias control apparatus comprising:

means for deriving a signal representative of the magnitude of black image current conducted by said electron gun during bias control intervals;

means for providing an auxiliary signal
10 proportional to the bias of said electron gun during image blanking bias control intervals;

control means, responsive to said derived signal and to said auxiliary signal, for developing a bias control voltage as a function of the magnitudes of both
15 said derived signal and said auxiliary signal; and

means for coupling said control signal to said image reproducing device for maintaining a correct black current level.

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2. Apparatus according to Claim 1, wherein said auxiliary signal exhibits a magnitude and sense for substantially negating the response of said control means to said magnitude of said derived signal when the magnitude of said derived signal is representative of a correct black current level.

3. Apparatus according to Claim 1 or 2, wherein said derived signal exhibits a magnitude other than zero when said black current level is correct.

4. Apparatus according to Claim 1, 2 or 3 and further comprising :

means for modifying the bias of said kinescope grid electrode during bias control intervals to induce respective cathode output current signals with magnitudes proportional to the black current level conducted by the associated electron gun.

5. Apparatus according to Claim 1, 2, 3 or 4 wherein said image reproducing device comprises a kinoscope with plural electron guns each having a cathode intensity control electrode and an associated grid electrode energized in common with respect to said plural cathode electrodes, said electron guns being subject to exhibiting mutually dissimilar conduction characteristics; and wherein

said system includes plural automatic bias control apparatus each respectively associated with respective ones of said plural electron guns.

6. A video signal processing system including a color image reproducing device with plural electron guns each having a cathode intensity control electrode for receiving video signals and an associated control grid electrode energized in common with respect to said plural cathodes, said electron guns being subject to exhibiting mutually dissimilar conduction characteristics; means for establishing initial correct black current levels for said electron guns with corresponding initial cathode potentials, said initial correct cathode black current levels and corresponding cathode potentials being subject to exhibiting mutual dissimilarities; and apparatus for automatically controlling the bias of said image reproducing device in response to changes in the operating parameters of said image reproducing device, the said apparatus comprising:

means for deriving signals respectively representative of electron gun black current variations produced in accordance with changes in the operating parameters of said image reproducing device; and

control means responsive to the magnitudes of both respective derived signals and initial cathode potentials for providing respective bias control signals to respective electron guns of said image reproducing device to maintain correct black current levels conducted by said electron guns in substantially the same mutual relationship as exhibited by the conduction characteristics of said electron guns.

7. Apparatus according to Claim 6, wherein said image reproducing device includes an additional grid electrode energized in common with respect to said plural cathodes; and

said means for establishing said initial correct black current levels for said electron guns comprises a source of variable bias potential coupled to said additional grid electrode.

8.   Apparatus according to Claim 6, and further comprising

means for modifying the bias of said control grid during bias control intervals to induce respective cathode output currents with magnitudes proportional to the black current level conducted by the associated electron gun.

9.   In a video signal processing system, apparatus for automatically controlling the bias of an image reproducing device of the system, substantially as hereinbefore described with reference to Figures 1 and 2 or to Figure 3 of the drawings.

10.   Apparatus according to claim 6, 7, 8 or 9, wherein the video signal processing system is a color television receiver.

THE PATENT OFFICE

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RENEWAL DETAILS

PATENT No 2129248

RENEWAL DATE 13 October 1983

RENEWAL FEE PAID FOR 5E YEAR OR due 13/10/86

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FOR THE COMPTROLLER

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Patent Granted:
  | WITH EFFECT FROM 11 JUN 86 |
  | SECTION 25(1) |

Application No.
  8327417 filed on 13 October 1983

Priority claimed:
  14 October 1982 in United States of America doc: 434328

Title:
  Automatic bias control apparatus for an electron gun in an image reproducer

Applicant:
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Classified to:
  H4F

Examination requested   17 OCT 1984.

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