

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Regulated Voltage Supplies

We, RADIO CORPORATION OF AMERICA, a Corporation organized under the laws of the State of Delaware, United States of America, of 30, Rockefeller Plaza, City and State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates generally to regulated voltage supplies, and particularly to regulated voltage supplies used for supplying high voltage to the color image reproducing device in a color television receiver.

It is a widespread practice in color television receivers to use a shunt regulator in association with the application of a high unidirectional potential to the kinescope's ultor (final accelerating) electrode. In conventional practice, the regulator comprises a grid-controlled electron discharge device, the space current path of which is connected effectively in parallel with the load presented by the kinescope to the high voltage supply. Variations in ultor voltage due to changes in the kinescope loading on the supply (caused, for example, by changes in the DC content of the liminance signal drive) are substantially avoided by controlling the regulator current inversely with respect to the current drawn by the kinescope. That is, when the kinescope current increases the tendency for the ultor voltage to decrease is opposed by causing the regulator current to decrease. Conversely, when the kinescope current decreases the tendency of the ultor voltage to increase is opposed by causing the regulator current to increase.

A familiar technique for producing the desired change in regulator current involves

applying a sample of the receiver's B-boost voltage to the regulator control grid. The desired effect is achieved because the B-boost voltage, derived from the same deflection source as the ultor voltage, responds similarly to changes in loading on the source, and thus reflects the undesired ultor potential variations.

In color television receivers employing cathode ray tubes which require the electron beam to be deflected through wide deflection angles such as 90°, raster distortions of the so-called "pincushion" type occur. It is desirable to correct these distortions. Broadly speaking, correction of pincushioning at the raster sides generally involves some form of modulation of the horizontal deflection field in accordance with a waveform of field rate. Correction of pincushioning at the raster top and bottom generally involves some form of modulation of the vertical deflection field in accordance with a waveform of line deflection rate. A problem associated with the use of this general approach to pincushion correction is the introduction of field rate variations into circuits auxiliary to the horizontal deflection system. Thus, for example, the ultor voltage supplied to the color kinescope may vary at a field rate with undesired effects on the reproduced color image.

The present invention is concerned with reducing undesired field rate variations in supply voltages. More particularly, the present invention relates to a voltage regulating arrangement for a cathode ray tube system developing display rasters having recurring fields or scanning lines. The cathode ray tube system includes a cathode ray tube and respective line and field rate cathode ray beam deflection circuits. The cathode ray tube includes an ultor electrode and additional electrodes. The operating

[Price 4s. 6d.]

potentials for the ultor electrode and of the additional electrodes are derived in respective supply circuits at least in part by rectification of flyback pulses generated in the line rate deflection circuit. The cathode ray tube system is subject to the appearance of undesired field rate variations in parameters of the line rate deflection circuit. The appearance of field rate variations in the operating potentials tends to adversely affect operation of the cathode ray tube.

The voltage regulating arrangement, therefore, comprises a regulating device having a control electrode. The regulating device is connected to the ultor electrode and serves as a controllable load of the ultor operating potential supply circuit. A source of control voltage is included which is sensitive to variations in the load presented by the cathode ray tube to the ultor operating potential supply circuit. Means are included for providing a direct current conductive coupling between the control voltage source and the regulating device control electrode for causing the regulating device to oppose long term D.C. variations in the ultor potential caused by the cathode ray tube load variations. The voltage arrangement finally includes regulating coupling means providing an exclusively alternating current coupling between the operating potential supply circuit for the additional electrodes and the regulating device control electrode for causing the regulating device to oppose undesired field rate variations in the ultor potential.

A primary object of the present invention is to provide voltage regulating apparatus for attenuating undesired field rate variations in the outputs of voltage supplies associated with a line deflection system.

In the accompanying drawing, a color television receiver is illustrated. Block representations of a number of major segments of the receiver are used to simplify the drawing. However, pertinent portions of the receiver's horizontal deflection circuitry and associated voltage supplies are illustrated in schematic detail.

The signal input portion of the receiver, represented by the block 11, labeled television signal receiver, selects a radiated color television signal, converts the selected modulated RF signal to intermediate frequencies, amplifies the resultant modulated IF signal, and, by detection of the IF signal, recovers a composite color video signal. It may comprise the usual tuner, IF amplifier and video detector. The composite color video signal output of receiver 11 is supplied to a video amplifier 13, from which is derived inputs for the receiver's chrominance channel 15, luminance channel 17, and deflection sync separator 19.

The chrominance channel 15, shown only

in block form may comprise the usual circuitry associated with proper recovery of color-difference signal information from the modulated color subcarrier which is a component of the composite color video signal output of video amplifier 13. Such circuitry generally includes a bandpass amplifier for selectively amplifying the color subcarrier bands, an array of synchronous detectors for demodulating the color subcarrier and matrix circuits of combining the detector outputs to obtain a set of color-difference signals for application to the receiver's color image reproducer. To provide the desired synchronous detection of the modulated color subcarrier, there will be associated with the chrominance channel 15, detectors, a local source of oscillations of subcarrier frequency and reference phase, as well as means for phase synchronizing this local oscillation source in accordance with the reference information of the burst component of the composite color video signal.

The red, blue and green color-difference signal outputs of the chrominance channel 15 appear at respective output terminals CR, CB and CG, which are directly connected to the respective control grids, 23R, 23B and 23G, of the red, blue and green electron guns of a color kinescope 20, which is of the well-known tri-gun, shadow-mask type.

Luminance information is added to the color-difference signal drive of color kinescope 20 by application to the respective cathodes 21R, 21B and 21G of color kinescope 20. Luminance channel 17, which may, in its usual form, comprise suitable wideband amplifier means, develops luminance signal outputs at respective output terminals LR, LB and LG for direct application to the respective kinescope cathodes. Desirably, the luminance channel 17 may include means for adjusting the relative amplitudes of the luminance signal outputs appearing at the respective output terminals, LR, LB and LG, for color balance purposes. A luminance signal output also appears at an additional luminance channel output terminal LD, for use in a regulator control arrangement to be subsequently described.

The color kinescope 20 additionally includes individual screen grid electrodes 25R, 25B and 25G for the respective red, blue and green electron guns, each screen grid electrode being supplied with an individually adjustable operating D.C. potential; focusing electrode structure 27 for the electron gun trio, subject to common energization via the output terminal F of an adjustable D.C. source 69; and ultor (final accelerating) electrodes structure 29, adapted to operate at a high voltage, supplied thereto via the output terminal U of a regulated high voltage supply. The voltage supplies for the aforesaid kinescope electrodes are

associated with the receiver's deflection circuitry in a manner to be explained in detail subsequently.

Associated with the color kinescope 20 is a deflection yoke 40 for developing magnetic beam deflection fields within the kinescope to cause the kinescope beams to trace a scanning raster on the kinescope's viewing screen. The deflection windings, which, upon energization with deflection currents of appropriate frequencies and waveshapes, provide the respective line and field rate deflections of the kinescope beams desired for raster development.

The deflection synchronizing separator 19 separates the deflection synchronizing components from the remainder of the received composite color video signal. The sync separator 19 supplies a vertical pulse output to the vertical deflection circuits 41 and a horizontal sync pulse output to the horizontal deflection circuits 45.

Under suitable control of the applied synchronizing pulses, the vertical deflection circuits 41 generate an appropriately shaped and timed field rate scanning current wave for application to the vertical deflection windings V, V' of yoke 40. The horizontal deflection circuits 45 perform a similar function with regard to a line rate scanning current wave for energizing the horizontal windings H, H' of yoke 40. However, the output circuit elements associated with the driving device for the horizontal yoke windings should be considered in detail at this point.

The horizontal output tube 47 (partially illustrated) has its output electrode, anode 49, connected to an intermediate terminal O of the horizontal output transformer 50, which provides step-down autotransformer coupling to the horizontal deflection winding H, H' of yoke 40. The transformer winding segment extending from the intermediate terminal O to the end terminal L constitutes the primary winding for the step-down autotransformer coupling. A portion of this winding segment, extending between an intermediate tap Y and the end terminal L, serves as the secondary across which the yoke winding is to be coupled.

A damper tube circuit is provided for conventional reaction scanning and power recovery purposes. The cathode of a damper diode 60 is connected (via an RF choke) to a transformer tap D, positioned intermediate the drive input terminal O and the yoke-connecting tap Y. The anode of damper diode 60 is connected to the receiver's B+ voltage supply (not illustrated) by a direct current conductive path including an additional RF choke in series with a variable inductor 61, which serves a linearity or efficiency adjustment purpose. The adjustable inductor 61 is shunted by a capacitor

67, and the respective end terminals of the adjustable inductor 61 are coupled by respective capacitors 63 and 65 to a common terminal BB (directly connected to the end terminal L of transformer 50).

Periodic conduction by diode 60 develops a charge across capacitors 63 and 65, resulting in the development at terminal BB of a D.C. potential of increased amplitude relative to B+, i.e., the so-called B-boost potential. In addition to serving as the effective anode potential for the horizontal output tube 47, the B-boost potential is also available for use for other purposes, as will be discussed subsequently.

During each of the recurring retrace intervals of the scanning waves delivered to the horizontal yoke windings, a so-called flyback voltage pulse is developed across the windings of transformer 50 due to sudden cutoff of output tube 47. These flyback pulses are subject to rectification for various voltage supply purposes associated with the operation of color kinescope 20. One such flyback pulse is used as an energizing potential for the ultor electrode 29. Diode 70 serves as the flyback pulse rectifier for the development of the high voltage required by the ultor electrode 29. A stepped-up version of the flyback pulses appearing across the O-L primary winding of transformer 50 is supplied as an input to the anode 71 of the ultor rectifier 70. Anode 71 is connected to the high potential end terminal P of transformer 50, with the full P-L winding serving as a step-up autotransformer secondary for these purposes.

The development of an energizing potential for the focusing electrode structure 27 of color kinescope 20 is also based on flyback pulse rectification. For such purposes, an adjustable focus voltage supply 69 (shown only in block form) is provided, with its input derived from transformer 50, and output delivered to the focus electrode energizing terminal F. In a known structure, two inputs for the focus supply are derived from the associated horizontal output transformer, one being a flyback pulse input of relatively large magnitude (of the order of the potentials in the desired D.C. focus potential range), and the other being flyback pulse input of considerably smaller magnitude (e.g., equal in amplitude to a fraction of the width of the desired focus potential range). For operation of the focus supply 69 of the known type, a high potential flyback pulse input is derived from terminal O of transformer 50, while a relatively low potential flyback pulse input is derived from a transformer tap J, located on transformer 50 between the yoke driving terminals Y and L.

An additional voltage supply associated with the output transformer 50 involves de-

magnitude.

velopment of so-called "boosted-boost" potential. Such a "boosted-boost" voltage supply is provided for energizing the color kinescope screen grid electrodes. In the boosted-boost circuit of the drawing herein, the anode of a diode 90 is connected to the transformer tap J, while its cathode is coupled via a filter capacitor 91 to the transformer end terminal L. The periodic conduction of diode 90, in response to flyback pulse occurrences, develops a charge across capacitor 91 that effectively adds to the D.C. potential available at the end terminal L (i.e., that adds to the B-boost potential).

The D.C. potential at the junction of diode 90 and capacitor 91 is thus of increased amplitude relative to the B-boost potential, and is accordingly referred to as a "boosted-boost" potential. A resistor 93 is connected in series with a filter capacitor 95, in the order named, between the diode 90-capacitor 91 junction and a point of B+ potential. The values of resistor 93 and capacitor 95 are suitable chosen so that the potential at their junction S is relatively free of line frequency ripple. The voltage level at S is somewhat less than at the cathode of diode 90 due to voltage dropping action of resistor 93.

The filtered boosted-boost potential at junction S is used in the energization of the kinescope screen grid electrodes 25R, 25G and 25B. Each of the screen grid electrodes is connected to a respective one of the adjustable taps of a trio of potentiometers 31R, 31G and 31B. A dropping resistor 35 is connected between a point of B+ potential and a fixed end terminal of each of the three potentiometers. The remaining fixed end terminals of the three potentiometers are jointly connected to junction S.

Adjustment of the taps of potentiometers 31R, 31G and 31B allows individual selection of the respective screen grid potentials in a range intermediate the receiver's B+ potential and the potential of the boosted-boost rectifier output. The precise range is determined by the relative values of the resistors 35 and 93, and the net resistance presented by the paralleled potentiometer resistances.

The voltage supply which energizes the ultor electrode 29 is subject to severe loading variations in the course of the normal operation of the receiver. The load represented by the color kinescope 20 varies widely in accordance with the D.C. content of its luminance signal drive. For proper operation of the color kinescope, however, wide variations in the voltage at ultor electrode 29 cannot be tolerated. Accordingly, it is conventional practice to provide means for dynamically regulating the ultor potential. For this purpose, a regulator tube 80 is provided, with its space current path

effectively shunted across the variable kinescope load. Such shunt relationship is established in the circuit of the drawing by connection of the regulator tube anode 83 to the ultor terminal, and by return of the regulator tube cathode 81 (via resistor 84) to a point of B+ potential.

The desired operation for the regulator involves its use as a load on the ultor voltage supply that varies with variations in the kinescope load, but in an opposing sense. In other words, it is desired that any decrease in kinescope current (such as may be caused by a darkening of the displayed picture) is accompanied by a corresponding increase in regulator current. Conversely, the regulator current should decrease to offset an increase in kinescope current (such as may be caused by brightening of the displayed picture).

The B-boost voltage available at terminal BB is sensitive to variations in the loading on transformer 50, and its level will accordingly vary as the kinescope load varies. Thus a suitable method of controlling the regulator tube 80 may be the application of a sample of the B-boost voltage to the regulator tube control grid 82. In the circuit of the drawing, a voltage divider is connected between terminal BB and chassis ground, and control grid 82 connected to a tapping point on this voltage divider, for such regulator control purposes. The B-boost voltage sampling divider specifically includes a fixed resistor 85, a fixed resistor 86 and a variable resistor 87, connected in series in the order named between terminal BB and chassis ground. The control grid 82 is connected to the junction of the fixed resistors 85 and 86 of the voltage divider.

The above-described control of regulator tube 80 by sampling the B-boost voltage is supplemented in the illustrated circuit by application to control grid 82 of an additional D.C. control voltage. Specifically, the supplemental D.C. control involves use of the D.C. component of the luminance signal driving the color kinescope cathodes. As previously noted, a luminance signal output of luminance channel 17 is available at an output terminal LD for regulator control purposes. Resistor 88 provides a direct current conductive connection between terminal LD and the regulator tube control grid 82, in combination with the previously mentioned fixed resistor 86 and variable resistor 87, thus provides a luminance signal voltage divider, applying a sample of the luminance signal to the control grid 82. Variable resistor 87 provides means for jointly adjusting the precise amplitudes of the two control voltage samples at control grid 82.

It should be noted that there is no bypass capacitor connected directly between control grid and cathode of the regulator tube 80. In its stead is a capacitor 97, coupled

directly between the regulator control grid 82 and junction S in the previously described boosted-boost circuit.

The function otherwise performed by the omitted capacitor, viz., inhibiting the response of regulator 80 to AC components of the applied control voltages continues to be served by the added capacitor 97. With appropriate capacitance values, the series combination of capacitor 97 and boosted-boost filter capacitor 95 presents a sufficiently low impedance, at the horizontal deflection frequency and higher video frequencies, relative to the impedances of the respective resistors 85 and 88, that the undesired A.C. components of the applied D.C. control voltages are divided down to an insignificant level at grid 82.

An additional function, however, is served by the capacitor 97. Field rate variations appearing in the output transformer 50, and reflected in associated supply potentials (such as the ultor potential and the kinescope screen grid potentials) are opposed by the regulator 80 and thereby attenuated to a tolerable level, due to the coupling of such field rate variations to grid 82 via the capacitor 97.

To illustrate the problem and the solution, attention is first directed to a segment of the illustrated receiver not heretofore discussed, viz., the pincushion correction circuits 43. Schematic details of such circuits have not been specifically shown in the drawing, but rather represented by a block shown common to the outputs of both deflection circuits, and effectively intervening (as suggested by the dotted lines) in the couplings of scanning currents to the respective windings of yoke 40.

The nature of pincushion raster distortion, and its likely presence when a color kinescope of a wide-angle type is used, have been previously discussed herein. Also previously noted is the usual character of circuits for the correction of pincushion distortion. Their principles of operation involve interaction between the vertical and horizontal deflection circuits.

An appropriate example is a saturable reactor arrangement for side pincushion correction shown in Figure 2 of the United States Patent, No. 2,842,709. There, the variable impedance winding of a saturable reactor is connected as a series element in the path of the line rate scanning current traversing the horizontal deflection windings of a yoke; the control winding of the saturable reactor is traversed by a current varying in accordance with a field rate waveform of parabolic shape. The peak-to-peak amplitude of the line rate scanning current wave is thereby modulated at a field rate, with a modulation envelope of appropriate parabolic shape. The resultant compression

of raster width at picture top and bottom relative to picture middle may thus compensate for the raster side bowing that constitutes the side pincushion distortion sought to be corrected.

The described dynamic width modulation has a side effect, however, that is pertinent to the present analysis. The circuit traversed by the modulated line rate scanning current appears to the driving transformer as a load that varies at a field rate. As a consequence, the flyback pulse outputs of the transformer that are applied as inputs to associated voltage supplies are subject to amplitude variations reflecting the field rate changes in loading on the transformer.

In a color television receiver with voltage supply arrangements of the general character previously described there are several potentially adverse effects of such field rate variations in line flyback pulse amplitude. For example, translation of the pulse amplitude variations into ultor potential variations can adversely affect operation of the color kinescope 20 in such critical areas as dynamic beam convergence. Moreover, such ultor potential variations can adversely affect the efficiency of the pincushion correction effort itself by reinforcing the distortion, rather than opposing it. Additionally translation of the pulse amplitude variations into screen grid potential variations can produce annoying shading or banding effects in the displayed picture, e.g., darkening of the picture at the top and bottom relative to picture middle.

A substantial minimization of such adverse effects is accomplished through use of the present invention. The development of undesired field rate variations in line flyback pulse amplitude (as may be caused, for example, by operation of pincushion correction circuits 43 in the general manner indicated above) is directly reflected in variations of the boosted-boost potential at junction S. These variations are coupled to the control grid 82 of the existing regulator tube 80 by the provision of a suitably valued coupling capacitor 97 between the junction S and control grid 82. The regulator tube 80 is thereby caused to alter its conduction with the applied field rate potential variations, producing variable transformer loading effects that tend to oppose and thereby significantly attenuate the troublesome variations in flyback pulse amplitude and associated supply potentials.

Omission of the usual control-grid-to-cathode bypass capacitor avoids any substantial division of the A.C. boosted-boost potential variations at control grid 82, whereby adequate loop gain is ensured for the A.C. regulation arrangement. However, capacitors 97 and 95 provide a sufficiently low impedance path from control grid 82 to

A.C. ground to provide a strongly attenuating division of undesired A.C. components of the D.C. control voltage samples derived from terminals LD and BB.

- 5 It should be noted that, while pincushion correction circuits are one likely source of undesired field rate variations that the present invention will serve to minimize, the benefits of the invention extend to the
10 elimination of such potential variations however introduced. Thus, for example, use of the invention will stabilize the ultor potential supply and other flyback pulse based potential supplies against variations of field rate
15 order caused by kinescope loading variations in response to field rate components of the luminance signal drive. It has also been observed that the use of the present invention reduces high voltage transients caused by
20 sudden scene changes (as produced, for example, by the switching between cameras). Thus, it should be appreciated that advantageous use of the present invention is not solely limited to receivers employing
25 pincushion correction circuits.

Circuitry in accordance with the present invention has been successfully employed in a color television receiver employing a wide-angle color kinescope together with pincushion correction circuitry of a saturable reactor type. Although the pincushion correction circuits in said receiver took an improved form, incorporating provisions
30 tending to reduce variations of the transformer loading, there remained residual effects on the transformer loading of sufficient magnitude to adversely affect receiver operation in the various manners previously described. Use of the present invention, however,
40 afforded a reduction of these residual variations by a factor of the order of four to one. A set of values for the pertinent circuit elements of the drawing, that proved satisfactory in such use, are set forth below,
45 by way of example only:

- Resistor 84—1000 ohms
Resistor 85—1.5 megohm
Resistor 86—1.5 megohm, shunted by 12 megohms
50 Resistor 87—500,000 ohms
Resistor 88—12 megohms
Resistor 93—100,000 ohms
Capacitor 91—.0022 microfarad
Capacitor 95—.01 microfarad
55 Capacitor 97—.01 microfarad
Triode 80—6BK4A
Diode 70—3A3
Diode 90—Selenium (stack) rectifier 800 p.i.v.

60 WHAT WE CLAIM IS:—

1. A voltage regulating arrangement for a cathode ray tube system developing display rasters comprising recurring fields of scanning lines, said system including a cathode ray tube and respective line and field
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rate cathode ray beam deflection circuits, said cathode ray tube including an ultor electrode and additional electrodes, the operating potentials for said ultor electrode and said additional electrodes being derived
70 in respective supply circuits at least in part by rectification of flyback pulses generated in said line rate deflection circuit, said system being subject to the appearance of undesired field rate variations in parameters of said
75 line deflection circuit, occurrence of said field rate variations in said operating potentials tending to adversely affect operation of said cathode ray tube, said voltage regulating arrangement comprising a regulating device having a control electrode, said
80 regulating device being connected to said ultor electrode and serving as a controllable load on said ultor operating potential supply circuit, a source of control voltage sensitive
85 to variations in the load presented by said cathode ray tube to said ultor operating potential supply circuit, means providing a direct current conductive coupling between said control voltage source and said regulating
90 device control electrode for causing said regulating device to oppose variations in said ultor potential occurring at a rate lower than the field frequency which are caused
95 by said cathode ray tube load variations and being characterized by regulating coupling means providing an exclusively alternating current coupling between the operating potential supply circuit for said
100 additional electrodes and said regulating device control electrode for causing said regulating device to oppose undesired field rate variations in said ultor potential.

2. A voltage regulating arrangement in accordance with Claim 1 characterized in
105 that said regulating coupling means is disposed relative to said direct current conductive coupling providing means in such manner as to inhibit response by said regulating device to A.C. components of
110 said control voltage having frequencies not lower than line frequency.

3. A voltage regulating arrangement in accordance with Claim 1 characterized in
115 that a source of D.C. voltage is provided substantially free of A.C. components of line frequency and higher, but subject to said undesired field rate variations, said regulating coupling means being so disposed relative to said direct current
120 conductive coupling providing means and its reactance values being so proportioned relative to the impedance of said direct current conductive coupling providing means, that A.C. components of said control
125 voltage having frequencies not lower than line frequency appear only with severely attenuated amplitude at said control electrode.

4. A voltage regulating arrangement in 130

A.C. ground to provide a strongly attenuating division of undesired A.C. components of the D.C. control voltage samples derived from terminals LD and BB.

- 5 It should be noted that, while pincushion correction circuits are one likely source of undesired field rate variations that the present invention will serve to minimize, the benefits of the invention extend to the
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20 sudden scene changes (as produced, for example, by the switching between cameras). Thus, it should be appreciated that advantageous use of the present invention is not solely limited to receivers employing
25 pincushion correction circuits.

- Circuitry in accordance with the present invention has been successfully employed in a color television receiver employing a wide-angle color kinescope together with pincushion correction circuitry of a saturable reactor type. Although the pincushion correction circuits in said receiver took an improved form, incorporating provisions tending to reduce variations of the trans-
30 former loading, there remained residual effects on the transformer loading of sufficient magnitude to adversely affect receiver operation in the various manners previously described. Use of the present invention, however, afforded a reduction of these residual variations by a factor of the order of four to one. A set of values for the pertinent circuit elements of the drawing, that proved satisfactory in such use, are set forth below,
45 by way of example only:

- Resistor 84—1000 ohms
- Resistor 85—1.5 megohm
- Resistor 86—1.5 megohm, shunted by 12 megohms
- 50 Resistor 87—500,000 ohms
- Resistor 88—12 megohms
- Resistor 93—100,000 ohms
- Capacitor 91—.0022 microfarad
- Capacitor 95—.01 microfarad
- 55 Capacitor 97—.01 microfarad
- Triode 80—6BK4A
- Diode 70—3A3
- Diode 90—Selenium (stack) rectifier 800 p.i.v.

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1. A voltage regulating arrangement for a cathode ray tube system developing display rasters comprising recurring fields of scanning lines, said system including a cath-
65 ode ray tube and respective line and field

rate cathode ray beam deflection circuits, said cathode ray tube including an ultor electrode and additional electrodes, the operating potentials for said ultor electrode and said additional electrodes being derived
70 in respective supply circuits at least in part by rectification of flyback pulses generated in said line rate deflection circuit, said system being subject to the appearance of undesired field rate variations in parameters of said
75 line deflection circuit, occurrence of said field rate variations in said operating potentials tending to adversely affect operation of said cathode ray tube, said voltage regulating arrangement comprising a regulat-
80 ing device having a control electrode, said regulating device being connected to said ultor electrode and serving as a controllable load on said ultor operating potential supply circuit, a source of control voltage sensitive
85 to variations in the load presented by said cathode ray tube to said ultor operating potential supply circuit, means providing a direct current conductive coupling between said control voltage source and said regulat-
90 ing device control electrode for causing said regulating device to oppose variations in said ultor potential occurring at a rate lower than the field frequency which are caused
95 by said cathode ray tube load variations and being characterized by regulating coupling means providing an exclusively alternating current coupling between the operating potential supply circuit for said
100 additional electrodes and said regulating device control electrode for causing said regulating device to oppose undesired field rate variations in said ultor potential.

2. A voltage regulating arrangement in accordance with Claim 1 characterized in
105 that said regulating coupling means is disposed relative to said direct current conductive coupling providing means in such manner as to inhibit response by said regulating device to A.C. components of
110 said control voltage having frequencies not lower than line frequency.

3. A voltage regulating arrangement in accordance with Claim 1 characterized in
115 that a source of D.C. voltage is provided substantially free of A.C. components of line frequency and higher, but subject to said undesired field rate variations, said regulating coupling means being so dis-
120 posed relative to said direct current conductive coupling providing means and its reactance values being so proportioned relative to the impedance of said direct current conductive coupling providing means, that A.C. components of said control
125 voltage having frequencies not lower than line frequency appear only with severely attenuated amplitude at said control electrode.

4. A voltage regulating arrangement in 130



- accordance with Claim 1 wherein said cathode ray tube system is used in a television receiver having a source of B-boost voltage derived from the horizontal deflection circuit, characterized by a source of boosted boost potential including means for adding to said B-boost voltage a D.C. voltage component derived by rectification of said flyback pulses, said boosted boost potential reflecting undesired field frequency variations; said direct current conductive coupling means being arranged between said B-boost voltage source and said regulating device control electrode and said regulating coupling means being capacitive means coupled between said source of boosted boost potential and said regulating device control electrode for causing said regulating device to oppose the undesired field frequency variations in said ultor potential.
5. A voltage regulating arrangement in accordance with Claim 4 characterized by means, including a filter capacitor, for deriving an operating potential for the cathode ray tube screen grid electrode from said source of boosted boost voltage, said direct current conductive coupling means including a resistor serially connected between said B-boost voltage source and said regulator tube control grid, said regulating coupling means including a coupling capacitor connected between said boosted boost potential source and said regulator tube control grid, said coupling capacitor and said filter capacitor forming a series combination connected between said regulator tube control grid and a point of A.C. ground potential, the capacitance value of said series combination being so related to the resistance value of said resistor that response by said regulator tube to A.C. components of said B-boost voltage having frequencies not lower than line frequency is strongly inhibited.
6. A voltage regulating arrangement substantially as described herein with respect to the accompanying drawing.
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