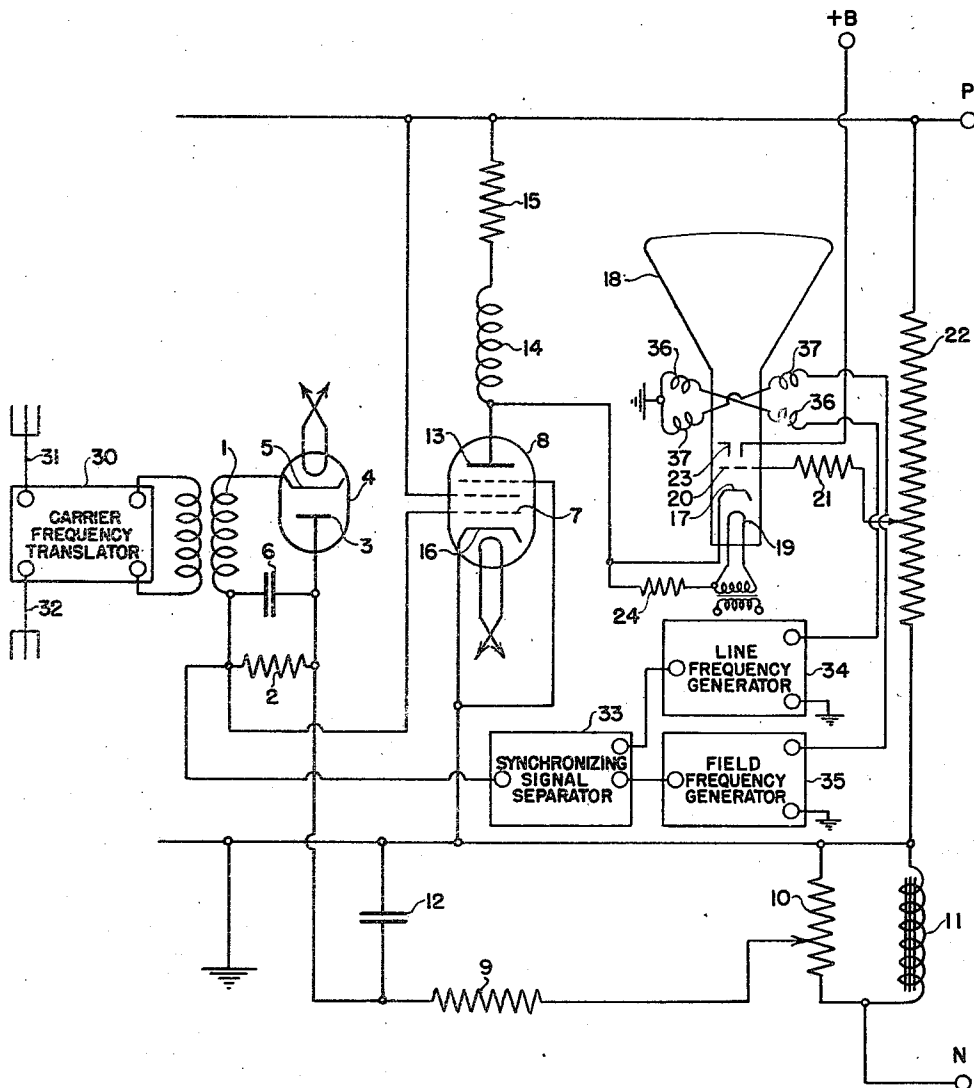


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TELEVISION RECEIVER VIDEO CIRCUIT

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This invention relates generally to television receivers and more specifically to such receivers of the type employing a cathode-ray tube for the reproduction of a scene transmitted in accordance with a system in which light variations of the scene are represented by variations in carrier-wave amplitude.

It is usual in television receivers of the above-mentioned type to apply the output of a video-frequency amplifier between the control electrode and the cathode of a cathode-ray tube in order to modulate the electron stream, the cathode of the tube being held at a fixed potential. When directly heated tubes are used to rectify the high-voltage supply of the receiver, such receivers have the disadvantage that there is generally insufficient bias for the control electrode of the cathode-ray tube during the warming up period of the receiver tubes. During this period the cathode of the cathode-ray tube of such a system tends to supply an excessive emission current and may, therefore, be damaged. Further, until the time-bases or scanning fields of the receiver commence to operate, which operation is delayed due to the initial warm-up or cathode heating period of the thermionic tube means employed therein, a bright spot is formed on the fluorescent screen of the tube and the screen may be burned in the region of the spot and permanently damaged. A further disadvantage of the above arrangement is that degeneration of the cathode-ray tube used for image reproduction may be introduced by reason of the resistance generally included in series with its cathode and the negative terminal of the high voltage supply of the tube.

It is an object of the present invention to provide a television receiver of the type described which does not suffer from the disadvantages set forth above.

In accordance with the invention, therefore, a television receiver of the type described comprises a signal-translating stage including a thermionic vacuum tube, a cathode-ray tube for reproducing a desired received television signal, the tube including a thermionic cathode, and means for producing scanning fields to deflect the cathode ray of the cathode-ray tube in accordance with a predetermined scanning pattern. The last-named means also comprises thermionic tube means having an initial warm-up period during which there are produced insufficient scanning fields to deflect the cathode ray of the cathode-ray tube, thereby tending to damage the latter. The receiver also includes

means for maintaining the cathode ray extinguished during the aforesaid warm-up period comprising means responsive to the space current of the translating stage vacuum tube for biasing the cathode-ray tube to cutoff for values of space current below a predetermined minimum value and for reducing the bias of the cathode-ray tube to a normal operating value for values of the space current in excess of the aforesaid predetermined minimum value, the space current of the translating stage vacuum tube being less than the aforesaid predetermined minimum value during its warm-up period and the translating stage vacuum tube having a warm-up period not less than the warm-up period of the scanning tube means.

For a better understanding of the invention, together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

The single figure of the drawing is a circuit diagram, partly schematic, of a complete television receiver in accordance with the invention.

Referring now more particularly to the drawing, the system illustrated comprises a complete television receiver including an antenna 31, 32 to which is connected in cascade, in the order named, a carrier-frequency translator 30, a detector 4, a video-frequency signal-translating stage, such as a thermionic vacuum tube amplifier 8, and an image-reproducing device such as a cathode-ray tube 18. The receiver includes means for producing scanning fields to deflect the cathode ray of the cathode-ray tube 18 in accordance with a predetermined scanning pattern, this means comprising a line-frequency generator 34 and a field-frequency generator 35 which are coupled to the output circuit of detector 4 through a synchronizing-signal-separating device 33, the line-frequency generator 34 and the field-frequency generator 35 being coupled to the line-deflecting coils 36 and the field-deflecting coils 37 of the receiver, respectively. It will be understood that units 34 and 35 include in conventional manner thermionic vacuum-tube means having an initial warm-up period during which there are produced insufficient scanning fields to deflect the cathode-ray beam of tube 18, thereby tending to damage the latter. The stages or units 30-37, inclusive, may all be of well-known construction so that a detailed illustration and description thereof are deemed

unnecessary herein. The carrier-frequency translator 30 may comprise conventional radio-frequency stages, an oscillator-modulator or frequency changer, or one or more intermediate-frequency amplifiers to conform to conventional superheterodyne practice in a manner well understood in the art.

Referring briefly to the operation of the system described above and neglecting for the moment the features comprising the instant invention, presently to be described, television signals intercepted by antenna circuit 31, 32 are selected, amplified, and delivered as a carrier-frequency signal to detector 4. The modulation components of the signal are derived by detector 4 and are supplied to video-frequency amplifier 8, wherein they are amplified and from which they are supplied to the brilliancy-control circuit of image-reproducing device 18. Synchronizing signals derived from the load circuit of detector 4 are separated by synchronizing-signal separator 33 and are supplied to the synchronizing control elements of generators 34 and 35. The intensity of the scanning ray of cathode-ray reproducing device 18 is thus modulated or controlled in accordance with the video-frequency voltages impressed upon its input circuit in the usual manner. The scanning waves generated in the line-frequency and field-frequency generators 34 and 35, which are controlled by synchronizing voltage pulses supplied from synchronizing-signal separator 33, are applied to the scanning elements of image-reproducing device 18 to produce electric scanning fields, thereby to deflect the scanning ray in two directions normal to each other so as to trace a rectilinear pattern on the screen and thereby reconstruct the transmitted image.

Referring now more particularly to the portion of the system embodying the present invention, carrier-frequency signals are applied to detector 4 through the transformer coupled to unit 30, the secondary winding 1 being coupled to detector 4 through a load resistor 2 by-passed for carrier-frequency signals by condenser 6. Video-frequency signals are applied from the load resistor 2 to the control grid 7 of video-frequency amplifier 8, a bias being provided for the anode 3 of detector 4 by means of a resistor 9 coupled to a tap on a resistor 10 which is connected across a filter reactor 11, one end of which is connected to the negative terminal N of a direct current source PN. The anode 13 of video-frequency amplifier 8 is connected to the positive terminal P of the direct current source PN through a load circuit comprising a series-connected inductor 14 and resistor 15, while its indirectly-heated cathode 16 is grounded. Cathode-ray tube 18 comprises an electron gun, which may be of conventional construction, for developing, focusing, and accelerating a cathode-ray beam and comprising at least an indirectly-heated cathode 17, a control grid 20, and an anode 23. In order to maintain the control grid 20 of cathode-ray tube 18 at a substantially uniform potential during reproduction of a received signal, it is connected by way of grid-leak resistor 21 to a tap on a resistance potential divider 22 connected across source PN through the filter reactor 11. The potential of the cathode 17 of cathode-ray tube 18 is caused to vary in accordance with the signal to be reproduced by means of a conductive connection to the anode 13 of video-frequency amplifier 8, the potential of

the cathode 17 thus varying in accordance with variations of potential of the anode 13. Suitable operating potentials are provided for the several tubes of the receiver in a conventional manner.

At the temperatures at which heaters in cathode-ray tubes operate the insulation between the heater and the cathode is usually bad. It is, therefore, desirable to prevent the heater assuming a potential greatly different from that of the cathode and for this purpose a leak resistance 24 may be connected between the heater and the cathode. As the capacity to earth of the secondary winding of the heater transformer is generally large the value of the resistance must be high in relation to the anode load resistance of the pentode valve in order to make the impedance of the shunt path to earth small.

In considering the operation of the portion of the system just described, it will be seen that, when operating potentials are applied to the receiver, a high unidirectional voltage is applied to the anode 13 of video-frequency amplifier 8. Due to the fact that the cathode heater of tube 8 takes an appreciable time to heat the cathode 16 to an emitting temperature, there is an appreciable period during which little or substantially no space current flows through the load circuit 14, 15 of tube 8 and its anode 13 is at maximum positive potential. Since the control electrode 20 of tube 18 is held, during this period, at a potential more negative than that of the anode 13 of tube 8 and cathode 17 of cathode-ray tube 18, the tube develops no cathode ray and, therefore, deleterious effects on its fluorescent screen during this interval are prevented. As the current in the load circuit of tube 8 increases, the potential of its anode and, therefore, the potential of cathode 17, decreases until an operative condition for cathode-ray tube 18 is established. By the time this operative condition is established, the thermionic tubes of the scanning system of the receiver have also warmed up and the scanning system has thus reached an operative condition and a complete raster is scanned on the fluorescent screen of tube 18 for normal signal reproduction.

Thus, the load inductor 14 and resistor 15 of amplifier 8 comprise means for maintaining the anode potential of amplifier tube 8 above normal during its warm-up period to maintain the cathode ray of tube 18 extinguished during the initial warm-up period of the thermionic tubes of the scanning system 34, 35. The grid 20 of the cathode-ray tube 18, the biasing circuit therefor including the resistor 22, and the conductive connection of the cathode 17 and anode 13 of the respective tubes 18 and 8 comprise means responsive to the space current, or the anode potential, of the amplifier tube 8 for biasing the cathode-ray tube 18 to cutoff for values of the space current below a predetermined minimum value or for values of the anode potential above normal and for reducing the bias of the cathode-ray tube to a normal operating value for values of the space current in excess of this predetermined minimum value or for substantially normal values of anode potential. The space current of tube 8 is less than the aforesaid predetermined minimum value during its warm-up period, and correspondingly its anode potential is above normal during this period and, as before stated, the warm-up period of this tube is proportioned to be not less than the warm-up period of the thermionic tubes of the scanning system 34, 35.

Stated in another way, the biasing circuit for the grid 20 of tube 18, which circuit includes the resistor 22, comprises means for maintaining the potential of the control grid 20 substantially constant during the reproduction of the signal, the conductive connection between the anode 13 and the cathode 17 of the respective tubes 8 and 18 comprise means for varying the potential of the cathode 17 in accordance with the signal output of the amplifier tube 8, thereby to effect reproduction of the signal by tube 18, and the load circuit of tube 8 including the inductor 14 and resistor 15 comprise means dependent upon a substantial output from the amplifier 8 for biasing the cathode 17 to an operative potential. The amplifier tube 8 has substantially no output during its warm-up period and, as before stated, the warm-up period of tube 8 is so proportioned that it is not less than the warm-up period of the tubes of the scanning system 34, 35.

Since the cathode circuit of cathode-ray tube 18 includes only the anode load resistor 15 of video-frequency amplifier 8, the other resistance in the circuit being negligible, degeneration of tube 18 is reduced to an unobjectionable value.

While there has been described what is at present considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A television receiver comprising, a signal-translating stage including a thermionic vacuum tube, a cathode-ray tube for reproducing a desired received television signal, said tube including a thermionic cathode, means for producing scanning fields to deflect the cathode ray of said cathode-ray tube in accordance with a predetermined scanning pattern, said last-named means comprising thermionic tube means having an initial warm-up period during which there are produced insufficient scanning fields to deflect said cathode ray, thereby tending to damage said cathode-ray tube, and means for maintaining said cathode ray extinguished during said initial warm-up period comprising means responsive to the space current of said first-named tube for biasing said cathode-ray tube to cutoff for values of said space current below a predetermined minimum value and for reducing the bias of said cathode-ray tube to a normal operating value for values of said space current in excess of said predetermined minimum value, said space current of said first-named tube being less than said predetermined minimum value during its warm-up period and said first-named tube having a warm-up period not less than the warm-up period of said scanning tube means.

2. A television receiver comprising, a signal-translating stage including a thermionic vacuum tube having an anode, a cathode-ray tube for reproducing a desired received television signal, said tube including a thermionic cathode, means for producing scanning fields to deflect the cathode ray of said cathode-ray tube in accordance with a predetermined scanning pattern, said last-named means comprising thermionic tube means having an initial warm-up period during which there are produced insufficient scanning fields to deflect said cathode ray, thereby tending to dam-

age said cathode-ray tube, and means for maintaining said cathode ray extinguished during said initial warm-up period comprising means for maintaining the anode potential of said first-named vacuum tube above normal during its warm-up period, and means responsive to values of said anode potential above normal for maintaining said cathode ray extinguished, the warm-up period of said first-named tube being proportioned to be not less than the warm-up period of said tube of said scanning means.

3. A television receiver comprising, a signal-translating stage including a thermionic vacuum tube having an anode, a cathode-ray tube for reproducing a desired received television signal, said tube including a thermionic cathode, means for producing scanning fields to deflect the cathode ray of said cathode-ray tube in accordance with a predetermined scanning pattern, said last-named means comprising thermionic tube means having an initial warm-up period substantially longer than that of said cathode-ray tube cathode during which there are produced insufficient scanning fields to deflect said cathode ray, thereby tending to damage said cathode-ray tube, and means for maintaining said cathode ray extinguished during said initial warm-up period comprising means for maintaining the anode potential of said first-named vacuum tube above normal during its warm-up period, and means responsive to values of said anode potential above normal for maintaining said cathode ray extinguished, the warm-up period of said first-named tube being proportioned to be not less than the warm-up period of said tube of said scanning means.

4. A television receiver comprising, a video-frequency amplifier including a thermionic vacuum tube having an anode and a conductive load circuit connected thereto, a cathode-ray tube including a control grid and a thermionic cathode for reproducing a desired received television signal, means for producing scanning fields to deflect the cathode ray of said cathode-ray tube in accordance with a predetermined scanning pattern, said last-named means comprising thermionic tube means having an initial warm-up period during which there are produced insufficient scanning fields to deflect said cathode ray, thereby tending to damage said cathode-ray tube, and means for maintaining said cathode ray extinguished during said initial warm-up period comprising means for maintaining the potential of said control grid substantially constant during the reproduction of said signal, means comprising a conductive connection between said load circuit and said cathode for varying the potential of said cathode in accordance with variations of potential of said anode, thereby to effect reproduction of said signal by said cathode-ray tube, and means for maintaining the potential of said anode sufficiently higher than normal during its warm-up period that said cathode ray is extinguished, the warm-up period of said amplifier tube being proportioned to be not less than the warm-up period of said tube of said scanning means.

5. A television receiver comprising, a video-frequency amplifier including a thermionic vacuum tube, a cathode-ray tube including a control grid and a cathode for reproducing a desired received signal, means for producing scanning fields to deflect the cathode ray of said cathode-ray tube in accordance with a predetermined scanning pattern, said last-named means comprising

thermionic tube means having an initial warm-up period during which there are produced insufficient scanning fields to deflect said cathode ray, thereby tending to damage said cathode-ray tube, and means for maintaining said cathode ray extinguished during said initial warm-up period comprising means for maintaining the potential of said control grid substantially constant during the reproduction of said signal, means for varying the potential of said cathode in accordance with the signal output of said amplifier, thereby to effect reproduction of said signal by said tube, and means dependent on a substantial output from said video-frequency amplifier for biasing said cathode to an operative potential, said amplifier tube having substantially no output during its warm-up period and said warm-up period being so proportioned that it is not less than the warm-up period of the tube of said scanning means.

5 6. A television receiver comprising, a signal repeater including a conductive load circuit, a cathode-ray tube including a control grid, a cathode and a cathode heater for reproducing a desired received television signal, means for maintaining the potential of said control grid substantially constant during signal reproduction, means comprising a conductive connection between said load circuit and said cathode for varying the potential of said cathode in accordance with said desired received signal, thereby to effect reproduction of said signal by said cathode-ray tube, and means including a resistor connected between said cathode and said heater, the resistance value of said resistor being large relative to the resistance of said load circuit.

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