

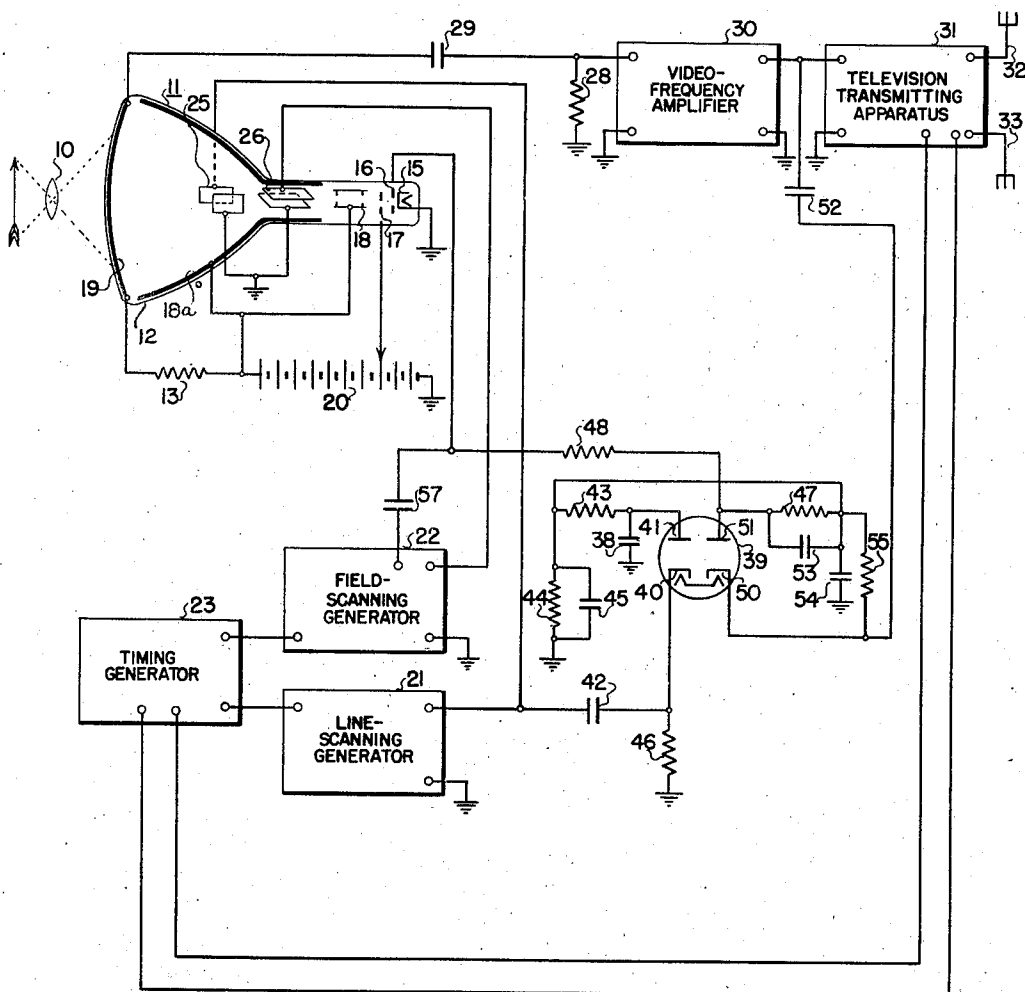
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TELEVISION SIGNAL GENERATOR

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TELEVISION SIGNAL GENERATOR

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This invention relates to television signal generators and, particularly, to television signal generators of the type including a cathode-ray television signal-generating tube.

The operating characteristics of television signal generators of the type which includes a cathode-ray signal-generating tube vary rather critically with the value of the tube beam current. Specifically, the shading effect characteristic of tubes of this type and the sensitivity of such a signal-generating tube vary with variations of the beam current of the tube. Many factors, such as a variation of the unidirectional supply potential, changes in temperature, etc., may cause the beam current of the tube to vary. In a conventional television transmitter which includes a tube of the type under consideration, it is customary to provide a manual control for the beam current of the signal-generating tube and it is necessary for the operator to vary the adjustment from time-to-time to maintain a value of beam current which provides most satisfactory operation. Since the value of beam current for optimum sensitivity does not usually correspond to that giving minimum shading effects, in practice, it is customary to adjust the beam current to that value which provides a reasonable compromise between the shading effect in the signal output and maximum sensitivity. However, in some television signal transmitter installations it is necessary to leave the transmitters unattended. It is particularly desirable, therefore, to provide an arrangement for automatically maintaining a predetermined optimum value of beam current in a cathode-ray television signal-generating tube independent of variations in operating conditions.

It is well known that the output signal of a television signal-generating tube of the type under consideration includes spurious pulses which are generated due to any sudden changes in the beam current, which changes may be caused, for example, by spot-translation velocity changes or by the fact that the beam travels from the photosensitive target to the nonphotosensitive margin or backing plate of the target, as well as the desired video-frequency television signal components developed by light from the object to be televised and incident on the photosensitive elements of the mosaic. The spurious pulses in the output signal of the tube have an amplitude which is many times that of the desired video-frequency television signal components and frequencies corresponding to the line-scanning and field-scanning frequencies. It has been found that the am-

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plitude of these spurious pulses varies with the magnitude of the beam current of the tube and that a suitable control effect can be derived therefrom to control the beam current in the desired manner mentioned above.

It is an object of the present invention, therefore, to provide an improved television signal generator of the type including a cathode-ray signal-generating tube which is not subject to one or more of the above-mentioned disadvantages of television signal generators of the prior art.

It is another object of the invention to provide an improved television signal generator including a cathode-ray signal-generating tube in which the beam current of the tube is maintained substantially constant during trace scanning periods of the signal generator.

In accordance with the invention, a television signal generator comprises a cathode-ray television signal-generating tube including a source of beam current and a beam-control electrode and means for deriving a signal output from the tube which includes video-frequency television signal components and spurious periodic pulses of larger amplitude than the television signal components, which pulses vary in amplitude with variations of the beam current. The signal generator of the invention also comprises means responsive primarily to the periodic pulses for deriving a unidirectional control effect and means for utilizing the control effect to maintain the beam current of the signal-generating tube substantially constant during trace periods of the signal generator.

For a better understanding of the invention, together with other and further objects thereof, reference is had 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 schematic diagram of a complete television transmitting system including a television signal generator in accordance with the invention.

Referring now more particularly to the drawing, the television transmitting system represented includes a conventional camera or projector 10 and a cathode-ray tube 11. This tube comprises an elongated envelope 12 including a cylindrical end portion or neck and an enlarged end portion. In the neck of the tube 11 there are disposed a source of beam current such as a cathode 15, a beam-control electrode 16, a first anode 17, a second anode 18 and a collector electrode 18a, in the order named, these electrodes con-

stituting what is conventionally referred to in the art as an electron gun. The collector anode 18a preferably comprises a metallic film or coating on the inner surface of the envelope 12, as shown. A photosensitive target 19 is disposed in the enlarged end portion of the tube. The target may be constructed in a conventional manner and include a thin sheet of dielectric material, such as mica, having a transparent metallic coating or signal plate facing the camera 10, and a photosensitive mosaic front surface of suitable material, such as a silver-caesium-oxygen mixture or compound, thereby providing, in effect, a multitude of minute condensers having the signal plate as a common electrode. Suitable operating potentials are supplied to the several electrodes of tube 11 from a source of unidirectional operating potential, such as a battery 20.

There are also provided in the transmitter of the drawing a line-scanning generator 21 and a field-scanning generator 22 which are timed by a timing generator 23 and which have their output circuits connected to deflecting plates 25 and 26 of tube 11, respectively. The output circuit of tube 11 includes a load resistor 28 connected to the signal plate of target 19 through a coupling condenser 29 and to a conventional video-frequency amplifier 30 of one or more stages, which, in turn, is coupled to a conventional television transmitting apparatus, indicated generally at 31, and terminated in an antenna system 32, 33. Line-synchronizing and field-synchronizing signals are also applied from timing generator 23 to the television transmitting apparatus 31 for transmission with the video-frequency signal generated in tube 11.

The apparatus just described, in general, represents a conventional television transmitting system and, the construction and operation of such apparatus being well known in the art, a detailed description thereof is unnecessary herein. In brief, however, in the operation of the apparatus described, images of the scene to be transmitted are projected by the camera 10 on the mosaic surface of target 19 effecting photoemission by the various mosaic elements in accordance with the light intensity at the corresponding elements of the image being transmitted. Electrons are generated, accelerated, and developed into a beam by the electron gun comprising elements 15-18, inclusive, the beam being focused on the target 19 and causing secondary-electron emission by the elementary mosaic elements of a value varying in accordance with its potential as determined by its photoemission during the preceding scanning cycle. Potentials of saw-tooth wave form, generated by the generators 21 and 22, are applied to the scanning plates 25 and 26, respectively, thereby producing electrostatic fields which deflect the beam in two directions normal to each other, causing it to scan fields or series of parallel lines on the target in the usual manner. The secondary electrons which are emitted from the mosaic elements are collected by the collector electrode 18a. Voltages are thereby developed at the backing plate of target 19 which, in turn, cause to be developed in the output circuit of tube 11, which includes resistor 28, a video-frequency voltage which varies with variations in light and shade in the successive incremental areas of the scene to be transmitted. This video-frequency voltage is amplified in the video-frequency amplifier 30 and is utilized in the transmitting apparatus 31 to modulate a carrier wave which is broadcast from the

antenna system 32, 33 in a conventional manner. Line-synchronizing pulses and field-synchronizing pulses developed in timing generator 23 and applied to transmitting apparatus 31 are also modulated upon the carrier signal for translation with the video-frequency signal generated in tube 11.

Coming now to the portion of the system constituting the present invention, in order to derive a normal operating bias for signal-generating tube 11, there is provided a duplex rectifier 39 including cathode 40 and anode 41 for rectifying a signal output from line-scanning generator 21. The signal input for diode 40, 41 derived from line-scanning generator 21 is applied thereto through condenser 42 and load resistors 43 and 44 connected in series. Resistor 44 is by-passed by a condenser 45 while resistors 43 and 44 in series are by-passed by a condenser 38. The direct current path for diode 40, 41 is completed by means of a resistor 46 connected between cathode 40 and ground. The voltage developed across resistor 44 is applied as an operating bias to the control electrode 16 of tube 11 through a resistor 47 and a resistor 48 in series.

In order to derive a control effect which varies primarily with the spurious periodic pulses generated in tube 11, tube 39 includes a diode 50, 51 coupled to the output circuit of video-frequency amplifier 30 through a coupling condenser 52, a condenser 53 coupled in parallel with resistor 47, and a condenser 54. A direct current path is provided for diode 50, 51 which includes resistor 47 and a resistor 55; the inclusion of resistor 47 in the load circuit of diode 50, 51 provides a means for utilizing the control effect derived from diode 50, 51 to maintain the beam current of tube 11 substantially constant during trace periods of the signal-generating tube 11.

In order to cut off the beam current of tube 11, during field-retrace scanning periods, periodic pulses are derived from field-scanning generator 22 and applied through a condenser 57 to beam-control electrode 16.

In considering the operation of the circuit just described, it will be seen that an output from line-scanning generator 21 is rectified by diode 40, 41 to provide across the load circuit thereof including resistors 43, 44, a source of unidirectional voltage which is negative with respect to ground. The portion of this voltage across resistor 44 is applied through resistor 47 and isolating resistor 48 to the beam-control electrode 16 of tube 11 to provide a suitable normal negative operating bias for the beam-control electrode 16 of the tube. However, this bias voltage is substantially constant and, unless other precautions were taken, the beam current of tube 11 would vary with variations in operating conditions, as described above, thereby necessitating a manual adjustment of the beam current to an optimum value such that satisfactory sensitivity and minimum shading characteristics are imparted to the tube 11.

Inasmuch as the signal output from tube 11 which is amplified by video-frequency amplifier 30 includes, in addition to the desired video-frequency television components, spurious periodic signals of larger amplitude than the television signal components, as mentioned above, which spurious signals vary in amplitude with variations of the beam current of the tube, these spurious pulses can be utilized to control the beam current of tube 11 to maintain it at any preselected optimum operating value. The circuit 47, 53 of

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rectifier 50, 51 is given such a time constant that it operates as a peak rectifier for developing in the load circuit 47, 55 a voltage or control effect which varies with the peak value of these spurious pulses and, inasmuch as the resistor 47 is included in series in the grid-cathode path of tube 11, the portion of this voltage developed across resistor 47 serves to control the beam current of tube 11. By proper selection of circuit constants, this control voltage may be made effective to maintain the beam current substantially constant during trace periods of tube 11. The time constant of the circuit is preferably not appreciably shorter than the field-scanning period of the system and may be, for example, only slightly greater than the field period.

The pulses derived from field-scanning generator 22 and applied through condenser 57 to the beam-control electrode 16 serve to cut off the beam current during the field-retrace periods, in a manner which is well understood by those skilled in the art, to avoid the appearance of spurious lines in the reproduced image. If the tube beam current is not cut off during field-retrace periods the charge pattern on the mosaic is disturbed in such fashion that a record of the spot path during retrace remains on the mosaic for some portion of the ensuing trace period. During the ensuing trace period this disturbed condition of the mosaic is translated into a normal television signal which is then reproduced by the picture of the system. It will be understood that this feature of the circuit can be omitted, if desired.

While applicant does not intend to be limited to any particular circuit design, there follows a tabulation of design information which has been found to be particularly useful in practicing the invention:

Tube 11	Type 1847
Tube 39	Type 6H6
Resistor 13	megohms
Resistor 28	do
Resistor 43	kilohms
Resistor 44	megohms
Resistor 46	kilohms
Resistor 47	megohm
Resistor 48	do
Resistor 55	kilohms
Condenser 29	micro-microfarads
Condenser 38	microfarad
Condenser 42	micro-microfarads
Condenser 45	microfarad
Condenser 52	do
Condenser 53	do
Condenser 54	do
Condenser 57	micro-microfarads
Line-scanning frequency	2000
Field-scanning frequency	10

It will be understood that an average rectifier can be used in place of the peak rectifier 50, 51 and that, if a peak rectifier is used, it can be caused to be responsive to the peaks of the signal of either polarity although the rectifier is preferably made to be responsive to peaks of the signals which correspond to light values which are blacker than black.

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

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and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A television signal generator comprising, a cathode-ray television signal-generating tube including a source of beam current and a beam-control electrode, means for deriving a signal output from said tube including video-frequency television signal components and spurious periodic pulses of larger amplitude than said television signal components which pulses vary in amplitude with variations of said beam current, means responsive primarily to said periodic pulses for deriving a unidirectional control effect, and means for utilizing said control effect to maintain said beam current substantially constant during trace periods of said signal generator.

2. A television signal generator comprising, a cathode-ray television signal-generating tube including a source of beam current and a beam-control electrode, means for deriving a signal output from said tube including video-frequency television signal components and spurious periodic pulses of larger amplitude than said television signal components which pulses vary in amplitude with variations of said beam current, a rectifier responsive primarily to said periodic pulses for deriving a control potential, and means for utilizing said control potential to maintain said beam current substantially constant during trace periods of said signal generator.

3. A television signal generator comprising, a cathode-ray television signal-generating tube including a source of beam current and a beam-control electrode, means for deriving a signal output from said tube including video-frequency television signal components and spurious periodic pulses of larger amplitude than said television signal components which pulses vary in amplitude with variations of said beam current, a peak rectifier responsive primarily to said periodic pulses for deriving a control potential, and means for utilizing said control potential to maintain said beam current substantially constant during trace periods of said signal generator.

4. A television signal generator comprising, a cathode-ray television signal-generating tube including a source of beam current and a beam-control electrode, means for deriving a signal output from said tube including video-frequency television signal components and blacker-than-black spurious periodic pulses of larger amplitude than said television signal components which pulses vary in amplitude with variations of said beam current, a peak rectifier responsive primarily to said periodic pulses for deriving a unidirectional control potential, and means for utilizing said control potential to maintain said beam current substantially constant during trace periods of said signal generator.

5. A television signal generator comprising, a cathode-ray television signal-generating tube including a source of beam current and a beam-control electrode, a field-scanning means for said signal-generating tube, means for deriving a signal output from said tube including video-frequency television signal components and spurious periodic pulses of larger amplitude than said television signal components which pulses vary in amplitude with variations of said beam current, means responsive primarily to said periodic pulses for deriving a unidirectional control effect and including means for eliminating variations in said control effect at the frequency of said field-scanning means, and means for

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utilizing said control effect to maintain said beam current substantially constant during trace periods of said signal generator.

6. A television signal generator comprising, a cathode-ray television signal-generating tube including a source of beam current and a beam-control electrode, a field-scanning means for said signal-generating tube, means for deriving a signal output from said tube including video-frequency television signal components and spurious periodic pulses of larger amplitude than said television signal components which pulses vary in amplitude with variations of said beam current, means responsive primarily to said periodic pulses for deriving a unidirectional control effect and including a rectifier and a load circuit having a time constant not appreciably shorter than the period of said field-scanning means for eliminating variations in said control effect, and means for utilizing said control effect to maintain said beam current substantially constant during trace periods of said signal generator.

7. A television signal generator comprising, a cathode-ray signal-generating tube including a source of beam current and a beam-control electrode, means for applying a unidirectional operating bias potential to said electrode, means for deriving a signal output from said tube including video-frequency television signal components and

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spurious periodic pulses of larger amplitude than said television signal components which pulses vary in amplitude with variations of said beam current, means responsive primarily to said periodic pulses for deriving a unidirectional control potential, and means for applying said control potential to said electrode in series with said bias potential to maintain said beam current substantially constant during trace periods of said signal generator.

8. A television signal generator comprising, a cathode-ray television signal-generating tube including a source of beam current and a beam-control electrode, a field-scanning generator for said tube, means for deriving a signal output from said tube including video-frequency television signal components and spurious periodic pulses of larger amplitude than said television signal components which pulses vary in amplitude with variations of said beam current, means responsive primarily to said periodic pulses for deriving a unidirectional control effect, means for utilizing said control effect to maintain said beam current substantially constant during trace periods of said signal generator, and means for deriving blocking pulses from said field-scanning generator and applying them to said beam-control electrode to cut off the beam current of said tube during field-retrace periods of said scanning generator.

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