July 15, 1941. H. M. LEWIS 2,249,532

SYNCHRONIZING AND BACKGROUND CONTROL FOR TELEVISION RECEIVERS

Filed Dec. 2, 1937 4 Sheets-Sheet 1

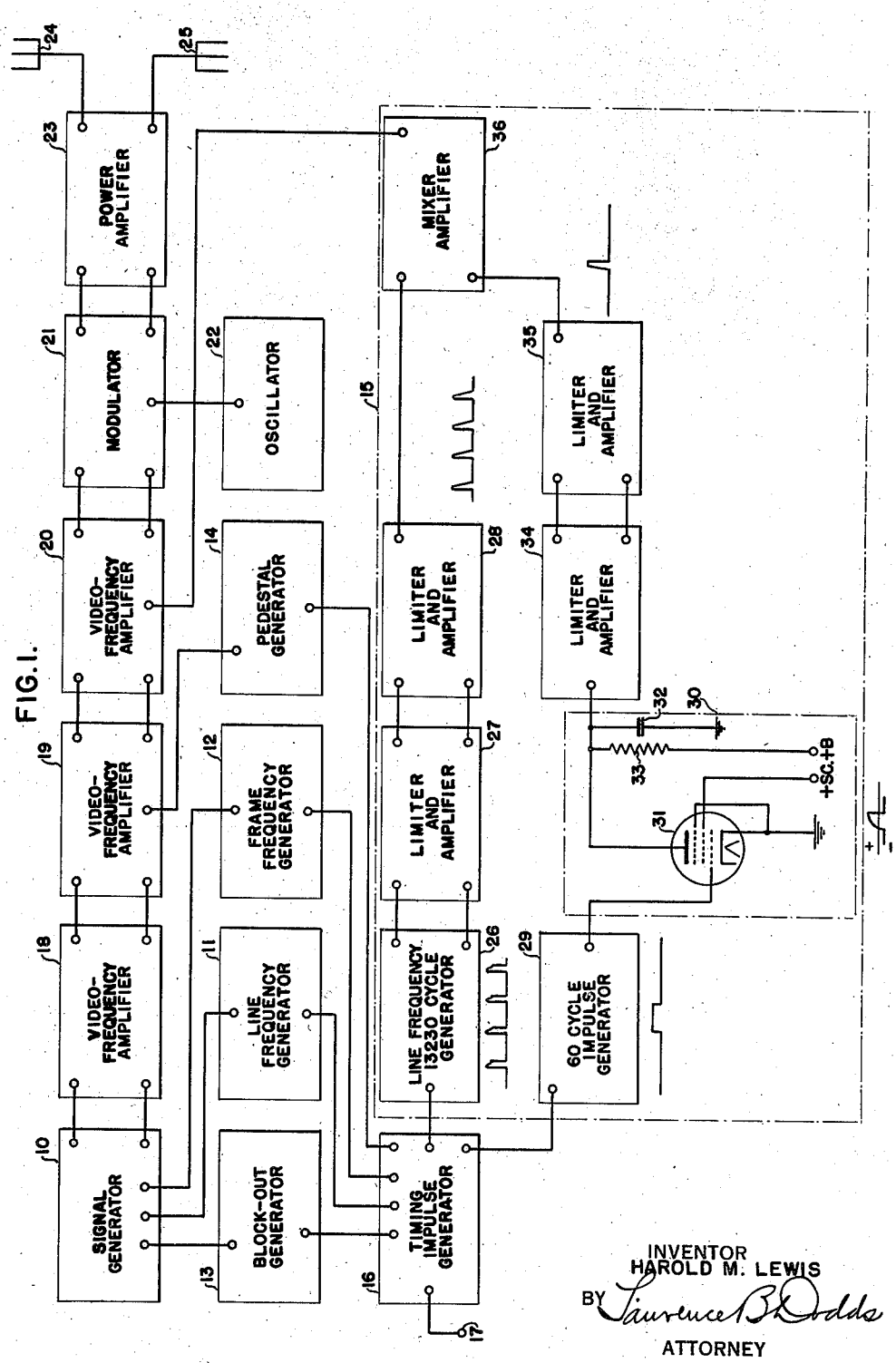

FIG. 1.

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SYNCHRONIZING AND BACKGROUND CONTROL FOR TELEVISION RECEIVERS

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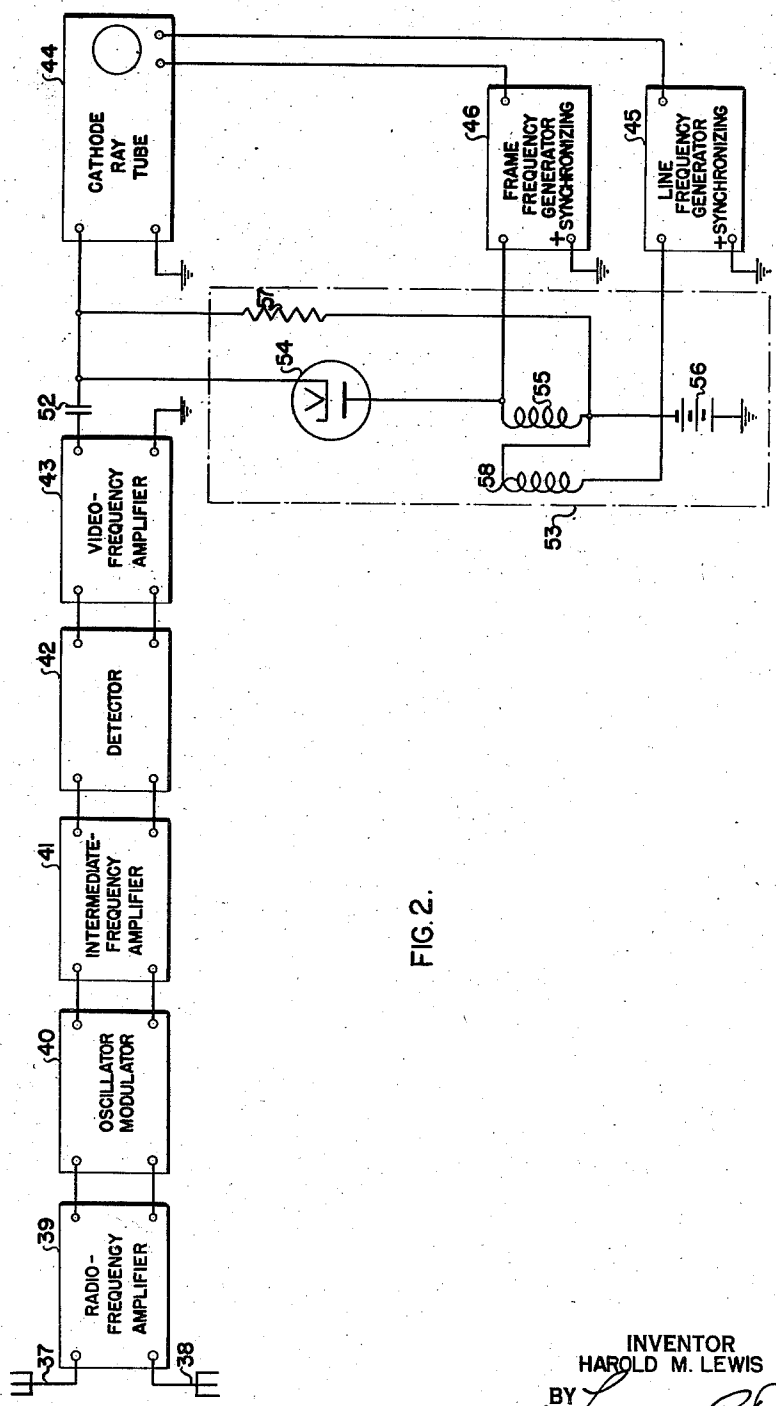

FIG. 2.

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SYNCHRONIZING AND BACKGROUND CONTROL FOR TELEVISION RECEIVERS

Filed Dec. 2, 1937 4 Sheets-Sheet 3

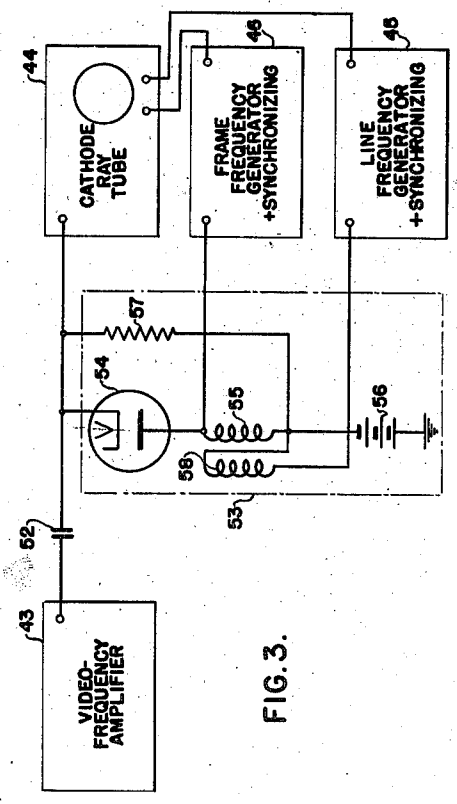

FIG. 3.

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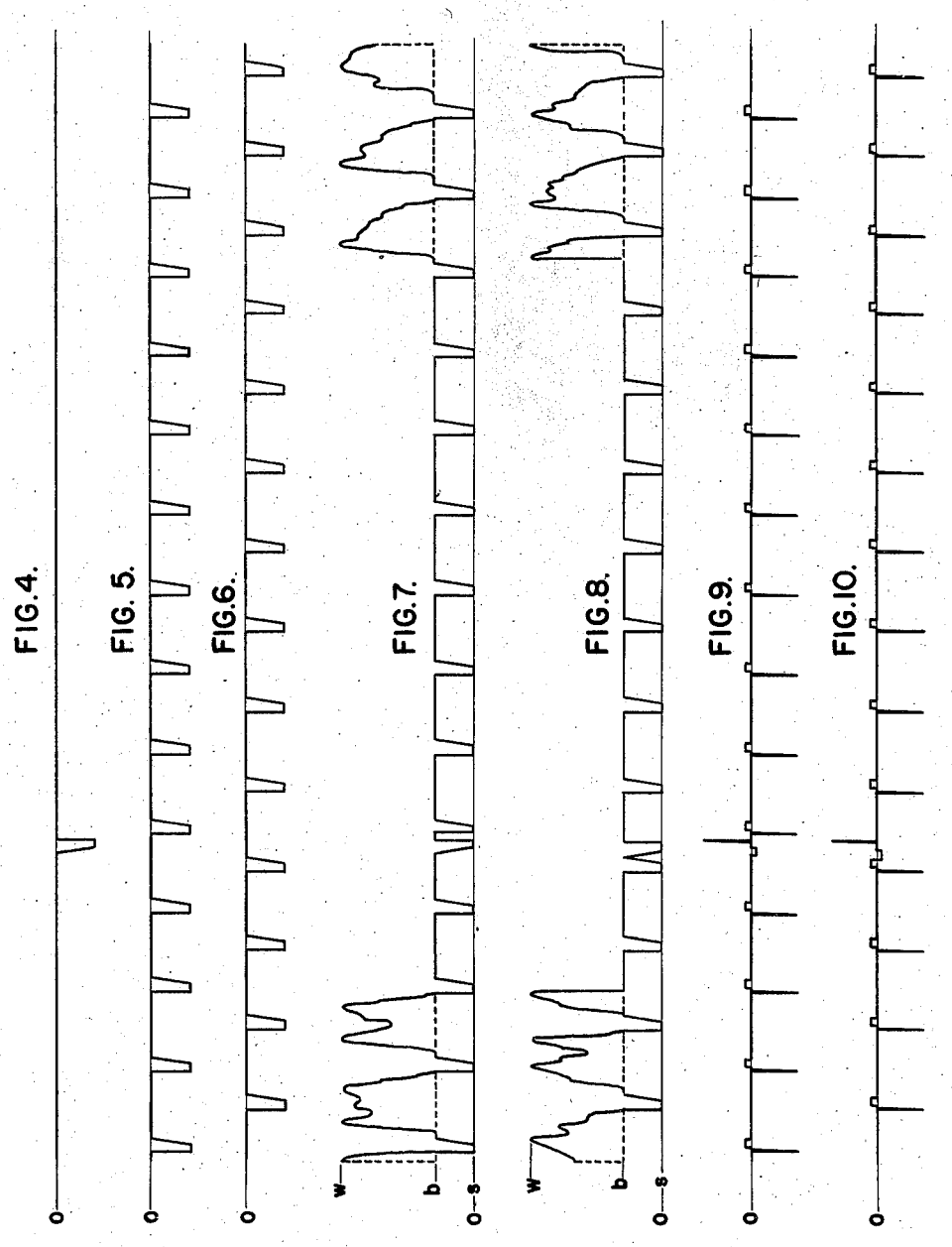
SYNCHRONIZING AND BACKGROUND CONTROL FOR TELEVISION RECEIVERS

Filed Dec. 2, 1937 4 Sheets-Sheet 4



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Patented July 15, 1941 2,249,532

UNITED STATES PATENT OFFICE

2,249,532

SYNCHRONIZING AND BACKGROUND CONTROL FOR TELEVISION RECEIVERS

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Application December 2, 1937, Serial No. 177,663

4 Claims. (Cl. 178—7.5)

This invention relates to television synchronizing and background control systems for television receivers adapted to receive and reproduce a video-frequency signal including combined video-frequency components, background-illumination components, and synchronizing components including line-synchronizing and field-synchronizing impulses having values outside the amplitude range of the video-frequency components.

In accordance with present television practice, there is developed and transmitted a signal which comprises a carrier, modulated during successive intervals or trace periods by video-frequency components representative of the light and shade values of an image being transmitted. During retrace intervals, between the trace periods, the carrier is modulated by synchronizing impulses or components which correspond to the initiations of successive lines and fields in the scanning of the image. There is also usually developed at the transmitter a unidirectional voltage which corresponds to the average background illumination of the image. While this voltage may be lost during transmission, the signal as received includes a component from which a unidirectional voltage representative of background illumination may be reproduced. At the receiver, a beam is so deflected as to scan and illuminate a target in a series of fields of parallel lines. The video-frequency and background illumination components of the received signal are utilized to control the intensity of the beam. The line- and field-scanning synchronizing components are separated from the video-frequency components and from each other and utilized to synchronize the operation of the receiver line- and field-scanning apparatus with the similar scanning apparatus utilized at the transmitter in developing the signal. The transmitted image is thereby reproduced on the target of the receiver.

In scanning of the interlaced type, the line and field frequencies are so related that successive fields are staggered, the lines of one field falling between or interlacing those of a preceding field and, due to persistence of vision, the optical effect produced is as though each frame or group of fields comprised a multiple of the actual number of lines scanned per field and the frame-scanning frequency equalled the field-scanning frequency.

Various types of carrier signal modulation scanning and synchronizing methods and apparatus heretofore have been proposed. The type of synchronizing signal which is required ordinarily depends upon the type signal employed and the type of scanning utilized.

For example, in certain systems negative modulation is employed, that is, a decrease in carrier amplitude corresponds to an increase in illumination, while in other systems positive modulation is utilized, in which an increase in carrier amplitude corresponds to an increase in illumination. The synchronizing components of the signals used in these systems ordinarily have amplitude values outside of the range of the video-frequency components, being represented by increases in the carrier amplitude where negative video modulation is employed and by decreases in carrier amplitude where positive video modulation is employed.

In interlaced scanning systems, certain of the field-synchronizing impulses necessarily occur between line-synchronizing impulses. In order that the line- and frame-synchronizing impulses may be successfully separated from the video-frequency components and from each other and utilized, various types of synchronizing signals and separating apparatus have been proposed, such as for example signals in which the field-synchronizing impulses are of greater height or of longer duration than the line-synchronizing impulses, and separating apparatus comprising amplitude discriminating or integrating circuits. Such arrangements, however, have been found to be subject to various objections such as being unstable, requiring an undesirably large portion of the total carrier amplitude, and involving relatively complicated separating apparatus.

It is an object therefore of the present invention to provide an improved method and means for effecting scanning synchronization and background-illumination control in a television receiving and reproducing system, which will overcome the above-mentioned disadvantages of the prior art.

It is a further object of the invention to provide an improved method and means of the character described which is adapted for deriving from a received television signal of the type including video-frequency components, background illumination components and combined synchronizing components, the video-frequency components and a unidirectional voltage representative of the background illumination, as well as effectively separating the synchronizing components from each other.

In accordance with the invention, a television system for receiving and reproducing a video-frequency signal including combined video-fre-

quency components, background-illumination components, and synchronizing components including line-synchronizing and field-synchronizing impulses having amplitude values outside the amplitude range of the video-frequency components comprises, a single rectifier and associated load circuit for simultaneously deriving from the signal a unidirectional-bias voltage representative of background illumination and effectively separating the line-synchronizing and field-synchronizing impulses from each other. The system comprises also means for utilizing the effectively separated synchronizing impulses for synchronizing separate scanning operations of the system and means responsive to the above-mentioned bias voltage for controlling only the background illumination of the image reproduced by the system.

In the preferred embodiment of the invention, the line-synchronizing impulses have leading edges of steeper slope than their trailing edges while the field-synchronizing impulses have trailing edges of steeper slope than their leading edges, these respective impulses being separately developed and combined to develop the composite synchronizing signal. Differentiating apparatus at the receiver derives from the composite synchronizing signal, a synchronizing signal in which the line-synchronizing and frame-synchronizing impulses are poled in opposite senses. Hence, this derived signal may be utilized to effect synchronization of line-scanning apparatus entirely independently of the frame-synchronizing impulses and to effect synchronization of the frame-scanning apparatus entirely independently of the line-synchronizing impulses by simply applying the synchronizing wave to the scanning apparatus with the proper polarities.

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 drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawings, Fig. 1 is a circuit diagram, partially schematic, of a complete television transmitting apparatus useful in generating a television signal for application to a receiving and reproducing system constructed in accordance with the invention; Fig. 2 is a circuit diagram, partially schematic, of a complete television receiving system embodying the invention; and Figs. 3–9 are curves illustrating the wave forms of periodic current or voltage waves developed at different points in the systems of Figs. 1 and 2 to aid in the understanding of the invention.

Referring now more particularly to Fig. 1 of the drawings, there is illustrated a television transmitting system of a type useful in generating a television signal including combined video-frequency components, background-illumination components, and synchronizing components including line-synchronizing and field-synchronizing impulses having amplitude values outside the amplitude range of the video-frequency components for application to a receiving and reproducing system in accordance with the invention, and comprising a signal generator 10 which may be of a conventional design including the usual cathode-ray signal-generating tube and scanning elements. For developing scanning voltages or currents for the generator 10, there are provided a line-frequency saw-tooth wave generator 11 and a frame-frequency saw-tooth wave generator 12, the output circuits of these generators being connected to the scanning elements of the signal generator 10 in the usual manner. In order to block out the cathode-ray of the generator 10 during the retrace scanning periods, there is provided a block-out wave generator 13 having its output circuit suitably connected to the signal generator 10. For providing impulses to suppress undesirable signal impulses during retrace scanning periods and to insure proper form of the modulation signal to be developed, there is provided a pedestal impulse generator 14 and, in order to develop a suitable scanning synchronizing signal, there is provided synchronizing signal-generating apparatus indicated generally at 15 and hereinafter more fully described.

For the purpose of synchronizing the generators 11—14, inclusive, and the apparatus 15, there is provided for the system, a timing impulse generator 16 having the input circuits of the generators 11—14, inclusive, and apparatus 15 coupled thereto. The timing impulse generator is preferably stabilized by means of a connection 17 to a suitable source of periodic voltage, for example, to the power supply circuit or to the synchronizing voltage source of a motion picture mechanism, where such is employed.

Connected in cascade to the output circuit of the signal generator 10, in the order named, are video-frequency amplifiers 18, 19 and 20, a modulator 21 and associated coupled carrier-frequency oscillator 22, a power amplifier 23, and an antenna system 24, 25, all according to conventional practice. The output circuit of the pedestal generator 14 is coupled to the video-frequency amplifier 19, while the output circuit of the synchronizing signal-generating apparatus 15 is coupled to the video-frequency amplifier 20. Suitable means (not shown) may also be provided for developing a unidirectional background control voltage and applying the same to the amplifier 19.

Neglecting for the moment the details of the synchronizing signal-generating apparatus 15, the system just described comprises the elements of a television transmitting system of conventional design and, the various parts thereof which are illustrated schematically being of any well-known construction, a detailed description of the general system and its operation is unnecessary. Briefly, however, the image of a scene to be transmitted is focused on the target of the cathode-ray tube of the signal generator 10 in which tube a cathode-ray is developed, focused and accelerated toward the target in the usual manner. Scanning or deflecting currents or voltages developed by the generators 11 and 12 are applied to the scanning elements of the generator 10 to provide electric fields which serve to deflect the cathode-ray horizontally and vertically thereby to scan successive series of parallel lines or fields upon the target. The deflecting currents or voltages and, hence, the scanning fields, are of well-known saw-tooth wave form, providing a relatively slow linear trace and rapid retrace. The number of lines per field is determined by the relative value of line- and frame-scanning frequencies. The line frequency is preferably a multiple (which is an integer plus a fraction) of the field frequency so that the successive fields of parallel lines traced on the target are interlaced in the well-known manner. The line-scanning frequency may, for example, be 13,230 cycles and the field-scanning frequency

60 cycles per second, respectively. Block-out impulses developed by the generator 13 are applied to the control electrode of the cathode-ray tube to suppress or block out the beam during retrace portions of the scanning cycles, while pedestal impulses developed by the generator 14 are applied to the amplifier 19 to suppress surges which occur and set the level at black during each line and field retrace interval.

The synchronizing impulse signal developed by the apparatus 15 is applied to the modulation amplifier 20 while the timing impulses developed by the generator 16 are applied to the generators 11—14, inclusive, in the apparatus 15 to lock these generators and apparatus in synchronism.

The photosensitive elements of the target in the cathode-ray tube of the generator 14 being electrically affected to an extent dependent upon the varying values of light and shade at the corresponding incremental areas of the image focused thereon, as the cathode-ray scans the target, a video-frequency voltage of correspondingly varying amplitude is deveolped in the output circuit of the generator 10 and applied to the video-frequency amplifier 18, wherein this voltage is amplified and from which it is translated to the amplifier 19. Where a unidirectional back-ground illumination voltage has been developed by suitable means (not shown) it may also be applied to the amplifier 19. Here the video-frequency voltage is further amplified and mixed with the unidirectional voltages and with pedestal impulses supplied from the generator 14. The amplified mixed voltages in the output circuit of the amplifier 19 are thereupon applied to the amplifier 20, wherein they are further amplified and mixed with the synchronizing impulse signal supplied from the apparatus 15. The modulation voltages are thereupon supplied to the modulator 21, wherein they are so impressed upon the carrier wave generated by the oscillator 22 as to develop a positively modulated-carrier such as described above. The resultant modulated-carrier signal is delivered to the power amplifier 23 for amplification and is thereafter impressed upon the antenna system 24, 25 to be broadcast.

Referring now more particularly to the apparatus 15 provided for the purpose of developing line-synchronizing impulses, there is provided a generator 26, which may comprise signal-generating apparatus of any suitable conventional type adapted to develop periodic impulses of line-scanning frequency, for example, 13,230 cycles per second, and of rectangular or peaked impulse wave form, as indicated immediately below the generator 26. The input circuit of this generator is coupled to the timing generator 16 for synchronization, while its output circuit is coupled to a limiter and amplifier 27 having its ouput circuit connected in turn to a further limiter and amplifier 28. The limiters and amplifiers may comprise any suitable conventional circuit arrangement, including, for example, vacuum tubes so biased as to cut off predetermined portions of the applied waves.

For the purpose of developing frame-synchronizing impulses, there is provided a generator 29, which may be of any suitable conventional construction adapted to develop a periodic impulse wave of the desired field frequency, for example, 60 cycles, the impulses of which are of rectangular form as indicated immediately below this generator. The input circuit of the generator 29 is coupled to the timing generator 16 for synchronization, while its output circuit is coupled to a so-called "short memory" circuit 30.

The device 30 may comprise a pentode vacuum tube 31 having a condenser 32 included in its anode circuit in parallel with a high impedance feed resistor 33, by way of which operating potential is supplied to the anode of the tube from a suitable source as indicated at +B, while a suitable potential is applied to its screen from a source indicated at +Sc. The input circuit of a limiter and amplifier 34 is connected across the condenser 32 while the output circuit of this device is in turn connected to a second limiter and amplifier 35. The limiters and amplifiers 34 and 35 may be similar in construction and operation to the limiters and amplifiers 27 and 28. The output circuits of the limiters and amplifiers 28 and 35 are connected to a mixing amplifier 36 for the purpose of combining the line-synchronizing and field-synchronizing impulses while the output circuit of the amplifier 36 is in turn coupled to the video-frequency amplifier 20 as explained above.

In the operation of the synchronizing signal-generating apparatus 15, the generator 26, synchronized by the timing generator 16, serves to develop a periodic rectangular or peaked impulse wave of line-scanning frequency and to deliver this wave by way of the limiters and amplifiers 27 and 28 wherein, due to their limiting and amplifying action, there are developed periodic line-synchronizing impulses having leading edges of steeper slope than their trailing edges, as indicated by the wave adjacent the limiter and amplifier 28.

The generator 29, synchronized by the timing generator 16, serves to develop a periodic rectangular impulse wave of the desired field-scanning frequency and this wave is applied to the grid of the tube 31 of the short-memory circuit 30 with such polarity that the grid is positive during the trace portion of each cycle, that is during the periods between the impulses, when the tube 31 constitutes a low resistance shunt path across the condenser 32. During the short retrace periods, that is, for the duration of the impulses, the grid is made highly negative so that the condenser charges exponentially by way of the resistor 33. At the termination of each impulse, the condenser 32 is again shorted by way of the anode-cathode conductance of the tube and discharges more raidly. The resultant voltage impulses developed across the condenser 32, therefore, have leading edges of relatively gradual slope and terminating edges of steep slope as indicated by the curve immediately below tube 31. The limiters and amplifiers 34 and 35 serve to cut off the upper and lower portions of these impulses, thereby to develop field-synchronizing impulses of the desired wave form, such as indicated adjacent the limiter and amplifier 35.

The line-synchronizing and field-synchronizing impulses are combined in the mixing amplifier 36 and applied to the amplifier 20 as mentioned above. The significance of the particular shapes of the synchronizing impulses will be better understood in connection with the following description of receiving apparatus embodying the present invention and the general explanation of the system in connection with the curves of Figs. 3-9, inclusive.

Referring more particularly to Fig. 2, the system there illustrated comprises a television re-

ceiver of the superheterodyne type including an antenna system 37—38 connected to a radio-frequency amplifier 39 to which there is connected in cascade, in the order named, an oscillator-modulator 40, an intermediate-frequency amplifier 41, a detector 42, a video-frequency amplifier 43, and a cathode-ray signal-reproducing tube 44. A line-frequency generator 45 and a frame-frequency generator 46 are also coupled to the output of the video-frequency amplifier 43 by way of suitable synchronizing signal-separating apparatus 53 and to the scanning elements of the cathode-ray tube. The stages or units 37—44, inclusive, 45 and 46, may all be of conventional well-known construction so that detailed illustrations and descriptions thereof are deemed unnecessary herein.

Referring briefly to the operation of the receiving system, television signals transmitted, for example, from a system such as shown in Fig. 1 and intercepted by the antenna circuit 37, 38, are selected and amplified in the radio-frequency amplifier 39 and supplied to the oscillator-modulator 40 wherein they are converted to intermediate-frequency signals which, in turn, are selectively amplified in the intermediate-frequency amplifier 41 and delivered to the detector 42. The modulation components of the signal are derived by the detector 42 and are supplied to the video-frequency amplifier 43 wherein they are amplified and from which they are supplied to a brilliancy-control electrode of the cathode-ray tube 44. The intensity of the electron beam of the tube 44 is thus modulated or controlled in accordance with the video-frequency voltages impressed upon the control electrode of the tube in the usual manner. The modulation components are also supplied to the apparatus 53, wherein synchronizing components are separated from the video-frequency components and the line-synchronizing and frame-synchronizing impulses are effectively separated from each other, as further explained hereinafter, and applied to the generators 45 and 46, respectively. Saw-tooth current or voltage scanning waves are generated by the line-frequency and frame-frequency generators 45 and 46, which are controlled by the synchronizing impulses supplied from the apparatus 53, and the scanning waves are applied to the scanning elements of the cathode-ray tube 44, to produce electric scanning fields, thereby to deflect the ray vertically and horizontally so as to trace successive interlaced fields of parallel lines on the screen of the tube, to reproduce the transmitted picture.

Referring now more particularly to the portion of the system of Fig. 2 embodying the present invention, the unit 53 is provided for the purpose of deriving the effectively separated line-synchronizing and frame-synchronizing impulses, so that they may be applied to the generators 45 and 46 free from mutual interference and for the purpose of stabilizing the signal input to cathode-ray tube 44.

This arrangement is adapted for use in a system in which the composite modulation signal includes combined video-frequency components, back-ground illumination components, the latter being represented by the peak value of the signal on the black side of its zero axis, and synchronizing components of the type described above. This arrangement provides a single rectifier and associated load circuit responsive to the amplitude of, and the slopes of the edges of, the synchronizing pulses for simultaneously deriving from the signal a back-ground illumination control voltage as well as for effectively separating the line-synchronizing and frame-synchronizing impulses from each other. Moreover, with this embodiment of the invention the scanning wave generators of the receiver may include synchronizing circuits which are both adapted to be controlled by synchronizing impulses of the same polarity.

In this system, the output of the video-frequency of the amplifier 43 is connected to the control grid of the cathode-ray tube 44 by way of a coupling condenser 52 and is also coupled to the generators 45 and 46 by means of rectifying and separating apparatus indicated generally at 53. The generators 45 and 46 include synchronizing circuits adapted to be controlled by positive synchronizing impulses. The rectifying means comprises a diode 54 connected across the output of the amplifier 43 through an inductance 55 in series therewith, as shown, and a source of biasing potential, indicated by the battery 56, a resistor 57 being connected across the diode 54 and inductance 55. The electrical values of the condenser 52 and the resistor 57 are very large and provide a large time constant for the rectifier. The battery 56 provides an initial negative bias for the control grid of the cathode-ray tube to ensure proper operation thereof and also provides a negative bias to the vacuum tubes at the input of geeprators 45 and 46 whereby only the positively poled synchronizing pulses are effective.

The diode 54 acts as a peak rectifier passing current only during the synchronizing impulses, cutting off the video-frequency components. The inductance 55 provides a load or output circuit across which are developed synchronizing impulse voltages. The flow of these impulses of current through the inductance 55 is effective to develop a voltage, which is the derivative of the current, across inductance 55, thereby serving effectively to separate the line-synchronizing and frame-synchronizing impulses from each other. A reversing inductance 58 is coupled to the inductance 55 and the inductances 55 and 58 are connected to the synchronizing circuits of the generators 45 and 46, respectively.

In the operation of the system of Fig. 2, considering a signal of the type described above to have been received and developed in the output circuit of the amplifier 43, the diode passes current only during occurrences of the synchronizing impulses as stated above, this being determined by the large time constant circuit comprising the condenser 52 and the resistor 57 and the initial bias provided by the battery 56. Hence, during each of the synchronizing impulses, current flows through the inductance element 55 in series with the diode and there are developed across this element synchronizing impulses free from the video-frequency components of the signal. Moreover, this element serves to differentiate the current wave flowing therethrough so that a periodic voltage wave is developed thereacross comprising impulses the form of which is dependent upon the wave forms of the applied impulses, particularly the relative slopes of the leading and trailing edges of the synchronizing impulses. Since the signal component derived by the detector 42 corresponds to the synchronizing signal developed at the transmitter, the leading edges of the line-synchronizing impulses are of steeper slope than their trailing edges, while the trailing edges of the field-synchronizing impulses are of steeper slope

than their leading edges. The synchronizing components developed by differentiation across the inductance element 55 are of the form of double impulses, one-half of each double impulse being a relatively narrow pulse of substantial amplitude and the other half being of inappreciable amplitude. Moreover, since the corresponding differences in slope of the line-synchronizing and field-synchronizing impulses are opposite in sense, the resultant line-synchronizing and frame-synchronizing pulses of substantial amplitude are of the opposite polarity. The inductance 58 being coupled to the inductance 55 to provide a reversal of polarity, the voltage across the inductance 58 may be applied directly to the synchronizing circuit of the line-frequency generator 45. This is possible since the line impulses thus developed, which are of appreciable amplitude, are then positively poled as applied to generator 45. The frame pulses developed across the inductance 55 are also positively poled as applied to generator 46. Hence, circuits of both the generators 45 and 46 are adapted to be controlled by positively poled impulses.

The control grid of the cathode-ray tube is initially biased negatively by the battery 56 approximately to a point corresponding to the black level of the signal as applied to the tube. The diode derives from the signal output of the amplifier 43 a positive unidirectional voltage equal to the peak value of the composite modulation signal on the black side of its zero axis, this voltage appearing across the resistor 57 and being applied to the control grid of the cathode-ray tube in opposition to the initial fixed negative bias of the battery 56 to control only the background illumination of the image reproduced by the system. The resultant video-frequency signal applied to the control grid, therefore, is of a desired wave form which includes the unidirectional and low-frequency background components as well as the video-frequency picture components of the signal.

The general operation of the entire system may be readily explained by reference to the curves of Figs. 3–9, inclusive, which illustrate the wave forms of waves developed at various points in the systems of Figs. 1 and 2, time being represented by abscissae and relative amplitude by ordinates in each instance. The curve of Fig. 3 represents the wave form of the frame-synchronizing impulse wave developed in the output circuit of the limiter 35 in the system of Fig. 1. For simplicity, all synchronizing impulses are shown in Figs. 3–7, inclusive, with negative polarity. It will be noted that the impulse of this curve is characterized by a leading edge of relatively gradual slope and a trailing edge of relatively steep slope. The curves of Figs. 4 and 5 represent the wave forms of the periodic line-synchronizing impulses, developed in the output circuit of the limiter and amplifier 26, as they appear during alternate field-scanning cycles, that is, during the intervals when the field-synchronizing pulse occurs. The unique feature of the line-synchronizing impulses is that their leading edges have relatively steep slopes and their trailing edges have relatively lesser slopes, it thus being seen that the line-synchronizing and field-synchronizing impulses have leading and trailing edges of a predetermined difference in slope, the corresponding differences in slope of the line-synchronizing and field-synchronizing impulses being in opposite senses. In a preferred arrangement, for example, the line and frame frequencies may be, as has been stated, 13,230 and 60 cycles, respectively. After the line-synchronizing and frame-synchronizing impulses have been combined in the mixing amplifier 36 and have been further combined in the amplifier 20 with the video-frequency signals, the combined signal appearing in the output circuit of the amplifier 20 is of a form such as shown by the curves of Figs. 6 and 7, where again the two curves represent the signal as it appears during alternate field-scanning cycles, the background-illumination component of the signal being represented by the peak value of the signal in the black direction.

In Fig. 6 there is indicated by the letters *w*, *b* and *s*, the respective signal levels representing white, black, and the peak amplitude of the synchronizing impulses in the black direction. Since this signal, as shown, is applied to the carrier wave as modulation, it will be apparent that increases in the amplitude of the carrier correspond to increases in illumination of the image, while the synchronizing impulses are all represented by decreases in carrier amplitude.

The curves of Figs. 6 and 7 also represent the wave forms of the signals developed in the output circuit of the amplifier 43 of the receiver of Fig. 2. The video-frequency portions of the curves being removed, as explained above, by virtue of the biasing of the diode 54 in the system of Fig. 2, the synchronizing signal voltages and resultant currents through the inductance element 55 are, therefore, of the form shown by the lower portions *b*—*s* of these curves. Since these currents are differentiated by the inductance element 55, the resultant voltages developed across this element is of the forms shown by the curves of Figs. 8 and 9 where, as explained above, the only pulses of each resultant double impulse of the respective line-synchronizing and frame-synchronizing components of appreciable amplitude are of opposite polarity.

While there have been described what are at present considered to be the preferred embodiments 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 system for receiving and reproducing a video-frequency signal including combined video-frequency components, background-illumination components, and synchronizing components including line-synchronizing and field-synchronizing impulses having amplitude values outside the amplitude range of the video-frequency components, comprising a single rectifier and associated load circuit for simultaneously deriving from said signal a unidirectional bias voltage representative of background illumination, and effectively separating the line-synchronizing and field-synchronizing impulses from each other, means for utilizing said effectively separated synchronizing impulses for synchronizing separate scanning operations of the system, and means responsive to said bias voltage for controlling only the background illumination of the image reproduced by the system.

2. A television system for receiving and reproducing a video-frequency signal including combined video-frequency components, background-illumination components, and synchro-

nizing components including line-synchronizing and field-synchronizing impulses having amplitude values outside the amplitude range of the video-frequency components and having leading and trailing edges of a predetermined difference in slope, the corresponding differences in slope of said line-synchronizing and field-synchronizing impulses being in opposite sense, comprising a single rectifier and associated load circuit and responsive to the amplitude of, and to the slopes of the edges of, said synchronizing impulses for simultaneously deriving from said signal a unidirectional bias voltage representative of background illumination, and line-synchronizing and field-synchronizing impulses effectively separated from each other, means for utilizing said effectively separated synchronizing impulses for synchronizing separate scanning operations of the system, and means responsive to said bias voltage for controlling only the background illumination of the image reproduced by the system.

3. A television system for receiving and reproducing a video-frequency signal including combined video-frequency components and synchronizing components including line-synchronizing and field-synchronizing impulses having amplitude values outside the amplitude range of said video-frequency components having leading and trailing edges of a predetermined difference in slope, the corresponding differences in slope of said line-synchronizing and field-synchronizing impulses being in opposite senses, the background-illumination being represented by the peak value of the signal in the black direction, comprising a single rectifying means and associated load circuit for deriving from said signal a background-illumination control-bias voltage proportional to said peak value of said signal, and responsive to the slopes of the edges of said synchronizing impulses for developing from said signal impulses corresponding to said line-synchronizing and frame-synchronizing components effectively separated from each other, means for utilizing said synchronizing impulses for synchronizing separate scanning operations of the system, and means for utilizing said bias voltage for controlling only the background-illumination of the image reproduced by the system.

4. A television system for receiving and reproducing a video-frequency signal including combined video-frequency components and synchronizing components including line-synchronizing and field-synchronizing impulses having amplitude values outside the amplitude range of the video-frequency components and having leading and trailing edges of a predetermined difference in slope, the corresponding differences in slope of said line-synchronizing and field-synchronizing impulses being in opposite senses and the background-illumination being represented by the peak value of the signal in the black direction comprising a source of bias voltage, a single diode rectifier for deriving from said signal a bias voltage proportional to said peak value of said signal, an inductance element in circuit with said rectifier for deriving from said signal line-synchronizing and field-synchronizing impulses effectively separated from each other, means for utilizing said effectively separated synchronizing impulses for synchronizing the separate scanning operations of the system, and means responsive jointly to both said bias voltages for controlling only the background-illumination of the image reproduced by the system.

HAROLD M. LEWIS.

CERTIFICATE OF CORRECTION.

Patent No. 2,249,532. July 15, 1941.

HAROLD M. LEWIS.

It is hereby certified that error appears in the above numbered patent requiring correction as follows : In the drawing, strike out Sheet 3 containing Fig. 3; in the headings to Sheets 1 and 2, for "4 Sheets" read --3 Sheets--; in the heading to the last sheet of drawing, for "4 Sheets-Sheet 4" read --3 Sheets-Sheet 3--; and for the figures now numbered 4, 5, 6, 7, 8, 9, and 10 read 3, 4, 5, 6, 7, 8, and 9 respectively; in the printed specification, page 3, second column, line 53, for "raidly" read --rapidly--; page 4, second column, line 31, for "geenrators" read --generators--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of September, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.