Feb. 4, 1941. M. CAWEIN 2,230,284

TELEVISION SYNCHRONIZING SYSTEM

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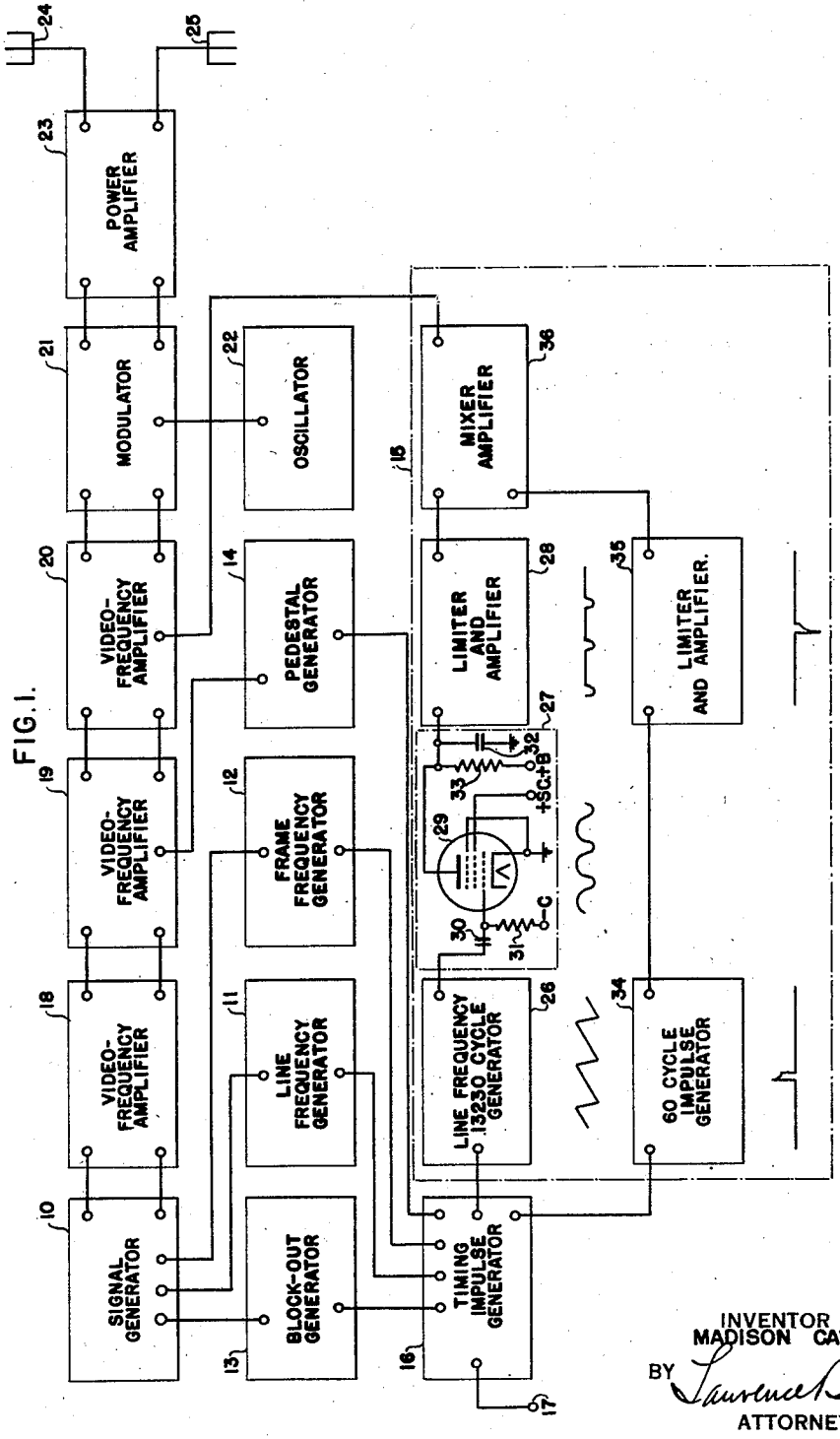


FIG. 1.

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Filed Dec. 2, 1937 3 Sheets-Sheet 2

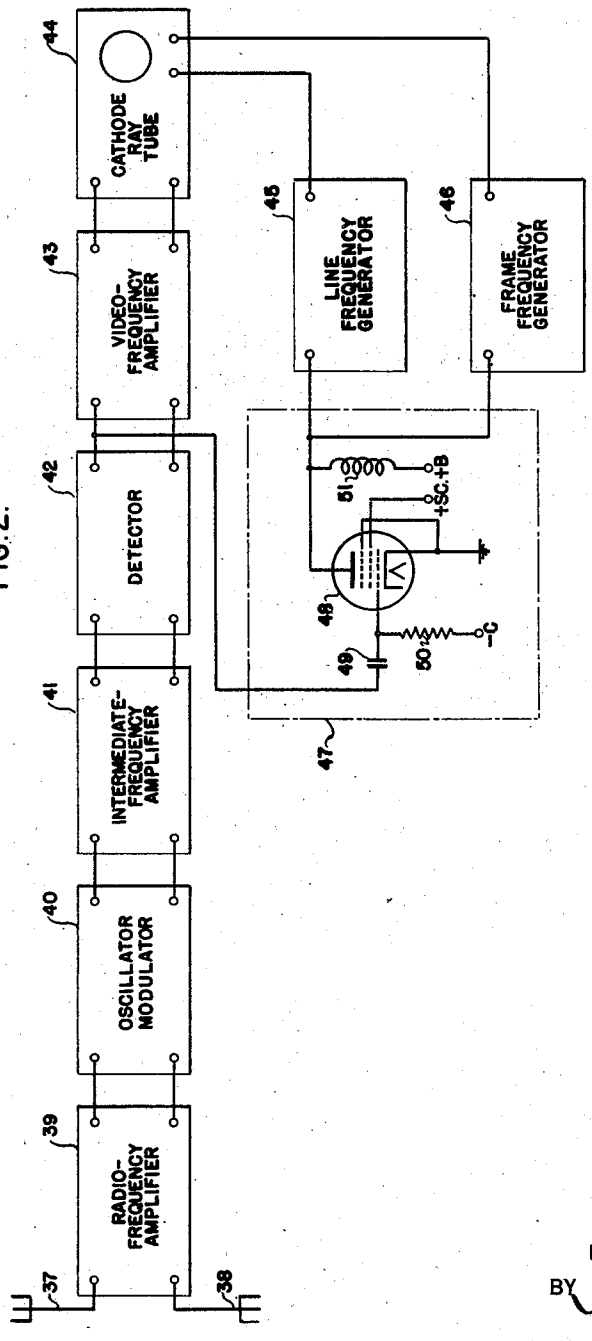


FIG. 2.

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TELEVISION SYNCHRONIZING SYSTEM

Filed Dec. 2, 1937 3 Sheets-Sheet 3

FIG. 3.

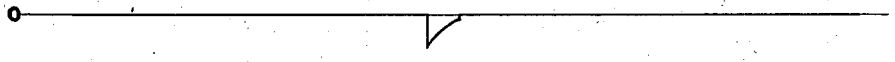


FIG. 4.

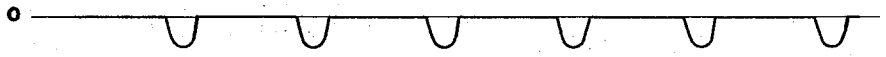


FIG. 5.

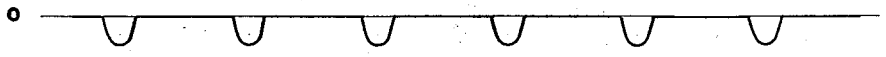


FIG. 6.

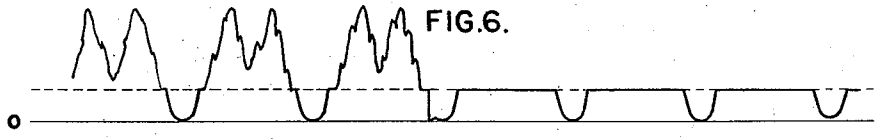


FIG. 7.

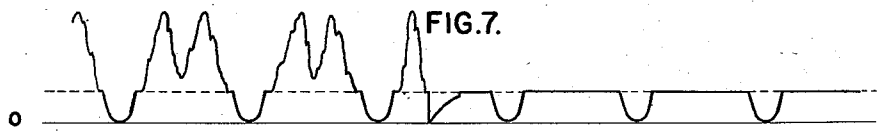


FIG. 8.

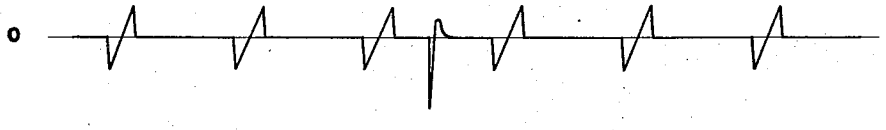
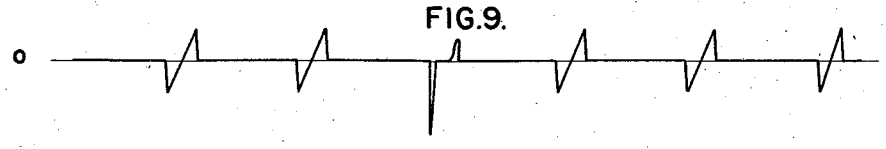


FIG. 9.



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UNITED STATES PATENT OFFICE

2,230,284

TELEVISION SYNCHRONIZING SYSTEM

Madison Cawein, Manhasset, N. Y., assignor to Hazeltine Corporation, a corporation of Delaware

Application December 2, 1937, Serial No. 177,697

19 Claims. (Cl. 178—6.8)

This invention relates to television systems and, more particularly, to signal-generating and receiving apparatus for use in such systems. The invention is especially concerned with the provision of an improved method of, and means for, effecting synchronization of television scanning apparatus.

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. At the receiver, a beam is so deflected as to scan and illuminate a target in a series of parallel lines. The video-frequency 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 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 required ordinarily depends upon the type of video 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 modulation is employed and by decreases in carrier amplitude where positive modulation is employed.

In interlaced scanning systems, certain of the field-synchronizing impulses must 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 for utilization, various types of synchronizing signals and separating apparatus have been proposed, 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 of the present invention, therefore, to provide an improved method of, and means for, effecting scanning synchronization in a television system which will overcome the above-mentioned disadvantages of the prior art.

In accordance with the present invention, there is provided a television synchronizing system which comprises means for developing and transmitting a composite synchronizing signal including line-synchronizing impulses each having an edge of a predetermined slope and field-synchronizing impulses each having an edge of a predetermined slope steeper than that of the said edge of the line-synchronizing impulses. Means are further provided for receiving and utilizing the composite signal which preferably comprises a single translating path for said composite synchronizing signal including a single slope-responsive device for effectively separating the line-synchronizing and field synchronizing impulses. Line-synchronizing and field-synchronizing circuits are coupled to the above-mentioned single path for individual control by the effectively separated line-synchronizing and field-synchronizing pulses, respectively.

Preferably, the line- and frame-synchronizing impulses are of the same amplitude and preferably are impressed as modulation upon a transmitted carrier which is positively modulated so that they appear as decreases in the carrier amplitude which preferably approaches zero during the synchronizing impulse peaks, while video-frequency components representing increases in

illumination are represented by increases in carrier amplitude.

In the preferred embodiment of the invention, the line-synchronizing impulses are of spaced parabolic-impulse form, while the field-synchronizing impulses are of rectangular- or peaked-impulse form such that their leading edges or wave fronts are substantially steeper than the leading edges or wave fronts of the line-synchronizing impulses, the line- and frame-synchronizing impulses being separately developed and combined to develop the composite signal. Differentiating apparatus is provided at the receiver to derive from the composite synchronizing signal, a synchronizing signal in which each of the synchronizing impulses appears as a double pulse, one pulse of each of the double frame-synchronizing impulses being of substantially greater amplitude than that of any of the other pulses developed. The line- and frame-synchronizing impulses are thus effectively separated and may be utilized individually to control separate line- and frame-scanning apparatus.

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 embodying the invention; Fig. 2 is a circuit diagram, partially schematic, of a complete television receiving system embodying the invention; and Figs. 3–9, inclusive, are curves illustrating the wave forms of periodic voltage waves developed at various 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 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 out-put 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 ensure proper form of the modulation signal to be developed, there is provided a pedestal-impulse generator **14** and, in order to develop a scanning synchronizing signal in accordance with the present invention, 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 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**.

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 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 values of line-scanning and field-scanning frequencies. The line-scanning frequency is preferably a fractional multiple of the field-scanning frequency so that the successive fields of parallel lines traced on the target are interlaced in the well-known manner. The line-scanning and frame-scanning frequencies may, for example, be 13,230 and 60 cycles, 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 modify the shape of the resultant video-frequency wave developed to aid in separating the line-scanning and frame-scanning synchronizing impulses at the receiver. 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, and 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 developed 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**. Here the video-frequency voltage is further amplified and mixed with pedestal impulses supplied from the generator **14**. The am-

plified mixed voltages in the output circuit of the amplifier 18 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 embodying the present invention, for the purpose of developing line-synchronizing signal impulses of the desired wave form, there is connected in cascade a saw-tooth wave generator 26, an integrating circuit or parabolic wave generator 27, and a limiter and amplifier 28. The generator 26 may comprise any suitable signal-generating apparatus of conventional type adapted to develop a periodic wave of the desired line-scanning frequency, for example, 13,230 cycles per second for interlaced scanning, and of saw-tooth wave form, as indicated immediately below the generator 26. The input circuit of this generator is coupled to the timing generator 16 for synchronization.

The integrating circuit or parabolic-impulse wave generator 27 may comprise a pentode vacuum tube 29 having its input circuit connected to the generator 26 by way of a coupling condenser 30 and leak resistor 31 and including in its anode circuit a condenser 32 and a feed resistor 33. Operating potentials are applied to the grid by way of resistor 31 directly to the screen, and to the anode by way of the resistor 33 from suitable sources, indicated at −C, +Sc, and +B, respectively. With suitable operating potentials applied to the electrodes of such a tube, it has a high internal impedance so that the current in its output circuit is of substantially the same wave form as the voltage applied to its input circuit, the wave form preferably being of saw-tooth type. The current flowing through condenser 32 is integrated thereby to develop thereacross a voltage wave of a second predetermined wave form which is the integral of the wave form of the voltage applied to the input of tube 29, this wave form being, in the preferred case, of parabolic type. More particularly, with a voltage wave of saw-tooth wave form applied to the input circuit of tube 29, a voltage wave of parabolic wave form is developed across its output circuit, as indicated immediately below the generator 27. The input of the limiter and amplifier 28 is connected across the condenser 32 and may comprise any suitable conventional circuit arrangement including, for example, a two-stage resistance coupled amplifier so biased as to cut off a predetermined portion of the wave applied thereto, thereby to limit the translated wave to obtain pulses of parabolic-impulse wave form and to develop in its output circuit a periodic line-synchronizing wave comprising such spaced parabolic impulses, as indicated below the limiter and amplifier 28.

For the purpose of developing field-synchronizing impulses, there is provided a periodic wave generator 34 which may be of any suitable conventional construction adapted to develop a periodic-impulse wave of the desired field-scanning frequency, for example, 60 cycles, the impulses of which are of rectangular peaked-impulse wave form, as indicated immediately below this generator and having leading edges of steeper slope than the leading edges of the line-synchronizing impulses. The input circuit of the generator 34 is coupled to the timing generator 16 for synchronization, while its output circuit is coupled to a limiter and amplifier 35, preferably a single-stage unit which may otherwise be similar in construction and operation to the limiter and amplifier 28 and effective to cut off all but a desired portion of the impulses generated by the unit 34. The output circuits of the limiters and amplifiers 28 and 35 are coupled to a mixing amplifier 36 to combine 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, develops a periodic saw-tooth wave of line-scanning frequency and delivers this wave to the generator 27, wherein a parabolic wave of the same frequency is developed, as explained above. The latter wave is impressed upon the limiter and amplifier 28, whereby, by virtue of its limiting or cutoff and amplifying action, a periodic line-synchronizing wave comprising spaced parabolic impulses is developed. The generator 34, synchronized by the timing generator 16, develops a periodic wave of rectangular- or peaked-impulse wave form and of the desired field-scanning frequency and this wave is applied to the limiter and amplifier 35, which operates to cut off and amplify the impulses, thereby to develop a field-synchronizing wave of rectangular- or peaked-impulse wave form, the impulses of which have leading edges which are substantially steeper than the corresponding edges of the line-synchronizing impulses. The line-synchronizing and field-synchronizing impulses are applied to the mixing amplifier 36 and combined therein to produce a composite line- and frame-synchronizing wave, which is, in turn, applied to the amplifier 20, as mentioned above. The significance of the particular shapes of the synchronizing impulses just described 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 receiver 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 scanning generator 45 and a field-frequency scanning generator 46 are also coupled to the output of the detector 42, by way of suitable synchronizing-signal separating apparatus 47, and to the scanning elements of the cathode-ray tube. These generators, in a well-known manner, may include synchronizing circuits which are adapted to be controlled by negative synchronizing impulses, the synchronizing circuit of the generator 46 being so biased as to be responsive only to impulses of relatively great amplitude, that is, greater than the amplitude of the impulses by

which the synchronizing circuit of the generator 45 is operated. The stages or units 39—46, inclusive, may all be of conventional well-known construction, so that detailed illustrations and descriptions thereof are deemed unnecessary herein.

Referring briefly, however, 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 in the usual manner 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 from detector 42 are also supplied to the apparatus 47, wherein the synchronizing components are separated from the video-frequency components and the line- and frame-synchronizing components are effectively separated from each other and applied to the control circuits of the generators 45 and 46, as will hereinafter be further explained. Saw-tooth current or voltage scanning waves are generated in the line- and frame-frequency generators 45 and 46, which are controlled by synchronizing voltage impulses supplied from the apparatus 47. The scanning waves are applied to the scanning elements of the cathode-ray tube 44 to produce electric scanning fields, thereby to deflect the intensity-modulated 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, for the purpose of effectively separating the line- and frame-synchronizing impulses so that they may be applied to the generators 45 and 46 free from mutual interference, the apparatus 47 comprises a pentode tube 48 having its control grid coupled to the output of the detector 42 by way of a suitable coupling condenser 49 and leak resistor 50. A substantially ideal inductance element 51 is included in the anode circuit of the tube 48, and operating potentials are supplied to the anode by way of the element 51 directly to the screen, and to the control grid by way of resistor 50 from suitable sources as indicated at +B +Sc, and —C, respectively.

In the operation of the synchronizing-signal separating apparatus 47 which is included in a single translating path for the composite synchronizing signal and which comprises a single slope-responsive device for effectively separating line- and field-synchronizing impulses, modulation voltages developed by the detector 42 are applied by way of the condenser 49 to the control grid of the tube 48 in such polarity and with the control grid so biased that the video-frequency component of the signal is cut off or suppressed and only the synchronizing impulses appear in its output circuit. The tube 48 operates as a conventional pentode amplifier having high internal impedance, so that a periodic current wave flows in its anode circuit comprising the line- and frame-synchronizing impulses of the same wave forms as those of the voltage wave impressed on its input circuit, that is, corresponding to the synchronizing wave developed at the transmitter. This current is differentiated or translated as an infinitesimal calculus function of itself by the inductance element 51 so that a periodic voltage wave is developed thereacross comprising impulses, the form of which is dependent upon the shapes or wave forms of the applied impulse, particularly the slopes of corresponding edges such as the leading edges thereof. The differential of both the parabolic line-synchronizing impulse and the peaked field-synchronizing impulse developed across inductance 51 is a double impulse. By virtue of the fact that the leading edges of the field-synchronizing impulses are of steeper slope than the leading edges of the line-synchronizing impulses, the first pulse or half of each double field-synchronizing impulse is relatively narrow and of substantially greater amplitude than any of the other pulses developed. The derivatives of the line- and field-synchronizing impulses may thus be effectively separated from each other by simple amplitude separation, since their pulses of one polarity are characterized by substantial differences in amplitude.

As explained above, the synchronizing circuits of the generators 45 and 46 are adapted to be controlled by negative impulses and the synchronizing circuit of the generator 46 is so biased as to be relatively insensitive, or responsive only to the impulses of relatively large amplitude, such as the field-synchronizing impulses. The synchronizing impulses developed across the inductance element 51, therefore, may be applied directly to the generators 45 and 46. The synchronizing circuit of the generator 46 is controlled solely by the field-synchronizing impulses and entirely without interruption from the impulses of the other type. While the negative pulses derived from the field-synchronizing impulses may be of a character to control the line-scanning generator 45, these pulses occur either substantially simultaneously with the negative pulses derived from the line-synchronizing impulse or substantially midway adjacent ones of said pulses, in either of which cases they do not affect the operation of the line-scanning generator 45 for more than one line cycle.

The general operation of both the transmitting and receiving systems, described above, 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 the abscissae and relative amplitude by the ordinates in each instance. The curve of Fig. 3 represents the preferred wave form of the frame-synchronizing impulse wave developed in the output circuit of the limiter 35 in the system of Fig. 1. It will be noted that the impulse of this curve is characterized by a leading edge of relatively steep slope and a trailing edge of relatively gradual slope. The curves of Figs. 4 and 5 represent the preferred wave forms of the periodic line-synchronizing impulses developed in the output circuit of the limiter and amplifier 28 as they appear during alternate field-scanning

cycles; by virtue of the staggering of their impulses, resulting from the relative line- and field-scanning frequencies, interlaced scanning is obtained. In a preferred arrangement, for example, these frequencies may, as stated above, be 13,230 and 60 cycles, respectively.

The line-synchronizing impulses being of parabolic wave form their leading edges have relatively gradual slopes. After these line- and frame-synchronizing impulses have been combined in the mixing amplifier 36 and the composite synchronizing signal thus derived has been further combined in the amplifier 20 with the video-frequency signal, 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, as in Figs. 4 and 5, the two curves represent the signal as it appears during alternate field-scanning cycles, the line- and field-synchronizing impulses being readily distinguishable from each other by their different shapes; more particularly by the differences in slope of their leading edges.

The curves of Figs. 6 and 7 also represent the wave form of the signal developed in the output circuit of the detector 42 of the receiver of Fig. 2. The video-frequency components of this signal are removed, as explained above, from the output circuit of tube 48 by virtue of the bias on its control grid. The synchronizing signal current appearing in the output circuit of this tube is, therefore, of the form shown by the portions of these curves below the dotted line. Since this current is differentiated by the inductance element 51, the resultant voltage developed across this element is of the form shown by the curves of Fig. 8 and 9 where, as explained above, the first half or pulse of each of the double field-synchronizing impulses is of relatively greater amplitude than that of any of the other pulses developed.

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 synchronizing system comprising means for developing and transmitting a composite synchronizing signal including line-synchronizing impulses each having an edge of a predetermined slope and field-synchronizing impulses each having an edge of a predetermined slope steeper than that of said edge of said line-synchronizing impulses, means for receiving and utilizing said composite signal comprising a single translating path for said composite synchronizing signal including a single slope-responsive device for effectively separating said line-synchronizing and field-synchronizing impulses, and line-synchronizing and field-synchronizing circuits coupled to said single path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

2. A television synchronizing system comprising means for developing and transmitting a composite synchronizing signal including line-synchronizing impulses each having an edge of a predetermined slope and field-synchronizing impulses each having an edge of a predetermined slope steeper than that of said edge of said line-synchronizing impulses, means for receiving and utilizing said composite signal comprising a single translating path for said composite synchronizing signal including a single device for differentiating said synchronizing impulses for effectively separating said line-synchronizing and field-synchronizing impulses, and line-synchronizing and field-synchronizing circuits coupled to said single path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

3. A television synchronizing system comprising means for developing and transmitting a composite synchronizing signal including line-synchronizing impulses and field-synchronizing impulses having corresponding edges with different slopes, the slopes of said edges of said field-synchronizing impulses being steeper than the slopes of said edges of said line-synchronizing impulses, means for receiving and utilizing said composite signal comprising a single translating path for said composite synchronizing signal including a single device responsive to the slopes of said corresponding edges of said synchronizing impulses for effectively separating said line-synchronizing and field-synchronizing impulses, and line-synchronizing and field-synchronizing circuits coupled to said single path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

4. A television synchronizing system comprising means for developing and transmitting a composite synchronizing signal including line-synchronizing impulses and field-synchronizing impulses having corresponding edges with different slopes, the slopes of said edges of said field-synchronizing impulses being steeper than the slopes of said edges of said line-synchronizing impulses and means for receiving and utilizing said composite signal comprising a single translating path for said composite synchronizing signal including a single device for differentiating said synchronizing impulses for effectively separating said line-synchronizing and field-synchronizing impulses and line-synchronizing and field-synchronizing circuits coupled to said differentiating means.

5. A television synchronizing system comprising means for developing and transmitting a composite synchronizing signal including line-synchronizing impulses having leading edges of a predetermined slope and field-synchronizing impulses having leading edges of a steeper predetermined slope, means for receiving and utilizing said composite signal comprising a single translating path for said composite synchronizing signal including a single device responsive to the slopes of the leading edges of said synchronizing impulses for effectively separating said line-synchronizing and field-synchronizing impulses, and line-synchronizing and field-synchronizing circuits coupled to said single path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

6. A television synchronizing system comprising means for developing line-synchronizing impulses of a predetermined wave form, means for developing field-synchronizing impulses of a different predetermined wave form such that predetermined edges of said field-synchronizing impulses have steeper slopes than corresponding edges of said line-synchronizing impulses, and means for combining said line-synchronizing and

field-synchronizing impulses to develop a composite synchronizing signal.

7. A television synchronizing system comprising means for developing line-synchronizing impulses, each having an edge of a predetermined slope, means for developing field-synchronizing impulses, each having an edge corresponding to said edges of said line-synchronizing impulses, and of a predetermined slope steeper than said first-mentioned predetermined slope, and means for combining said line-synchronizing and field-synchronizing impulses to develop a composite synchronizing signal.

8. A television synchronizing system comprising means for developing line-synchronizing impulses having leading edges of a predetermined slope, means for developing field-synchronizing impulses, each having a leading edge corresponding to said leading edges of said line-synchronizing impulses and of a predetermined slope steeper than that of the leading edges of said line-synchronizing impulses, and means for combining said synchronizing impulses of both of said frequencies to develop a composite scanning synchronizing signal.

9. A television synchronizing system comprising means for developing line-synchronizing impulses of parabolic wave form, means for developing field-synchronizing impulses of peaked wave form having the leading edges corresponding to leading edges of said line-synchronizing impulses and of steeper slope than that of the leading edges of said line-synchronizing impulses, and means for combining said line-synchronizing and field-synchronizing impulses to develop a composite synchronizing signal.

10. A television synchronizing system comprising line-synchronizing impulse generating means including means for developing a periodic sawtooth wave of a predetermined line-scanning frequency, means for integrating said wave to develop a parabolic-impulse wave of said predetermined frequency, means for limiting said parabolic wave to derive a spaced parabolic-impulse wave of said predetermined frequency, field-synchronizing impulse generating means including means for developing a periodic-impulse wave of a predetermined field-scanning frequency the impulses of which have relatively steep leading edges, and means for combining said parabolic-impulse wave and said field-synchronizing impulse waves to develop a composite synchronizing signal.

11. A television synchronizing system comprising means for developing line-synchronizing impulses of spaced parabolic-impulse wave form, means for developing field-synchronizing impulses including generating means for developing a periodic wave of rectangular peaked-impulse wave form and means for limiting said last-mentioned wave to derive field-synchronizing waves having impulses with relatively steep leading edges, and means for combining said last-mentioned wave and said spaced parabolic-impulse wave to develop a composite synchronizing signal.

12. A television synchronizing system adapted for the reception of a composite scanning synchronizing signal including line-synchronizing and field-synchronizing impulses of different predetermined wave forms, comprising a single translating path for said composite synchronizing signal including a single slope-responsive device for effectively separating said line-synchronizing and field-synchronizing impulses, and separate line-scanning and field-scanning synchronizing circuits coupled to said path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

13. A television synchronizing system adapted for the reception of a composite scanning synchronizing signal including line-synchronizing and field-synchronizing impulses of substantially equal amplitudes but of different predetermined wave forms, comprising a single translating path for said composite synchronizing signal including a single device for deriving as an infinitesimal calculus function of said composite signal a synchronizing signal including line-synchronizing and field-synchronizing impulses of different amplitudes, and separate line-scanning and field-scanning synchronizing circuits coupled to said path for individual control by said line-synchronizing and field-synchronizing impulses of different amplitude, respectively.

14. A television synchronizing system adapted for the reception of a synchronizing signal including line-synchronizing and field-synchronizing impulses having different predetermined wave forms, comprising a single translating path for said composite synchronizing signal including a single device for differentiating said signal effectively to separate said line-synchronizing and field-synchronizing impulses, and separate line-scanning and field-scanning synchronizing circuits coupled to said path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

15. A television synchronizing system adapted for the reception of a composite scanning synchronizing signal including line-synchronizing impulses and field-synchronizing impulses having corresponding edges with different slopes comprising a single translating path for said composite synchronizing signal including a single device responsive to the slopes of the corresponding edges of said synchronizing impulses for effectively separating said line-synchronizing and field-synchronizing impulses, and separate line-scanning and field-scanning synchronizing circuits coupled to said path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

16. A television synchronizing system adapted for the reception of a composite scanning synchronizing signal including line-synchronizing impulses and field-synchronizing impulses having leading edges of different predetermined slope, comprising a single translating path for said composite synchronizing signal including a single device responsive to the slopes of the leading edges of said synchronizing impulses for effectively separating said line-synchronizing and field-synchronizing impulses, and separate line-scanning and field-scanning synchronizing circuits coupled to said path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

17. A television synchronizing system adapted for the reception of a composite scanning synchronizing signal including line-synchronizing impulses and field-synchronizing impulses having leading edges of different predetermined slopes, comprising a single translating path for said composite synchronizing signal including a single device for differentiating said composite signal for effectively separating said line-synchronizing and field-synchronizing impulses, and separate line-scanning and field-scanning synchronizing circuits coupled to said path for individual control

by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

18. A television synchronizing system comprising means for developing and transmitting a composite synchronizing signal including line-synchronizing impulses of a predetermined shape and field-synchronizing impulses of a predetermined shape different from the shape of said line-synchronizing impulses, and means for receiving and utilizing said composite signal comprising a single translating path for said composite synchronizing signal including a single slope-responsive device for effectively separating said line-synchronizing and field-synchronizing impulses, and line-synchronizing and field-synchronizing circuits adapted to be excited by impulses of the same polarity directly coupled to said single path.

19. A television synchronizing system adapted for the reception of a composite scanning synchronizing signal including line-synchronizing and field-synchronizing impulses of different predetermined wave forms, comprising a single translating path for said composite synchronizing signal including a single slope-responsive device for effectively separating said line-synchronizing and field-synchronizing impulses, and separate line-scanning and field-scanning synchronizing circuits adapted to be excited by impulses of the same polarity coupled to said path for individual control by said effectively separated line-synchronizing and field-synchronizing impulses, respectively.

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