

July 22, 1941.

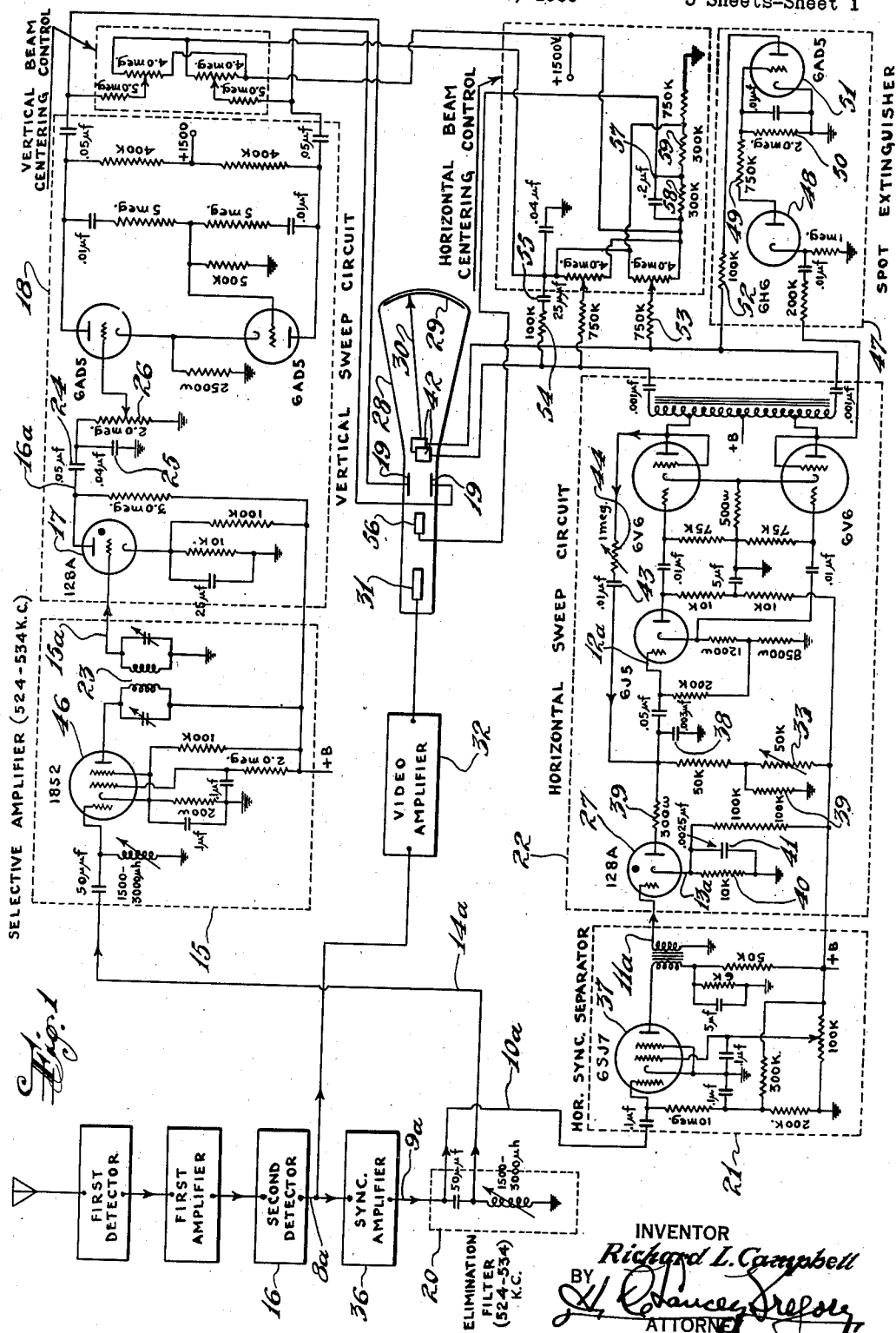
R. L. CAMPBELL

2,249,943

SYNCHRONIZING SYSTEM

Filed Dec. 22, 1939

3 Sheets-Sheet 1



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July 22, 1941.

R. L. CAMPBELL
SYNCHRONIZING SYSTEM

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Fig. 2

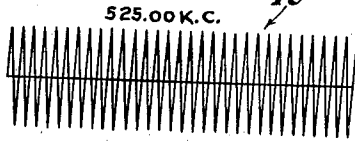


Fig. 3



Fig. 4

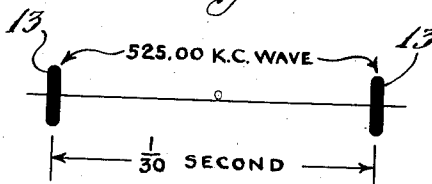


Fig. 5

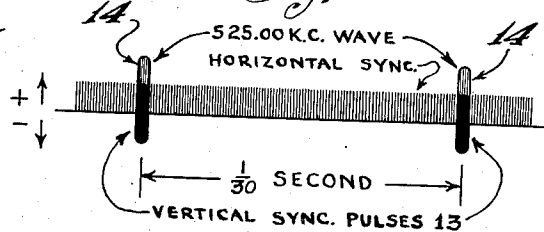


Fig. 6

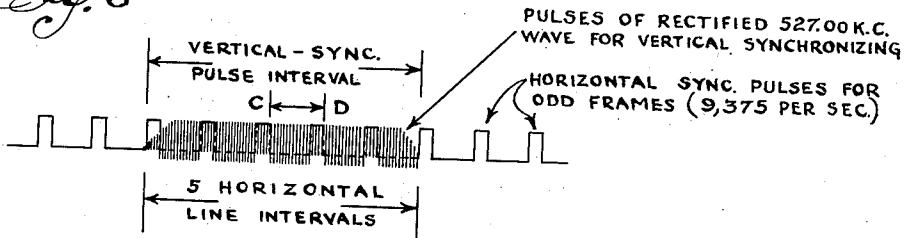


Fig. 6a

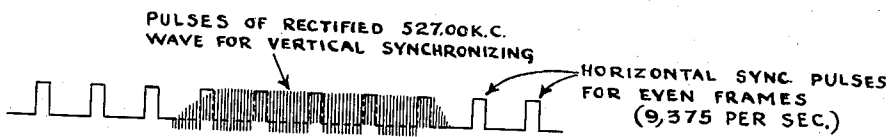
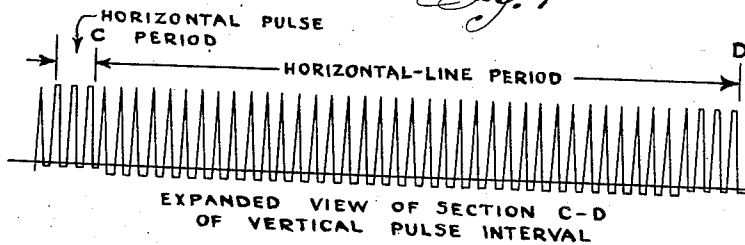


Fig. 7



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Fig. 8

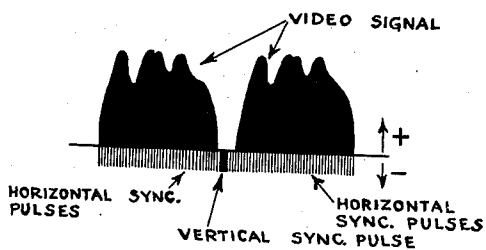


Fig. 9

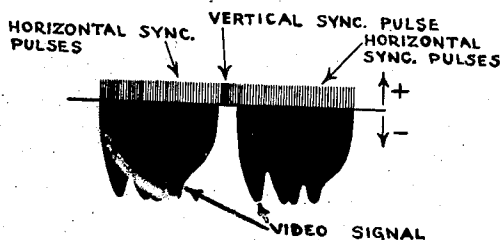


Fig. 10

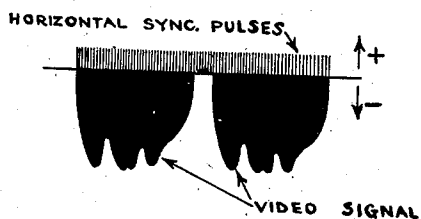


Fig. 11

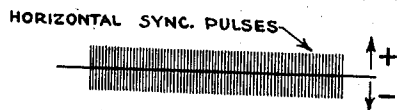


Fig. 12



Fig. 13



Fig. 14

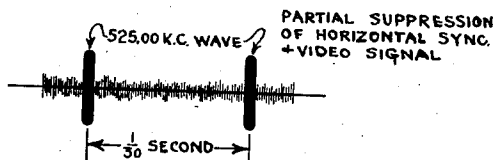


Fig. 15

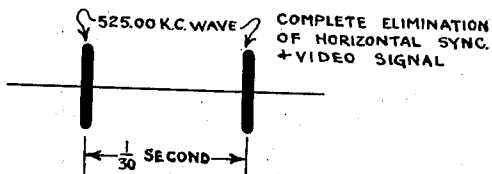
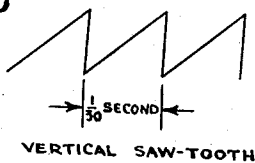


Fig. 16



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2,249,943

SYNCHRONIZING SYSTEM

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Application December 22, 1939, Serial No. 310,591

8 Claims. (Cl. 178-7.5)

My invention relates to improvements in methods and systems for television reception.

By using interlaced scanning in television communication with cathode-ray tubes, important advantages are obtained. However, in the various systems and methods proposed heretofore to synchronize for interlaced scanning with even the lowest interlace ratio of two, it has been found that positive interlace action at the receiver is difficult to maintain, although operating conditions might be made as ideal as possible. In order to obtain any degree of satisfactory results to maintain positive interlace action at the receiver, use of a rather complicated pulse form for the vertical synchronizing wave, which has both low and high frequency components, has been resorted to heretofore. Since the frequency content of the horizontal and vertical waves overlap in this system and method of the prior art, they cannot be effectively separated at the receiver, with the result that the desired, positive interlace action is not always maintained. Furthermore, in the prior systems and methods, the complex synchronizing wave forms embraced such expedients as equalizing pulses, serrated waves, and interrupted horizontal pulses. Also, the quality of the synchronizing pulses after separation was not as good as desired, the vertical synchronizing was affected by low frequency video transients and low-frequency surges, and there was serious distortion of the horizontal synchronizing wave train during occurrence of the vertical synchronizing pulses.

With the foregoing in mind, it is one of the objects of my invention to provide an improved method and system for television reception, whereby substantially more adequate separation of vertical and horizontal synchronizing signals is attained and, generally, more satisfactory synchronizing performance at the receiver results than is possible with the various methods and systems used heretofore.

Another object of my invention is the provision of an improved method and system for television reception in which there is used a vertical synchronizing signal whose frequency content is such that it can be substantially entirely removed from the horizontal signal without detrimental effect on the horizontal synchronizing, so that the vertical synchronizing does not interfere with horizontal synchronizing operation of the receiver.

Another object of my invention is the provision of an improved method and system for television reception, in which a vertical synchronizing pulse

can be readily separated from the combined video and synchronizing signals and in a manner so effective that the separated horizontal and vertical pulses at the receiver are so pure that the respective sweep circuits at the receiver can be driven more effectively than in the methods and systems used heretofore, thereby giving exceedingly positive synchronization.

Another object of my invention is the provision of an improved method and system for television reception, in which the horizontal and vertical synchronizing pulses can be separated so well and effectively that no frequency adjustment is necessary at the receiver, whereby the same will follow the transmitter over a considerable range, which action is not feasible in the various methods and systems proposed heretofore for television reception.

Another object of my invention is the provision of an improved method and system for television reception, in which both horizontal and vertical synchronization are so positive and effective that simplification of receiver controls is possible to the extent that the synchronizing controls heretofore necessary at the receiver can be eliminated.

Another object of my invention is the provision of an improved method and system for television reception, in which it is possible to use aperiodic sweep circuits which can be made to synchronize automatically over a wide range of scanning frequencies, whereby the receiver will respond to a television transmitting system which is flexible in the sense that the respective frequencies of the pulses transmitted for horizontal and vertical synchronizing might be changed as occasion or requirements might arise.

Other objects and advantages will hereinafter appear.

For the purpose of illustrating my invention, an embodiment thereof is shown in the drawings, wherein

Figure 1 is a simplified, diagrammatic view of a television receiving system constructed and operating in accordance with my invention; and

Figs. 2, 3, 4, 5, 6, 6a, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16 are views illustrative of the operating action in Fig. 1.

The specific receiving system shown in Fig. 1 is designed or adjusted to respond to synchronizing signals of the same character as those sent by the transmitting system described in my pending application Serial No. 300,263, filed October 19, 1939, and relating to improvements in television systems and synchronizing means therefor. In this system, a radio-frequency wave,

which may be of 525.00 k. c., and which is represented at 10 in Fig. 2, is generated. There are also generated horizontal synchronizing pulses, represented at 11 in Fig. 3 and which may occur at the rate of 9,375 per second, and with which the radiofrequency wave 10 is synchronous. A constant phase relation is therefore maintained between the wave 10 for vertical synchronizing and the horizontal synchronizing pulses 11. At the transmitter there are also generated pulses which occur at the desired vertical scanning frequency of 30, for example, and which are utilized to trigger off the radiofrequency wave 10 to produce a series of vertical synchronizing pulses, represented at 13 in Fig. 4, these vertical synchronizing pulses or signals occurring accordingly at the desired vertical pulse or field frequency of 30.

By means of a mixing amplifier at the transmitter, the vertical synchronizing pulses or signals 13 are mixed with the horizontal synchronizing pulses 11, to obtain a composite synchronizing signal represented in Fig. 5. At the radio transmitter, this composite signal is mixed in the well known manner with the video signals, to form a composite television signal. In the transmitter, that part of the vertical synchronizing pulses 13, represented by the lighter portions 14 in Fig. 5, is "clipped" or "saturated off" in the well known manner.

From the foregoing, it will be seen that the horizontal synchronizing pulses or signals 11 are not interrupted to permit insertion of the vertical synchronizing pulses 13, as in the various systems and methods proposed heretofore, but are allowed to and actually do remain on continuously. Therefore, the pulses 11 at the horizontal scanning frequency of 9,375, are obtained simply from a frequency divider unit of the synchronizing generator at the transmitter, and mixed with the vertical synchronizing pulses 13 without requiring a "blanking" amplifier for insertion of the vertical pulses, as heretofore. The basic composite synchronizing signal, represented in Fig. 5, is comprised of a continuous, uninterrupted train of the horizontal synchronizing pulses 11 occurring at the rate of 9,375 per second, and the vertical synchronizing pulses 13 of the radio-frequency wave 10, occurring at the rate of 30 per second.

On account of the relation of scanning frequencies chosen, there will be interlaced scanning, with an interlace ratio of two. Fig. 6 represents the composite synchronizing wave for the odd frames, for example, while Fig. 6a represents the composite synchronizing wave for the even frames. Also, in the example given, the frame frequency will be 15, and there be 625 lines per frame.

As shown in Fig. 5, the negative half-cycles of the vertical synchronizing pulses 13 extend considerably below the axis. These negative half-cycles also extend considerably below the negative portion of the horizontal pulses 11. The equal positive and negative portions of the carrier are not the best type of synchronizing signal, because the negative loop of the carrier is visible on the received picture. Therefore, it might be desirable to "clip off" this negative loop and obtain a resulting signal such as is shown in Figs. 6 and 6a.

For the above purpose, at the transmitter the lower nodes of the vertical pulses 13, extending below the axis as shown in Fig. 5, may be removed, so that only the positive peaks of the wave are effective. As illustrated in Fig. 7, the vertical

synchronizing wave is then no longer a radio-frequency carrier pulse, but is a series of positive half cycles of radio-frequency which introduces new frequency components in the synchronizing wave. The carrier wave before "clipping" is of sinusoidal form, at the selected frequency of 525.00 k. c. After "clipping", the synchronizing signal is comprised of positive half-sine loops, occurring at the rate of 525,000 per second. This so-called "clipping" operation is only necessary for preventing the vertical synchronizing pulse from showing up at the receiver as a modulation on the screen during the vertical return period.

Aside from the above, it may be desirable to transmit the lower, negative loops or nodes as shown in Fig. 5, and eliminate them at the receiver.

At the receiver, shown in Fig. 1, the composite television signal received from the transmitter and comprising video signal, horizontal synchronizing pulses and vertical synchronizing pulses, will appear as represented in Fig. 8, in the output connection 8a from the second detector 16. This composite signal will be inverted in the synchronizing amplifier 36, and will appear as represented in Fig. 9, in the output connection 9a from this amplifier.

In the elimination filter 20, there will be partial suppression of the video signal and the horizontal synchronizing pulses, so that in the output connection 14a from this filter to the selective amplifier 15, the composite signal will appear as represented in Fig. 14. In the selective amplifier 15, there is complete elimination of any remaining video signal and any remaining horizontal synchronizing pulses, so that there will be substantially only pure vertical synchronizing pulses, as represented in Fig. 15, in the output connection 15a from the selective amplifier 15 to grid of the gas-discharge tube 17. The tube 17 has relatively high μ , and generates the vertical scanning saw-tooth wave for the vertical sweep circuit 18, connected as shown to the associated deflecting plates 19. This vertical scanning saw-tooth wave is represented in Fig. 16, and appears in the output connection 16a from the discharge tube 17.

In the output connection 10a from the elimination filter 20, there will be substantially only horizontal synchronizing pulses and video signal, as represented in Fig. 10, from which it will be seen that this filter eliminates the vertical, radio-frequency pulses. This signal, as shown in Fig. 10, is applied by the connection 10a to the grid of tube 37 in the horizontal synchronizing separator 21 which eliminates by amplitude selection the video signal so that in the output connection 11a from this separator there appears only a continuous, uninterrupted train of horizontal synchronizing pulses, as represented in Fig. 11. The output of the horizontal synchronizing separator 21 is applied, as shown, to the grid of the gas-discharge tube 27 in the horizontal sweep circuit 22, and at considerable amplitude in order to effect positive synchronization of this circuit. Because the vertical synchronizing signal is removed so effectively, a high amplitude of horizontal pulse can be used without the distortive effects which would otherwise take place if vertical synchronizing signals were present in the horizontal signals.

In the operation of the vertical sweep circuit 18, the output of the tuned transformer 23 is applied to the grid of the gas-discharge tube 17 so that the incoming pulses of the vertical syn-

chronizing carrier cause this tube to discharge the series-connected condensers 24 and 25. After the discharge, the gas tube 17 becomes non-conductive, and the condensers 24 and 25 are charged through the resistor 26, which furnishes the scanning portion of the saw-tooth wave. The gas tube 17 is so operated that it is essentially a non-oscillating device, and requires the grid signal to start conduction.

Due to the fact that the type of vertical synchronizing pulse employed can, in my improved system and method, be very positively and effectively separated from other signals, the synchronizing signal as applied to the grid of tube 17 is sufficiently pure so that the non-oscillating type of sweep circuit can be used, thus providing a more positive synchronizing action than if an oscillator type of sweep circuit were used, as heretofore.

The horizontal sweep circuit 22, employing the gas-discharge tube 27, operates in a manner similar to that of the vertical sweep circuit 18. In the output connection 12a from tube 27, there will be the saw-tooth wave as represented in Fig. 12, for horizontal deflection.

The scanning device at the receiver is represented as being a cathode-ray tube 28 of a conventional construction, and comprises a fluorescent screen 29 which is scanned by a ray 30 of electrons. The electron ray 30 is developed by a gun 31, and by means of the plates shown and the respective, associated sweep circuits 18 and 22, is deflected horizontally at a line frequency of 9,375 and is deflected simultaneously vertically at the field frequency of 30. The video signals, supplied from the amplifier 32, are applied in the usual manner to the control grid of the gun 31.

By use of the high frequency carrier for the vertical synchronizing pulses, good separation of both pulses is possible. That is to say, the vertical pulses can be filtered out by means of a tuned circuit and applied to the vertical synchronizing circuit with very little interference effect from other signals, such as horizontal synchronizing signals and video signals. Also, the vertical pulses can be removed from the horizontal pulses by means of an effective filter circuit, which then provides a more nearly pure wave-train of horizontal pulses, which are continuous for all practical purposes and are not interrupted during the vertical pulse intervals.

Other details in the construction and operating action of my improved television receiving system are as follows, keeping in mind that the composite television signal, as represented in Fig. 8 and consisting of the picture or video signal with positive polarity and the horizontal and vertical synchronizing pulses of negative polarity, is obtained from the second detector 16 and passed through the synchronizing amplifier 36 where it is amplified and inverted in phase, as illustrated in Fig. 9. This signal is then passed through the 525.00 k. c. elimination filter 29, where the 525.00 k. c. vertical pulses are removed, as illustrated in Fig. 10. The signal now consisting of picture signal of negative polarity and the horizontal pulses of positive polarity, next goes to the horizontal synchronizing separator 21 having a sharp cut-off pentode 37 operated at low plate and screen potentials, where the picture signal is entirely removed, as illustrated in Fig. 11. The horizontal synchronizing pulses are then fed into the horizontal sweep circuit 22.

The horizontal sweep circuit 22 contains the

gas triode 27, in the plate circuit of which is connected a condenser 38, which is charged through resistor 33 from the "B" supply. Resistor 39 is used to adjust the maximum horizontal deflection, which may be attained through varying the size of control resistor 33. By the connection 11a, the grid of tube 27 is connected to the horizontal synchronizing separator 21 so that the horizontal pulses cause the grid to go sufficiently positive to ionize the tube 27, whereupon the charge on condenser 38 discharges through resistor 39, the tube 27, and resistor 40 to ground. This discharge current causes a positive voltage to appear on the cathode of the tube 27, due to the voltage drop across resistor 40 which charges condenser 41. This charge leaks off at 13a through resistor 40 in a manner illustrated in Fig. 13, so the cathode remains above ground for a time which is dependent on the time constant of 40 and 41. This effectively raises the bias on the tube 27 between horizontal pulses, and makes this tube less susceptible to random disturbances occurring between the horizontal pulses.

Resistor 39 in the plate circuit of tube 27 serves to prolong the life of this tube and to control the ionization time by limiting the peak current through the tube when it discharges condenser 38.

The voltage across condenser 38 is a saw-tooth of the horizontal scanning frequency and is amplified and applied to the plates 42 for horizontal deflection of the electron ray 30. This saw-tooth wave is illustrated in Fig. 12, and appears in the output connection 12a. A positive feedback connection through condenser 43 and resistor 44 is employed to straighten the charging part of the cycle and to improve the horizontal linearity.

The vertical pulses of 525.00 k. c. are picked off in the elimination filter 20 by the connection 14a and passed through the 525.00 selective amplifier 15 where any remaining horizontal pulses and any remaining video signal are eliminated by frequency selection through the use of a tuned circuit in the grid and the tuned transformer 23 in the plate of the amplifier tube 46. These pure vertical pulses, as illustrated in Fig. 15, are then applied to the grid of the gas triode 17 in the vertical sweep circuit 18, and in the manner similar to that in horizontal sweep circuit 22 the vertical deflection potentials are produced.

The function of the spot extinguisher 47 is to remove the scanning spot from the screen 29 of the cathode-ray tube when there is no signal present. When a signal is present and the horizontal sweep circuit 22 is functioning, a sweep potential of negative polarity from the output of this circuit is applied to the cathode of diode 48. In the plate circuit of this tube a negative voltage is developed across resistors 49 and 50 and applied to the grid of triode 51. This negative voltage holds triode 51 beyond cut-off, and no plate current flows. When there is no horizontal sweep voltage at the output of the horizontal sweep circuit, the bias is removed from triode 51, allowing it to draw plate current through isolating resistor 52 from the D. C. deflection plate potential, causing a voltage drop across resistor 53. This produces an unbalancing in the D. C. potentials applied to the deflection plates and causes the scanning spot to be deflected off the fluorescent screen 29 thereby preventing damage by a stationary spot to the

fluorescent screen material. Resistor 54 and condenser 55 are connected to the opposite plate to balance the resistive and capacitive load presented by triode 51 and resistor 52.

The horizontal and vertical beam-centering controls shown serve to center the pattern traced by the electron ray 30 on the fluorescent screen 29, and correct for any slight mechanical misalignment of the gun structure 31. The second anode 56 is connected to a point 57 on a voltage divider made up of resistors 58 and 59 placed across the centering controls so that the mean D. C. voltage on the deflecting plates is equal to the second anode voltage.

One of the reasons why extremely positive synchronization could not be utilized at the receiver heretofore, was the disturbance caused by the vertical synchronizing pulse in the horizontal circuit, which initiated a low-frequency transient requiring several horizontal-line periods for recovery. In my improved system and method, on the other hand, positive synchronization is effected by virtue of the fact that the vertical synchronizing pulses are substantially filtered out of the horizontal synchronizing wave-train so that a more continuous train of pulses is applied to the horizontal sweep circuit 22, and therefore no transient such as mentioned above can occur.

From the foregoing it will be seen that in my improved method for synchronizing the respective scanning devices at the transmitting and receiving stations, there are mixed the synchronizing signals occurring continuously at the given line frequency with a wave at a radio frequency and which occurs only during intervals at the given field frequency, to obtain thereby the composite synchronizing signal as illustrated in Fig. 5. Considering the broader aspect of my invention, this resides in use of the source of synchronizing signals 11 occurring continuously at the given line frequency, use of the wave 10 at radio frequency and which occurs only during the intervals at field frequency, as illustrated in Fig. 4, and use of suitable means for mixing the synchronizing signals 11 and the intermittently occurring radio wave to obtain the composite synchronizing signal as illustrated in Figs. 5, 6, 6a and 7.

Considering the broader aspect of my invention further, this resides in a system and method such as that disclosed herein, whereby it is possible to use aperiodic sweep circuits for horizontal and vertical deflection. In such case, the vertical sweep circuit 18 would be responsive to frequencies from 20 cycles to 100 cycles, and the horizontal sweep circuit 22 would be responsive to frequencies from 5000 cycles to 20,000 cycles. An aperiodic sweep circuit, as called for in the claims, is intended to be a sweep circuit which is responsive to control pulses or signals which might vary in frequency over a substantial range, i. e., a frequency range of which the highest frequency is from four to five times the lowest frequency; and which has such a characteristic of frequency-response without requiring synchronization or tuning adjustments.

The feasibility of using aperiodic sweep circuits, as in my improved system and method, results in a very important advantage, which is that the entire system is flexible in the sense that the respective frequencies of the pulses transmitted for horizontal and vertical synchronizing might be changed as occasions or re-

quirements might arise, and the sweep circuits at the receiver would still respond satisfactorily without requiring synchronization or tuning adjustments. If the scanning frequencies are changed in my improved system, it may be necessary to adjust the resistances 26 and 33 to get the proper output sweep amplitudes.

The specific frequencies and values given and the types of tubes designated in the drawings are by way of example only, and may be changed to suit particular requirements.

Considering the broader aspect of my invention, this resides, in one respect, in the provision of a "trigger-type" vertical sweep circuit, which differs from previously disclosed circuits for the same purpose in that selected, radio-frequency pulses for vertical synchronizing are applied directly to the grid of a discharge device 17 by means of a radio-frequency transformer 23. It will be understood that the synchronizing pulses can be applied by means other than a transformer, or they may be passed through selective amplifiers other than transformer-coupled and detected before application to the discharge device 17.

While a high vacuum tube could be employed in the same manner as the gas-discharge tube 17, the latter is independent of pulse amplitude, shape, etc., whereas the saw-tooth output of a high vacuum discharge tube would vary considerably with shape and amplitude of incoming signal.

A further point in the above connection is that the output of the selective amplifier 15 may be applied to synchronize a blocking tube, or other type of sweep oscillator, either directly as radio-frequency or detected separately and applied to the circuit.

The vertical-sweep discharge device may be of the non-oscillating type, or adjusted so that it is non-oscillating when no signal is present. By virtue of the selective system and type of synchronizing pulse, it is possible to employ the non-oscillating type sweep.

Important features of construction and operating action in my improved television receiver may be enumerated as follows. There are the radio-frequency, vertical-pulse synchronizing circuit; the constant-amplitude discharge-tube circuit through the use of gas tubes; one-stage synchronizing separator for horizontal synchronizing; "spot" protection operating on deflection plates; transformer-coupled horizontal-sweep output circuit; "noise" blocking in the horizontal discharge circuit; and "noise-free" operation of both non-oscillating sweep circuits.

Both synchronizing separating circuits, or circuits which accomplish separation in a like manner on the new type of synchronizing as disclosed herein and in my copending application referred to, can be readily applied to sweep circuits employing oscillators. This is an important aspect of my invention, because a blocking tube oscillator can be driven, or synchronized tightly enough so that it is for all practical purposes an aperiodic device. Electromagnetic deflection may be employed as well as electrostatic.

It will be understood that various modifications, within the conception of those skilled in the art, are possible without departing from the spirit of my invention or the scope of the claims.

I claim as my invention:

1. In a television receiving system, a scanning device for reproducing the transmitted view,

means for effecting scanning action of said device in one sense at a given line frequency, means for effecting scanning action of said device in another sense at a given field frequency, means for receiving a composite video and synchronizing signal comprising a continuous train of synchronizing pulses occurring at said given line frequency and mixed with synchronizing pulses of a wave occurring at regular intervals and at a rate corresponding to said given field frequency, said wave being at a frequency substantially greater than said given line frequency, and having a duration greater than the interval between synchronizing pulses that occur at line frequency, means comprising a filter for partial elimination of said wave and clipping means for removing video signals for separating from said composite synchronizing signal said first-named pulses at said line frequency and applying such separated line pulses to said first-named means to control the same, means comprising said first named filter for partial elimination of the video signal and said line frequency synchronizing pulses, and a filter for substantially complete elimination thereof for selecting from said composite synchronizing signal said pulses of said wave and applying such selected wave pulses to said second-named means to control the same, and means for applying video signals to said scanning device without interruption during successive field periods.

2. In a television receiving system, a cathode-ray tube for reproducing the transmitted view and comprising a screen and means for developing a ray of electrons directed at said screen, means for deflecting said ray in one sense at a given line frequency, means for deflecting said ray in another sense at a given field frequency, means for receiving a composite synchronizing signal comprising a continuous train of synchronizing pulses occurring at said given line frequency and mixed with synchronizing pulses of a wave occurring at regular intervals and at a rate corresponding to said given field frequency, said wave being at a frequency substantially greater than said given line frequency, and having a duration greater than the interval between synchronizing pulses that occur at line frequency, means comprising a filter for partial elimination of said wave and clipping means for removing video signals for separating from said composite synchronizing signal said first-named pulses at said line frequency and applying such separated line pulses to said first-named ray-deflecting means to control the same, means comprising said first named filter for partial elimination of the video signal and said line frequency synchronizing pulses, and a filter for substantially complete elimination thereof for selecting from said composite synchronizing signal said pulses of said wave and applying such selected wave pulses to said second-named ray-deflecting means to control the same, and means for applying video signals to said cathode-ray tube without interruption during successive field periods.

3. In a television receiving system, a scanning device for reproducing the transmitted view, means for effecting scanning action of said device in one sense at a given line frequency, means for effecting scanning action of said device in another sense at a given field frequency, means for obtaining a source of composite television signal comprising video signal at one polarity

and a continuous train of synchronizing pulses at the opposite polarity and occurring at said given line frequency and synchronizing pulses of a wave mixed with said first-named pulses at said opposite polarity and occurring at regular intervals and at a rate corresponding to said given field frequency, said wave being at a frequency substantially greater than said given line frequency, and having a duration greater than the interval between synchronizing pulses that occur at line frequency, means comprising a filter for partial elimination of said wave and clipping means for removing video signals for removing from said composite television signal said video signal and said pulses of said wave to obtain substantially only said first-named pulses at said line frequency for application to said first-named means to control the same, means comprising said first named filter for partial elimination of the video signal and said line frequency synchronizing pulses, and a filter for substantially complete elimination thereof for selecting from said composite television signal said wave pulses to the exclusion of said video signal and said synchronizing pulses at said line frequency for application of such selected wave pulses to said second-named means to control the same, and means for applying video signals to said cathode-ray tube without interruption during successive field periods.

4. In a television receiving system, a scanning device for reproducing the transmitted view, means for effecting scanning action of said device in one sense at a given line frequency, means for effecting scanning action of said device in another sense at a given field frequency, means for obtaining a source of composite synchronizing signal comprising a continuous train of synchronizing pulses occurring at said given line frequency and mixed with synchronizing pulses of a wave occurring at regular intervals and at a rate corresponding to said given field frequency, said wave being at a frequency substantially greater than said given line frequency, and having a duration greater than the interval between synchronizing pulses that occur at line frequency, means comprising a filter for partial elimination of said wave and an additional filter for more complete elimination of said wave for separating from said composite synchronizing signal said first-named pulses at said line frequency and applying such separated pulses to said first-named means to control the same, means comprising said first named filter for partial elimination of said line frequency synchronizing pulses, and a filter for substantially complete elimination thereof for selecting from said composite synchronizing signal said pulses of said wave and applying such selected wave pulses to said second-named means to control the same, said fifth-named means including a selective amplifier tuned to a frequency corresponding to that of said wave, and means for supplying video signals to said scanning device and without interruption during successive field periods.

5. In a television receiving system, a scanning device for reproducing the transmitted view, means for effecting scanning action of said device in one sense at a given line frequency, means for effecting scanning action of said device in another sense at a given field frequency, means for obtaining a source of composite synchronizing signal comprising a continuous train of syn-

chronizing pulses occurring at said given line frequency and mixed with synchronizing pulses of a wave occurring at regular intervals and at a rate corresponding to said given field frequency, said wave being at a frequency substantially greater than said given line frequency, and having a duration greater than the interval between synchronizing pulses that occur at line frequency, means comprising a filter for partial elimination of said wave and an additional filter for more complete elimination of said wave for separating from said composite synchronizing signal said first-named pulses at said line frequency and applying such separated pulses to said first-named means to control the same, means comprising said first named filter for partial elimination of said line frequency synchronizing pulses, and a filter for substantially complete elimination thereof for selecting from said composite synchronizing signal said pulses of said wave and applying such selected wave pulses to said second-named means to control the same, said fifth-named means including a selective amplifier tube having a grid circuit tuned to the desired band of frequencies and a plate circuit tuned to the desired band of frequencies corresponding to the frequencies involved in the selection of said wave pulses, and means for supplying video signals to said scanning device and without interruption during successive field periods.

6. A television receiving system comprising means for receiving video signals and a composite synchronizing signal which comprises a continuous train of synchronizing pulses occurring at line frequencies mixed with synchronizing pulses of a wave occurring at regular intervals and at a rate corresponding to field frequency, said wave being at a frequency substantially greater than said line frequency and having a duration greater than the interval between synchronizing pulses that occur at line frequency, together with a scanning device comprising a cathode-ray tube having a fluorescent screen and means for developing a ray of electrons and directing it at said screen, means for causing said ray to scan said screen, said means comprising a horizontal sweep circuit and a vertical sweep circuit, said horizontal sweep circuit comprising a sweep generator adapted to be automatically controlled in frequency by the rate of incoming horizontal synchronizing pulses over a range in frequency of approximately two to one and said vertical sweep circuit comprising a sweep generator adapted to be automatically controlled in frequency by the rate of incoming vertical synchronizing pulses over a range in frequency of approximately two to one.

7. A television receiving system comprising means for receiving video signals and a compos-

ite synchronizing signal which comprises a continuous train of synchronizing pulses occurring at line frequencies and mixed with synchronizing pulses of a wave occurring at regular intervals and at a rate corresponding to field frequency, said wave being at a frequency substantially greater than said line frequency and having a duration greater than the interval between synchronizing pulses that occur at line frequency, together with a scanning device comprising a cathode-ray tube having a fluorescent screen and means for developing a ray of electrons and directing it at said screen, means for causing said ray to scan said screen, said means comprising a horizontal sweep circuit and a vertical sweep circuit, said horizontal sweep circuit comprising a filter for partial elimination of said wave and an additional filter for more complete elimination of said wave and a sweep generator adapted to be automatically controlled in frequency by the rate of incoming horizontal synchronizing pulses over a range in frequency of approximately two to one and said vertical sweep circuit comprising a filter for partial elimination of said line frequency synchronizing pulses and a filter for substantially complete elimination thereof and a sweep generator adapted to be automatically controlled in frequency by the rate of incoming vertical synchronizing pulses over a range in frequency of approximately two to one.

8. A television receiving system comprising means for receiving video signals and a composite synchronizing signal which comprises a continuous train of synchronizing pulses occurring at line frequencies and mixed with synchronizing pulses of a wave occurring at regular intervals and at a rate corresponding to field frequency, said wave being at a frequency substantially greater than said line frequency and having a duration greater than the interval between synchronizing pulses that occur at line frequency, together with a scanning device comprising a cathode-ray tube having a fluorescent screen and means for developing a ray of electrons and directing it at said screen, means for causing said ray to scan said screen, said means comprising a horizontal sweep circuit and a vertical sweep circuit, said horizontal sweep circuit comprising a sweep generator adapted to remain inactive until horizontal synchronizing signals are applied thereto and cause its frequency to be the same as the frequency of said horizontal synchronizing signals, and said vertical sweep circuit comprising a sweep generator adapted to remain inactive until vertical synchronizing signals are applied thereto and cause its frequency to be the same as the frequency of said vertical synchronizing signals.

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