

Aug. 18, 1942.

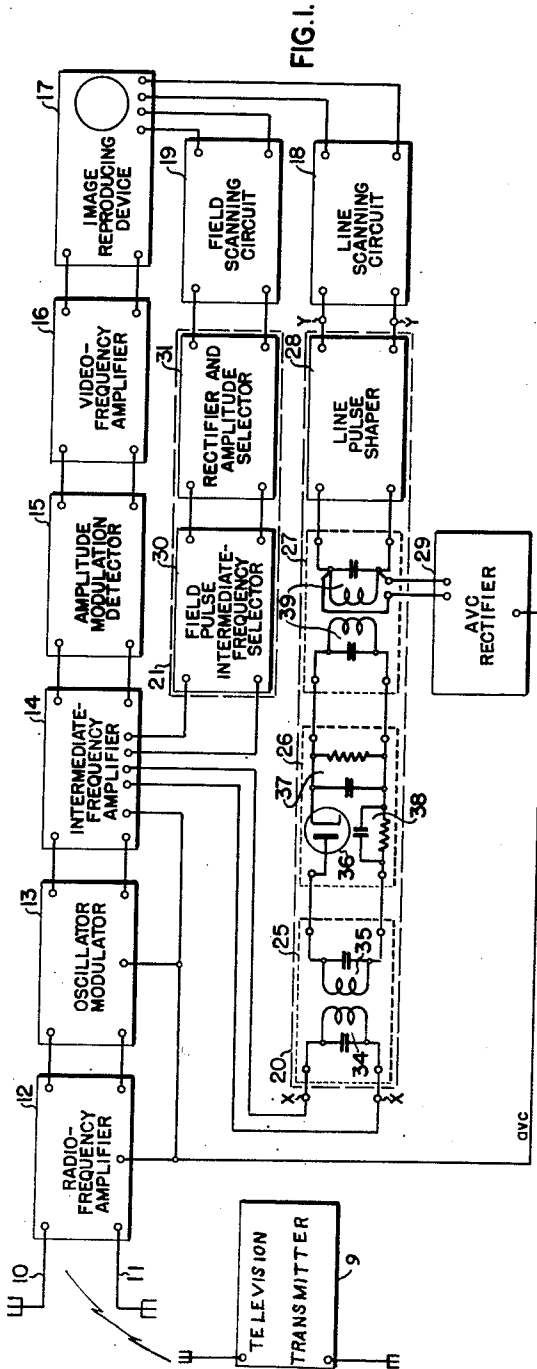
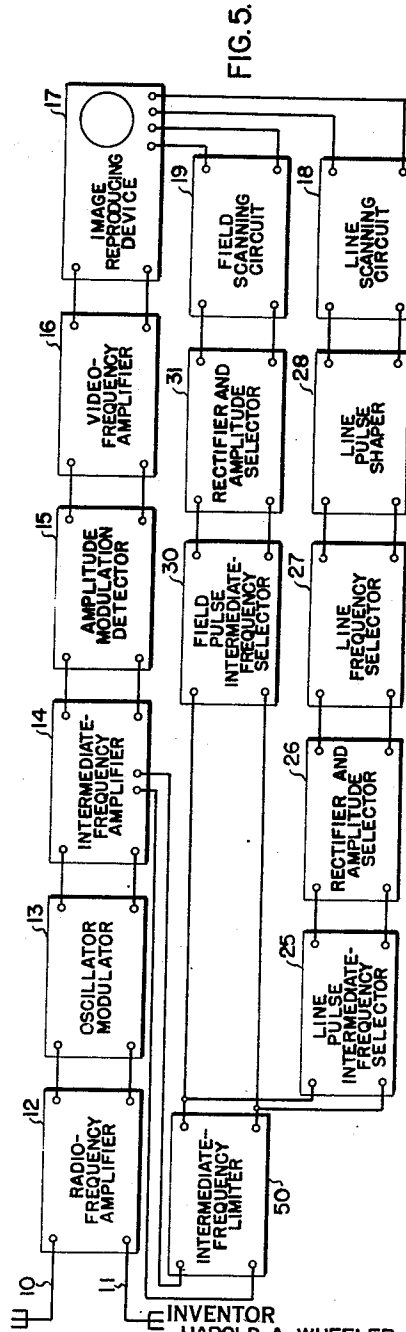
H. A. WHEELER

2,293,233

TELEVISION RECEIVER

Filed Feb. 7, 1940

2 Sheets-Sheet 1



INVENTOR
HAROLD A. WHEELER
BY *Lawrence B. Rodda*
ATTORNEY

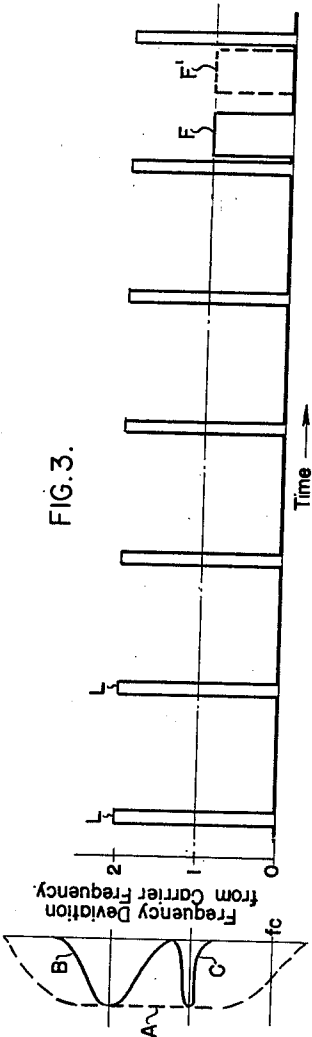
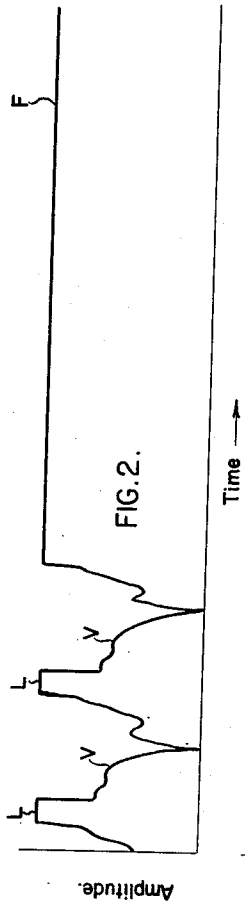
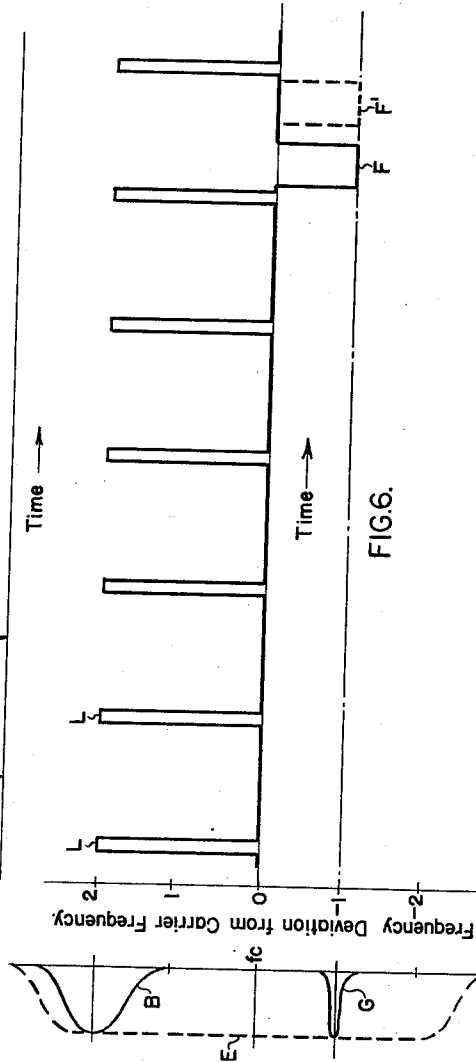
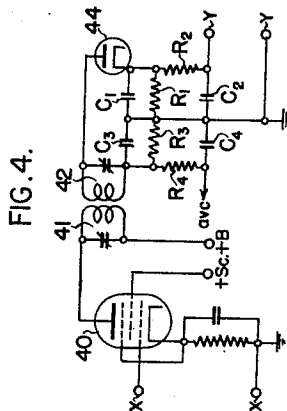
Aug. 18, 1942.

H. A. WHEELER
TELEVISION RECEIVER

2,293,233

Filed Feb. 7, 1940

2 Sheets-Sheet 2



INVENTOR
HAROLD A. WHEELER
BY *Lawrence B. Dodds*
ATTORNEY

UNITED STATES PATENT OFFICE

2,293,233

TELEVISION RECEIVER

Harold A. Wheeler, Great Neck, N. Y., assignor
to Hazeltine Corporation, a corporation of Del-
aware

Application February 7, 1940, Serial No. 317,628

10 Claims. (Cl. 178-6.8)

This invention relates to television receivers and is particularly concerned with the provision of an improved television receiver for receiving a carrier wave amplitude-modulated with video signals and frequency-modulated with synchronizing signals.

It has been proposed, in United States Letters Patent No. 2,254,435, granted September 2, 1941, on the application of Arthur V. Loughren, to provide a television system utilizing rectilinear scanning at the transmitter and the receiver in which the video signals are transmitted as amplitude modulation on a carrier wave during the trace intervals of the scanning cycle and in which the synchronizing signals of the system are transmitted as frequency modulation on the same carrier wave during the retrace intervals. Such a system has the advantage of reserving the full amplitude-modulation range for the transmission of video signals and is further advantageous in that relatively simple and efficient arrangements are available for deriving, at the receiver, the composite transmitted synchronizing signal separate from all video-signal components and for deriving the transmitted video-signal components separate from all synchronizing-signal components. However, even in such systems, the problem of separating the synchronizing signals of one type from those of another type still remains and it is, therefore, desirable to provide a receiver for reproducing a carrier wave of the type under discussion in which simple and effective means are provided for separating line-synchronizing and field-synchronizing signals.

It is an object of the invention, therefore, to provide an improved television receiver adapted to receive a carrier wave amplitude-modulated with video-signal components and frequency-modulated with synchronizing-signal components.

It is a further object of the invention to provide a television receiver of the general type under discussion which comprises a fast-acting means for automatically controlling an operating characteristic of the receiver, such as the amplification, in accordance with the amplitude of the received signal.

In accordance with the invention, there is provided in a television system including a transmitter adapted to transmit a carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration synchronizing pulses of one type, preferably line-synchronizing pulses, to a predeter-

mined deviation and by relatively long duration synchronizing pulses of another type, preferably field-synchronizing pulses, to a deviation of lesser magnitude than the first-mentioned deviation, a television receiver comprising, a relatively broadly-selective carrier-frequency selector circuit responsive to the carrier-frequency deviations by the synchronizing pulses of the one type, and a relatively narrowly-selective carrier-frequency selector circuit responsive to the carrier-frequency deviations by the synchronizing components of the other type. There is coupled to the broadly-selective circuit means for deriving synchronizing signals of the one type for the receiver, and there is coupled to the narrowly-selective circuit means for deriving synchronizing signals of the other type for the receiver.

In accordance with a preferred embodiment of the invention, the field-synchronizing pulses occur between line-synchronizing pulses and the carrier-frequency deviations of the television signal for transmitting both line-synchronizing and field-synchronizing pulses are in the same direction. A transmitter for generating and transmitting a wave of this general type is fully described in copending application of Arthur V. Loughren, Serial No. 317,622, filed concurrently with the present application.

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.

Fig. 1 of the drawings is a schematic circuit diagram of a system including a television receiver of the superheterodyne type constructed in accordance with the invention; Figs. 2 and 3 are graphs used to illustrate certain of the operating characteristics of the receiver of Fig. 1; Fig. 4 is a circuit diagram of a portion of the line-synchronizing channel of the receiver of Fig. 1; Fig. 5 is a schematic circuit diagram of a television receiver including a modification of the synchronizing-signal channel of the receiver of Fig. 1; and Fig. 6 is a graph utilized to explain certain of the operating characteristics of the modification of the invention illustrated in Fig. 5.

Referring now to Fig. 1, the system there illustrated comprises a receiver of the superheterodyne type constructed in accordance with the present invention and adapted to be utilized in a television system including a transmitter 9 which may be generally similar to that disclosed

in the aforementioned Patent 2,254,435 but adapted to develop and transmit a carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration synchronizing pulses of one type to a predetermined deviation and by relatively long duration synchronizing pulses of another type to a deviation of lesser magnitude than the first-mentioned deviation. This receiver includes an antenna system 10, 11, to which are connected, in the order named, a radio-frequency amplifier 12, an oscillator-modulator or frequency changer 13, an intermediate-frequency amplifier 14, an amplitude-modulation detector 15, a video-frequency amplifier 16, and an image-reproducing device 17 preferably of the cathode-ray type. Preferably, as explained below, the stages 12, 13, and 14 are designed for single-sideband reception. A line-scanning circuit 18 is also coupled to amplifier 14 by way of line-synchronizing signal-deriving apparatus 20, hereinafter described in more detail. A field-scanning circuit 19 is also coupled to amplifier 14 by way of a field-synchronizing signal-deriving circuit 21 hereinafter described in more detail. The circuits 18 and 19 are coupled to the scanning elements of signal-reproducing device 17 in a conventional manner and preferably include conventional synchronizing circuits which are adapted to be controlled by synchronizing impulses developed by apparatuses 20 and 21, respectively. The elements or units 10-19, inclusive, may all be of any conventional well-known construction so that detailed illustrations and descriptions thereof are unnecessary herein.

Referring briefly to the general operation of the receiving system, television signals are selected by antenna circuit 10, 11, amplified in radio-frequency amplifier 12, and converted in frequency changer 13 into intermediate-frequency signals. The intermediate-frequency signals are, in turn, selectively amplified in the intermediate-frequency amplifier 14 and delivered to the detector 15. The video-modulation components of the signal are developed by the amplitude-modulation detector 15 and are supplied to the video-frequency amplifier 16 wherein they are amplified and from which they are supplied in the usual manner to a brightness-control electrode of signal-reproducing device 17. The intermediate-frequency signal is also supplied from the amplifier 14 to the apparatuses 20 and 21 wherein line-synchronizing signals and field-synchronizing signals, respectively, are derived as explained hereinafter, the line-synchronizing and field-synchronizing components being applied to the control circuits of the scanning circuits 18 and 19 in a conventional manner. Saw-tooth current or voltage scanning waves are developed by the line-scanning and field-scanning circuits 18 and 19 and applied to the scanning elements of the signal-reproducing device 17 to produce electric scanning fields, thereby to deflect the intensity-modulated scanning beam in two directions normal to each other so as to trace successive fields of parallel lines on the target of the tube to reconstruct the transmitted image.

Referring now more particularly to the portions of the system of Fig. 1 involving the present invention, and particularly to the synchronizing-signal deriving apparatuses 20 and 21, there is comprised in apparatus 20 a line-synchronizing pulse intermediate-frequency selector 25 to

which are coupled in cascade, in the order named, a rectifier and amplitude selector 26, a line-frequency selector 27, and a line-pulse shaper 28. An automatic amplification control or A. V. C. rectifier 29 is also coupled to line-frequency selector 27 and has an output circuit coupled to one or more of the units 12, 13, and 14 to control the amplification of the receiver inversely in accordance with the received signal amplitude. The line-pulse intermediate-frequency selector 25 comprises a band-pass selector including coupled tuned circuits 34, 35. The rectifier and amplitude selector 26 comprises a diode 36 having a load circuit including two time constants due to resistor-condenser combinations 37 and 38. The time constant of the combination 38 is long with reference to the period of the line pulses so that a bias is provided for diode 26 to effect a proportional cutting of the applied signal in a manner understood in the art and the time constant of combination 37 is such that line-frequency components of the signal are developed thereacross for application to selector 37. Selector 37 comprises a band-pass selector including coupled tuned circuits 39, 39. The apparatus 21 comprises a field-pulse intermediate-frequency selector 30 coupled to intermediate-frequency amplifier 14 and having coupled in cascade therewith a rectifier and amplitude selector 31, the output circuit of which is coupled to field-scanning circuit 19. Units 30 and 31, respectively, may comprise circuits similar to those described with reference to units 25 and 26.

In considering the operation of the portion of the receiver of Fig. 1 constituting the present invention, it will be assumed that the received modulated-carrier wave is of the type illustrated in Figs. 2 and 3 of the drawings. A transmitter for generating and transmitting a modulated-carrier wave of this type is fully described in the above-mentioned application of A. V. Loughren. The transmitted signal comprises a modulated-carrier wave amplitude-modulated by video-signal components during the trace portions of the scanning cycle and frequency-modulated by relatively short duration line-synchronizing pulses, during line-retrace intervals, to a predetermined deviation and by relatively long duration field-synchronizing pulses, during field-retrace intervals and between line-synchronizing pulses, to a deviation in the same direction as the predetermined deviation but of lesser magnitude. One-half of the amplitude-modulation envelope of the received carrier is illustrated in Fig. 2 wherein the transmitted signal is represented as having a predetermined peak or unmodulated amplitude L during the line-retrace intervals during which line synchronizing pulses are transmitted and an amplitude F during the field-retrace intervals during which field-synchronizing pulses are transmitted, the amplitudes L and F being equal. The amplitude of the transmitted carrier wave is varied or modulated during trace intervals in accordance with the video-signal components being transmitted, as indicated by the portions V of the curve of Fig. 2.

The frequency deviation of the carrier wave during the occurrence of line-synchronizing pulses is indicated by pulses L of Fig. 3 while the frequency deviation of the carrier wave during the occurrence of field-synchronizing signals is indicated by the pulse F of Fig. 3. It is thus seen that, during line-synchronizing pulses, the

received carrier wave has a frequency deviation or modulation of two units as referred to Fig. 3 and that, during field-synchronizing pulses, the received carrier wave has a deviation or modulation of one unit. It is furthermore seen that the field-synchronizing pulse F occurs between line-synchronizing pulses so that there is no interruption of the line-synchronizing pulses during the field-synchronizing pulses. It is further noted that the deviation of the carrier frequency representing the line-synchronizing pulses is in the same direction as the deviation representing the field-synchronizing pulses. In case a double interlaced scanning cycle is utilized in the system, the field-synchronizing pulse succeeding pulse F preferably has a relationship to the line-synchronizing pulses as illustrated by the dotted pulse F'.

The band-pass characteristics of certain portions of the receiver circuit of Fig. 1 are illustrated by the band-pass curves to the left in Fig. 3. Thus, the units 12, 13, and 14 preferably have band-pass characteristics of the shape of curve A, the carrier frequency of the system during the interval when video-signal components are being transmitted being located at the half-amplitude point on the slope of the characteristic A in a conventional manner, as indicated by the line f_c . The over-all selective characteristic of units 25, 26, and 27 is illustrated by curve B, the unit 25 thus effectively comprising a relatively broadly-selective carrier-frequency selector, while the over-all selective characteristic of the units 30 and 31 is illustrated by curve C, the unit 30 thus effectively comprising a relatively narrowly-selective carrier-frequency selector circuit.

It is thus seen that the receiver of Fig. 1 is effective to operate as a conventional amplitude-modulation receiver insofar as the transmitted video-signal components are concerned. In considering the line-synchronizing channel of the system, it will be seen that, since the carrier wave is deviated by two units, with reference to Fig. 3, during the line-synchronizing pulses, the selective properties of units 25, 26, and 27, as represented by curve B, are effective to separate the line-synchronizing components from the transmitted wave. Rectifier 26 is a conventional rectifier and comprises means for amplitude-selecting only amplitude values above a predetermined value in order to derive line-synchronizing signals for the receiver substantially free of all other signal components. It is apparent that video-signal components, as well as noise components, may lie within the frequency range of the response characteristic of curve B. However, the amplitude of these components is small with reference to the peak-amplitude carrier wave of the line-synchronizing pulses so that, due to the amplitude-selecting properties of unit 26, substantially only line-synchronizing pulses are fed to unit 27, wherein they are further selected, and afterwards shaped in the unit 28 for application to the line-scanning circuit 18. The units 26 and 27 thus comprise amplitude-selecting means coupled to the above-mentioned relatively broadly-selective carrier-frequency selector for deriving line-synchronizing components. Inasmuch as the amplitude of the signal transmitted by unit 27 varies in accordance with the peak amplitude of the received signal and contains substantially no components of the transmitted signal other than line-synchronizing components, the A. V. C. rectifier 29, 75

which is excited from unit 27, may be designed with a time constant which only need be long compared to the period of the line-synchronizing pulses so that it is effective to provide a fast-acting automatic amplification control bias, or control effect, for the receiver for controlling the amplification of the receiver inversely in accordance with the received signal amplitude, in a manner which will be understood by those skilled in the art.

In considering the operation of the field-synchronizing channel of the receiver of Fig. 1, it will be seen that the field-synchronizing pulses F are selected by field-pulse selector 30 with an amplitude equal to the peak amplitude of the carrier wave. While video-frequency components are present within the frequency pass band of selector 30, which is represented by curve C of Fig. 3, the amplitudes of these components are small with respect to the peak amplitude of the transmitted carrier wave representing the field-synchronizing pulses. Also, while line-synchronizing components are present within the frequency pass band represented by curve C, these components are within such pass band only for the extremely short intervals required to sweep the carrier frequency through this pass band, which is dependent on the steepness of the edges of the line-synchronizing pulses. Therefore, only an extremely small amount of energy is applied to the field-synchronizing channel during such intervals, while the field-synchronizing pulse F is of appreciable duration and supplies considerable energy to the field-synchronizing channel. Amplitude selection is also provided in unit 31 in a manner similar to that described above for unit 26 so that only signal components above a predetermined amplitude value are supplied to field-scanning circuit 19 and the input thereto thus comprises substantially only field-synchronizing pulses. The unit 31 thus effectively comprises amplitude-selecting means coupled to the above-mentioned narrowly-selective circuit for deriving field-synchronizing signals for the receiver.

Preferably, the frequency deviation of the carrier wave represented by the pulses L of Fig. 3, which is used to transmit the line-synchronizing pulses, is many times the line-scanning frequency of the system, for example, 500 kilocycles, which is many times 13 kilocycles. Also, the band width of curve B of Fig. 3 is preferably many times the line-scanning frequency of the system, for example, 500 kilocycles. The band width of curve C of Figs. 1 and 3 is at least as great as the line-scanning frequency of the system and preferably greater, for example, 100 kilocycles.

In Fig. 4 there is illustrated a modification of the line-synchronizing channel of Fig. 1 which can be substituted in the receiver of Fig. 1 by connecting points X, X and Y, Y to correspondingly marked terminals of the circuit of Fig. 1. The circuit of Fig. 4 comprises a line-pulse intermediate-frequency selector including vacuum tube 40 having input electrodes coupled to terminals X, X and output electrodes coupled through band-pass selector 41, 42 to the detector and amplitude selector 44. Detector 44 is a diode having a load network including series-connected resistors R_1 and R_3 , by-passed, respectively, by condensers C_1 and C_3 , the resistor R_1 being shunted by series-connected resistor R_2 and condenser C_2 , and the resistor R_3 being shunted by series-connected resistor R_4 and condenser C_4 .

The operation of the circuit of Fig. 4 will be readily apparent when considered in connection with the description given above with reference to corresponding portions of Fig. 1, and it will be understood that the line-pulse intermediate-frequency selector including vacuum tube 40 and selector circuit 41, 42 may have a characteristic generally as indicated by curve B of Fig. 3. Detector 44 is thus effective to detect components of these frequencies and, by proper selection of the time constants of the branches of its load network, may be made to provide an output at terminals Y, Y which is limited to amplitude values above a predetermined value so that line-synchronizing components are effectively selected from noise components and video-signal components which may appear within the frequency range of the band-pass characteristic B. Preferably, the circuit of Fig. 3 is so proportioned that R_1 is much less than R_2 ; C_1, R_1 is much less than C_3, R_3 ; $C_1, R_1 + C_2, R_2$ is much less than a line-scanning period; C_3, R_3 and C_4, R_4 are much greater than a line-scanning period; C_1, R_1 and C_2, R_2 are much greater than the period of the intermediate frequency of the receiver; and $C_3, R_3 + C_4, R_4$ is greater than the period of the field-synchronizing pulses of the system. The diode 44 is thus effective to operate as a multiple time-constant device and to effect a proportional cutting of the signal applied thereto.

While applicant does not intend to be limited to any specific circuit values, the following constants are suggested for the circuit of Fig. 4 and are particularly applicable for a system in which 60-cycle field-synchronizing pulses and 13,230-cycle line-synchronizing pulses are utilized:

C_1 -----	micro-microfarads	100
C_2 -----	do	100
C_3 -----	do	1,000
C_4 -----	do	1,000
R_1 -----	ohms	10,000
R_2 -----	do	10,000
R_3 -----	megohm	1
R_4 -----	do	1

In Fig. 5 there is illustrated a receiver circuit in accordance with the invention and adapted to receive a double-sideband carrier signal amplitude-modulated with video signals during trace intervals and in which line-synchronizing pulses are represented by a frequency modulation or deviation of the carrier frequency in one direction during line-retrace intervals and in which field-synchronizing pulses are represented by a deviation of the carrier frequency in the opposite direction during field-retrace intervals. The receiver of Fig. 5 is generally similar to that of Fig. 1 and similar circuit elements have identical reference numerals. The circuit of Fig. 5 differs from that of Fig. 1 primarily in that units 25 and 30 of Fig. 5 are coupled to the intermediate-frequency amplifier 14 through an intermediate-frequency limiter 50 rather than directly as in Fig. 1.

In considering the operation of the circuit of Fig. 5, it will be assumed that the received carrier wave is amplitude-modulated by video-frequency signals; that both sidebands are transmitted; that the frequency deviation for transmitting line-synchronizing pulses is two units in one direction, as illustrated in Fig. 6; and that the frequency deviation for transmitting field-synchronizing pulses is one unit in the opposite direction, as illustrated in Fig. 6. It will be fur-

ther assumed that the over-all band-pass characteristic of units 12, 13, and 14 of Fig. 5 is of the form illustrated by curve E; that the relationship of the carrier frequency of the received signal thereto is as illustrated by the line f_c of Fig. 6; and that the over-all band-pass characteristic of the line-synchronizing channel of Fig. 5 is exactly similar to that of Fig. 1 and is represented by the band-pass characteristic of curve B of Fig. 6. However, the over-all band-pass characteristic of the field-synchronizing channel, that is, of units 30 and 31 of Fig. 5, is as illustrated by curve G of Fig. 6, in order to provide a selective response to the carrier wave when deviated in frequency in the direction herein arbitrarily chosen as negative, which is utilized to transmit field-synchronizing pulses.

The operation of the receiver of Fig. 5 will be readily apparent to those skilled in the art from the above description of the operation of the receiver of Fig. 1 when it is pointed out that the added circuit element or intermediate-frequency limiter 50 is effective substantially to eliminate all amplitude-modulation components from the input circuits of units 25 and 30. The system of Fig. 5 has the desirable characteristic that only the transmitted line-synchronizing signals are effective to energize units 30 and 31 having the band-pass characteristic illustrated by G of Fig. 6 for the reason that the frequency deviation utilized for transmitting line pulses is in the opposite direction and because video-signal sideband components are effectively eliminated by the amplitude limiting effected in limiter 50. The receiver of Fig. 6 is subject to the limitation that an over-all increased band width is required for the transmission of a given television signal with a given fidelity.

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. In a television system including a transmitter adapted to transmit a modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration synchronizing pulses of one type to a predetermined deviation and by relatively long duration synchronizing pulses of another type to a deviation of lesser magnitude than said predetermined deviation, a television receiver comprising, a relatively broadly-selective carrier-frequency selector circuit responsive to said carrier-frequency deviation by synchronizing components of said one type, a relatively narrowly-selective carrier-frequency selector circuit responsive to said carrier-frequency deviation by synchronizing components of said other type, means coupled to said broadly-selective circuit for deriving synchronizing signals of said one type for said receiver, and means coupled to said narrowly-selective circuit for deriving synchronizing signals of said other type for said receiver.
2. In a television system including a transmitter adapted to transmit a modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration line-synchronizing pulses to a predetermined deviation and by relatively long dura-

tion field-synchronizing pulses to a deviation of lesser magnitude than said predetermined deviation, a television receiver comprising, a relatively broadly-selective carrier-frequency selector circuit responsive to said line-synchronizing carrier-frequency deviations, a relatively narrowly-selective carrier-frequency selector circuit responsive to said field-synchronizing carrier-frequency deviations, means coupled to said broadly-selective circuit for deriving line-synchronizing signals for said receiver, and means coupled to said narrowly-selective circuit for deriving field-synchronizing signals for said receiver.

3. In a television system including a transmitter adapted to transmit a modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration line-synchronizing pulses to a predetermined deviation many times the frequency of said line-synchronizing pulses and by relatively long duration field-synchronizing pulses to a deviation of lesser magnitude than said predetermined deviation, a television receiver comprising, a relatively broadly-selective carrier-frequency selector circuit having a band width many times the frequency of said line-synchronizing pulses and responsive to said line-synchronizing carrier-frequency deviations, a relatively narrowly-selective carrier-frequency selector circuit having a band width at least greater than the frequency of said line-synchronizing pulses and responsive to said field-synchronizing carrier-frequency deviations, means coupled to said broadly-selective circuit for deriving line-synchronizing signals for said receiver, and means coupled to said narrowly-selective circuit for deriving field-synchronizing signals for said receiver.

4. In a television system including a transmitter adapted to transmit a modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration line-synchronizing pulses to a predetermined deviation and by relatively long duration field-synchronizing pulses between line-synchronizing pulses to a deviation of lesser magnitude than said predetermined deviation, a television receiver comprising, a relatively broadly-selective carrier-frequency selector circuit responsive to said line-synchronizing carrier-frequency deviations, a relatively narrowly-selective carrier-frequency selector circuit responsive to said field-synchronizing carrier-frequency deviations, amplitude-selecting means coupled to said broadly-selective circuit for selecting therefrom only amplitude values above a predetermined value to derive line-synchronizing signals for said receiver, and amplitude-selecting means coupled to said narrowly-selective circuit for selecting therefrom only amplitude values above a predetermined value to derive field-synchronizing signals for said receiver.

5. In a television system including a transmitter adapted to transmit a modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively long duration field-synchronizing pulses to a predetermined deviation and by relatively short duration line-synchronizing pulses to a deviation including values outside said predetermined deviation, a television receiver comprising, a carrier-frequency selector circuit selectively responsive to said line-synchronizing carrier-frequency deviations outside said predetermined deviation, means coupled to said selective circuit for deriv-

ing a control effect responsive to variations in a characteristic of said received signal, and means for utilizing said control effect for controlling an operating characteristic of said receiver in response to changes in said characteristic of said received signal.

6. In a television system including a transmitter adapted to transmit a modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration line-synchronizing pulses to a predetermined deviation and by relatively long duration field-synchronizing pulses between line-synchronizing pulses to a deviation of lesser magnitude than said predetermined deviation, a television receiver comprising, a relatively broadly-selective circuit responsive to said line-synchronizing carrier-frequency deviations, a relatively narrowly-selective circuit responsive to said field-synchronizing carrier-frequency deviations, means coupled to said broadly-selective circuit for deriving a control effect responsive to variations in a characteristic of the received signal, and means for utilizing said control effect for controlling an operating characteristic of said receiver.

7. In a television system including a transmitter adapted to transmit a modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration line-synchronizing pulses to a predetermined deviation and by relatively long duration field-synchronizing pulses between line-synchronizing pulses to a deviation of lesser magnitude than said predetermined deviation, a television receiver comprising, a relatively broadly-selective circuit responsive to said line-synchronizing carrier-frequency deviations, a relatively narrowly-selective circuit responsive to said field-synchronizing carrier-frequency deviations, means coupled to said broadly-selective circuit for deriving a control effect responsive to the amplitude of the received signal, and means for utilizing said control effect for controlling the amplification of said receiver inversely in accordance with the received signal amplitude.

8. In a television system including a transmitter adapted to transmit a single-sideband modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration line-synchronizing pulses to a predetermined deviation within said amplitude-modulation sideband and by relatively long duration field-synchronizing pulses to a deviation in the same direction as said predetermined deviation but of lesser magnitude, a television receiver comprising, a relatively broadly-selective carrier-frequency selector circuit responsive to said line-synchronizing carrier-frequency deviations, a relatively narrowly-selective carrier-frequency selector circuit responsive to said field-synchronizing carrier-frequency deviations, means coupled to said broadly-selective circuit for deriving line-synchronizing signals for said receiver, means coupled to said narrowly-selective circuit for deriving field-synchronizing signals for said receiver, and means for selecting and reproducing said single-sideband video-signal components of said carrier wave.

9. In a television system including a transmitter adapted to transmit a modulated-carrier wave amplitude-modulated by video-signal components and frequency-modulated by relatively short duration line-synchronizing components to

a predetermined deviation and by relatively long duration field-synchronizing pulses to a deviation in the opposite direction from said predetermined deviation, a television receiver comprising, a relatively broadly-selective carrier-frequency selector circuit responsive to said line-synchronizing carrier-frequency deviations, a relatively narrowly-selective carrier-frequency selector circuit responsive to said field-synchronizing carrier-frequency deviation, means coupled to said broadly-selective circuit for deriving line-synchronizing signals for said receiver, means coupled to said narrowly-selective circuit for deriving field-synchronizing signals for said receiver, and means for reproducing said video-signal components of a received carrier wave.

10. In a television system including a transmitter adapted to transmit a double-sideband modulated-carrier wave amplitude-modulated by

5 video-signal components and frequency-modulated by relatively short duration line-synchronizing components to a predetermined deviation and by relatively long duration field-synchronizing pulses to a deviation in the opposite direction from said predetermined deviation, a television receiver comprising, a relatively broadly-selective carrier-frequency selector circuit responsive to said line-synchronizing carrier-frequency deviations, a relatively narrowly-selective carrier-frequency selector circuit responsive to said field-synchronizing carrier-frequency deviation, means coupled to said broadly-selective circuit for deriving line-synchronizing signals for said receiver, means coupled to said narrowly-selective circuit for deriving field-synchronizing signals for said receiver, and means for reproducing said double-sideband video-signal components of a received carrier wave.

HAROLD A. WHEELER.