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TELEVISION RECEIVER

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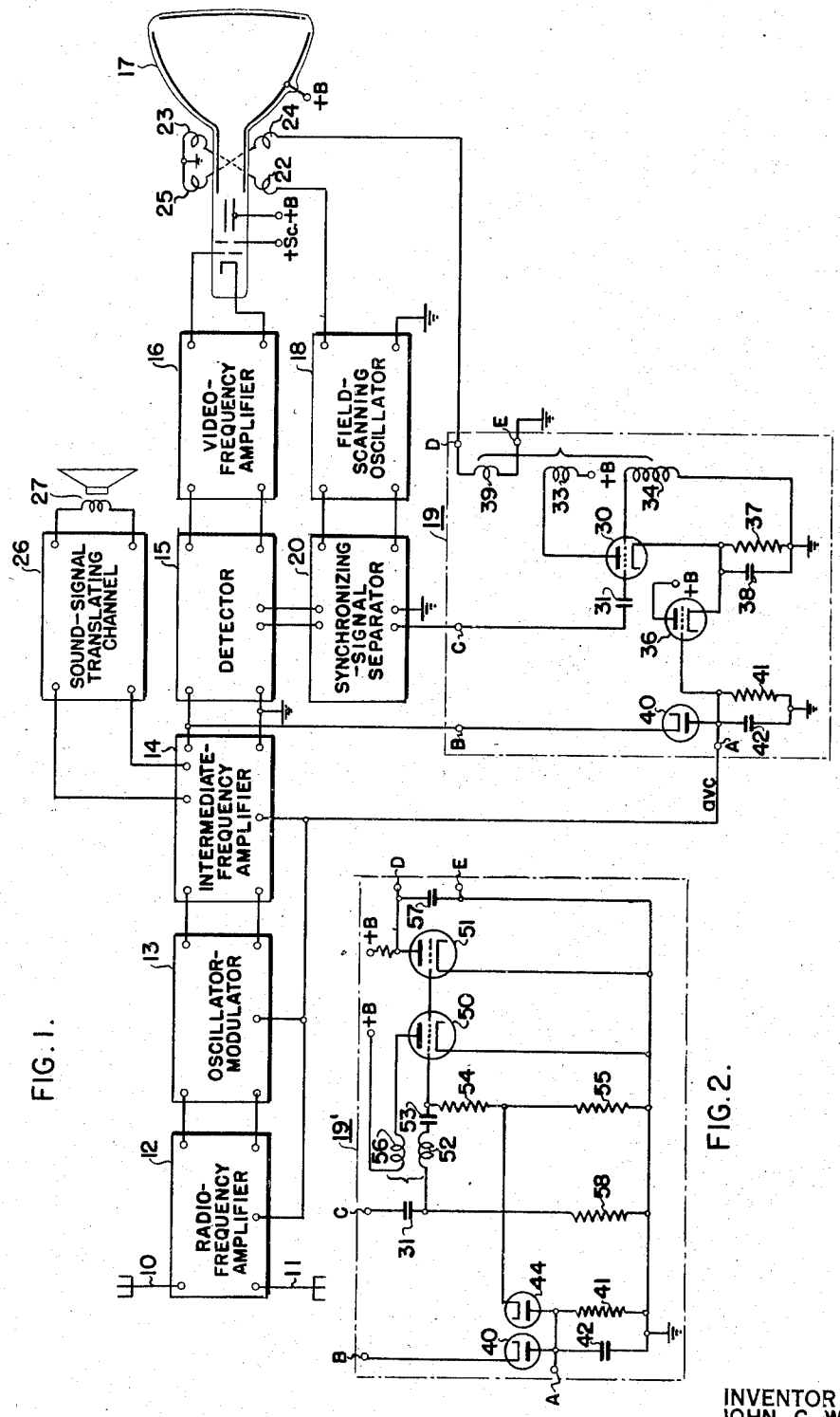


FIG. 1.

FIG. 2.

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TELEVISION RECEIVER

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9 Claims. (Cl. 178—7.5)

This invention relates generally to television receivers and, particularly, to a television receiver incorporating and arrangement for effectively preventing the reproduction of noise from the line-scanning oscillator of the receiver during periods when the oscillator is operative but during which no synchronizing signals are provided therefor, due, for instance, to the fact that no television signal is being received.

It is customary to design a scanning oscillator of a television receiver normally to have a frequency considerably below the frequency corresponding to that of the associated scanning field and to utilize synchronizing signals associated with the received television signal to increase and maintain the oscillator frequency at the proper value. The natural frequency of such an oscillator is made considerably lower than that of the associated scanning field for the reason that such an oscillator usually comprises a discharge device, such as a vacuum tube, the operating potentials of which may vary considerably in use thereby varying its natural frequency. Inasmuch as it is necessary to utilize the synchronizing signals of a received television signal to increase the frequency of the scanning oscillator, it is, therefore, highly desirable to provide an oscillator for normally generating oscillations of a frequency considerably below that of the associated scanning field in order that the frequency of such normally generated oscillations will be lower than that of the associated scanning field, and thus subject to synchronizing control under all normal conditions of operation. Thus, in the absence of a received television signal, the scanning oscillators of conventional television receivers run at considerably lower frequencies than those corresponding to the associated scanning fields when a television signal is being received. Conventionally, a line-scanning frequency of 13,230 cycles per second is utilized and the oscillator in such a receiver is usually designed to have a normal frequency in the vicinity of 10,000 cycles in the absence of a received television signal. Oscillations having a frequency of this order are particularly troublesome for the reason that this frequency is well within the audible range for most users and the frequency is one at which mechanical noise, due to the oscillations, can frequently be heard, even in the absence of a sound-reproducing system associated with the television receiver. Furthermore, oscillations having a frequency in this vicinity may also be particularly troublesome due to the fact that they are cross-coupled into the sound-reproducing apparatus associated with the television receiver. Oscillations at the field-scanning frequency of conventional television signals, that is, 60 cycles per second, are not particularly troublesome due to the fact that sufficient energy at this latter frequency is not readily translated to portions of the system where such energy produces undesirable effects.

It is an object of the invention, therefore, to provide an improved television receiver by means of which one or more of the above-mentioned disadvantages of receivers of the prior art may be eliminated.

It is a further object of the invention to provide a television receiver comprising a line-scanning oscillator, the natural frequency of which is increased during periods when no television signals are being received.

It is a further object of the invention to provide a television receiver comprising a line-scanning oscillator having associated therewith apparatus for preventing noise from being generated at the normal natural oscillator frequency during periods when no television signal is being received.

In accordance with the invention, a television receiver adapted to receive a television signal including line-synchronizing components comprises a line-scanning oscillator, means responsive to a received television signal for deriving a control effect, and means for utilizing the control effect for conditioning the oscillator to generate oscillations at a frequency substantially less than the line-scanning frequency of a television signal being received and for rendering such oscillations inaudible in the absence of a received television signal. The receiver also includes means for utilizing received line-synchronizing components for synchronizing the oscillator at the line-scanning frequency to develop a line scanning field for the receiver.

In accordance with a preferred embodiment of the invention, a television receiver comprises a line-scanning oscillator normally having a predetermined natural frequency for generating oscillations, means responsive to a received television signal for deriving a control effect, and means for utilizing said control effect for decreasing the natural frequency of the oscillator to, and maintaining it at, a value substantially less than the line frequency of the television signal being received. Means are also provided for utilizing line-synchronizing components associated with the received television signal for synchronizing the oscillator at the line-scanning frequency of

the received signal to develop a line-scanning field for the receiver.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Fig. 1 of the drawing is a circuit diagram, partly schematic, of a complete television receiver of the superheterodyne type embodying a line-scanning oscillator in accordance with the present invention; while Fig. 2 is a circuit diagram of a modification of the portion of the circuit of Fig. 1 comprising the present invention.

Referring now more particularly to Fig. 1 of the drawing, the system represented comprises a receiver of the superheterodyne type including an antenna system 10, 11 connected to a radio-frequency amplifier 12 to which is connected in cascade, in the order named, an oscillator-modulator 13, an intermediate-frequency amplifier 14, a detector 15, a video-frequency amplifier 16, and an image-reproducing device 17. A field-scanning oscillator 18 and a line-scanning oscillator 19 are coupled to an output circuit of detector 15 through a synchronizing-signal separator 20, the field-scanning oscillator 18 and the line-scanning oscillator 19 being coupled to the field-deflecting windings 22, 23 and the line-deflecting windings 24, 25, respectively, of the image-reproducing device 17. A sound signal-translating channel 26 and associated loudspeaker 27 are coupled to an output circuit of intermediate-frequency amplifier 14 in order to translate and reproduce sound signals accompanying the received television program. The stages or units 10—27, inclusive, with the exception of unit 19, presently to be described, 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 system described above, television signals intercepted by antenna circuit 10, 11 are selected and amplified in radio-frequency amplifier 12 and coupled to the oscillator-modulator 13, wherein they are converted into intermediate-frequency signals which, in turn, are selectively amplified in the intermediate-frequency amplifier 14 and delivered to the detector 15. The modulation components of the signal are derived by the 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 brilliancy-control electrode of the image-reproducing device 17. Modulation components derived in detector 15 are also supplied through synchronizing-signal separator 20 to the synchronizing-control elements of field-scanning oscillator 18 and line-scanning oscillator 19. The intensity of the scanning ray of device 17 is thus modulated or controlled in accordance with the video-signal voltages impressed upon its control electrode in the usual manner. Scanning waves are generated by the field-scanning oscillator 18 and the line-scanning oscillator 19, which are controlled by synchronizing-voltage pulses supplied from detector 15 through synchronizing-signal separator 20, and applied to the scanning elements of the image-reproducing device 17 to reproduce electric scanning fields, thereby to deflect the scanning ray in two directions normal to each other so as to trace a rectilinear scanning pattern on the screen and thereby reconstruct the transmitted image.

Referring now, more particularly, to the portion of the system of Fig. 1 embodying the present invention, unit 19 comprises a line-scanning oscillator of the E/L type comprising a vacuum tube 30 to the input electrodes of which line-synchronizing signals are applied through a coupling condenser 31. The oscillator 19 comprises an inductance 33 in the anode circuit of tube 30 and an inductance 34 in the grid-cathode circuit of tube 30, the inductance 34 being regeneratively inductively coupled to inductance 33. A suitable normal bias is provided for vacuum tube 30 by means of a cathode resistor 37 by-passed for alternating currents by condenser 38. An inductance 39 is connected in series with line-scanning coils 24, 25 and inductively coupled to inductance 33 in the anode circuit of tube 30.

In order to provide a suitable automatic amplification control source for the receiver, there is included in unit 19 a diode 40 coupled across the output circuit of intermediate-frequency amplifier 14 through a suitable time-constant load circuit comprising a resistor 41 and a condenser 42. The voltage across resistor 41 is applied over the conductor designated A. V. C. to one or more of the tubes of radio-frequency amplifier 12, oscillator-modulator 13, and intermediate-frequency amplifier 14 to control the amplification of the translated signal inversely in accordance with the amplitude of the received signal.

In order to provide means responsive to a received television signal for deriving a control effect and means for utilizing said control effect for decreasing the natural frequency of the line-scanning oscillator of the system and for maintaining such natural frequency at a value substantially less than the line-scanning frequency of the television signal being received, the unidirectional voltage developed across resistor 41 is also utilized to supply a control bias for vacuum tube 30, being applied to the grid circuit thereof through a direct current amplifier 36.

In considering the operation of the system just described, it will be seen that there is comprised in unit 19 an oscillator of a conventional type, the operation of which is described in detail, for instance, in United States Letters Patent No. 2,118,977, granted May 31, 1938. Briefly, when the tube 30 becomes conductive, current flows through the inductance 33 and, since the resistance of the anode circuit is small and the reactance of inductance 33 is chosen to be high relative to the internal impedance of the tube 30, the current builds up through the inductance 33 substantially linearly with time. This increasing anode current causes a voltage to be fed back to the grid circuit of tube 30 so as to increase the potential of the grid thereof positively, still further increasing the conductivity of the tube, until current saturation in tube 30 is approached. At this time, the rate of increase of current begins to decrease and the potential of the grid of tube 30 also decreases actually reversing in polarity and building up negatively to an extent such that the tube can be operated to cutoff by a negative synchronizing pulse applied to its input electrode through condenser 31. Upon the termination of the synchronizing pulse, the tube 30 again becomes conductive and the cycle is repeated at the line-scanning frequency. The input potential at which vacuum tube 30 becomes conductive is, in the absence of a received television signal, dependent upon the bias provided by resistor 37. The circuit is so adjusted that, in the absence of a received tele-

vision signal, the oscillations generated by the arrangement have a predetermined natural frequency greater than the line-scanning frequency of the television signals to be received or above the value which would produce undesirable noise in the associated sound channel of the television system and, preferably, a frequency substantially above the audible range so that no disturbing noise is reproduced by the receiver.

In considering the operation of the system under the condition when a television signal is being received, it will be seen that a negative bias, dependent in value upon the amplitude of the received carrier signal, is applied to vacuum tube 30 through the amplifier 36 whenever a television signal is being received so that the unidirectional potential developed across resistor 41 exceeds that developed across resistor 37. The system is so adjusted that, under these conditions when triode 36 is conductive, the natural frequency of the line-scanning oscillator is decreased and maintained at a value substantially less than the line-scanning frequency of the system. As pointed out above in the preliminary portion of the specification, this is the manner in which line-scanning oscillators are conventionally designed and the received line-synchronizing pulses are, therefore, effective to synchronize the scanning of the oscillator in the normal manner.

The embodiment illustrated in Fig. 2 is substantially similar to unit 19 of Fig. 1 and circuit elements which are similar in the two figures have identical reference numerals. The unit 19' of Fig. 2 may be connected into the receiver of Fig. 1 by connecting the terminals of Fig. 2 to correspondingly-marked terminals of the receiver of Fig. 1 and substituting scanning plates for the windings 24, 25. The oscillator of Fig. 2 differs from that of Fig. 1 primarily in the fact that a conventional type of blocking oscillator is utilized. This blocking oscillator of Fig. 2 comprises vacuum tubes 50 and 51. There is included in the input circuit of vacuum tube 50 in series with coupling condenser 31 a series-connected inductance 52, a condenser 53, and resistors 54 and 55. An inductance 56 is connected in the output circuit of tube 50 and inductively coupled to the inductance 52. The control electrode of vacuum tube 51 is connected directly to the control electrode of vacuum tube 50 while there is included in the output circuit of vacuum tube 51 a condenser 57 coupled across the output terminals D, E of the unit 19'. A resistor 58 is coupled between the common junction of condenser 31 and inductance 52 and ground.

In considering the operation of the circuit of Fig. 2, and neglecting for the moment the function performed by the diode 44, it will be seen that the circuit comprises a blocking oscillator of a conventional type and that, when a synchronizing signal is applied positively through condenser 31, the condenser is immediately charged due to the small time constant of resistor 58 and condenser 31, and the control electrode of tube 50 is thereby rendered more positive to cause the tube 50 to become conductive. The tube 50 is regenerated by the feed-back winding 56 and completes one-half cycle of oscillation at the natural frequency of the grid circuit during which condenser 53 acquires a sufficient negative charge to block tube 50. The condenser 53 then discharges slowly through the circuit including resistors 54, 55, and 58 and inductance 52 until the negative potential of the control electrode of tube 50 is reduced to such a value that the tube will be rendered conductive upon a succeeding synchronizing pulse being applied to terminal C. The time constant of condenser 31 and resistor 58 is made to be quite small relative to the time constant of the closed circuit including condenser 53 and resistors 54, 55, 58. The grid potential of tube 50 is also applied to tube 51, which can be considered to be an amplifying tube, the condenser 57 performing the function of a wave-shaping element in the circuit.

In considering the operation of the circuit of Fig. 2 under the condition when diode 44 becomes nonconducting, it will be seen that the time constant of the grid circuit of tube 50 is thereby increased to decrease the natural frequency of the oscillator. The circuit of Fig. 2, therefore, also comprises means responsive to a received television signal for effectively decreasing the natural frequency of the oscillations of unit 19' to, and maintaining it at, a value substantially less than the line-scanning frequency of the television signal being received, together with means for utilizing line-synchronizing components derived from the received television signal and applied to terminal C of unit 19' for synchronizing the oscillator at the line-scanning frequency to develop a line-scanning field for the receiver. At the same time, in the absence of a received television signal, the natural frequency of the line-scanning oscillator is sufficiently high to avoid reproduction of disturbing audible oscillations. Specifically, in the circuit of Fig. 2, a control voltage is developed across resistor 41 and tube 44 is a biased unilaterally-conductive device through which the control voltage is applied to the oscillator to effect the desired control.

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 receiver adapted to receive a television signal including line-synchronizing components and comprising, a line-scanning oscillator, means responsive to a received television signal for deriving a control effect, means for utilizing said control effect for conditioning said oscillator to generate oscillations at a frequency substantially less than the line-scanning frequency of a television signal being received and for rendering said oscillations inaudible in the absence of said received television signal, and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

2. A television receiver adapted to receive a television signal including line-synchronizing components and comprising, a line-scanning oscillator normally having a predetermined natural frequency for generating oscillations, means responsive to a received television signal for deriving a control effect, means for utilizing said control effect to decrease the natural frequency of said oscillator to, and maintain it at, a value substantially less than the line-scanning frequency of said television signal being received,

and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

3. A television receiver adapted to receive a television signal including line-synchronizing components and comprising, a line scanning oscillator normally having a natural frequency greater than the line-scanning frequency of television signals to be received for generating oscillations, means responsive to a received television signal for deriving a control effect, means for utilizing said control effect to decrease the natural frequency of said oscillator to, and maintain it at, a value substantially less than the line-scanning frequency of said television signal being received, and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

4. A television receiver adapted to receive a television signal including line-synchronizing components and comprising, a line-scanning oscillator normally having a natural frequency greater than that which is audible at said receiver for generating oscillations, means responsive to a received television signal for deriving a control effect, means for utilizing said control effect to decrease the natural frequency of said oscillator to, and maintain it at, a value substantially less than the line-scanning frequency of said television signal being received, and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

5. A television receiver adapted to receive a television signal including line-synchronizing components and comprising, a line-scanning oscillator normally having a predetermined natural frequency for generating oscillations, means responsive to the amplitude of the received television signal for deriving a control effect, means for utilizing said control effect to decrease the natural frequency of said oscillator to, and maintain it at, a value substantially less than the line-scanning frequency of said television signal being received, and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

6. A television receiver adapted to receive a television signal including line-synchronizing components and comprising, a line-scanning oscillator normally having a predetermined natural frequency for generating oscillations, means responsive to the amplitude of the carrier signal of the received television signal for deriving a control effect, means for utilizing said control effect to decrease the natural frequency of said oscillator to, and maintain it at, a value substantially less than the line-scanning frequency of said television signal being received, and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

7. A television receiver adapted to receive a television signal including line-synchronizing components and including an automatic amplification control source comprising, a line-scanning oscillator normally having a predetermined natural frequency for generating oscillations, means responsive to said automatic amplification control source for deriving a control effect, means for utilizing said control effect to decrease the natural frequency of said oscillator to, and maintain it at, a value substantially less than the line-scanning frequency of said television signal being received, and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

8. A television receiver adapted to receive a television signal including line-synchronizing components and comprising, a line-scanning oscillator normally having a predetermined natural frequency for generating oscillations, means responsive to a received signal for developing a bias voltage, means for utilizing said bias voltage for deriving a control effect, means for utilizing said control effect to decrease the natural frequency of said oscillator to, and maintain it at, a value substantially less than the line-scanning frequency of said television signal being received, and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

9. A television receiver adapted to receive a television signal including line-synchronizing components and comprising, a line-scanning oscillator normally having a predetermined natural frequency for generating oscillations, means responsive to a received signal for developing a control voltage, a biased unilaterally-conductive device, means for applying said control voltage to said oscillator through said device for decreasing the natural frequency of said oscillator to, and maintaining it at, a value substantially less than the line-scanning frequency of said television signal being received, and means for utilizing said received line-synchronizing components for synchronizing said oscillator at said line-scanning frequency to develop a line-scanning field for said receiver.

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