April 11, 1944. H. J. DE N. McCOLLUM 2,346,499

TELEVISION APPARATUS

Filed Aug. 5, 1942

Fig. 1.

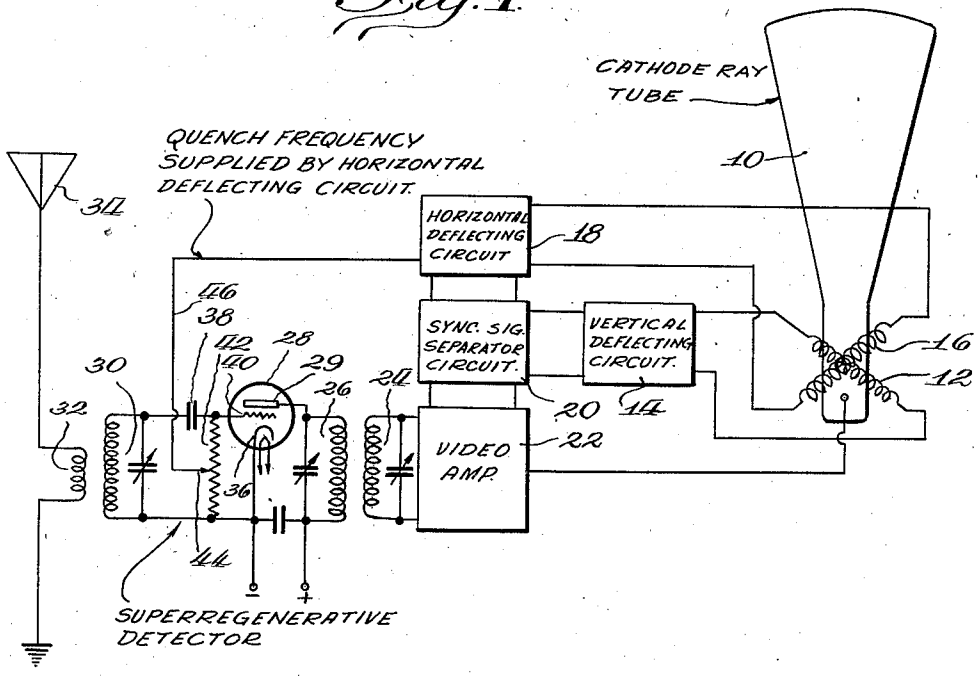
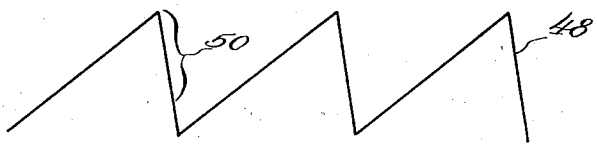


Fig. 2.



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3 Claims. (Cl. 178—7.5)

My invention relates generally to television apparatus, and more particularly to improvements in the radio frequency amplifier for apparatus of this type.

In television apparatus, particularly receivers, the cost of the radio frequency amplifier and detector represents a substantial portion of the cost of the complete apparatus, since a number of stages of amplification are required.

It is an object of my invention to provide an improved radio frequency amplifier and detector which may be produced at a low cost, which is simple, and which is capable of transmitting an adequately wide band of frequencies.

A further object is to provide an improved superregenerative amplifier detector for television receivers in which the quench potential is applied during the return time of the saw-tooth wave provided by the horizontal deflecting circuit of the cathode ray tube.

Other objects will appear from the following description, reference being had to the accompanying drawing, in which:

Figure 1 is a schematic wiring diagram of a television receiver incorporating the invention; and

Figure 2 shows the wave form of the horizontal deflecting circuit.

Superregenerative oscillator - detector - amplifier circuits are known to provide high gain and to be extremely sensitive to weak signals. Such circuits are, however, not generally used in radio receivers because of the difficulty of tuning them sharply. However, the very high carrier frequencies used in the transmission of television signals, and the breadth of the band, necessarily make it desirable that the tuning be rather broad so that there will be a minimum of distortion of the video signal.

It has not been found possible, in the past, to use a superregenerative oscillator-detector-amplifier in a television receiver in the manner it may be used in radio receivers, because the time during which the oscillation is quenched may coincide with the reception of a video or synchronizing signal and may thus result in the blanking out or distortion of a portion of the image on the screen of the cathode ray tube. This difficulty has been overcome by my invention, in which means are provided to synchronize the application of the quenching potential (upon the regenerative oscillator grid) with the return sweep of the horizontal deflection impulse. Thus, though the superregenerative circuit is ineffective to transmit the received signal during a substantial portion of the time, such interruption does not affect the image appearing upon the screen of the cathode ray tube or in any other way affect the operation of the receiver.

The invention is shown in Fig. 1 as forming part of a television receiver, which, in the main, may be of conventional construction and is diagrammatically illustrated as including a cathode ray tube 10, the vertical deflecting coils 12 of which are coupled to a vertical deflecting circuit, indicated as a block 14, while the horizontal deflecting coils 16 of which are indicated as coupled to a horizontal deflecting circuit, shown as a block 18. Both the horizontal deflecting circuit and the vertical deflecting circuit are coupled to a synchronizing signal separator circuit 20, the latter being supplied with its signal from a video amplifier 22, the video amplifier supplying the necessary signal to the control grid of the cathode ray tube 10.

The video amplifier receives its signal through a broadly tuned input circuit 24, which is inductively coupled with the tuned output circuit 26 of a superregenerative detector, including an electron discharge device 28. The oscillator is illustrated as having the device 28 in the form of a triode having its plate 29 connected to a suitable terminal of a plate current supply system through the broadly tuned mesh 26. The input circuit for the tube 28 comprises a tuned inductance capacitance mesh 30, which is inductively coupled to the antenna coil 32 connected between an antenna 34 and ground.

One terminal of the tuned mesh 30 is connected to the cathode 36 of the triode 28, and thus connected to a negative terminal of a suitable power supply system, while the other terminal of the mesh 30 is connected through a condenser 38 to the grid 40 of the triode 28. A grid resistor 42 is connected between the grid 40 and cathode 36, and is in the form of a potentiometer having a sliding contactor 44 connected to a conductor 46. The other end of the conductor 46 is connected to any suitable element of the horizontal deflecting circuit at which the potential goes negative during the return portion of the sweep cycle.

As indicated in Fig. 2, the horizontal deflecting circuit generates a saw-tooth wave 48 shown in this figure, having a short return portion during which the potential rapidly drops from its maximum positive value to zero or its lowest negative value. During the return portion of the wave,

the horizontal deflecting circuit is arranged to impress a negative potential upon the conductor 46. If the horizontal deflecting circuit is of such a nature that this negative potential is impressed upon the conductor 46 only during the initial major portion of the return portion of the wave, that is, the portion indicated by the bracket 50 on curve 48, the results will be improved, and, if desired, a suitable phase shifting network may be coupled between the horizontal deflecting circuit and conductor 46 so as to provide a negative impulse only during that portion of the wave included within the bracket 50. This, however, is not essential, since the negative potential may be impressed upon the conductor 46 throughout that portion of the wave 48 during which the potential is decreasing or going negative.

It will be understood that the superregenerative detector will commence oscillation when the most minute signal is impressed upon its grid, and may, in fact, commence oscillation due to thermal agitation. Such oscillation rapidly builds up because of the great amount of feedback through the interelectrode capacitance in the tube 28, which continues until the grid drops to a sufficiently negative value (beyond cutoff) to block oscillation. The circuit elements associated with the tube 28, particularly the values of the condenser 38 and resistor 42, are so chosen that this blocking or quenching of the oscillator will take place at a frequency of approximately, but preferably slightly less than, 15,750 cps., assuming that the receiver is operating at the standard number of frames per second and the standard number of lines per inch, and that, therefore, the horizontal deflecting circuit generates a saw-tooth wave at the frequency of 15,750 cps. Since the superregenerative detector thus tends naturally to be quenched at a frequency close to 15.75 kc., the impulse impressed across a portion of the grid resistor 42, and provided by the horizontal deflecting circuit 18, will be effective to stabilize the quenching or blocking frequency at this value.

As a result, the detector will be blocked only during the intervals that the cathode ray beam is not traversing the screen, so that the quenching or blocking of the superregenerative detector cannot have any effect upon the image produced upon the screen of the cathode ray tube.

In utilizing the invention, the means 24, 26, and 30 are tuned broadly to the carrier frequency. The first carrier frequency impulses impressed upon the grid of the tube 28 will initiate oscillation in the circuits associated with this tube at the frequency of the carrier wave, and in a rather unexplainable manner will result in demodulation of the input signal so that the demodulated video signal (with the synchronizing signals) will be transmitted to the video amplifier 26.

The single electron discharge device 28, with its associated circuits, thus performs the functions of a number of stages of radio frequency amplification and detection. Due to its great simplicity, its use results in a considerable reduction in cost of the receiver, as compared with the present systems using a number of stages for amplification and detection, usually with an undesirably high frequency intermediate stage.

While I have shown and described a particular embodiment of my invention, it will be apparent to those skilled in the art that numerous modifications and variations may be made without departing from the underlying principles of the invention. I therefore desire, by the following claims, to include within the scope of my invention all such modifications and variations by which substantially the results thereof may be obtained by the use of substantially the same or equivalent means.

I claim:

1. In a television receiver having a cathode ray tube for producing the image, a horizontal sweep impulse producing means for said tube, and a video amplifier, the combination of a superregenerative oscillator operating as an amplifier and detector, said oscillator having input and output circuits, means coupling said input circuit to a modulated carrier signal source, means coupling said output circuit to the video amplier, and a circuit deriving an electrical impulse from the horizontal sweep producing means and impressing it upon said oscillator to quench the oscillation thereof in synchronism with the horizontal sweep impulse producing means during the return portion of the sweep impulse produced thereby.

2. In a television receiver having a cathode ray tube for producing the image, a horizontal sweep impulse producing means for said tube, and a video amplifier, the combination of a superregenerative oscillator-detector, said oscillator-detector having input and output circuits, means coupling said input circuit to a modulated carrier signal source, means coupling said output circuit to the video amplifier, and a circuit deriving an electrical impulse from the horizontal sweep producing means and impressing it upon said oscillator-detector to quench the oscillation thereof in synchronism with the horizontal sweep impulse producing means during the initial return portion of the sweep impulse produced thereby.

3. In a cathode ray type television receiver having means providing a saw-tooth wave for horizontal deflection of the cathode ray beam, the combination of a superregenerative oscillator coupled in the receiver to operate as a modulated carrier wave amplifier and detector, and means coupled to the horizontal deflection wave producing means to stabilize the quench frequency of said oscillator in synchronism with the saw-tooth wave and in phase with the substantially vertical portion of said wave.

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