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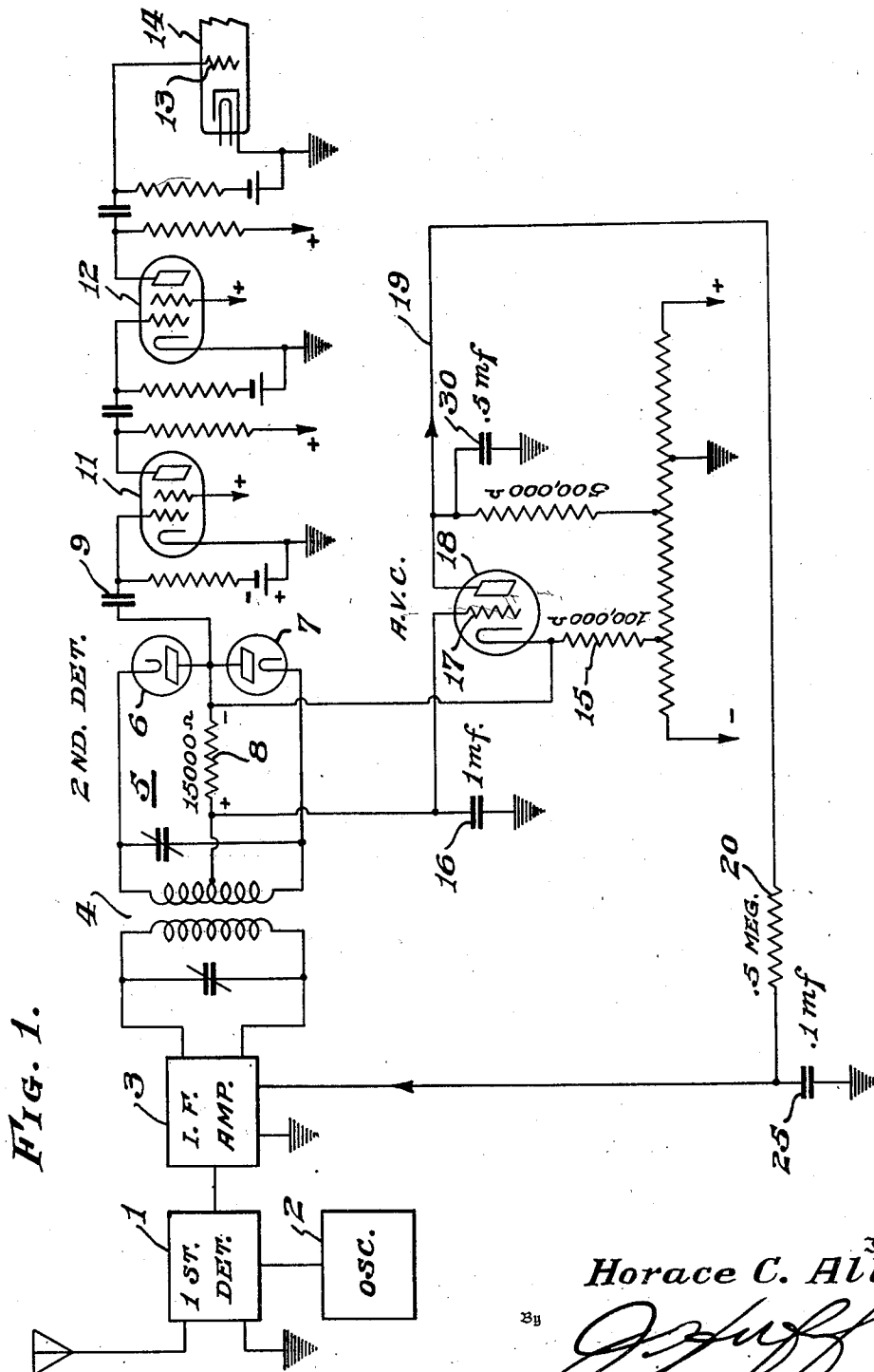
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2,299,292

AUTOMATIC VOLUME CONTROL SYSTEM

Filed Dec. 28, 1939

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

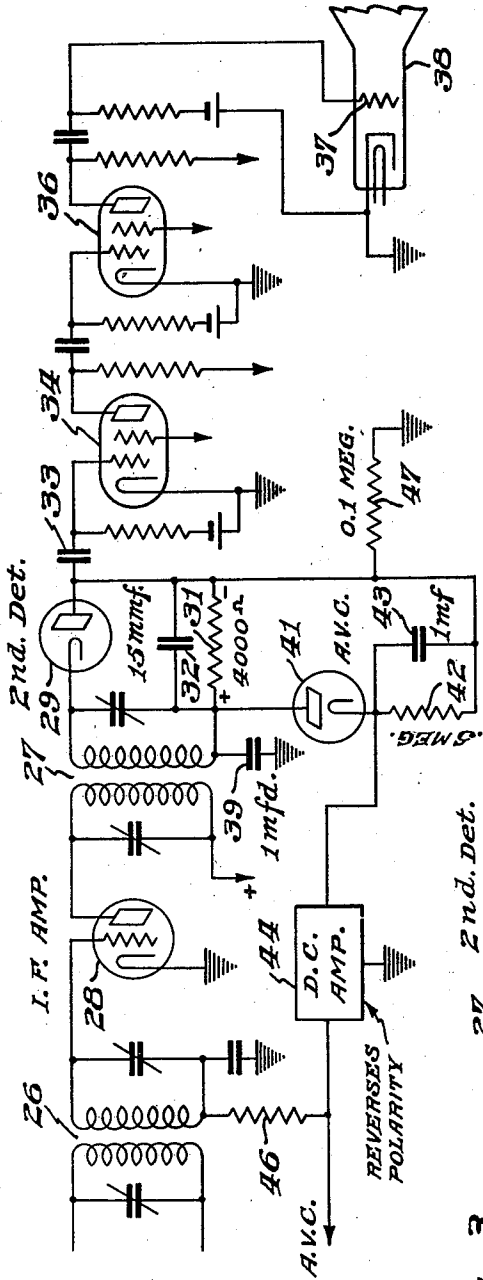


FIG. 2.

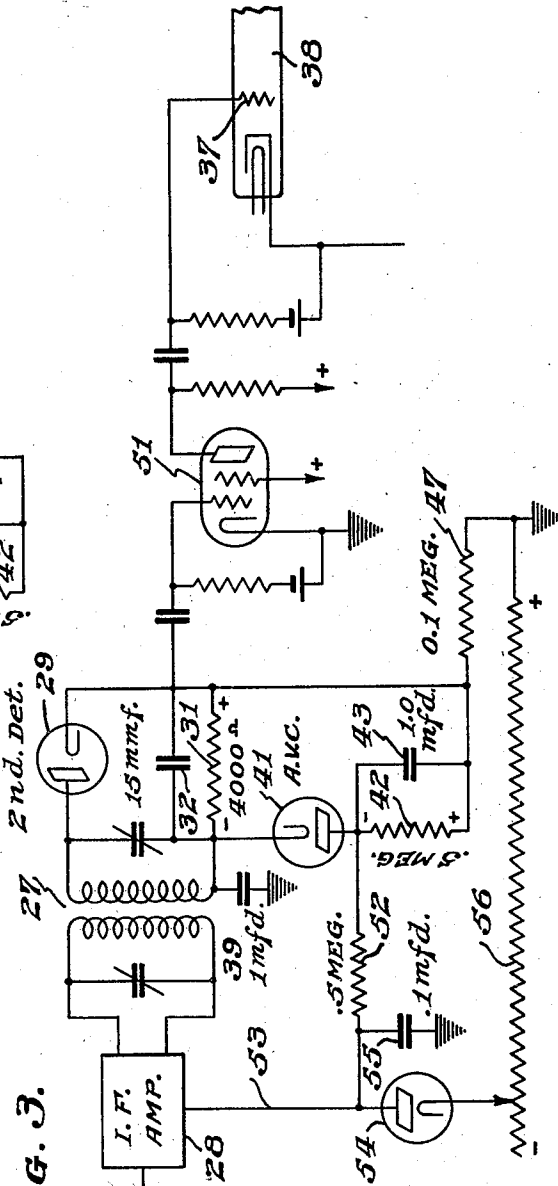


FIG. 3.

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UNITED STATES PATENT OFFICE

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AUTOMATIC VOLUME CONTROL SYSTEM

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3 Claims. (Cl. 178-7.5)

My invention relates to automatic volume control or A. V. C. systems and particularly to A. V. C. systems for use in television receivers.

In some television receiver designs it has been the practice to employ one more video amplifier stage than is required for sufficient amplification in order that the picture signal will be applied to the cathode ray tube with the correct polarity while using a certain desired A. V. C. circuit design. More specifically, it has been considered necessary to take both the video signal being supplied to the cathode ray tube and the signal being supplied to the A. V. C. circuit off the same end of the output resistor of the second detector whereby the polarity required by the A. V. C. circuit determines the number of video stages required for applying signal of the correct polarity to the cathode ray tube.

One object of my invention is to provide an improved receiver design which avoids the above-mentioned difficulty whereby an even number of video amplifier stages may be employed in receivers previously requiring an odd number of stages.

A further object of my invention is to provide an improved television receiver circuit which permits greater flexibility in the application of A. V. C. to the receiver.

In accordance with my invention the receiver is so designed that the video signal which is supplied to the cathode ray tube may be taken off one end of the second detector output resistor while the signal which is supplied to the A. V. C. circuit is taken off the other end of this resistor. In this circuit arrangement one end of the second detector resistor is effectively grounded for the video signals by means of a large capacity condenser instead of being directly connected to ground, whereby the A. V. C. tube may be supplied with signal from this effectively grounded end of the resistor.

The invention will be better understood from the following description taken in connection with the accompanying drawings in which

Figure 1 is a circuit diagram of a television receiver embodying my invention, and

Figures 2 and 3 are circuit diagrams of other embodiments of my invention.

Referring to Fig. 1, there is illustrated a portion of a television receiver of the superheterodyne type comprising the usual first detector 1, tunable oscillator 2, intermediate frequency amplifier 3, and a tuned I. F. transformer 4 feeding into a push-pull second detector 5 which includes diodes 6 and 7.

The second detector 5 includes an output resistor 8 which in the example illustrated has its negative end connected through a coupling condenser 9 to the input circuit of a video amplifier 11. The video signal is supplied through a second video amplifier 12 to the control electrode 13 of a cathode ray tube 14 which may be of conventional construction.

In accordance with my invention, the other end of the output resistor 8, in this example the positive end, is effectively grounded for video signals by means of a large capacity condenser 16. This capacity is indicated on the drawings, by way of example, as being one microfarad.

It will be understood that this television receiver is designed for the reception of the usual television signal comprising picture signals and periodically recurring horizontal and vertical synchronizing pulses, the synchronizing pulses being of greater amplitude than the picture signals and being utilized at the cathode ray tube for blocking the electron beam during the return line periods of horizontal and vertical deflection. Thus it is required that the polarity of signal applied to the grid 13 of the cathode ray tube be such that the synchronizing pulses are applied to the grid 13 with negative polarity in order to block the cathode ray for the duration of each synchronizing pulse. It will be apparent that in the circuit shown in Fig. 1 the signal is applied to the cathode ray tube with the proper polarity by employing an even number of video amplifier stages.

The particular A. V. C. circuit shown in Fig. 1, which in the past has been found to be one of the preferred circuits, requires that the signal applied thereto be of positive polarity. Formerly when this circuit was employed the connections of the diodes in the second detector were reversed and an odd number of video amplifier stages were employed whereby the A. V. C. circuit could be connected to the same end of the second detector output resistor as the video amplifier.

In accordance with my invention, however, the control grid 17 of the A. V. C. tube 18 is connected to that end of the output resistor 8 which is held at ground potential for video frequencies, this, of course, having been made the positive end.

It will be understood that this A. V. C. circuit is of the general type known as an average carrier A. V. C. circuit and that the amount of direct current flow through the output resistor 8 determines the D. C. potential applied to the input electrodes of the tube 18 and therefore the amount of gain control voltage applied over the conductor 19 to the I. F. amplifier 3.

It will be seen that the input electrodes of the A. V. C. tube 18 are direct current connected across the output resistor 8 and that the polarity of connection is such that in response to an increase in the strength of an incoming signal the control grid 17 is made more positive whereby the A. V. C. voltage supplied over the conductor 19 and through the filter resistor 20 becomes more negative to reduce the gain of the I. F. amplifier 3. The filter resistor 20 and a filter condenser 25 comprise the usual smoothing filter employed in A. V. C. circuits.

The A. V. C. tube 18 is provided with a cathode resistor 15 whereby the negative end of the detector output resistor 8 from which video signal is taken is held above ground potential.

Preferably, a by-pass or filter condenser 30 is connected between the plate of the tube 18 and ground.

Referring to Fig. 2, there is illustrated another embodiment of my invention in which a television receiver is especially designed for the reception of a television signal wherein the direct current component is being transmitted. The specific circuit constants which are given on the drawings, by way of example, are for a receiver designed for the reception of a signal transmitted in accordance with present day standards, that is, for the reception of a 443 line picture interlaced with a frame frequency of 30 per second.

The receiver includes the usual tuned I. F. transformers 26 and 27 and I. F. amplifier tube 28 and a second detector diode 29. The second detector circuit includes an output resistor 31 and a shunting condenser 32, the negative end of output resistor 31 being connected through a coupling condenser 33 to the video amplifier comprising two video stages 34 and 36 for supplying picture signal and blanking pulses of the proper amplitude and polarity to the control grid 37 of a cathode ray tube 38.

As in the case of the circuit shown in Fig. 1, the positive end of the detector output resistor 31 is held substantially at ground potential by means of a large capacity condenser 39, whereby the video signal appearing across the resistor 31 is impressed across the input electrodes of video amplifier stage 34.

The A. V. C. circuit is of the type described in Holmes Patent No. 2,109,618, issued March 1, 1938. It may be described as a peak detector circuit which produces an A. V. C. voltage which is a measure of the height of the synchronizing pulses. It comprises a diode 41 which has its plate connected to the positive end of the output resistor 31 and which has its cathode connected through a large impedance resistor 42 to the negative end of the resistor 31. The resistor 42 is shunted by a condenser 43, the resistance and capacity values of the elements 42 and 43 being such that the charges built up in the condenser 43 by the periodically recurring horizontal synchronizing pulses hold over between successive synchronizing pulses except for a small amount of leakage through the resistor 42.

Thus a D. C. voltage appears across resistor 42 which is a measure of the height of the synchronizing pulses and which therefore is a measure of the amplitude of the incoming signal. Since this voltage becomes more positive at the cathode of the diode 41 in response to an increase in signal strength, it is necessary to reverse the polarity of the signal by means of a direct current amplifier 44 or the like before it is applied

through the usual filter resistor 46 to the control grids of the I. F. amplifier tubes.

The direct current circuit for the A. V. C. voltage which is applied to the I. F. amplifiers is completed by means of a resistor 47. This resistor, it will be noted, has such high resistance that the end of the detector output resistor 31 from which the video signal is taken is held well above ground potential.

Referring to Fig. 3, there is shown an embodiment of my invention in which the A. V. C. circuit is similar to that shown in Fig. 2 but in which a single video amplifier is employed. Like parts in the two figures are indicated by the same reference characters.

It will be noted that in Fig. 3 the connections of the detector diode 29 are reversed to permit the use of the single video amplifier stage 51. Likewise the connection of the A. V. C. diode 41 is reversed with the result that the A. V. C. voltage at the plate of the diode 41 becomes more negative with increase in signal strength and may be applied through a filter comprising a resistor 52 and a condenser 55 and through a conductor 53 directly to the I. F. amplifier.

For the purpose of providing delay in the A. V. C. action there may be provided a diode 54 which is so connected between a voltage divider 56 and the junction point of the resistor 52 and the conductor 53 that in the absence of an incoming signal there is a flow of current through the diode 54 and through the resistors 47, 42 and 52.

Upon reception of a weak signal the upper end of resistor 42 will go slightly negative whereby the plate of the diode 54 is made less positive. Therefore, the current through the resistor 52 becomes less, and the total A. V. C. voltage applied to the I. F. amplifier remains substantially constant until the plate of the diode 54 reaches the same potential as its cathode and the flow of diode current stops. From this point on, any further increase in signal strength causes a more negative potential to be applied to the I. F. amplifier.

In Fig. 3, as in Fig. 2, the circuit constants, given by way of example, are indicated in ohms, megohms, microfarads, and micro-microfarads. Also, these particular values are for a receiver designed to receive a television signal transmitted, as above-mentioned, in accordance with the present television standards.

I claim as my invention:

1. In a television receiver for the reception of a modulated carrier wave, a detector for demodulating said carrier wave, said detector including an output resistor, an amplifier for amplifying the output signal appearing across said resistor, said amplifier having input electrodes comprising a control electrode and a cathode, said control electrode being coupled to one end of said output resistor and said cathode being connected to a certain point such as ground, means comprising a large capacity condenser connected between the other end of said output resistor and said certain point for holding said other end at substantially the same potential as that of said cathode for A. C. voltages, and a gain control circuit including a tube having two rectifier electrodes, one of said rectifier electrodes having a D. C. connection to said other end of said output resistor, and the other of said rectifier electrodes also having a D. C. connection to said one end of said output resistor, means comprising a parallel combination of a resistor

and a condenser connected in series with said rectifier electrodes whereby said control tube functions as a peak detector to produce a gain control voltage across said last resistor, and a D. C. connection from said one end of said output resistor to the cathode of said amplifier through a high impedance resistor.

2. In a television receiver for the reception of a carrier wave modulated by picture signals and by synchronizing pulses of greater amplitude than picture signals of like polarity, a detector for demodulating said carrier wave, said detector including an output resistor, an electric discharge tube having input electrodes comprising a control electrode and a cathode, said control electrode being coupled to one end of said output resistor and said cathode being connected to a certain point such as ground, means comprising a large capacity condenser connected between the other end of said output resistor and said certain point for holding said other end at substantially the same potential as that of said cathode for A. C. voltages, and a gain control circuit including a peak detector having at least two electrodes, one of said last two electrodes having a D. C. connection to said other end of said output resistor, and the other of said last two electrodes also having a D. C. connection to said one end of said output resistor, said peak detector being connected in the direction to rectify the peaks of said synchronizing pulses, and a D. C. connection from said one end of said output resistor to the cathode of said amplifier through a high impedance resistor.

3. In a television receiver for the reception of a carrier wave modulated by picture signals and by synchronizing pulses of greater amplitude than picture signals of like polarity, a detector for demodulating said carrier wave, said detector including an output resistor, an amplifier for amplifying the output signal appearing across said resistor, said amplifier having input electrodes comprising a control electrode and a cathode, said control electrode being coupled to one end of said output resistor and said cathode being connected to a certain point such as ground, means comprising a large capacity condenser connected between the other end of said output resistor and said certain point for holding said other end at substantially the same potential as that of said cathode for A. C. voltages, and a gain control circuit including a diode having cathode and plate electrodes, one of said last two electrodes having a D. C. connection to said other end of said output resistor, and the other of said last two electrodes having a D. C. connection to said one end of said output resistor through a parallel combination of a resistor and a condenser, and a D. C. connection from said one of said output resistor to the cathode of said amplifier through a high impedance resistor, the resistance and capacity values of said parallel combination being such as to make said diode function as a peak detector, and said diode being connected in the direction to rectify the peaks of said synchronizing pulses whereby a gain control voltage appears across said parallel combination.

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