Dec. 22, 1942. C. C. MARTINELLI 2,305,931

NOISE LIMITER

Filed Aug. 21, 1941

Fig. 1.

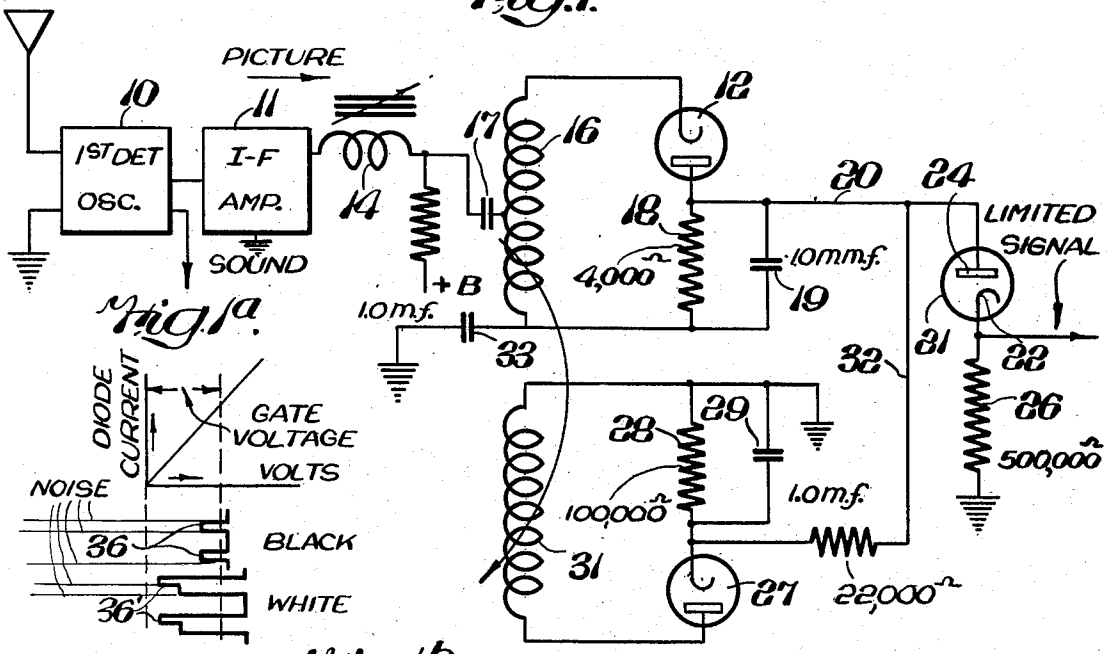


Fig. 1a.

Fig. 1b.

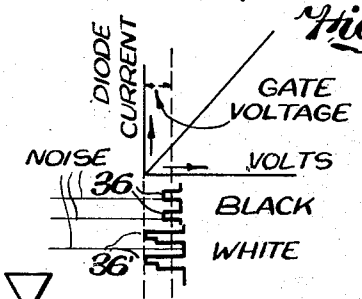
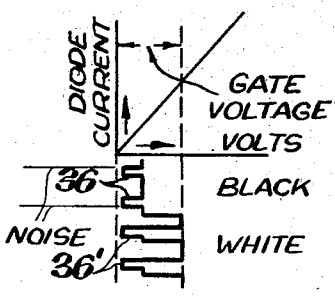


Fig. 2.

Fig. 2a.



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Patented Dec. 22, 1942 2,305,931

UNITED STATES PATENT OFFICE

2,305,931

NOISE LIMITER

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Application August 21, 1941, Serial No. 407,739

5 Claims. (Cl. 178—7.5)

My invention relates to noise limiters for radio receivers and, particularly, to limiters applied to the picture channel of a television receiver.

In my copending application Serial No. 324,239, filed March 16, 1940, and entitled "Noise limiters," there is described and claimed a preferred noise limiter for use in a picture channel, this limiter having a fixed limiter or gate voltage and being direct current connected in the picture channel. With a limiter circuit of this character, the noise clipping level remains fixed regardless of signal strength with the result that, for the weaker incoming signals, the clipping level is substantially beyond a 100% modulated signal. As a result, a substantial part of the noise is not removed.

An object of the present invention is to provide an improved noise limiter, especially adapted for use in the picture channel of a television receiver.

A further object of the invention is to provide an improved noise limiter for the picture channel of a television receiver, the limiter being supplied with a limiter or gate voltage which varies with variations in the strength of the incoming signal.

A still further object of the invention is to provide an improved noise limiter for a picture signal channel in a television system of the type employing direct current transmission.

In one of the preferred embodiments of the invention as applied to a television receiver, a series type noise limiter is coupled to the second detector of the picture channel and supplied with a gate voltage which is obtained from a peak rectifier coupled to the second detector input circuit. The connection is such that the gate voltage depends upon the peak value of the synchronizing pulses and, therefore, changes in response to changes in the signal strength such as those caused by fading or by tuning the receiver to a different television transmitter.

Where the limiter is employed in a picture channel, it is preferred that the picture signal be applied to the limiter through a direct current connection in order that the noise may be clipped off at substantially 100% modulation regardless of changes in the picture background.

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

Figure 1 is a circuit diagram showing one embodiment of the invention applied to a television receiver,

Figures 1*a* and 1*b* are curves which illustrate the operation of the noise limiter shown in Fig. 1,

Figure 2 is a circuit diagram illustrating one of the preferred embodiments of the invention as applied to a television receiver,

Figure 2*a* is a group of curves illustrating the operation of the noise limiter shown in Fig. 2.

In the several figures, like parts are designated by the same reference characters.

Referring to Figure 1, the invention is shown applied to a television receiver comprising a first detector and tunable oscillator **10**, an I.-F. amplifier **11** and a second detector **12**. The detector **12** may be coupled to the amplifier **11** through a coupling circuit comprising a tunable primary coil **14** connected to a point on a secondary coil **16** through a coupling condenser **17**.

In series with the detector diode **12**, there is a load resistor **18** which is shunted by a condenser **19** for bypassing the I.-F. carrier wave.

The video signal appears across resistor **18** and is supplied to the noise limiter circuit which comprises a diode **21** having an anode **24** connected through a conductor **20** to the plate of the second detector **12** and having a cathode **22** connected to ground through a signal output resistor **26**.

The noise limiter operates on the same principle as that described in my above-identified copending application, namely, a limiter or gate voltage is applied to the diode **21** with the proper polarity to cause a flow of diode current while the signal voltage is applied to the limiter circuit with the opposite polarity. Thus, the flow of diode current ceases if the amplitude of noise in the signal voltage exceeds the amplitude of the gate voltage and there is no longer a flow of current through the output resistor **26**.

In accordance with a preferred embodiment of my invention, the gate voltage is obtained by means of a peak rectifier circuit comprising a diode **27** having in series therewith an RC circuit consisting of a resistor **28** and a condenser **29**, the diode **27** and the RC circuit having I.-F. signal applied thereto from a coil **31** which is close coupled to the secondary coil **16**.

The time constant of the RC circuit **28—29** is such that the voltage produced thereacross is a D. C. voltage which changes only with changes in signal strength. This is the gate voltage which is applied to the limiter diode **21** through a circuit which may be traced from the cathode end of resistor **28**, through a resistor **23** and a conductor **32** to the anode **24** of the limiter diode **21**, through the limiter diode and output resistor **26** to ground, and through ground to the other end of resistor **28**. The resistor **23** is provided

to prevent condenser 29 from bypassing resistor 18.

The second detector output is applied across the series combination of limiter diode 21 and output resistor 26 by means of the conductor 20 and a condenser 33 connected between the lower end of resistor 18 and ground, the polarity of the applied signal being that the noise pulses (in the direction of black in the picture) oppose current flow in the diode.

The operation of the above-described limiter circuit is illustrated in Figures 1 and 1*b*. It is assumed that the incoming signal for the picture channel is a negatively modulated carrier wave and that the modulating signal is the usual mixture of picture signal, including the picture D. C. component, and synchronizing signal such as defined by the present R. M. A. standards. The latter signal includes horizontal synchronizing pulses occurring at the end of each scanning line and a slotted vertical synchronizing pulse occurring at the end of each vertical deflection. In Figs. 1*a* and 1*b*, the horizontal synchronizing pulses are indicated at 36 and 36', the pulses 36 occurring during a dark picture, and the pulses 36' occurring during a light picture.

The curves of Figs. 1*a* and 1*b* represent conditions for a strong incoming signal and for a weak incoming signal, respectively. A comparison of the two figures shows that the limiter or gate voltage appearing across resistor 28 (Fig. 1) is greater for the strong signal (Fig. 1*a*) than for the weak signal (Fig. 1*b*). Therefore, more noise is clipped off the weak signal than would be the case if the gate voltage remained at the value required for the stronger signal.

It will be noted that, since the signal is applied to the limiter in Fig. 1 through an A. C. connection (the condenser 33 breaking the D. C. path), the noise is not clipped off as close to the synchronizing pulses for a dark or black picture as for a light or white one. This disadvantage may be avoided by employing the circuit shown in Fig. 2.

Referring to Fig. 2, the gate voltage which appears across resistor 28 and the signal voltage which appears across resistor 18 are applied in series relation to the limiter diode 21 rather than in parallel relation as in Fig. 1. This is done in the example illustrated by connecting the lower end of resistor 18 to the cathode end of resistor 28 through a conductor 41, instead of to ground through a condenser as in the first circuit. It will be seen that the signal output of the second detector is now applied to the limiter through a D. C. coupling.

The advantage of the circuit of Fig. 2 is illustrated in Fig. 2*a*. Since the D. C. component of the picture signal is not lost at the limiter, the synchronizing pulses for pictures having a dark background will remain at the same level as synchronizing pulses for pictures having a light background. Consequently, the same percentage of the noise is removed regardless of the background component of the transmitted picture. It will be understood, also, that the gate voltage varies with changes in signal strength, just as described in connection with Fig. 1, to insure removal of most of the noise for weaker signals as well as for strong signals.

I claim as my invention:

1. A television receiver for the reception of a carrier wave negatively modulated by a composite signal consisting of picture signals and synchronizing pulses, said receiver comprising means for demodulating said received signal to produce picture signals and synchronizing pulses, a signal amplitude limiter which is connected to receive signal from said demodulating means and which comprises a diode and an output resistor connected in series, and peak rectifier means for inserting a direct current voltage in series with said series combination of diode and output resistor with the proper polarity to maintain a flow of current through said diode until the signal to be limited exceeds a predetermined amplitude and with an amplitude that increases in response to an increase in signal strength.

2. A television receiver for the reception of a carrier wave negatively modulated by a composite signal consisting of picture signals and synchronizing pulses and also modulated by a direct current component of the transmitted picture, said receiver comprising means for demodulating said received signal to produce picture signals and synchronizing pulses, a signal amplitude limiter which is direct current connected to said demodulating means and which comprises a diode and an output resistor connected in series, and peak rectifier means for inserting a direct current voltage in series with said series combination of diode and output resistor with the proper polarity to maintain a flow of current through said diode until the signal to be limited exceeds a predetermined amplitude and with an amplitude that increases in response to an increase in signal strength.

3. In a television system of the type in which the direct current component of the picture is transmitted whereby the carrier wave varies in accordance with the changes in background of the transmitted picture and in which the carrier wave is negatively modulated by the picture signal and by synchronizing pulses, a receiver comprising means for demodulating said transmitted picture signals, and a signal amplitude limiter through which the output of said demodulating means is fed to a utilization circuit, said limiter being direct current connected to said demodulating means and comprising a diode and an output resistor connected in series, means for inserting a direct current voltage in series with said series combination of diode and output resistor with the proper polarity to maintain a flow of current through said diode until the signal to be limited exceeds a predetermined amplitude and with an amplitude which varies in accordance with the peak amplitude of said synchronizing pulses, and means for applying said signal across the series combination of diode, output resistor and D. C. voltage with such polarity as to oppose current flow through said diode.

4. A television receiver for the reception of a carrier wave negatively modulated by a composite signal consisting of picture signals and synchronizing pulses and also modulated by the direct current component of the transmitted picture, said receiver comprising means for demodulating said received signal to produce picture signals and synchronizing pulses, said demodulating means including an output resistor, and an amplitude limiter circuit comprising a diode, an output resistor and peak rectifier means for providing a direct current voltage in series with said diode and said output resistor which increases in amplitude in response to an increase in the peak amplitude of said pulses, said series combination of diode, output resistor and direct current means being direct current connected across the output resistor of said demodulating

means, said diode being connected in such a direction in the circuit that the synchronizing pulses appearing across the demodulator output resistor oppose current flow through the diode, and said direct current voltage having the proper polarity to maintain a flow of current through the diode so long as the signal appearing across the demodulator output resistor having the polarity of the synchronizing pulses does not exceed a predetermined amplitude.

5. A television receiver for the reception of a carrier wave negatively modulated by a composite signal consisting of picture signals and synchronizing pulses and also modulated by the direct current component of the transmitted picture, said receiver comprising means for demodulating said received signal to produce picture signals and synchronizing pulses, said demodulating means including an output resistor, and an amplitude limiter circuit comprising a diode, an output resistor and peak rectifier means for providing a direct current voltage in series with said diode and said output resistor which increases in amplitude in response to an increase in the peak amplitude of said pulses, said series combination of diode, output resistor and peak rectifier being direct current connected in series fed relation to the output resistor of said demodulating means, said diode being connected in such a direction in the circuit that the synchronizing pulses appearing across the demodulator output resistor oppose current flow through the diode, and said direct current voltage having the proper polarity to maintain a flow of current through the diode so long as the signal appearing across the demodulator output resistor having the polarity of the synchronizing pulses does not exceed a predetermined amplitude.

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