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REDUCTION OF NOISE

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Fig. 1.

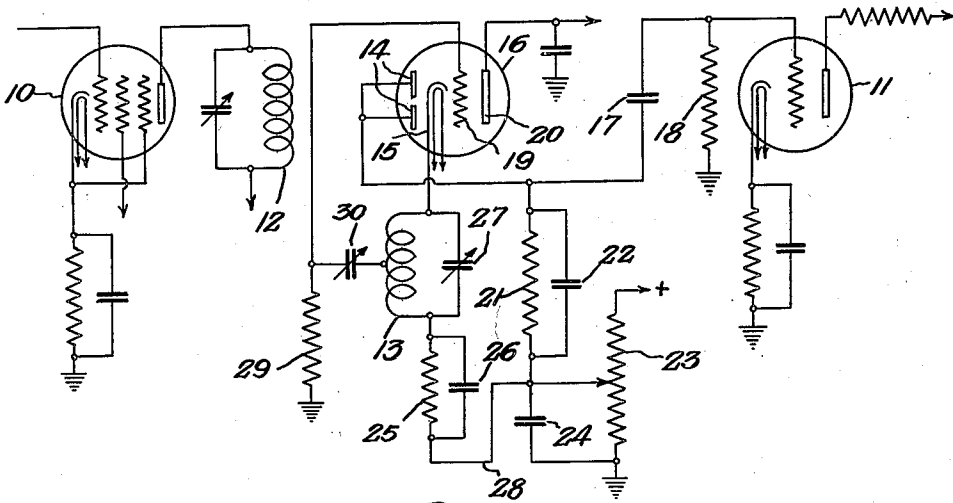
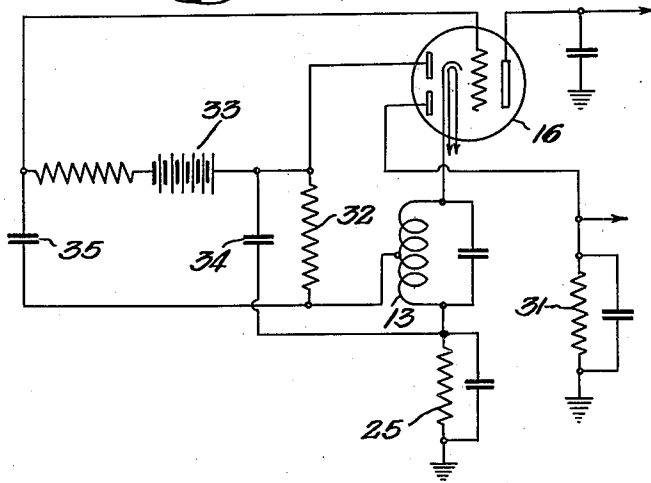


Fig. 2.



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REDUCTION OF NOISE

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6 Claims. (Cl. 250—20)

This invention relates to the reduction of noise such as that produced in radio receivers and like apparatus by impulses extraneous to the signal. It has for its principal object the provision of an improved apparatus and method of operation whereby the efficiency of the signal transmitting channel is varied or controlled to prevent the passage of noise impulses having an amplitude substantially in excess of that of the signal.

Various types of noise reduction systems have been heretofore proposed or used. Some of these systems have involved the use of means for balancing or neutralizing the effect of the impulses which tend to produce noise. Others have involved the use of means for short circuiting, open circuiting, or otherwise controlling the transmitting efficiency of the signal channel during the periods of the impulses which tend to produce objectionable noise. Many of these systems have not been altogether satisfactory for the reason that they do not operate with sufficient accuracy or involve the use of unduly expensive and complicated means for segregating the noise impulses from the signal channel output.

In accordance with the present invention, these difficulties are minimized or avoided by the provision of an improved system including an electron valve or tube arranged to function as a detector in the absence of noise impulses and to interrupt the signal channel in the presence of such impulses.

This invention will be better understood from the following description when considered in connection with the accompanying drawing, and its scope is indicated by the appended claims.

Referring to the drawing:

Fig. 1 is a wiring diagram of a noise reduction system illustrating the invention, and

Fig. 2 is a wiring diagram of a similar modified system.

The system of Fig. 1 includes an intermediate frequency amplifier 10 from which the desired signal is supplied to an audio frequency amplifier 11 through (1) an intermediate frequency transformer including a primary winding 12 and a secondary winding 13, (2) the rectifying or detecting electrodes 14 and 15 of an electron discharge tube 16, and (3) a coupling including a condenser 17 and a resistor 18. It will be noted that the tube 16 also includes a control grid 19 and an anode 20 which, as hereinafter explained, function in response to noise impulses to arrest the rectifying action of the tube.

The circuit by which these results are achieved includes (1) a resistor 21 which is shunted by a capacitor 22 and is connected to ground through an adjustable part of a resistor 23 shunted by a capacitor 24, (2) a resistor 25 which is shunted by a capacitor 26, is connected to the cathode 15 through the intermediate frequency transformer secondary 13 and its shunt connected capacitor 27 and is connected through lead 28 to the adjustable tap of the resistor 23, and (3) a resistor 29 provided with one terminal which is connected to ground and with another terminal which is connected directly to the grid 19 and through a capacitor 30 to an intermediate tap of the secondary winding 13.

The operation of the system of Fig. 1 will be readily understood without detailed explanation. Thus, when no audio signal or carrier is present, the voltage between the cathode 15 and the grid 19 is adjusted by means of the resistor 23 which supplies a fixed direct current potential so that no plate current flows through the tube 16 and there is no voltage drop across the resistors 21 and 25. Under these conditions, small noise impulses will tend to produce a voltage drop across the resistors 21 and 25 due to the rectifying action of the electrodes 14 and 15 and the flow of the resulting rectified current through these resistors. However, the small noise impulses due to the voltage drop produced across the upper section of the radio frequency coil 13 also tend to raise the grid 19 to a positive voltage above the cut-off value, thus (1) permitting plate current to flow through the tube 16 and the resistor 25, (2) raising the potential of the cathode 15 due to the plate current flowing between the cathode and ground to a value at which little or no rectified current flows between the cathode and the electrodes 14 and 15, and (3) interruption of the supply of signal current to the audio amplifier 11.

When a signal is tuned in, the average drop across resistors 21 and 25 will each be one-half the peak voltage of the unmodulated carrier, assuming the resistances of the resistors 21 and 25 to be equal. This additional bias between the grid 19 and cathode 15 precludes the flow of plate current through the tube 16. The audio component of the drop across the resistor 25 is filtered off from the grid bias by the action of the resistor 29 and the condenser 30 and will therefore not appear between the grid 19 and the cathode 15. Due to the fact that the capacitor 30 is returned to a tap on the secondary winding 13, producing one-fourth the effective intermedi-

ate frequency input voltage between the grid 19 and cathode 15, any modulation less than 100% will not cause plate current to flow.

Noise impulses of an amplitude greater than this value will swing the grid 19 more positive than cut-off, plate current producing a large voltage drop in the resistor 25 will flow, and the rectifying action of the electrodes 14 and 15 will be interrupted as previously explained. The audio output voltage will, therefore, drop to zero during the period of the highest part of the noise impulse.

The noise reduction system of Fig. 2 is similar to that of Fig. 1 but differs therefrom in that it is adapted to produce full instead of one-half output. To this end one of the rectifier anodes is connected to ground through a resistor 31 and the other through a resistor 32, and the secondary winding 13 is tapped to impress one-half the input voltage between the cathode and grid. This modification involves the use of a floating grid bias battery 33 which is not acceptable under some conditions of operation. The capacitor 34 is provided for by-passing the intermediate frequency components and the capacitor 35 for by-passing the audio frequency components. In this modification of the invention, the resistance of the resistor 31 is made large as compared to that of the resistor 25 in order to secure greater output of the detector. Its operation is otherwise similar to that of the system of Fig. 1 and will therefore be readily understood without detailed description.

I claim as my invention:

1. The combination of a signal channel, an electron discharge device provided with detector electrodes including a cathode and with a grid and anode operatively associated with said cathode, a resistor common to the detector and anode circuits of said device providing a positive voltage on the cathode with respect to the anode for interrupting the operation of said detector circuit in response to impulses of a predetermined range of amplitudes.

2. The combination of a signal channel, an electron discharge device provided with detector electrodes including a cathode and with a grid and anode operatively associated with said cathode, means for applying a signal between said detector electrodes, and means connected between said electrodes and between said cathode and anode providing a positive voltage on the cathode with respect to the anode for interrupting the current of said detector electrodes in response to impulses of a predetermined range of amplitudes.

3. The combination of a signal channel, an electron discharge device provided with detector electrodes including a cathode and with a grid and anode operatively associated with said cathode, means for applying a signal between said detector electrodes, means connected between said electrodes and between said cathode and anode providing a positive voltage on the cathode with respect to the anode for interrupting the current of said detector electrodes in response to impulses of a predetermined range of amplitudes, and means for filtering said signal from said interrupting means.

4. In a signal amplifying channel for modu-

lated signals, the combination of a diode rectifier having a cathode and an anode, amplifier electrodes comprising a second anode associated with said cathode and a control grid interposed therebetween for the control of anode current through said second anode, a signal input circuit comprising a tuning inductance connected between the cathode and the diode anode, means for tuning said inductance to a predetermined carrier wave, a diode rectifier output resistor comprising substantially equal resistor elements connected in series between said tuning inductance and the diode anode, means for providing an adjustable source of biasing potential between said resistors and ground, means including a coupling impedance connected between the control grid and ground through which said biasing potential is applied to said grid with respect to the cathode, and a capacitor providing a coupling between a tap point on said tuning inductance and said control grid for applying thereto signal impulses of a predetermined range of amplitudes.

5. In a modulated carrier wave signal amplifying channel, the combination of an electron discharge device including a cathode, a diode rectifier anode associated therewith, an amplifier anode electrode associated therewith and a control grid interposed between said last named anode and the cathode, means for providing a tuned input circuit for applying modulated carrier wave and noise impulse signals between the cathode and the diode anode, means providing a diode output resistor between said input circuit and the diode anode having a center tap connection for the control grid, means providing a coupling impedance and an adjustable negative biasing potential for said control grid between said center tap connection and said grid, whereby the amplifier anode current may be reduced substantially to zero, and means including a tap connection on said input circuit for said control grid for applying thereto a portion of the signal and impulse voltages in said tuned circuit in predetermined relation to the potential across said output resistor in response to received signals and signal impulses of a predetermined range of amplitudes.

6. In an intermediate frequency amplifier, a noise reducing system comprising in combination an amplifying tube having a cathode, a control grid, an anode and an auxiliary electrode associated with the cathode, an intermediate frequency amplifier coupling transformer having a secondary connected in circuit with said cathode and the auxiliary anode electrode, a resistor element connected between said secondary and said auxiliary anode electrode, means providing a positive potential on said cathode with respect to ground having a positive tap connection on said resistor element, a resistor connected between said control grid and ground, means for coupling the grid terminal of last-named resistor to said secondary for applying signals thereto and for causing the anode current of said tube through said resistor element to raise the cathode to a positive potential with respect to the auxiliary anode electrode in response to signals exceeding a predetermined amplitude, thereby to interrupt the detecting action of said tube.