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RADIO RECEIVER ALARM

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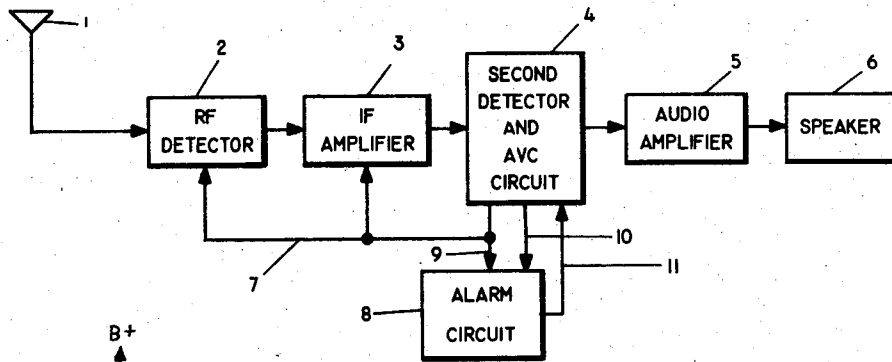


FIG. 1

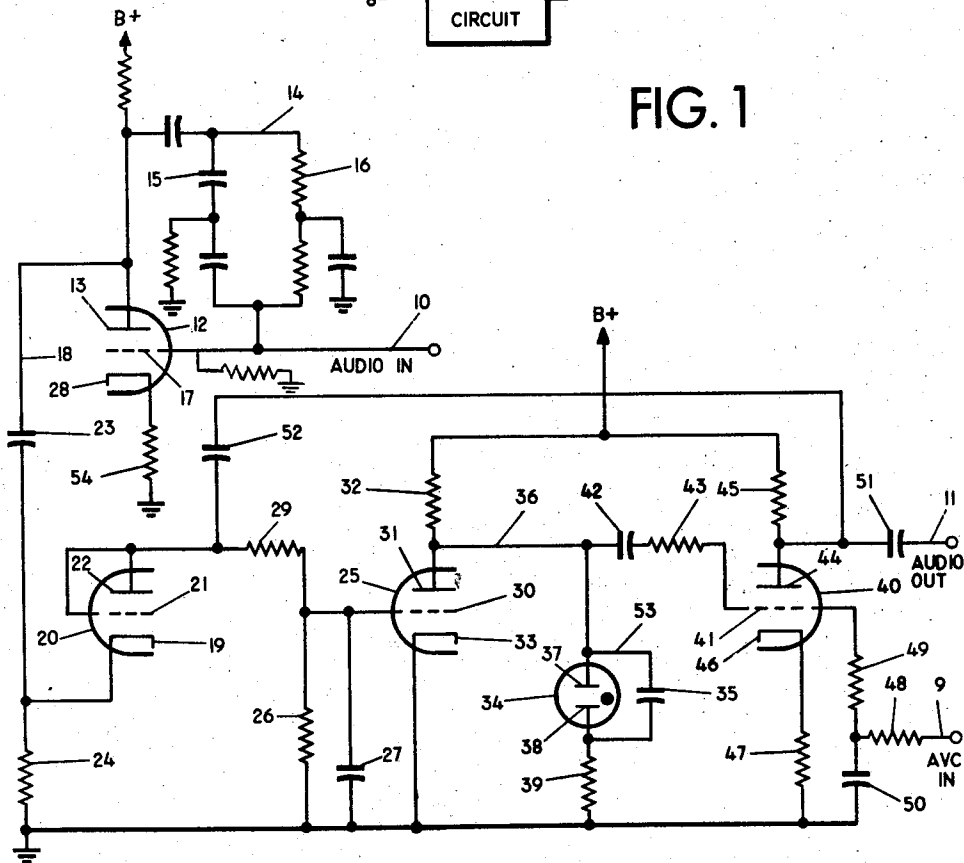


FIG. 2

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RADIO RECEIVER ALARM

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7 Claims. (Cl. 250—20)

This invention relates to a radio alarm device for use in radio receivers of the type having an automatic volume control circuit which generates a feedback voltage for controlling the receiver gain when a signal is being received. The alarm circuit is automatically responsive to both an audio signal of predetermined frequency which is impressed on the radio carrier wave continuously for a pre-selected period of time and to a change in the automatic volume control feedback voltage caused by the absence of a radio frequency carrier wave signal input to the receiver for automatically generating an audio alarm signal. The alarm signal is applied to the receiver output to attract the attention of persons in the area.

Conventional automatic type radio receiver alarm circuits require a pulse type code signal which must be de-coded to produce an alarm. Devices operating on this principle are inherently more complicated than the device of this invention, which obtains reliable automatic operation without use of pulse coding.

Under the present Civilian Defense system certain key broadcast stations, upon being notified of an impending enemy attack, will transmit, after making several short station breaks in a predetermined code sequence, a thousand cycle audio signal which appears as a modulation on the radio frequency carrier wave for alerting its listeners as well as all local broadcast stations monitoring the key station. The individual local broadcast stations will then transmit a similar thousand cycle audio signal for alert purposes. The one thousand cycle audio signal will appear as a sustained modulation on the carrier wave for a period of approximately 15 seconds, after which the radio station may broadcast preliminary instructions to listeners for a period of 60 seconds. Then the broadcast transmitter will stop operating at the regular broadcast frequency and switch over to an assigned "Conelrad" broadcast frequency for transmitting information given out by the Civilian Defense authorities. This already established broadcast procedure is compatible with this invention to provide a warning signal in a radio receiver even when the receiver volume control potentiometer is adjusted to a "stand-by" condition. That is, the receiver is "on" but is not producing an output from the speaker because of insufficient signal amplification.

An object of this invention is to provide an alarm device for use with a conventional radio receiver which will not interfere with the normal receiver operation and which will operate automatically to produce an alarm sound in response to two distinct control functions exercised remotely at the broadcast transmitter. One control function being an audio modulation of predetermined frequency which is applied to the carrier wave and the second control function being a break in the carrier wave following the transmission of the audio signal. In this manner inadvertent operations of the alarm device is made highly improbable.

Another object of this invention is to provide an alarm device which may be packaged as an individual

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unit and easily installed on conventional receivers presently in use, or which may be readily incorporated into the design of new receivers.

Another object of this invention is to provide an automatic alarm device employing a simple electronic circuit requiring a minimum of components and which may be economically manufactured.

Still another object of this invention is to provide an automatic alarm device which is dependable in operation and which occupies a relatively small amount of space as compared with the space required for conventional automatic receiver alarm devices.

Further and other objects will become apparent from a reading of the following description, especially when considered together with the accompanying drawings, wherein like numerals refer to like parts.

In the drawings:

Fig. 1 is a block diagram of a standard radio receiver incorporating the alarm device of this invention.

Fig. 2 is a schematic circuit diagram of the alarm device.

Referring to Fig. 1, the receiver includes a radio antenna 1, or other suitable pick-up, for receiving radio frequency carrier wave energy. The radio frequency carrier wave energy picked up by antenna 1 is fed to a radio frequency detector circuit which is tunable to receive any desired broadcast frequency. The output from the radio frequency detector 2 is applied to a conventional intermediate frequency amplifier circuit 3 where the carrier wave modulation signal is amplified and then fed into a second detector and automatic volume control circuit 4 where the audio modulation on the carrier wave is extracted from the received signal to provide an audio signal. The audio signal is amplified in audio amplifier 5 and applied to a speaker 6 which transforms the electrical signals into sound impulses which may be picked up by the human ear. To maintain the audio signal strength substantially constant even though the carrier wave power level may change, the automatic volume control circuit generates a negative feedback voltage which is applied to detector 2 and amplifier 3 through lead 7 to control the receiver gain while radio frequency carrier wave signals are being received. This negative feedback voltage is also applied to alarm circuit 8 through lead 9, as shown in Fig. 1, to provide one of the control functions required for automatic control of the circuit. The audio signals extracted from the radio frequency carrier waves in the second detector and automatic volume control circuit 4 are also applied to alarm circuit 8 through lead 10 to provide the second control function required for producing an alarm signal. As hereinafter described in detail, the alarm circuit signal output is fed to the automatic volume control circuit 4 through lead 11 and applied to speaker 6 to provide a distinctive alarm tone which is easily heard by anyone near the receiver.

As shown in Fig. 2, the alarm circuit includes a tuned amplifier 12 employing one side of a dual triode vacuum tube, wherein the anode 13 is connected to a suitable source of electrical potential identified as B+ and the cathode 28 is grounded through a resistor 54. A conventional tuned resistor-condenser network 14 including condensers 15 and resistors 16 arranged in parallel and having the proper values to be resonant at the predetermined frequency of the audio modulation control signal on the received carrier wave, which for compatibility with the present Civilian Defense system should be one thousand cycles per second, is connected at one end to anode 13 and at the opposite end to grid 17 of amplifier 12. While any suitable tuned circuit may be used with amplifier 12, the resistor-condenser network 14 appears best at the audio frequencies involved since

a more selective circuit may be obtained. The band width of such a network may be made as narrow as desired, which is important for the proper operation of the alarm device, as will hereinafter become apparent.

Grid 17 of tuned amplifier 12 connects with the second detector and automatic volume control circuit 4 of the receiver through lead 10 for receiving the audio signal modulated on the radio carrier wave. Only if the frequency of the signal applied to grid 17 is substantially equal to the resonant frequency of tuned circuit 14, will amplifier 12 respond to amplify the audio signal. The amplifier output is taken at anode 13 through lead 18 and applied to the cathode 19 of a diode rectifier 20, which may be the second section of the dual triode tube used for tuned amplifier 12. Grid 21 is connected directly to anode 22 in the second section of the dual triode causing it to function as a diode rectifier. A coupling condenser 23 is inserted in lead 18 between anode 13 and cathode 19 of the dual triode tube for blocking direct current voltages from B+. A cathode biasing resistor 24 connects with cathode 19 and with ground to allow the positive portion of the audio signal to leak off while the negative portion of the signal passes the rectifier for controlling the operation of an oscillator valve 25.

The output from diode rectifier 20 is obtained at anode 22 and is applied to the resistor 26 and condenser 27 storage network through resistor 29. A negative potential is thereby built up on condenser 27 when the audio input signal to the tuned amplifier 12 is at the resonant frequency of tuned circuit 14. The output from the storage network is applied to grid 30 of oscillator control valve 25 to render the latter non-conducting when the negative voltage has reached the required value. Valve 25 is actually one-half of a second dual triode vacuum tube wherein anode 31 connects with B+ through a load resistor 32 and cathode 33 connects with ground. In the absence of a negative biasing voltage on grid 30, valve 25 will conduct. Therefore, valve 25 is designated as a "normally on" tube in the alarm circuit.

An audio oscillator circuit 53 comprising a glow discharge tube 34 and a condenser 35 connects directly with anode 31 of valve 25 through lead 36 so that the same voltage which appears at anode 31 is applied to electrode 37 of glow discharge tube 34 and to condenser 35. Condenser 35 is connected across electrodes 37 and 38 of tube 34 to provide a non-regenerative type of oscillating circuit for producing an alarm tone. When a charge on condenser 35 which is built up from the anode voltage of valve 25 reaches a certain value, glow discharge tube 34 fires, discharging condenser 35 through resistor 39 to ground. The voltage then drops below that required to maintain tube 34 in an operative condition and the tube therefore cuts off, allowing condenser 35 to again build up a charge sufficient to fire tube 34 a second time. This charging and discharging of condenser 35 produces an alternating current which, when applied to the speaker 6 of the receiver, will produce a rather loud and distinctive alarm sound. By selecting the proper values for resistor 32 in the anode circuit of valve 25 and for condenser 35 in the oscillator, operation of the latter may be controlled by valve 25. That is, the voltage drop across resistor 32 when valve 25 is conducting is large enough to prevent building up a charge on condenser 35 which is of sufficient magnitude to fire tube 34, but when valve 25 is in the non-conducting condition brought about by a negative bias applied to its grid 30, the voltage drop across resistor 32 is reduced, allowing the voltage applied to condenser 35 to reach B+ which will cause the oscillator to operate.

The output from oscillator circuit 53 is applied to a gated amplifier 40 which may be the other half of the dual triode vacuum tube which is employed in the oscillator control circuit as valve 25. A direct current blocking condenser 42 and a resistor 43 are connected in

series in the line between the oscillator output and grid 41 of amplifier 40. Condenser 42 serves to isolate grid 41 from the B+ voltage fed to anode 31 and to oscillator circuit 53. Anode 44 of amplifier tube 40 connects with B+ through a plate load resistor 45 while the cathode 46 is biased to ground through resistor 47.

The automatic volume control feedback voltage from the second detector and automatic volume control circuit 4 shown in Fig. 1 is applied through lead 9 and through a pair of resistors 48 and 49 to grid 41 of amplifier tube 40. Since the automatic volume control feedback voltage may contain some unwanted alternating current components, a condenser 50 is connected to lead 9 between resistors 48 and 49 and fed to ground for passing the same while blocking the direct current feedback voltage for loading grid 41 and maintaining amplifier 40 in a non-conducting condition so long as the automatic volume control feedback voltage is present. Condenser 50 also serves to filter the alternating current output from oscillator 53 to ground to avoid applying the same to the automatic volume control feedback circuit in the receiver. Only when the automatic volume control feedback voltage applied to grid 41 falls off to zero will the output from oscillator 53 be allowed to control the output of amplifier 40 or otherwise interfere with the normal operation of the receiver.

The audio oscillator alarm signal output from the alarm circuit is obtained at anode 44 of tube 40 and applied to the receiver circuit through condenser 51 which effectively blocks any direct current voltage applied to the amplifier tube from B+.

As previously mentioned, the audio modulation signal on the radio carrier wave is present for approximately 15 seconds preceding the drop in the carrier wave in the present "Conelrad" Civilian Defense system. This 15 second period during which the audio modulation signal on the carrier wave is applied to tuned amplifier 12, an output from anode 22 of diode rectifier 20 in the alarm circuit is feeding storage condenser 27 through resistor 29 causing a negative biasing voltage to be applied to grid 30 of valve 25, cutting the valve off and allowing the oscillator circuit 53 to operate. This operation of the oscillator will occur only so long as valve 25 is held cut off by a biasing voltage applied to its grid. While the storage network, including condenser 27, will hold valve 25 in a non-conducting condition for a little over one minute after the audio modulation signal has ended, it is necessary to provide additional means for controlling the operation of valve 25 for an unlimited time once the alarm signal is initiated. This is accomplished by feeding the audio alarm signal output appearing in lead 11 back to grid 30 of valve 25 through a direct current blocking condenser 52 and resistor 29. This feedback voltage applied to grid 30 will be 180 degrees out of phase with the oscillator output generated by glow discharge tube 34 and condenser 35. Thus, valve 25 will be turned off and on at a rate proportional to the frequency of the output signal from the oscillator and at a phase relationship which will allow the oscillator to continue functioning; that is, when the audio output signal applied to grid 30 of valve 25 is negative the valve will be in the non-conducting condition allowing condenser 35 in the oscillator circuit to take a charge sufficient to cause tube 34 to fire. While tube 34 is discharging condenser 35 through resistor 39 to ground, the audio signal feedback voltage from amplifier 40 will be positive, allowing valve 25 to conduct. When the charge on condenser 35 is drained off through glow discharge tube 34 the feedback voltage applied to grid 30 becomes negative once again cutting valve 25 off and allowing condenser 35 to again take a charge sufficient to fire tube 34. This action will continue so long as gated amplifier 40 is allowed to conduct.

During normal receiver operation the radio frequency carrier waves transmitted by a broadcast station to which the receiver is tuned are picked up by receiver antenna 1

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and operated on in conventional fashion to extract the carrier wave envelope and transform the same into audible sounds through a speaker 6. The audio signals modulated on the carrier wave will normally vary widely in frequency within the range of audibility. A small percentage of this audio signal modulated on the carrier wave will likely be at the audio alarm signal input frequency which, for purposes of this description, was selected as one thousand cycles per second. These one thousand cycle components of the received carrier wave signal will not be continuous but will appear infrequently as a part of the over-all carrier wave signal. These intermittent one thousand cycle notes are unavoidably applied to the receiver alarm circuit and, as a result, maintain a slight charge on storage condenser 27. However, this charge will normally be far below the charge required to cut valve 25 off and allow the oscillator circuit to become operative. Should this happen to occur, the oscillator output will not be applied to the receiver so long as the automatic volume control feedback voltage is applied to gated amplifier 40. Obviously, it is desirable that the oscillator circuit 53 not operate under normal conditions even though the alarm circuit will not produce an output when the receiver is tuned to a station, since when the receiver is re-tuned to a different broadcast station the oscillator alarm signal would be applied to the receiver output and produce an objectionable noise signal while the receiver tuner is being adjusted. By maintaining the band width of tuned amplifier 12 sufficiently narrow and by selecting the proper values of condenser 27 and resistor 26 in the storage network of the alarm circuit, the extraneous audio signals at or near the one thousand cycle frequency to which the alarm circuit is tuned, can effectively be held to a sufficiently low value to prevent interference with the alarm circuit operation. Only when an audio signal of the predetermined frequency, which here is selected as being at one thousand cycles per second, is applied to the alarm circuit continuously for a period in the neighborhood of 15 seconds, will the charge on condenser 27 in the storage network be sufficient to render valve 25 non-conducting. When this audio signal of predetermined frequency is picked up by the receiver, causing valve 25 to be cut off, the voltage at anode 31 of valve 25 increases, allowing the charge on condenser 35 in the oscillator circuit to reach a value sufficient to fire tube 34 and start the oscillator operating. The oscillator output is impressed on grid 41 of gated amplifier 40 but is not allowed to affect receiver operation until the automatic volume control feedback voltage applied to grid 41 approaches a zero voltage value. When this condition is reached, gated amplifier 40 is allowed to conduct at a rate controlled by the output from the oscillator circuit. During the period between the application of the audio signal of predetermined frequency on grid 17 of tuned amplifier 12 and the reduction in the automatic volume control feedback voltage, the charge on condenser 27 in the storage network maintains valve 25 in the non-conducting condition by impressing a biasing voltage on grid 30 of the valve. This charge on condenser 27 in the storage network will last for a length of time, depending upon the values of resistor 26 and condenser 27, slightly greater than one minute to allow the broadcast station to issue preliminary instructions for approximately one minute after broadcasting the one thousand cycle per second audio signal. The oscillator circuit is thereby kept in operation by the storage network until gated amplifier 40 is turned on by the drop in the automatic volume control feedback voltage. This output voltage at anode 44 of amplifier 40 is applied to the receiver through lead 11 at a point between the receiver volume control potentiometer, not shown, and speaker 6. The amplitude of this audio output is sufficient to produce a loud and distinctive alarm tone in the receiver for attracting the attention of those in the area. When gated amplifier 40 starts to conduct and produce an output proportional to the signal gener-

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ated by the oscillator circuit 53, the audio output voltage appearing at anode 44 of tube 40 is also applied to grid 30 of valve 25 causing the latter to be cut off periodically in the proper phase sequence with the oscillator circuit as hereinabove described, to keep the latter operating until gated amplifier 40 is cut off, or until the B+ supply to the alarm circuit and receiver is removed. This feedback of the audio output voltage from amplifier 40 allows the oscillator to continue operation even after the initial charge on condenser 25 in the storage network has leaked off to ground through resistor 26.

As described hereinabove, the alarm signal, once the alarm circuit has been energized, will be applied to receiver 6 of the speaker for an indefinite time, even after the broadcast station has gone off the air. When the station comes back on the air, or when the receiver is tuned to a broadcast station which is transmitting a radio frequency carrier wave, the automatic volume control feedback voltage will again be generated to produce a bias on grid 41 of tube 40, causing it to be cut off and stopping the alarm sound.

The automatic operation of the alarm circuit allows a receiver to be used in the normal manner for receiving standard radio programs and also to serve as a device for warning the citizenry of all, or a large section of the country, of impending danger at all times of the night and day. Even when the receiver volume is turned down so that it will remain in a "stand-by" condition, not producing an output from the speaker, the alarm circuit will be operative to generate an alarm sound. An audio modulation signal of predetermined frequency for a given period of time, followed by a drop in the carrier wave, will automatically produce a loud and distinctive alarm sound in the speaker.

While a specific circuit has been shown and described in some detail, it is for purposes of illustration rather than for purposes of limitation, and it is to be understood that many alterations, modifications, substitutions may be made to the instant disclosure without departing from the spirit and scope of this invention as defined by the appended claims.

We claim:

1. In combination with a radio receiver of the type including a radio frequency detector, an audio frequency network, a sound reproducer, and an automatic volume control circuit producing a gain control voltage only in response to the application of radio frequency carrier waves, an automatic alarm device comprising, a tuned amplifier connecting with said audio frequency network and being responsive to a signal of predetermined frequency and duration in the receiver to produce an effective output signal, rectifier means responsive to the output from said tuned amplifier to produce a biasing voltage, an energy storage network connecting with said rectifier means for storing said biasing voltage, valve means electrically connecting with said storage network and being responsive to the energy stored therein from said effective output signal for actuation, an audio oscillator connecting with said valve means and being responsive to actuation of the latter for producing an audio signal, a gated amplifier connecting with said oscillator and with said sound reproducer and being responsive to a change in the automatic volume control voltage for impressing the oscillator output on said sound reproducer whereby to generate an audible alarm signal from said sound reproducer, and feedback means connecting with the output from said gated amplifier and with said valve means for sustaining the operation of said oscillator.

2. An automatic alarm warning device for radio receivers having an automatic volume control circuit which generates a voltage output only in response to receipt of radio carrier waves comprising, a source of electrical potential, a multiple electrode grid controlled normally conducting electronic valve connecting with said source of electrical potential, impedance means interposed between said valve and said source of electrical potential to pro-

vide a voltage at the anode of said valve which varies inversely with the current flow therethrough, frequency sensitive filter means connecting with the grid of said valve and with the receiver circuit and being responsive to an audio modulation on the received carrier wave of predetermined frequency to produce a biasing voltage on the grid of said valve causing the same to become non-conducting, an oscillator connecting with the anode of said valve and being operative to produce audio oscillations only in response to a voltage level obtained at the anode of said valve when the latter is non-conducting, a vacuum tube having an anode, a cathode and a grid, the anode of said tube connecting with said source of electrical potential and with the receiver output, the grid of said tube connecting with the output from said oscillator and with the automatic volume control circuit output, said tube grid being biased by the automatic volume control voltage whereby the tube will conduct only in the absence of said voltage for amplifying the oscillator output and applying the same to the receiver output, and feedback means connecting said tube anode with the grid of said valve for maintaining a bias thereon sufficient to allow operation of said oscillator so long as the vacuum tube is conducting and said oscillator is generating an output signal whereby to produce an audible alarm signal in the receiver.

3. An automatic alarm device for radio receivers having an automatic volume control circuit which generates a voltage output only in response to receipt of radio carrier waves comprising, a normally conducting electronic valve, said valve including a control grid, frequency sensitive filter means connecting with the receiver circuit and with said control grid and being responsive to an audio signal of predetermined frequency on the received carrier wave to produce a biasing voltage rendering said valve non-conducting, oscillator means connecting with said valve and producing audio oscillations only when said valve is in the non-conducting condition, gating means connecting with the receiver output circuit, with the automatic volume control circuit output and with said oscillating means, said gating means passing the output from said oscillating means to the receiver output circuit only in the absence of a voltage output from the automatic gain control circuit, and feedback means connecting with said gating means and with said valve for maintaining the oscillator means in operation only during the absence of an output voltage from the automatic volume control circuit whereby the presence of an audio modulation signal of predetermined frequency followed by a break in the radio carrier wave will automatically produce an alarm sound in the receiver which will continue until a carrier wave is again received or until the receiver is turned off.

4. An automatic alarm device for radio receivers of the type having an automatic volume control circuit which generates a voltage output only in response to receipt of radio carrier waves comprising, a source of electrical potential, an oscillator connecting with said source of electrical potential, impedance means interposed between said source of electrical potential and said oscillator, valve means connecting with said oscillator for conducting electrical energy from said source of electrical potential to ground through said impedance means whereby the voltage applied to said oscillator is insufficient to effect operation thereof only when current is flowing through said valve means, means connecting with said receiver and with said valve means for rendering the latter non-conducting in response to an audio signal of predetermined frequency from said receiver which is applied to said means for a predetermined length of time, and gating means connecting with the automatic volume control circuit and completing a circuit between the oscillator output and the receiver output for producing an alarm sound only during the absence of an output from said automatic volume control circuit.

5. An automatic alarm device for radio receivers of

the type generating an automatic volume control feedback voltage only in response to receipt of radio carrier waves comprising, an audio oscillator, electronic filter means connecting with said receiver and with said oscillator and causing the latter to become operative only in response to a signal of predetermined frequency from the receiver, gating means connecting the output of said oscillator with the output of said receiver only in the absence of an automatic volume control feedback voltage for producing an audible alarm signal, and feedback means connecting with said gating means and with the first mentioned means for maintaining said oscillator in operation subsequent to the application of said signal of predetermined frequency.

6. An automatic radio alarm device comprising, a radio frequency detector adapted to receive modulated radio frequency carrier waves, an audio frequency network connecting with said radio frequency detector and providing an audio output representing the modulation on the radio frequency carrier wave, an automatic volume control circuit operatively connecting with said audio frequency network and producing a gain control voltage only in response to the receipt of radio frequency carrier waves by said radio frequency detector, an audio oscillator connecting with said audio frequency network, electronic filter means connecting with said oscillator and producing a control voltage in response to a pre-selected code signal appearing in the audio frequency network to cause said oscillator to generate an audio alarm signal, a sound reproducer connecting with said audio frequency network and being responsive to a voltage output therefrom to produce sound, a gated amplifier connecting with said oscillator and with said audio frequency network for amplifying and applying the output from said oscillator to said sound reproducer only in the absence of an automatic volume control voltage whereby to cause an audible alarm signal to be emitted, and feedback means connecting the output of said gated amplifier with said oscillator for sustaining the operation of said oscillator.

7. In combination with a radio receiver of the type including a radio frequency detector, an audio frequency network, a sound reproducer, and an automatic volume control circuit producing a gain control voltage only in response to the application of radio frequency carrier waves, an automatic alarm device comprising, a tuned amplifier connecting with said audio frequency network and being responsive to a signal of predetermined frequency and duration in the receiver to produce an effective output signal, rectifier means responsive to the output from said tuned amplifier to produce a biasing voltage, an energy storage network connecting with said rectifier means for storing said biasing voltage, normally conducting valve means electrically connecting with said storage network and being responsive to the energy stored therein from said effective output signal for actuation to a non-conducting condition, an audio oscillator connecting with said valve means and being responsive to actuation of the latter to the non-conducting condition for producing an audio signal, a normally closed gated amplifier connecting with said oscillator and with said sound reproducer and being responsive to a drop in the carrier wave for amplifying the oscillator output and applying the same to said sound reproducer whereby to generate an audible alarm signal from said sound reproducer, and feedback means connecting with the output from said gated amplifier and with said valve means for sustaining the operation of said oscillator.

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