

Feb. 18, 1964

B. F. CRAIG ETAL
CONELRAD WARNING DEVICE

3,121,841

Filed July 12, 1961

2 Sheets-Sheet 1

Fig. 4

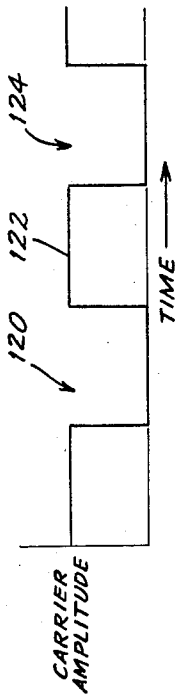


Fig. 5

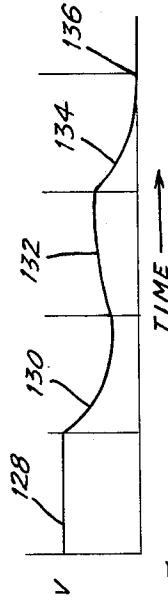


Fig. 3

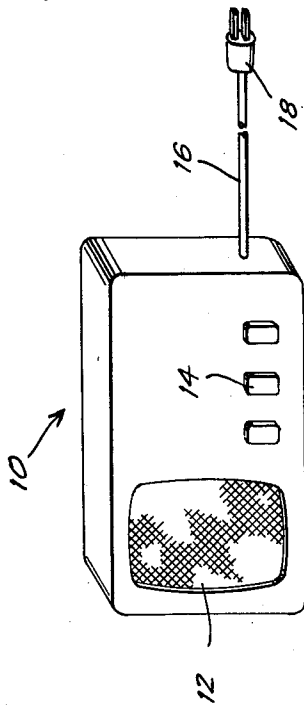
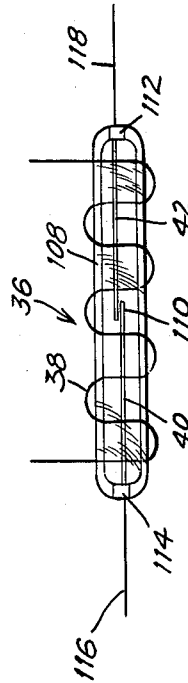


Fig. 1.

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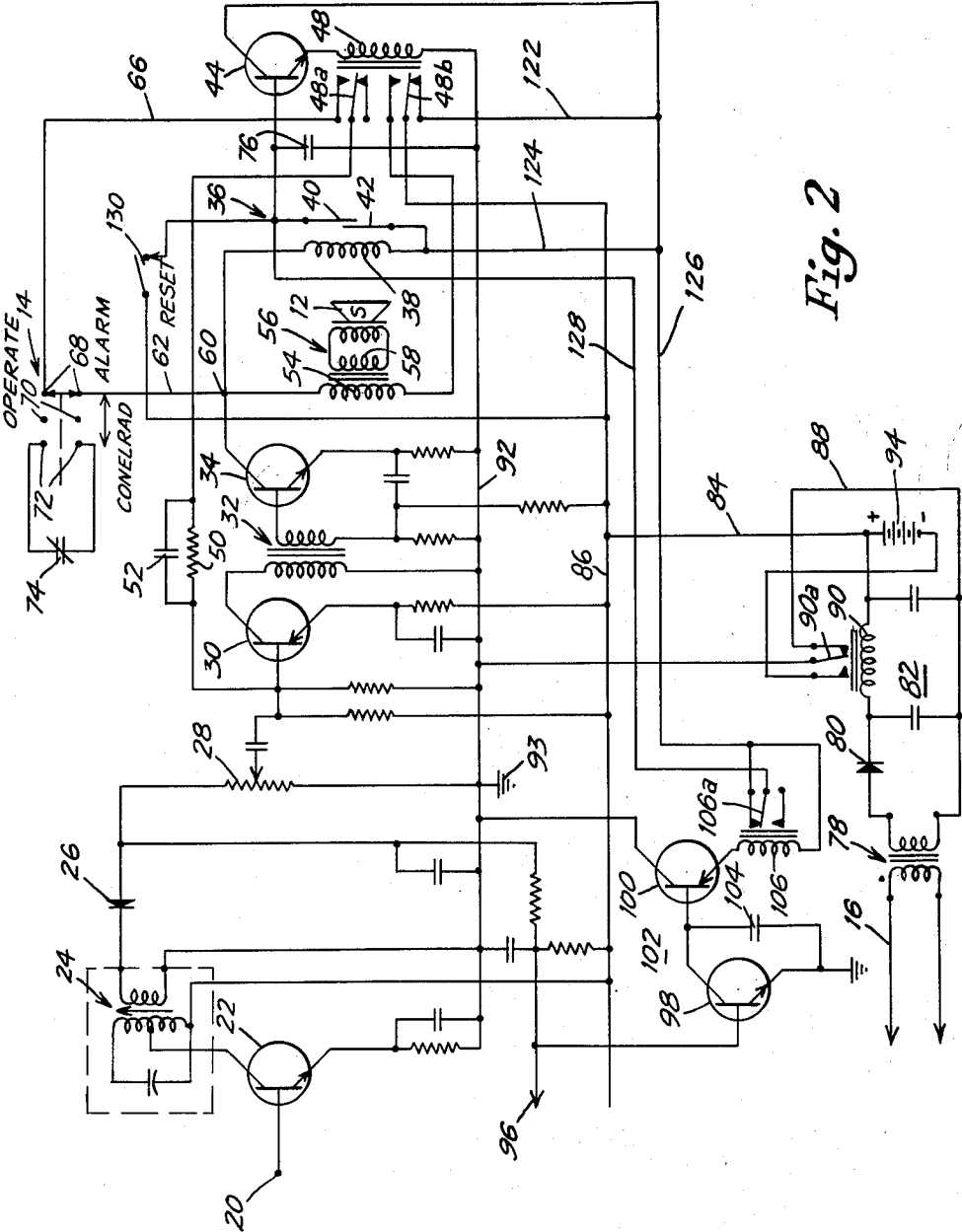
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3,121,841

CONELRAD WARNING DEVICE

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17 Claims. (Cl. 325-466)

This invention relates to a radio warning device and more particularly to a radio receiver warning device for giving an audible warning of a Conelrad alert.

Various radio warning systems and devices have been known for many years. None, however, is particularly suited for use in conjunction with standard Conelrad warning signals and many of the prior devices require complicated equipment and expensive circuit components. The present invention avoids these difficulties by providing a simplified inexpensive unit usable in the home to give an audible indication of warning which unit is particularly suited for use in conjunction with standard Conelrad warning alerts.

It is therefore a primary object of the present invention to provide a novel radio warning device.

Another object of the present invention is to provide a system for giving audible warnings of a Conelrad alert.

Another object of the present invention is to provide a simplified unit for use in the home to give audible warnings of a radio alert.

Another object of the present invention is a radio warning device particularly suited for use in conjunction with the existing Conelrad warning system.

These and further objects and advantages of the invention will be more apparent upon reference to the following specification, claims and appended drawings wherein:

FIGURE 1 is a perspective view of the warning device of the present invention;

FIGURE 2 is a detailed circuit diagram of the novel portion of the radio warning device of the present invention;

FIGURE 3 is an enlarged view of the reed relay incorporated in the circuit of FIGURE 1;

FIGURE 4 shows the carrier waveform of a typical Conelrad alert broadcast; and

FIGURE 5 shows the voltage waveform across capacitor 104 of FIGURE 2 during the carrier interruption period illustrated in FIGURE 4.

While the present invention will be described in conjunction with, and is particularly suited for, use with the existing Conelrad broadcast system, the present invention has utility for other warning purposes, such as general broadcast information as well as tornado, hurricane and other weather alerts.

In the event of any enemy bomber or missile attack, it is well known that the general public will have very little warning and will have only a short time to take cover, evacuate and to make other arrangements essential to their protection during an attack. The time after general warning and before attack can be estimated in minutes and even the most optimistic estimates consider 45 minutes as about the greatest possible warning present systems are able to provide to the general public.

While conventional air raid warning sirens to some extent provide a usable general warning system, they have many undesirable features, among which may be listed the high expense of installation and upkeep along with the periodic disturbance and annoyance to the public when the sirens are tested or inadvertently turned on.

The novel warning device of the present invention may be incorporated in a small transistorized container in the form of a small transistor radio receiver and permanently plugged into the conventional A.C. outlet of a home.

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Upon receipt of a predetermined series of signals from the local stations before going off the air during a Conelrad alert, the device is actuated and amplifies the 1,000 cycle audio tone emitted at the beginning of a Conelrad alert to such an amplitude as to provide an audible warning which can be heard throughout an entire household. The device is operative throughout an entire 24-hour day on an automatic basis so that it does not depend upon a homeowner having his radio turned on and will operate to warn the public even during the night when most are asleep.

Referring to the drawings, the warning device of the present invention comprises a modified radio receiver generally indicated at 10 approximately the size of a transistor radio receiver including a speaker 12, three button switch 14 and a cord 16 leading to a plug 18 for insertion in the conventional 120-volt 60-cycle outlet of the average home.

The warning device of the present invention includes the conventional RF antenna for receiving broadcast transmissions over the commercial AM or FM broadcast bands as well as conventional radio receiver RF and first IF stages, all of which are omitted from FIGURE 2 for the sake of clarity. The novel portion of the receiver is illustrated in detail in FIGURE 2 wherein terminal 20 receives the output from the first IF transformer of a conventional receiver front end. From terminal 20, the incoming signal passes through an IF amplifier 22 comprising an NPN junction transistor to second IF transformer 24.

The output from the second IF transformer 24 is to the audio frequency detector 26 and potentiometer 28 of the first AF amplifier 30 comprising a PNP junction transistor. Output from amplifier 30 is by way of audio transformer 32 to the second AF amplifier stage 34 comprising a second NPN junction transistor.

Connected to the output of the second AF amplifier stage 34 is a reed relay generally indicated at 36 comprising a coil 38 and a pair of vibratory reeds 40 and 42. Connected across relay 36 is an emitter follower power amplifier 44 comprising an NPN junction transistor. Incorporated in the emitter circuit of power amplifier 44 is the coil of the alarm relay 48. Movable contacts 48a and 48b of relay 48 are shown in the down position which they assume when relay coil 48 is energized.

Connected to the first AF amplifier 30 is a regenerative feedback circuit comprising parallel resistor 50 and capacitor 52. When relay 48 is deenergized and movable contacts 48a and 48b are in the up position, resistor 50 and capacitor 52 provide a regenerative feedback loop for the 1,000 cycle tone from the primary 54 of a speaker transformer 56, the secondary 58 of which drives the receiver speaker 12. The regenerative feedback path is from the junction 60 by way of lead 62 through manual switch 14, lead 66, contact 48a and the parallel resistor-capacitor arrangement 50 and 52 to the base input of audio amplifier 30.

Switch 14 is a manually movable sliding switch adapted to alternatively close three separate pairs of contacts indicated respectively as the alarm contacts 68, operate contacts 70 and Conelrad contacts 72. Switch 14 is indicated in the alarm position with the movable element of the switch closing the circuit between contacts 68. Movement of switch 14 to the intermediate or operate position to close contacts 70 removes the regenerative feedback and causes the receiver to operate as a conventional radio receiver tuned to a preset local station in a manner to be more fully discussed below. Further movement of switch 14 to the left-most position completing the connection across contacts 72 places a trimmer condenser 74 across the receiver local oscillator so as to change the RF frequency transmitted through the re-

ceiver. Condenser 74 is preferably adjusted to tune the receiver to the Conelrad frequency.

Connected across the input of power amplifier 44 is a bias capacitor 76 which develops a positive potential between the base and emitter electrodes of power amplifier 44 to hold this transistor conducting and maintain relay 48 energized.

Cord 16, illustrated in FIGURE 2, supplies household energy through transformer 78 to rectifier 80 and low pass filter 82 where the alternating source of voltage is rectified and filtered. The D.C. output from filter 82 passes by way of lead 84 to positive line 86. The negative side of the voltage supply is connected by way of lead 88 and movable contact 90a of relay 90 to negative line 92 grounded at 93. The D.C. potential drop across lines 86 and 92 provides bias voltages for the amplifier and detector stages previously described.

A 9-volt stand-by battery 94 is provided but this battery is disconnected from the circuit by reason of movable switch 90a of relay 90 being held in the rightmost position with the relay energized by the D.C. passing through the relay coil 90. Coil 90, in addition to acting as a relay coil, also forms the series or choke coil of low pass filter 82.

Connected to the conventional automatic gain control terminal 96 of the receiver are NPN junction transistor 98 and PNP junction transistor 100 forming a portion of a Conelrad recognition circuit generally indicated at 102. Connected between the base of transistor 100 and the emitter of transistor 98 is a time delay capacitor 104. Transistor 100 drives a relay 106 in its emitter circuit having a movable contact 106a.

FIGURE 3 shows in more detail reed relay 36 comprising an evacuated glass tube 108 housing a pair of long, slender vibrating metallic reeds 40 and 42 which overlap at their free ends as indicated at 110. The reeds 40 and 42 are mounted on metallic inserts 112 and 114 embedded in each end of the glass tube. Surrounding the tube is the relay coil 38. Contact is made to the reeds from external leads 116 and 118 by way of inserts 112 and 114.

FIGURE 4 illustrates the standard Conelrad carrier signal waveform as a function of time illustrating that, at the beginning of the Conelrad alert, the carrier is switched off as indicated at 120 for five seconds, back on as at 122 for five seconds, off again at 124 for still another five seconds and then back on.

In operation, the alarm device 10 is plugged into the wall outlet of a home and remains silent until a Conelrad alert is given. During this time, which may be a period of several months or more, the unit is powered from the house outlet with the standby battery 94 unused. If, for some reason, either during or after an attack, the house current should fail, the disappearance of current through coil 90 of FIGURE 2 in the filter circuit causes relay arm 90a to drop out. Movement of arm 90a from the right-hand contact, as shown, to the left-hand contact completes the circuit to battery 94 and the battery then takes over supply to the receiver in place of the house current.

The alarm device 10 is initially tuned to one of the stronger local stations so that the Conelrad alert signal will be received any time it is sent from the local station. During such an alert, the regular program broadcast of the station is replaced by the Conelrad warning, a 1,000-cycle modulation signal superimposed on the broadcasting station carrier. This 1,000-cycle tone actuates the receiver and connects speaker 12 in the circuit so that the 1,000-cycle tone is broadcast to the occupants of a room or house as a loud audible tone through the speaker of the receiver. Once the occupants are alerted by this audible tone, they can then actuate manual switch 14 moving it from the alarm position shown in FIGURE 2 to the operate position closing contacts 70. This movement of switch 14 disconnects the regenerative feedback

loop from the circuit so that the alarm device functions as a simple radio receiver tuned to the local radio station so that any oral instructions or information that may be broadcast by the radio station can be heard and heeded. It is contemplated that, sometime after the initial warning, all stations will go off the air on their regular broadcast frequencies and various stations will broadcast over the Conelrad frequencies. When this happens, it is possible for the homeowner to move switch 14 into the third position so that the device is immediately tuned to the Conelrad frequency where additional information and instructions may be heard.

During normal broadcasting, the receiver alarm of the present invention is silent because of the fact that the speaker 12 is disconnected from the circuit by relay 48. During this silent time, either the D.C. bias alone or the bias in combination with the regular program modulation retains vibratory reeds 40 and 42 of reed relay 36 in contact so that the circuit is complete through the relay. As a result, capacitor 76 charges up to approximately positive bias voltage through the relay and maintains power amplifier 44 in the conductive state with relay 48 energized and movable contacts 48a and 48b in the down position illustrated in FIGURE 2.

However, when the broadcast modulation is replaced by 1,000-cycle tone modulation, this modulation acts to separate the reeds 40 and 42 over the greater portion of each modulation-cycle so that capacitor 76 tends to discharge towards 0 voltage and ultimately acts to cut off transistor 44. Reed relay 36 is a commercially available relay having a resonance at approximately 900 cycles. It has been found that, at a point slightly above resonance, the relay exhibits a marked change in characteristics from being closed over almost the entire modulation cycle to the opposite state wherein the reeds 40 and 42 are separated during the major portion of the modulation cycle. As a result, the relay moves from the substantially closed position to a substantially open position, thus permitting capacitor 76 to discharge through the base emitter circuit of transistor 44. The charging circuit for capacitor 76 is from positive line 86 by way of movable contact 48b of relay 48, lead 122, lead 124 and relay reeds 40 and 42.

The marked change in characteristics of the relay at a frequency slightly above resonance is not fully understood but it is believed that the increased power required to drive the mechanical reed elements when the physical reed length is longer than one wave length in combination with the loss in power with increase in frequency is believed to significantly contribute to the sharp change in characteristic evidenced at the point wherein the relay goes from the principally closed state to the principally open state.

In order to avoid inadvertent actuation of the alarm by spurious 1,000-cycle or higher tones, the Conelrad recognition circuit 102 is incorporated so that, even if a spurious tone causes relay 36 to open, capacitor 76 remains charged to approximately the positive supply potential by way of the secondary charging path traceable through movable contact 48b, lead 122, through lead 126, relay contact 106a and lead 128. The recognition circuit comprising transistors 98 and 100 is coupled to the conventional AGC terminal 96 so that the negative AGC voltage is applied to the base of transistor 98 keeping transistor 98 normally cut off. However, during broadcasting, capacitor 104 is charged through the emitter base circuit of transistor 100 with a positive voltage on its upper plate, which voltage tends to maintain transistor 100 cut off.

Interruption of the carrier after the 1,000-cycle tone has previously acted to open relay 36 as indicated at 120 in FIGURE 4 causes the negative AGC voltage to be removed from the base of transistor 98 so that this transistor becomes conducting and offers a low resistance discharge path to capacitor 104 so that the capacitor partially discharges from the potential 128 in FIGURE 5 along line 130 during the five second interval that the carrier is interrupted. When the carrier returns, capacitor

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104 tends to recharge along line 132 through the emitter-base circuit of transistor 100 but, since this is a high resistance path compared to the collector-emitter discharge path through transistor 98, the capacitor 104 does not recharge in this five second interval to its original potential. During the time indicated at 124 in FIGURE 4, the carrier is again absent for five seconds, permitting capacitor 104 to discharge along line 134 almost completely through transistor 98 to near zero as indicated at 136 so that the potential on the base of transistor 100 approaches zero and causes transistor 100 to conduct. Conduction of transistor 100 energizes relay 106, causing movable contact 106a to move from the upper position shown in FIGURE 2 to its lower position. As a result, the positive potential is removed from capacitor 76 and the capacitor is able to discharge through the base-emitter circuit of transistor 44 so that the potential of its upper plate drops to the point where transistor 44 is cut off.

With transistor 44 cut off, relay 48 is deenergized and movable contacts 48a and 48b are moved from the lower position illustrated in FIGURE 2 to the uppermost position with the result that primary 54 of the speaker transformer is connected to the output of the second AF amplifier 34 through contact 48b, and, at the same time, the regenerative feedback to the base input of the first AF amplifier 30 is completed through movable contact 48a. The 1,000-cycle audio tone is then transmitted to speaker 12 through the regenerative AF amplifier stages to produce a loud audible tone in the speaker which may be heard throughout a household. The alarm circuit may be reset by closing manual switch 130 which places positive potential back on capacitor 76 and the similar potential on the base of transistor 44 causing the transistor to conduct and relay 48 to be reenergized. The resumption of carrier broadcast with the accompanying negative AGC potential on terminal 96 will cause transistors 98 and 100 to become non-conducting and relay 106 to return to its initial state.

It is apparent from the above that the present invention provides a novel radio receiver alarm device of relatively simple construction of a size comparable with portable transistorized radio receiver. The alarm system is operative both day and night and can be preset to a local station so that any time that a Conelrad alert is transmitted the receiver is automatically energized and broadcasts the 1,000-cycle Conelrad tone as an audible sound to awaken sleeping household occupants or to draw the attention of occupants to the fact that an alert is being given. Through the manual switch 14 it is possible to switch the receiver from the alarm position to the operate position wherein the speaker 12 is normally driven without regeneration. With switch 14 in this operate position the unit may be removed from the wall plug and carried around in the pocket as a portable transistor radio automatically tuned to the preset local station. As soon as the connection is broken to the wall outlet battery 94 immediately is cut into the circuit and supplies the voltages necessary to reception. A further movement of switch 14 to the Conelrad position cuts in trimming capacitor 74 and tunes the RF stage of the receiver to the Conelrad frequency so that the device then constitutes a portable transistor radio tuned to the Conelrad frequency for receiving Conelrad instructions.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A warning device comprising a radio receiver hav-

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ing at least one audio stage, a speaker, switch means for connecting said speaker to the output of said audio stage, and a reed relay connected between the output of said audio stage and said switch means, said reed relay being held closed by bias signals for said audio stage during non-broadcast periods and during regular programming, said relay opening under the influence of a single frequency output signal from said audio stage of at least approximately one thousand cycles per second to render said switch means operative.

2. A warning device comprising a radio receiver having an audio section, a speaker, a relay switch for connecting said speaker to the output of said audio section, and a reed relay connected between said relay switch and the output of said audio section, said reed relay including a coil surrounding a pair of overlapping vibratory reeds resonant at approximately nine hundred cycles per second whereby said reeds separate when a constant frequency signal of at least approximately one thousand cycles per second is applied to the coil of said reed relay.

3. A warning device comprising a radio receiver having an audio section, speaker, switch means for connecting said speaker to the output of said audio section, capacitive means for controlling the operation of said switch means, said capacitive means being normally charged to retain said switch means in a first position with said speaker disconnected from said audio section, means for discharging said capacitor, said discharge means including a reed relay having a coil surrounding a pair of overlapping vibratory reeds, and means connecting said reed relay coil to the output of said audio section.

4. A warning device comprising a radio receiver having an audio section, a speaker, switch means including a relay coil for connecting said speaker to the output of said audio section, a variable impedance device for controlling the current flow through said relay coil, a capacitor connected to the control element of said variable impedance device, circuit means including a reed relay for controlling the potential across said capacitor, said reed relay including a pair of overlapping vibratory reeds surrounded by a reed coil, and means coupling said reed coil to the output of said audio section whereby said reed relay is energized by the audio output from said audio section.

5. A warning device according to claim 4 wherein said variable impedance device is a transistor.

6. A warning device according to claim 4 wherein said variable resistance device is an NPN junction type emitter follower transistor.

7. A warning device according to claim 6 wherein said reed relay is resonant at approximately 900 c.p.s. whereby said reed relay opens under the influence of a single frequency signal from said audio section of at least approximately 1000 c.p.s.

8. A warning device comprising a radio receiver having an audio section, a speaker, a relay switch including a relay coil for connecting said speaker to the output of said audio section, a transistor for controlling the current flow through said relay coil, a capacitor connected to the control element of said transistor, circuit means including a reed relay for controlling the potential across said capacitor, said reed relay including a pair of overlapping vibratory reeds surrounded by a reed coil, a regenerative feedback circuit between the input and output of said audio section, said relay switch upon actuation rendering said feedback circuit operative, and means coupling said reed coil to the output of said audio section whereby said reed relay is energized by the audio output from said audio section.

9. A warning device according to claim 8 wherein said reed relay is resonant at approximately 900 c.p.s. whereby said reed relay opens under the influence of a single frequency signal from said audio section of at least approximately 1000 c.p.s.

10. A warning device according to claim 9 including

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a three position switch for first coupling said audio section to said reed relay, second disconnecting said audio section from said reed relay and said regenerative circuit, and third connecting a trimmer capacitor into said receiver for changing the carrier frequency passed by said receiver.

11. A warning device according to claim 10 wherein said trimmer capacitor causes said receiver to pass a Conelrad frequency.

12. A warning device comprising a radio receiver having an audio section, a speaker, a relay switch for connecting said speaker to the output of said audio section, a reed relay connected between said relay switch and the output of said audio section, said reed relay including a coil surrounding a pair of overlapping vibratory reeds resonant at approximately nine hundred cycles per second whereby said reeds separate when a constant frequency signal of at least approximately one thousand cycles per second is applied to the coil of said reed relay, an automatic volume control circuit in said receiver, a source of potential for maintaining said switch means operative after actuation of said reed relay, and delay means for disconnecting said potential source from said switch means, said delay means being operative in response to a disappearance of signal in said automatic volume control circuit.

13. A warning device according to claim 12 wherein said delay means comprises a capacitor, and means for controlling the potential across said capacitor in response to successive absences of a signal in said automatic volume control circuit.

14. A warning device according to claim 13 wherein said delay means includes a pair of transistors for controlling the impedance in the charging and discharging circuits of said capacitor.

15. A warning device according to claim 14 wherein said delay means is responsive to two successive five second intervals of no automatic volume control signal separated by a five second interval in which said automatic volume control signal is present.

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16. A warning device comprising a radio receiver having an audio section, a speaker, a relay switch including a relay coil for connecting said speaker to the output of said audio section, a transistor for controlling the current flow through said relay coil, a capacitor connected to the control element of said transistor, circuit means including a reed relay for controlling the potential across said capacitor, said reed relay including a pair of overlapping vibratory reeds surrounded by a reed coil, a regenerative feedback circuit between the input and output of said audio section, said relay switch upon actuation rendering said feedback circuit operative, means coupling said reed coil to the output of said audio section whereby said reed relay is energized by the audio output from said audio section, an automatic volume control circuit in said receiver, a source of potential for maintaining said switch means operative after actuation of said reed relay, and delay means for disconnecting said potential source from said switch means, said delay means being operative in response to a disappearance of signal in said automatic volume control circuit.

17. A warning device according to claim 16 wherein said source of potential is connected through a switch to said switch relay coil, said delay means including a capacitor discharged by successive absences of signal in said automatic volume control circuit to disconnect said potential source from said switch relay coil.

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