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[54] TORNADO WARNING DEVICE

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[51] Int. Cl. H04b 1/16

[58] Field of Search 340/241, 224, 421;
325/364, 365, 67

[56] References Cited

OTHER PUBLICATIONS

"Now You Can 'See' Tornadoes on TV" by H. & V. Bradshaw, Popular Mechanics, March, 1969, pages 93-96, 225, 226.

Primary Examiner—John W. Caldwell

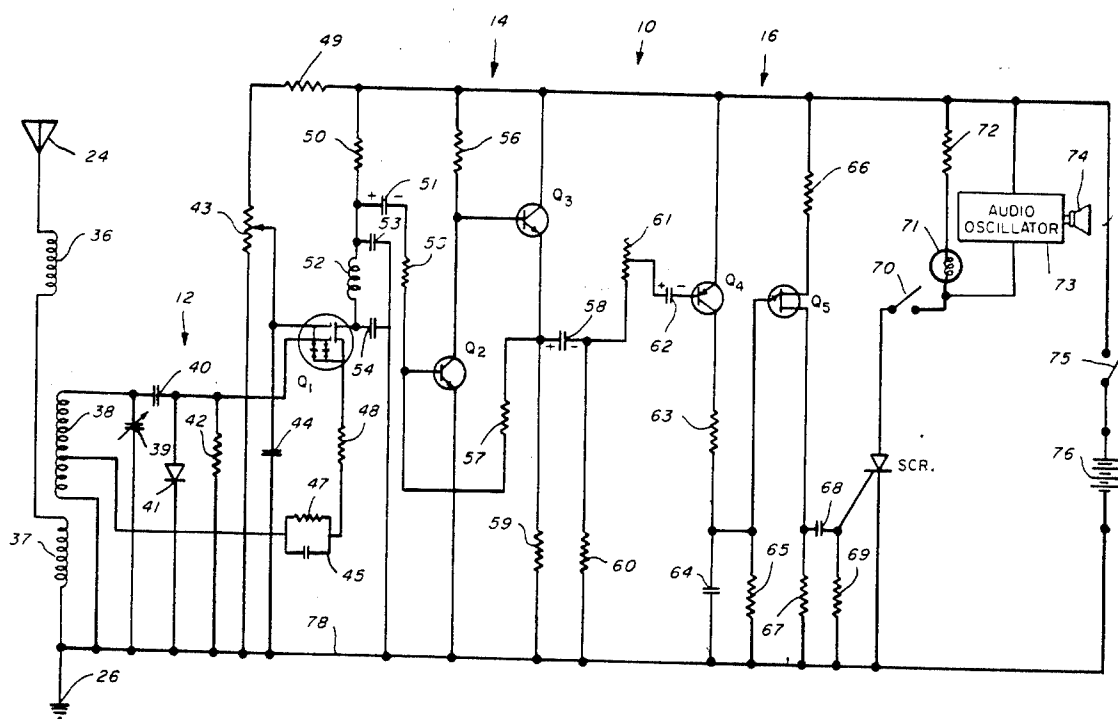
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[57] ABSTRACT

A radio receiver system for warning of an approaching tornado. The device is a regenerative detector tunable over the broad range of 25 to 60 MHz but normally tuned to the 53.25 MHz frequency. The system is capable of extracting from a carrier a tornado audio frequency signal as small as 0.5 microvolts. The tornado signal in the audio frequency range is extracted from the carrier frequency and is amplified by a general purpose amplifier. It is fed to trigger circuit for switching on an audio oscillator and a warning light. These warning devices stay on until they are manually switched off.

4 Claims, 4 Drawing Figures



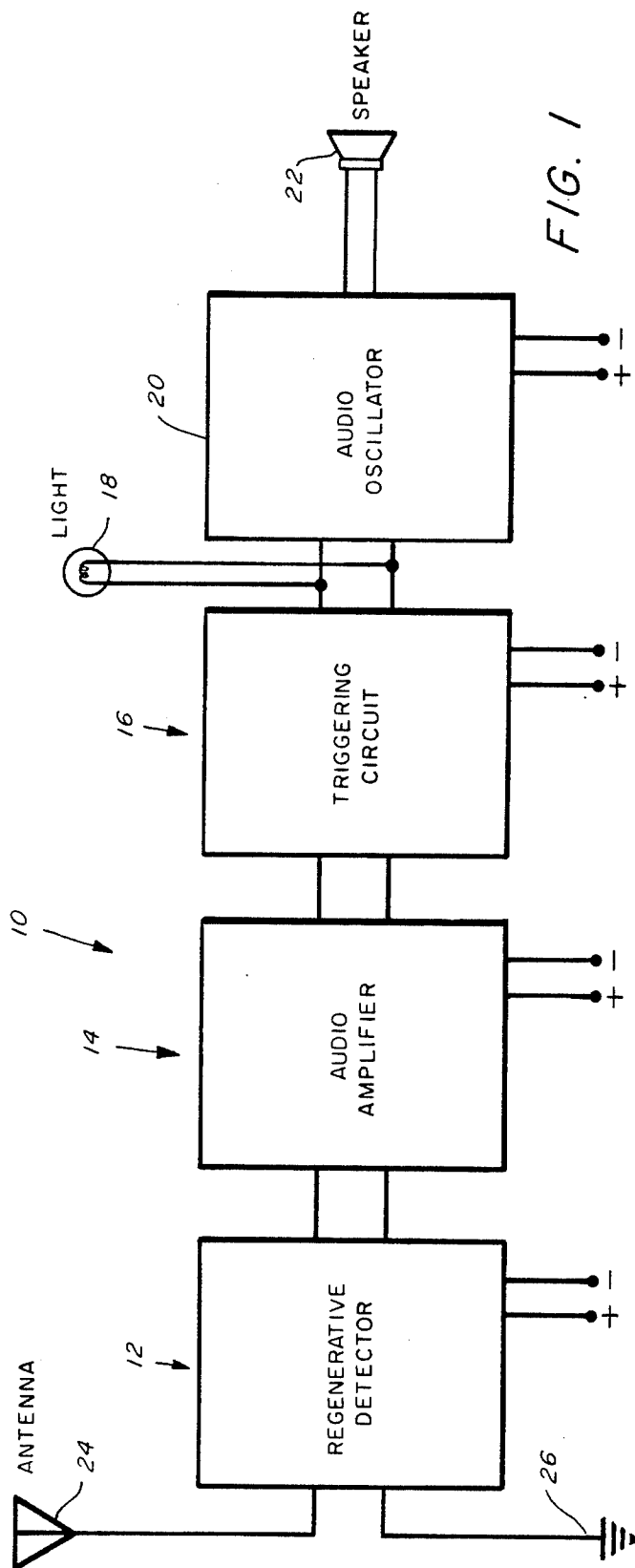


FIG. 1

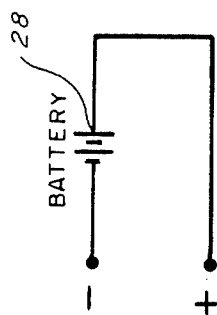


FIG. 2

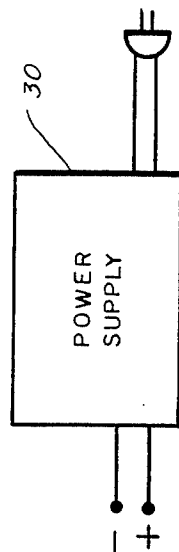


FIG. 3

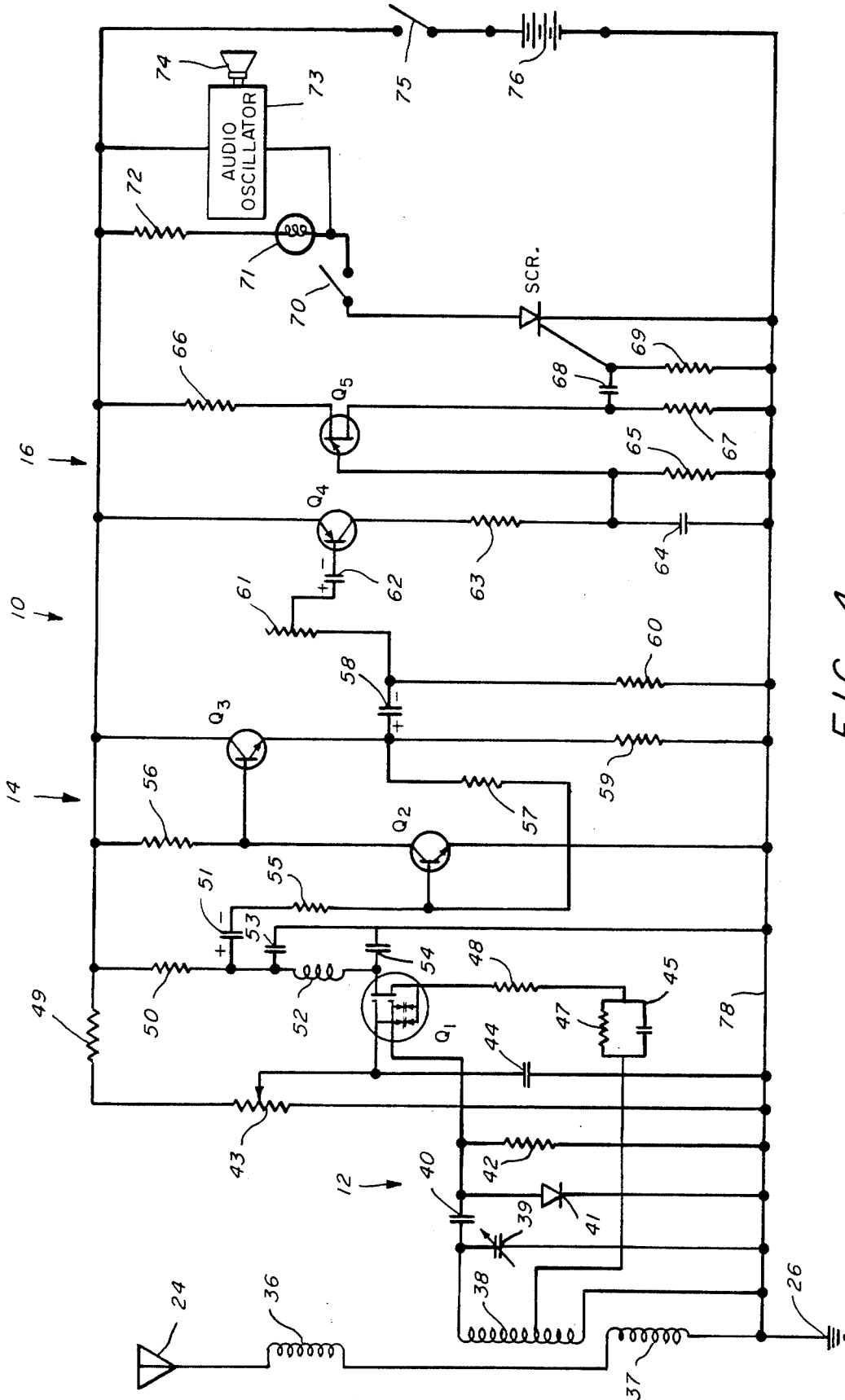


FIG. 4

TORNADO WARNING DEVICE

BACKGROUND OF THE INVENTION

This invention is in the field of storm warning receivers. More particularly it is concerned with a receiver-warning system for detecting and sounding alarms on the approach of tornadoes.

An approaching tornado will generate a signal in the 25 to 60 MHz band, and most commonly at a frequency of about 53.25 MHz. The tornado audio signal modulates this carrier frequency. The signal will appear as a 0.5 microvolt or larger signal at the antenna when the storm is approximately 10 to 20 miles distant from the antenna.

In the prior art various means, such as barometric pressure gauges, have been used to indicate the presence of storms. However, these are not particularly indicative of the type of storms, such as tornadoes, which are of great destructive power and occur frequently in certain areas of the country.

SUMMARY OF THE INVENTION

It is a primary object of this invention to provide a small, simple self-contained self-powered device for use in indicating the near presence of a tornado.

This and other objects of this invention are realized and the limitations of the prior art are overcome by the use of a regenerative type, highly sensitive radio receiver which is tunable in the range of 25 to 60 MHz and specifically tunable to a frequency of approximately 53.25 MHz. The receiver system has a detector portion in which the modulation on the carrier wave is detected and amplified in a two stage voltage amplifier. There is a filtering section with selectivity and sensitivity controls, which go to a trigger system for initiating audible and/or visible signals upon the reception of an audio signal indicative of a tornado.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects of this invention and a better understanding of the principles and details of the invention will be evident from the following description taken from conjunction with the appended drawings, in which:

FIGS. 1, 2 and 3 indicate in block diagram form the parts of this radio receiver tornado detector system and power sources for use therewith.

FIG. 4 indicates the circuit diagram of a preferred form of radio receiver, amplifier, trigger and signaling system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There has always been great interest among people living in certain areas of the Southwest and Midwest regions of the country, known generally as "tornado alley," in devices for indicating the proximity of severe tornado-like storms.

Studies have been made of the electrical signals generated by these storms and it has been found that tornadoes are unusual in that they provide audio modulated high frequency signals generally in the 25 to 60 MHz bands and more specifically in the 53.25 MHz frequency.

These carrier signals carry an audio modulation generally in the 5 to 2,000 Hz range. Unlike the normal

static burst from a stroke of lightning, these tornado signals are continuous, high level, audio signals and may have a signal amplitude of 0.5 microvolts or greater when the storm is at a distance of up to 20 miles from the receiver.

The system of this invention is illustrated in FIG. 1 where the system is broken up into four separate parts including a regenerative detector 12 having an antenna 24 connected thereto and a ground lead 26. The output of the detector 12 goes to an audio amplifier 14. The output signal from the amplifier goes to a triggering circuit 16, and when the voltage coming from the amplifier is high enough to trigger the circuit of 16 a warning light 18 and audio oscillator 20 and speaker 22 are enabled to provide an audio warning signal. Normally these pieces of equipment are powered by a battery such as 28 shown in FIG. 2, since during severe storms the power lines are generally not reliable. However, it is possible to use an a.c. power supply as shown in FIG. 3.

The complete circuit diagram is shown in FIG. 4. An incoming amplitude-modulated rf signal of 53.25 MHz is received across the antenna loading coil 36 which is series coupled to the antenna coil 37, to give a quarter wave length needed for the tuned circuit. Coil 37 is inductively coupled into the detector input tuned circuit by the inductor 38 and the variable capacitor 39. The variable capacitor 39 is used to tune the detector to 53.25 MHz signal frequency. The 53.25 MHz signal developed across the tuned circuit is applied to the MOS transistor Q_1 . The gate No. 1 to source circuit of the MOS transistor operates basically as a gate-leak detector. The negative clamper formed by the diode 41, the capacitor 40, and the gate leak resistor 42 bias the circuit so that only the positive leaks of the 53.25 MHz input signal result in current flow through the MOS transistor.

The magnitude of these current pulses vary according to the audio modulated signal (tornado pulse frequency) superimposed on the input 53.25 MHz carrier frequency. These audio-signal variations are amplified in the source-to-drain circuit of the MOS transistor Q_1 . The source-to-drain current of the MOS transistor Q_1 flows through a portion of the tuned circuit inductor 38. The rf components of this current are inductively coupled back to the tuned circuit by the autotransformer action of the inductor 37 in proper phase to reinforce the signal developed at gate No. 1 of the MOS transistor Q_1 . The regenerative feedback permits repeated amplification of the incoming signal and substantially increases sensitivity of the detector circuit.

The amount of regenerative feedback coupled back to the input tuned circuit must be controllable because maximum regenerative amplification for AM operation occurs at a critical point just prior to that at which the detector oscillates. The regenerative feedback is controlled by potentiometer 43. This adjustment varies the bias applied to gate No. 2 of Q_1 to control the gain of the MOS transistor Q_1 .

The rf choke 52 and the bypass capacitors 54 and 53 form a low-pass network that filters out the rf components in the drain-circuit current so that the current through the detector load resistor 50 consists almost entirely of audio-frequency components. The audio signal voltage developed by this current is coupled by capacitor 51 to the input of the voltage amplifier 14.

The voltage amplifier 14 is a two stage amplifier which uses a emitter input stage Q_2 coupled with an emitter-follower output stage Q_3 . The stages are connected in a self-adjusting configuration that maintains the amplifier in a stable operating state regardless of variation in supply voltage. This stability is achieved by use of a d.c. feedback applied from the output of transistor Q_3 to the input of transistor Q_2 through resistor 57.

If the emitter current of transistor Q_2 should increase, the base voltage of transistor Q_3 would decrease because of the rise in the voltage drop across resistor 56. This decrease in the base voltage of transistor Q_3 results in a corresponding reduction of voltage in the emitter of transistor Q_3 . Therefore the amount of positive d.c. voltage feedback from the emitter of transistor Q_3 to the base of transistor Q_2 is reduced. This reduction in voltage at the base of Q_2 causes a decrease in current through this transistor that compensates for the original increase, and the amplifier is stabilized.

The voltage output signal of the voltage amplifier is then applied to the base of transistor Q_4 through a low pass filtering system. A sensitivity rheostat 61 is used to suppress transient static pulses from lightning or other electrical apparatus. The transistor Q_4 acts as a series switch which when closed allows capacitor 64 to charge up through resistor 63 at a rate determined by the length of signal voltage applied to transistor Q_4 and the setting of sensitivity rheostat 61. When no signal is present, transistor Q_4 acts as an open switch, and capacitor 64 is discharged by resistor 65.

When a low frequency signal appears at the amplifier output at Q_3 , signaling a tornado, transistor Q_4 remains closed long enough to charge capacitor 64 and build up voltage to a point where unijunction transistor Q_5 breaks down. The capacitor 64 then discharges through Q_5 and a pulse is generated across resistor 67. The pulse is coupled, through capacitor 68, to the gate of SCR1 and causes the silicon control rectifier SCR1 to switch power supply voltage to the pilot light 71 and the audio oscillator 73. Resistor 72 limits the current flow in the SCR1 circuit.

If the switch 70 is closed and the SCR1 switches on, and an audible and visual alarm is given, the only way

to turn off the SCR1, is to open switch 70 and remove the power supply voltage from the SCR1. The switch can then be closed again for further use. Switch 75 is the main power switch that connects the d.c. power supply 76 to the electronic circuits.

While the invention has been described with a certain degree of particularity, it is manifest that many changes may be made in the details of construction and the arrangement of components. It is understood that the invention is not to be limited to the specific embodiment set forth herein by way of exemplifying the invention, but the invention is to be limited only by the scope of the attached claim or claims, including the full range of equivalency to which each element or step thereof is entitled.

What is claimed:

1. A tornado warning system, comprising:

- a. amplitude modulated radio receiver means and audio detector means tunable to a single frequency in the range of 25 to 60 MHz;
- b. audio amplifier means tunable to the range 5 to 2,000 Hz responsive to said detector means;
- c. trigger means responsive to said amplifier means for closing a power circuit; and
- d. alarm means responsive to said trigger means for initiating an audio visual alarm when said power circuit is closed.

2. The warning system as in claim 1 in which said trigger means includes:

- a. an amplifier stage for charging a capacitor, said capacitor having a discharging resistor, said capacitor and resistor of selected magnitudes;
- b. a unijunction transistor responsive to the voltage across said capacitor; and
- c. a silicon controlled rectifier means responsive to said unijunction transistor means, in series with said alarm means.

3. The warning system as in claim 1 in which said receiver is tunable to 53.25 MHz.

4. The warning system as in claim 1 in which said receiver is tunable to 53.25 MHz and wherein the carrier frequency is modulated by a tornado produced audio frequency.

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