United States Patent

[11] **3,578,990**

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[45] Patented **May 18, 1971**
[73] Assignee **The United States of America as represented by the Secretary of the Navy**

[54] **PULSE GENERATOR TIMING CIRCUITS**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **307/293,** 307/268, 307/287, 307/324
[51] **Int. Cl.** **H03k 17/28**
[50] **Field of Search** ..... 307/287, 293, 324, 273, 268; 328/55, 129—131

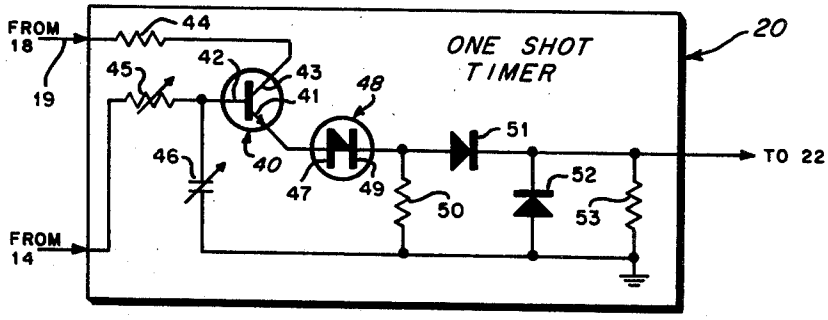
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Primary Examiner—Stanley D. Miller, Jr.
Attorneys—Edgar J. Brower and Henry Hansen

ABSTRACT: A detector provides a signal for switching on the power supply of a proximately positioned transmitter upon the detection of desired information. A signal representative of the desired information is transmitted and, at predetermined times thereafter, coded signature signals are produced for transmission, these latter signals being supplied by a code generator upon the receipt thereto of pulses from a one-shot and/or repetitive interval timer. The one-shot timer at a predetermined period of time after receipt of the switching signal provides a single pulse to the code generator. The repetitive interval timer provides recurring pulses to the code generator at predetermined intervals of time after receipt of the switching signal. The system consumes no power in the standby mode.



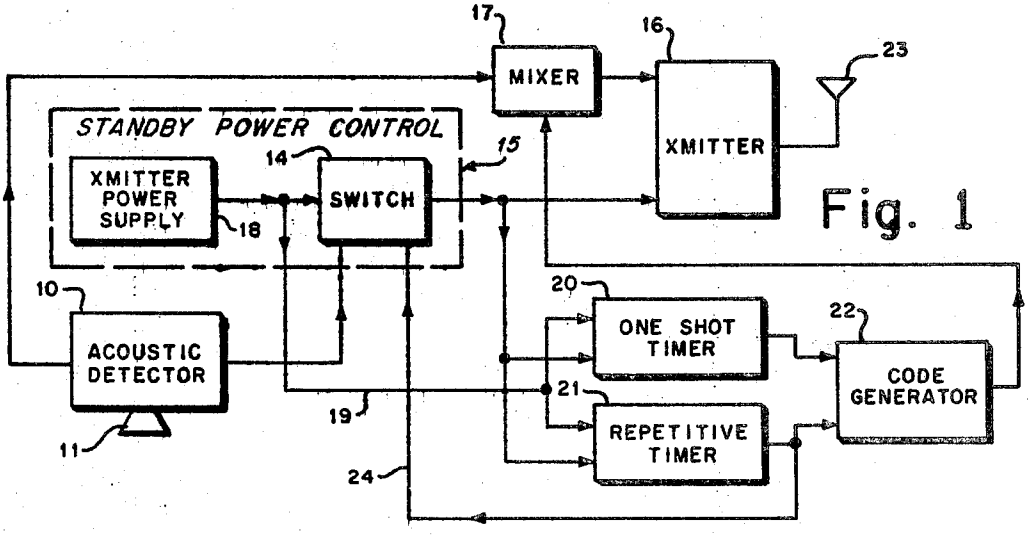


Fig. 1

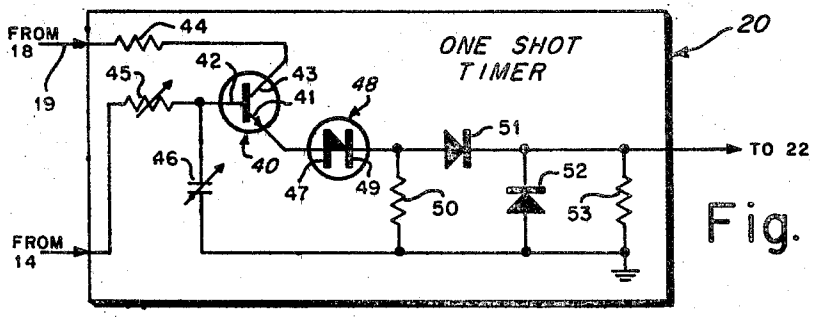


Fig. 2

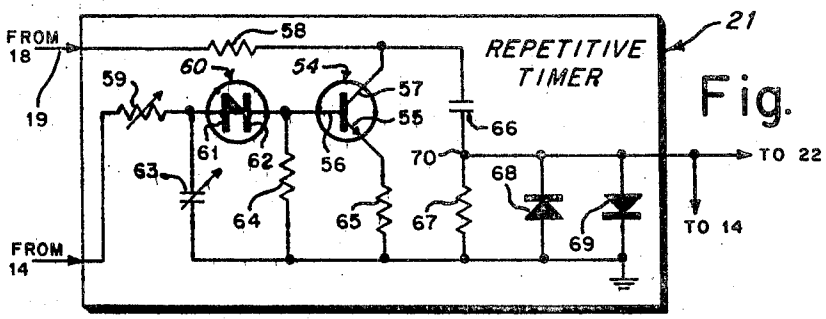


Fig. 3

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PULSE GENERATOR TIMING CIRCUITS

CROSS-REFERENCE TO RELATED APPLICATION

This application is a division of application Ser. No. 710,702 filed Feb. 27, 1968.

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

The invention relates to timers and more particularly to timing networks that provide pulses at predetermined intervals.

The present invention is contemplated for use as part of a device that functions as an electronic spy to listen for and activate means for transmitting signals indicative of vehicle and/or troop movements as well as button bomb detonations, rifle fire, and the like. The device may be secreted behind enemy lines and, once so secreted, may be unrecoverable. Consequently, it is paramount that transmission be kept at a minimum to both conserve power and avoid detection by the enemy. It is also paramount that information, when transmitted, may reasonably be assumed to contain desired information rather than mere random noise. In addition, as it is contemplated that a plurality of devices comprising the invention will be deployed in a predetermined pattern over a wide area, it is important that the listener know which one (or ones) of the devices is transmitting.

SUMMARY OF THE INVENTION

Accordingly, it is the general purpose of this invention to provide timing networks that supply pulses at predetermined intervals.

In particular, one timing network provides a single pulse regardless of the length of time it is provided with a pair of input signals so long as the input signals exceed a predetermined period of time.

Another timing network provides a pulse at predetermined intervals so long as a pair of input signals continue.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a block diagram of the system showing the various elements thereof in accordance with the invention;

FIGS. 2 and 3, are schematic diagrams of certain of the block diagram elements of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing and more particularly to FIG. 1, there is shown an adaptive acoustic detector **10** in accordance with and more fully explained in patent application, Ser. No. 679,255, entitled, "Adaptive Acoustic Detector Apparatus" by Henry Naubereit et al., filed Oct. 30, 1967, having at its input an acoustic sensor **11**, which may be a microphone. A first output from detector **10** is fed to a transmitter **16** through a mixer **17**. As disclosed in the above-mentioned patent application, the detector **10** provides a second output signal only when the signal received by sensor **11** contains desired information, such as the sound of vehicle movement. Should no such second signal be provided, switch **14**, positioned within the standby power control unit **15** and connected to the transmitter power supply **18**, is nonoperative. Thus, while the transmitter **16** continuously receives information from detector **10** through mixer **17**, the absence of the second signal from detector **10** prevents the closure of the switch **14** and hence precludes the transmitter power supply **18** from supplying its DC power to the transmitter **16**. In this way, transmitter power is conserved, no power being consumed by the system in the standby mode. That is, power is consumed only upon the enabling of switch **14**, a condition which occurs only upon the the receipt and detection of desired information by adaptive acoustic detector **10**.

The switch **14**, in addition to being electrically connected to the transmitter power supply **18**, is also electrically connected to two timing elements, one one-shot timer **20** and a repetitive timer **21**. The outputs of one-shot timer **20** and repetitive timer **21** are connected to a code generator **22** which, in response to signals received from the timers (in a manner hereinafter explained), provides a signal to mixer **17** and thence to transmitter **16**. The mixer **17** is of the type that will pass information from background insensitive amplifier **12** in the absence of a coded signature signal from code generator **22** and will pass the sum of the two signals in the presence of a coded signature signal. Both coded and uncoded information is radiated by antenna **23**.

The operation of the system of FIG. **1** will be described. As stated heretofore, if the detector **10** does not provide the second output signals, then even though detector **10** is providing the first signal to transmitter **16**, the power supply **18** thereof is inoperative to supply power due to the off condition of switch **14** and hence no signal is radiated by antenna **23**. If, however, the detector **10** does supply the second signal, the switch **14** is rendered operative to thereby permit the passage of voltage from transmitter power supply **18** to the transmitter **16**. Concurrently therewith, the supply **18** provides DC voltage to both the one-shot timer **20** and the repetitive timer **21** through the electrical connection **19**. One-shot timer **20** is designed, as hereinafter disclosed, to provide a pulse 3.0 seconds after the closure of switch **14**. This pulse is fed into the code generator **22** which, in response thereto, provides a coded signal to mixer **17**. If the information (first signal) the adapted acoustic detector **10** persists for a period greater than 3 seconds, the signature signal from code generator **22** mixes therewith in mixer **17** and the composite signal is supplied to transmitter **16** for radiation by antenna **23**. Conversely, if the first signal from the detector **10** persists for less than 3 seconds, the signature signal from code generator **22** will be passed by the mixer **17** directly to the transmitter **16** for radiation thereby.

It is noted that regardless of the duration of the first signal from detector **10**, or the duration of the second signal from the detector **10**, the switch **14** remains operative, once so rendered, until it receives a reset pulse via line **24** from repetitive timer **21**. This will be hereinafter described.

The transmitter power supply **18** also feeds the repetitive timer through the electrical conductor **19**. Repetitive timer **21** is designed to provide an output signal 10.0 seconds after the receipt of power from the supply **18**. The signal from repetitive timer **21** is fed concurrently to the code generator **22** and, via electrical conductor **24**, back to switch **14**. The code generator, in response to the signal received from the repetitive timer **21**, provides a signal to the mixer **17** in the same fashion as provided upon receipt of a signal from one-shot timer **20**. The signal from the code generator, **22**, in response to the signal produced by repetitive timer **21**, is radiated by the antenna **23** either as part of a composite signal or as merely the code signal itself in a manner identical with the radiation of the signal from one-shot timer **20** and the first output signal from detector **10**.

The signature signal from code generator **22**, in response to repetitive timer **21**, occurs 7.0 seconds after the signature signal responsive to the signal supplied by one-shot timer **20**. If, for example, a line of troops passes by the sensor **11** in a period between 3.0 and 10.0 seconds, then the first signature signal from code generator **22** will mix with the first signal supplied by detector **10** and a composite signal will be radiated by antenna **23**. The signature signal supplied as a result of the receipt of a signal from repetitive timer **21**, however, will not mix in the mixer **17** and will instead be directly radiated by antenna **23**. In this way the listener knows not only which of the strategically positioned devices is transmitting (as identified by the particular code signal transmitted) but also the length of time, within rather narrow limits, that a desired target is within the range of the sensor **11**.

Once the switch **14** is closed, the transmitter remains "ON" until the power supply **18** is disconnected therefrom by the

disabling of switch 14. The reset pulse provided at 10 second intervals by the repetitive timer 21 via line 24 attempts to reset or disable the switch 14 once every 10 seconds. However, the switch 14 is of a type such that it can not be reset in the presence of the second signal from the detector 10. Thus, as long as the sensor 11 of FIG. 1 is receiving a desired target signal, the transmitter 16 will remain ON. Upon the occurrence of the absence of a desired signal at sensor 11, however, the transmitter 16 remains ON for the conclusion of the 10 second cycle whereupon, the detector 10 no longer providing a second signal to switch 14, the reset pulse from the timer 21 is operative to disable the switch 14 and thereby disconnect the power supply 18 from the transmitter 16.

It is noted that the switch 14 is provided with a time-delay circuit of sufficient duration to insure that the signature signal from code generator 22 (as derived from repetitive timer 21) will be radiated by the antenna 23 prior to the disabling of the switch 14 upon receipt of a reset pulse.

Referring now to FIG. 2, the operation of the one-shot timer 20 will be described. The timer 20 comprises an NPN transistor 40 having an emitter 41, a base 42 and a collector 43. The collector 43 is connected to the transmitted power supply 18 through a resistor 44. The base 42 is connected to the switch 14 (and hence to the power supply 18) through a variable resistor 45. The base 42 is also connected to ground through a variable capacitor 46. The emitter 41 is connected to the anode 47 of a four-layer diode device 48. The cathode 49 thereof is connected to a resistor 50 and a pulse-shaping network comprising diodes 51 and 52 and resistor 53. The output to the code generator 22 is taken at one side of the resistor 53.

In the standby mode, power from transmitter power supply 18 develops a voltage through resistor 44 and hence upon the collector 43 of the transistor 40. However, the base 42 receives no signal and hence the transistor 40 is quiescent. Upon the receipt of a signal from detecting circuitry 13, however, switch 14 is rendered operative and power from the supply 18 flows through the switch 14 and charges the variable capacitor 46 at a rate determined by the ohmic value of variable resistor 45. The values of the resistor 45 and the capacitor 46 are preselected to provide a time delay 3.0 seconds before sufficient voltage is developed across the capacitor 46 such that it will discharge through the base 42 of transistor 40. Upon capacitor 46 discharging, the transistor 40 is rendered conductive and power is conducted through the collector resistor 44 and the transistor itself to overcome the breakdown voltage of four-layer diode 48. This results in a sharp, positive going impulse or spike developed across the resistor 50. This spike is shaped by the diodes 51 and 52 such that a relatively square pulse is developed across resistor 53 which is then fed into the code generator 22 thereby initiating the code signature signal process.

It is noted that the ohmic value of the resistor 44 is selected to provide a sustaining current for the four-layer diode 48 so that even though capacitor 46 may be continually charging and discharging at three-second intervals, no further output pulse from the timer 20 occurs. Thus, regardless of the duration of the signal received by the sensor 11 of FIG. 1, the one-shot timer 20 provides but one pulse to the code generator 22, this pulse being provided 3 seconds after the enabling of switch 14.

The operation of the repetitive timer 21 will now be described. With reference to FIG. 3, there is shown an NPN transistor 54, similar to transistor 40 OF FIG. 2, having an emitter 55, a base 56 and a collector 57. The collector is connected to the power supply 18 through a resistor 58. The base 56 is connected to the switch 14 through a variable resistor 59 and a four-layer diode 60 having an anode 61 and a cathode 62. The anode 61 is connected both to one side of a variable resistor 59 and to a variable capacitor 63, the other side of the capacitor 63 being connected to ground. The cathode 62 is connected to the base 56 of the transistor 54 and to ground through a resistor 63. The emitter 55 of transistor 54 is connected to ground through a resistor 65 while the collector 57 is connected to one side of a capacitor 66, the other side of the capacitor 66 being connected both to a resistor 67 and the respective anode and cathode of two diodes 68 and 69. The combination of elements comprising capacitor 66 and diodes 68 and 69 provide a pulse-shaping function which in conjunction with the resistor 67 provides a sufficiently wide and shaped pulse for supplying the code generator 22 with a signal upon which it can trigger.

Transmitter power supply 18 supplies a DC voltage to the collector 57 through the resistor 58. However, as no signal is applied to the base 56, the transistor 54 is quiescent. In addition, this voltage is blocked by the capacitor 66. Accordingly, the repetitive timer 21 consumes no power in this, the standby mode. Upon the receipt of the second signal from detector 10, however, switch 14 is rendered operative and voltage from the supply 18 is passed through the switch 14 to charge the variable capacitor 63 at a rate determined by the resistance of variable resistor 59. The values of the resistor 59 and capacitor 63 are preselected to provide a time delay of 10.0 seconds before the breakdown potential of four-layer diode 60 is reached such that the latter element will conduct. Upon this potential being achieved, the capacitor 63 discharges through the diode 60 and the resultant electrical signal is applied to the base 56 and is operative to render the transistor 54 conductive. Upon conduction, a pulsed voltage signal is supplied across the capacitor 66 and the resistor 67, a voltage division being affected at point 70. The portion of the signal across the capacitor 66 is pulse shaped by the diodes 68 and 69 to concurrently provide an output pulse to the switch 14 and the code generator 22.

It is noted that the variable transistor 59 is selected to be large enough to limit the current through the four-layer diode 60 such that that current is less than the required sustaining current for the device. Accordingly, the diode 60 is able to reset for another cycle, the cycle time being dependent upon the values of the resistor 59 and the capacitor 63. Thus the repetitive timer 21 supplies a signal to the code generator 22 and a reset signal to the switch 14 at 10 second intervals. The switch 14 is not disabled, however, so long as a signal is present. Upon the occurrence of the absence of such a signal, the reset pulse is operative to open the switch 14 and thereby disengages the transmitter 16 from its power supply 18.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. An electrical timer which consumes no power in the standby mode and which provides but one output pulse comprising:

time delay means adapted to provide an electrical signal a predetermined time after the receipt thereby of a first input electrical signal;

pulsing means connected with and responsive to said time delay means for providing an output pulse including, a four-layer diode, and a transistor having its base connected to said time delay means and its emitter connected to one side of said four-layer diode, said transistor being rendered conductive upon the receipt of said electrical signal from said time delay means;

a first resistor connected between ground and the other side of said four-layer diode; and

a pulse-shaping network connected across said first resistor.

2. An electrical timer according to claim 1 further including:

a second resistor for receiving a second input signal at one end thereof and connected at the other end thereof to the collector of said transistor, the ohmic value of said resistor being of sufficient magnitude to provide a sustaining current through said four-layer diode such that said four-layer diode cannot reset.

3. An electrical timer which consumes no power in the standby mode and which provides an output pulse repetitively at predetermined intervals comprising:

time delay means including a variable resistor and a variable capacitor connected between one terminal of said variable resistor and ground for receiving a first input electrical signal and for providing an output electrical signal in response thereto at the one terminal thereof a predetermined time after the receipt of said input signal;

pulsing means connected with said time delay means and responsive to the output electrical signal thereof for providing a pulse at predetermined intervals including, a transistor and a four-layer diode one end of said diode being connected to the base of said transistor and the other end of said diode being connected to said electrical time delay means at said one terminal of said variable resistor;

a first resistor for receiving a second input signal at one end thereof and connected at the other end thereof to the collector of said transistor;

a capacitor connected at one end thereof to the collector of said transistor; and

a second resistor connected between ground and the other end of said capacitor, whereby said transistor is rendered conductive upon the discharge of current through said four-layer diode.

4. An electrical timer according to claim 3 further including:

first and second diodes, each of said diodes connected across said second resistor such that the polarity of said first diode is opposite from the polarity of said second diode.

5. An electrical timer according to claim 2 wherein:

said capacitor and said first and second diodes comprise a pulse-forming network; and

said variable resistance has an ohmic value of sufficient magnitude to limit the current through said four-layer diode thereby to permit said diode to reset.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,578,990 Dated May 18, 1971

Inventor(s) Henry Naubereit

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 14, "2" should read -- 4 --.

Signed and sealed this 2nd day of November 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents

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