

[54] **DELAYED ALARM AND DROWSE FOR
CLOCK RECEIVERS**

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309.4, 328, 274, 220, 223, 384 E; 179/2 TC

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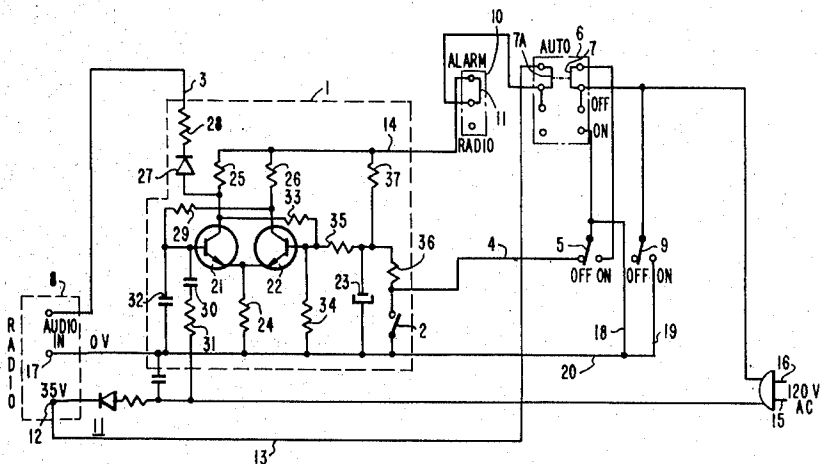
[57] **ABSTRACT**

A timed full alarm condition is delayed for a short period of subdued alarm, by connecting the timer output through a modified Schmidt trigger circuit to the full-alarm generator. At the same time the timer output is connected to the subdued alarm generator, without a delay mechanism.

The delay feature is given by combining a charging circuit in the Schmidt triggering scheme. A transistor of the Schmidt circuit is used for analog processing of an alarm buzz tone signal as well as for outputting the trigger impulse. A renewed delay can be manually introduced by discharging the charging circuit without restoration of the timed switch to its quiescent condition. Recharging then commences a second cycle of delay with subdued alarm, then a repeated full-alarm.

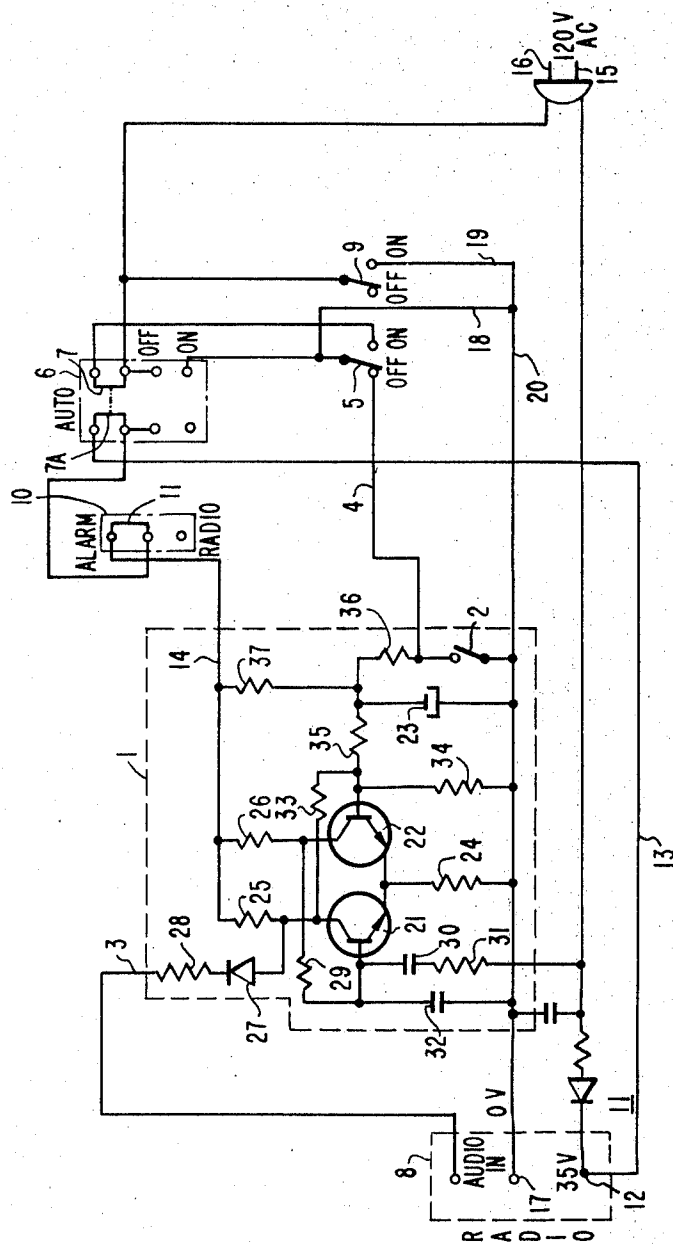
The invention is embodied in a clock radio, where personal subdued alarm is the radio playing, and the full alarm is amplified clipped line waveform reproduced as a buzz on the radio loudspeaker. The discharge switch gives a drowse facility, again with radio.

6 Claims, 1 Drawing Figure



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DELAYED ALARM AND DROWSE FOR CLOCK RECEIVERS

BACKGROUND OF THE INVENTION

The present invention relates to a circuit to produce an alarm signal after a short delay, typically a few minutes.

The alarm may be required to sound a buzzer on activation by a timer determining a longer period, and it may be required that the short delay period be renewable by a manual control. During such short delay period, it may be required that a subdued-alarm condition be created, such as a softer sound than that of the buzzer.

In more general terms, a brusque tone or other full alarm signal should commence only after a subdued alarm signal has subsisted for a short delay period, and, desirably, the short delay period should advantageously be renewable at will, such renewed period again being terminated by the full alarm condition. The alarm need not be an audible alarm.

BRIEF DESCRIPTION OF THE INVENTION

According to the invention, a delay circuit comprising, an active device which will draw current when given bias level is applied at a control electrode thereof, a biasing circuit for the active device and energizable to bias said control electrode to a level below said given bias level so that the active device assumes a non-conductive state, a storage device able to develop a voltage and connected to said control electrode of said active device, a charging circuit for charging said storage device such that the voltage developed thereby will surpass said given bias level after a short delay period has elapsed, means operable to discharge said storage device, a second active device coupled to the first active device and being biased thereby in a Schmidt trigger circuit, whereby the second device adopts a reduced current conducting condition when the first commences to draw current, and means to signal said reduced current condition. Thus the invention may reside in an add-on or auxiliary unit for an existing electric timer device. During such short delay period, there may be no alarm, or a subdued alarm condition may be set up.

According to a preferred feature of the invention the full alarm condition may be renewed automatically or manually after a further short delay period.

The invention may be embodied in a sound radio timer clock receiver, to give delayed full alarm and also drowse facilities, after a timed period has elapsed. The full alarm may then be the radio playing, or it may be a brusque wake-up bell or buzzer. In the latter case, the radio may be arranged to sound during the short delay period.

Prior art personal-alarm clock radios are known by which one can turn the alarm sound off for a drowse period, which is terminated by a renewed alarm. Radio receivers are also known which give the sleeper the choice of a radio sound or buzzer sound awakening. Devices including clockwork alarm clocks are known which provide subdued sounds prior to sounding more robustly.

As embodied, the invention may be a unit which provides a short delay (e.g. drowse) and buzzer facility to

a radio timer, by means of connections to the timer switch and to an audio stage thereof.

The term "short" for the delay period introduced by the unit signifies a time short compared with timed period, e.g. with the usual several hours of sleep programmed by an alarm clock radio. Such short period may then comprise a few minutes.

BRIEF DESCRIPTION OF THE DRAWING

Further features and advantages of the present invention will appear from the following description of an embodiment, given by way of example in conjunction with the accompanying drawing, which is a Schmidt trigger circuit schematic, and shows input and output connections thereof to and from relevant functions of a timer radio, not otherwise shown.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawing, the short or extended delay unit embodying the invention is shown within the dashed line surround 1 and comprises a manual switch 2 by which the short period may be purposely initiated, as a drowse period. At the end of such period, unit 1 delivers a full alarm signal on an output line 3. Unit 1 will also initiate a delay period and then sound the alarm, automatically on receiving over an input line 4 a timer signal, such as that delivered by the timed switch 5 of a clock radio adjusted to the "auto" state. A sleeper can thus waken gradually to the radio playing during the short delay period, before a louder full-alarm is initiated by a signal on output line 3.

Relevant parts of a clock timer radio to which the unit of the invention provides short delay and buzz facilities, are as follows. An AUTO-OFF-ON switch with a three position slider 7 enables the radio represented by box 8 to be turned on for normal play or timed play. In the latter, AUTO condition with the slider uppermost, a SLEEP switch 9 and/or the timed switch 5 may be made effective by manual setting. The former can be set to automatically switch off the radio after, say, half an hour's playing; the present invention is not concerned with it. The timed switch 5 can be set to switch on the radio 8 after, say, eight hour's sleeping time have elapsed. Unit 1 may switch on a full alarm buzzing sound through line 3 and an audio stage in radio 8 a few minutes after switch 5 has operated. A further switch 10 may be set, to RADIO if no full alarm is required, otherwise to ALARM with its slider 11 in its upper position shown, which position will be assumed held for the rest of this description.

Radio 8 contains the usual AM or FM demodulation, mixer, IF and audio circuits and a connection to the input of an audio transistor from the line 3. For convenience in explanation, the alternating line or mains voltage rectification circuit is shown outside the radio, generally at 11, the rectified output (of some 35 volts) being used not only in the radio via a terminal 12 but also in the delay unit 1 via a path 13, a second slider 7A of switch 6 when switched to AUTO, slider 11 of switch 10 when switched to ALARM, and the supply line 14 of unit 1. Thus unless the switches 6 and 10 are switched as shown, the delay unit 1 will be unenergized.

The radio terminal 12 will always be energized because the rectifier 11 is always connected to the (120 volts in USA) line input terminal 15, but the other line or mains terminal 16 will only be connected to the

other supply terminal 17 of the radio if any one of the following three conditions hold: (a) the sleep switch 9 has been set ON, wherefrom it will revert to the OFF position illustrated after the half hour's sleep period, (b) slider 7 is set to the lowest of the three positions, marked ON, of switch 6, or (c) slider 7 is set to AUTO and the timed switch 5 has been switched ON from the OFF position illustrated, by the timer not shown, after the predetermined 8 hours of timed sleep period have elapsed. In cases (b) and (c) a path 18 is operative, in case (a) path 19 connects terminal 16 through a path 20 to radio terminal 17. As aforesaid, second slider 7A of switch 6 ensures that DC supply only energizes unit 1 when switch 6 is on AUTO.

Referring to unit 1, a pair of transistors 21, 22 are connected as a Schmidt trigger circuit well known in the literature for sensitivity. The circuit is arranged to trigger when a very large, 470 microfarad capacitor 23 reaches a given state of charge, and instigate the full-alarm condition. Transistors 21, 22 are connected by a common emitter load resistor 24 to lead 20, which is the common line as far as the DC supply is concerned. The collectors of transistors 21, 22 are supplied from live DC supply line 14 through collector resistors 25, 26, the former collector being connected to the trigger output path 3 through a gating diode 27 and buffer resistor 28. The collector of transistor 22 is taken through a resistor 29 as per normal Schmidt trigger practice to the base of transistor 21, which is otherwise isolated from DC potentials but has a capacitor 30 connecting it through a large loading resistor 31 to an AC source, such as the input from that line cord terminal (15) used to produce the live DC supply. The base of transistor 21 may also be connected to the common DC line 20 through a small capacitor 32. The collector of output transistor 21 is connected through a resistor 33 to the base of transistor 22, which is connected to common potential through a large resistor 34, and to the storage time delay capacitor 23 by a resistor 35.

Capacitor 23 is thus slowly discharged by resistor 34, and undergoes fast discharge through a small resistor 36, either by the normally open drowse switch 2 when momentarily closed to initiate a drowse period, or by the normally open timed switch 5 of the clock timer through path 18 at any time other than when switch 5 has just closed at wake-up time. Capacitor 23 is slowly charged through a very large resistor 37, and to some extent through resistor 33, from supply line 14, just after switch 5 has been closed or switch 2 opened. This takes on the order of minutes, before the voltage thereon initiates the below described Schmidt trigger action.

Operation of unit 1 is as follows. Immediately after the closure of clock-timed switch 5 from the open position shown, capacitor 23 is fully discharged, but the supply line 14, already connected to live DC at 35V terminal 12, is made effective by completing the AC circuit through lines 18 and 20. At the same time the radio is preferably energized and commences playing, switches 6 and 10 being as shown. Thus begins the delay period prior to full alarm, preferably with a subdued alarm (radio play) subsisting.

Initially transistor 21 is conductive due to its base being connected through resistors 29 and 26 to positive line 14. Indeed, since the resistance of 25 is preferably large compared with emitter resistance 24 transistor 21 will saturate and its collector will be at too low a poten-

tial to charge capacitor 23 appreciably through resistor 35. Its collector potential will be low enough to reverse bias diode 27 whose cathode is connected, to some point in the audio side of radio 8 of a few volts potential. The base of the almost saturated transistor 21 now offers a low resistance to the high impedance fed 50Hz or 60Hz hum signal through capacitor 30, so that this signal is practically shunted to zero.

Capacitor 23 is now charging slowly to a potential determined mainly by potential division by resistors 37 and 34, but also somewhat by resistors 25 and 35. After charge on 23 has reached the proper magnitude, the base of transistor 22 overtakes its emitter in potential, and the delay period termination is initiated by transistor 22 becoming conductive, its collector potential decreasing and thus, through resistor 29, the base potential of transistor 21 reducing its conduction sharply, but not to zero. The emitter commoning assists this differential action. The base of transistor 21 now offers a high resistance to the mains AC feed through 30, 31, and the current flow through transistor 21 responds, to produce an amplified, extremely clipped 50 or 60Hz line waveform on its collector. This collector, having a higher direct potential than hitherto, tends to maintain capacitor 23 charged, and thus the full alarm condition continues. This higher direct potential forward biases diode 27, and allows the clipped AC tone through to the radio, whereat a loud buzz is reproduced at the loudspeaker. This continues until capacitor 23 is discharged, either for a long period through path 18 by manual turn-off of time switch 5, or temporarily for a renewed short delay period by drowse switch 2.

Discharge of capacitor 23 switches transistor 22 off, its collector then reverts up to the +35V of supply line 14 and again biases the base of transistor 21 to saturation. Diode 27 cuts off, the base again shunts the AC input, and the buzz is thus doubly stopped.

Meanwhile, if the drowse switch 2 has been operated and released, switch 5 is still maintaining in the ON position and the capacitor 23 again charges, so that the delay and buzz cycle can be repeated ad lib. The radio is still ON. Switching timer switch 5 off would terminate everything. Switching switch 6 from AUTO to ON, or switch 10 from ALARM to radio would terminate the alarm and switch off delay unit 1.

Preferred values of the various parameters concerned with unit 1 are as follows:

Direct voltage on path 14	35 volts
Direct voltage on path 20	0 volts
Resistor 24	2.7K
Resistor 25	27K
Resistor 26	18K
Resistor 28	27K
Resistor 29	470K
Resistor 31	10M
Resistor 33	180K
Resistor 34	4.7M
Resistor 35	10K
Resistor 36	10 ohms
Resistor 37	1.8M
Capacitor 21	0.0068mf (microfarad)
Capacitor 23	470mf
Capacitor 32	0.0068 mf

A subdued alarm from the switched-on radio is not necessary to the invention, likewise the buzzing tone can be replaced by other full alarm audible or otherwise sensible conditions. The clock timer can be digital or analog, or even mechanically operated. The use of the output stage of the Schmidt trigger to transmit a

tone signal is desirable but optional; its DC potential fall could be used alternatively merely to open a gate or otherwise initiate the full alarm mechanism.

Other alternatives or improvements will occur to the skilled man. The inventive essentials are set forth in the appended claims.

What is claimed is:

1. In a clock radio receiver a delayed alarm system comprising:

- a. an alarm signal source;
- b. a sound reproducing system;
- c. means for coupling said signal source to said sound reproducing system comprising:
 1. a first active device having a control electrode and a main current conducting path;
 2. biasing means coupled to said control electrode of said first active device for rendering said main current conductive path thereof nonconductive;
 3. a second active device coupled to said first active device and to said alarm signal source having a control electrode and a main current conducting path and biased to a first conductive condition;
 4. a charge storage device coupled to said control electrode of said first active device;
 5. means for charging said storage device at a predetermined rate, the rate being selected such that a voltage at said control electrode of said first active device sufficient to render said main current path of said first active device conductive is developed after a period of time, said second active device being responsive to conduction of said first device so as to change to a second conductive condition whereby said alarm signal source is coupled by said second active device to said sound reproducing system to produce a delayed alarm condition; and
 6. means operable to discharge said storage device.

2. The apparatus as defined in claim 1 wherein said first active device is an input transistor and said second

active device is an output transistor each transistor having a base as a control electrode and a main conducting path, said input transistor being responsive to a bias level at said base for producing a conductive state in said main conducting path of said input transistor after a period of delay which conduction biases said output transistor to a second conductive condition thereby producing a delayed full alarm signal.

3. The apparatus as defined in claim 2 wherein said charge storage device is a storage capacitor coupled to the base electrode of said input transistor, said capacitor building a charge at a predetermined rate so as to bias said base electrode of said input transistor to produce conduction in said main conductive path of said input transistor after a period of delay equivalent to the time required for said capacitor to build in charge up to said bias level of said input transistor.

4. The apparatus as defined in claim 3 wherein said means for charging said capacitor includes a resistor coupled to said capacitor and to said input transistor for causing said capacitor to build a charge over a period of time so as to bias said base electrode of said input transistor to produce a conductive state which conduction biases said output transistor to a second conductive condition thereby producing a delayed full alarm condition.

5. The apparatus as defined in claim 4 wherein said alarm signal source provides a direct current component and an audio frequency alternating component and said source further comprising rectification means to provide a direct current signal for charging said capacitor.

6. The apparatus as defined in claim 5 and further comprising means to signal said full alarm condition comprising a diode coupled to said output transistor and to said sound reproducing system, said diode becoming forward biased by the second conductive condition of said output transistor thereby allowing passage of the full alarm signal to said sound reproducing system.

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