

Multiple Alert Pager

5 Background of the Invention

The present invention relates to a pager and, more particularly, to a multiple alert pager for selectively generating alert signals by a plurality of alert means such as an audio alert means for generating an audible alert tone at a loudspeaker, a visual alert means
10 for generating a visual alert signal to turn on an LED, and a vibration alert means for generating a vibration alert signal to drive a motor, and so on.

In conventional pagers of this type, when a user
15 is paged or called, he must set a switch at a desired position to determine whether audio and visual alert means are simultaneously operated or one of the audio and visual alert means is operated. In this multiple alert pager, the switch must have the number of contacts which corresponds
20 to the number of combinations of the alert means, resulting in an increase in size of receiver.

Summary of the Invention

It is a principal object of the present invention to provide a pager having a plurality of alert modes
25 without an increased number of contacts.

It is another object of the present invention to provide a compact multiple alert pager with good

operability.

In an embodiment of the invention to be described a multiple alert pager comprises a radio receiver for receiving a carrier wave modulated with at least a paging signal and demodulating the carrier wave; a decoder for comparing a demodulated carrier wave with its own paging number and generating an alert signal when a coincidence between the demodulated carrier wave and its own paging number is found; a plurality of alert means for informing a user of the paging in response to the alert signal; a reset switch for stopping the alert signal; and first means provided in the decoder and being responsive to a first operation of the reset switch to switch the plurality of alert means.

Brief Description of the Drawings

Figs. 1 and 2 are block diagrams of conventional pagers;

Fig. 3 is a block diagram of a multiple alert pager according to an embodiment of the present invention;

Figs. 4A to 4L, Figs. 5L to 5S, and Figs. 6L to 6S are timing charts for explaining the operation of the multiple alert pager shown in Fig. 3;

Fig. 7 is a block diagram showing the main part of a multiple alert pager according to another embodiment of the present invention;

Figs. 8L to 8W show a timing chart for explaining the operation of the multiple alert pager shown in Fig. 7;

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and

Fig. 9 is a block diagram showing the main part of a multiple alert pager according to still another embodiment of the present invention.

5 Detailed Description of the Preferred Embodiments

Prior to describing the present invention in greater detail, examples of conventional pagers will first be described.

Fig. 1 is a block diagram of a conventional pager
10 having audio and visual alert functions. A carrier wave modulated with a paging signal is supplied from an antenna 1 to a radio receiver 2 and is demodulated. The demodulated signal is supplied to a decoder 3 and is compared with its own paging code stored in a paging code
15 memory 4. When the decoder 3 detects a coincidence between the demodulated signal and the preset paging code, an alert signal is supplied to a loudspeaker driver comprising a resistor 5 and transistor 6 so as to drive a loudspeaker 7. Otherwise, the alert signal is supplied to
20 a light-emitting diode driver comprising a resistor 8 and a transistor 9 so as to drive a light-emitting diode (to be referred to as LED hereinafter) 10. A battery 11 is a power source for the loudspeaker 7 or the LED 10. A switch 12 is switched to apply a voltage to an audio alert
25 means including the loudspeaker 7 through a contact a or a visual alert means including the LED 10 through a contact b. A reset switch 13 resets the pager so as to stop

23
generating the alert signal. In this manner, the user must select the audio or visual alert means by the switch 12.

Fig. 2 is a block diagram of another conventional pager having audio and visual alert functions. In this pager, an LED 10 constantly flashes when the user is called or paged. When a switch 12 is set at a contact b, a resistor 14 is series-connected between a battery 11 and a loudspeaker 7, so that an alert tone is more decreased than that in the case wherein the switch 12 is set at a contact a. In this manner, the user can select one of two alert modes: one alert mode for generating a soft audible alert tone and turning on the LED 10; and the other alert mode for generating a loud audible alert tone and turning on the LED 10.

As exemplified above, according to the conventional pagers for selecting alert means by the switches 12, the switch 12 must have contacts the number of which is the same as the number of combinations of the alert means. In order to obtain a multiple alert pager that satisfies all the up-to-date requirements, the switch 12 must have a large number of contacts. However, the pagers must be portable and compact. Demand has arisen for a pager overcoming these drawbacks.

The present invention will now be described by way of example with reference to Figs. 3 to 9.

Fig. 3 is a block diagram of a multiple alert

210

pager according to an embodiment of the present invention. Reference numerals 1, 2 and 4 to 14 denote identical or equivalent parts to those in Figs. 1 and 2. Figs. 4A to 4L show signals at points A to L in Fig. 3, respectively. It is also assumed that Q outputs of each flip-flop and each timer in Fig. 3 are set at a low level in the initial state.

The paging operation by an audio alert means will be first described. A signal received by an antenna 1 is demodulated by a radio receiver 2. The demodulated signal from the radio receiver 2 is compared by a comparator 101 in a decoder 300 with its own paging code stored in a paging code memory 4. When a coincidence between the demodulated signal and the paging code is found, the comparator 101 generates a coincidence signal (at time t_1 in Fig. 4A). The coincidence signal causes a D flip-flop 102 to be set (Fig. 4B). A Q output is supplied to an input terminal IN of an alert signal generator 104 through an OR gate 103, so that the input terminal IN goes high (from low to high, as shown in Fig. 4C). Since outputs from D flip-flops 105 and 106 are set at low level (Figs. 4D and 4E, respectively), an output from an OR gate 107 goes low, so that an AND gate 109 is enabled through an inverter 108 and an AND gate 110 is disabled. As a result, a signal (Fig. 4H) which is obtained through frequency-dividing (e.g., 1/2 frequency division) an output (Fig. 4G) from a clock generator 111 by the use of



a frequency divider 112, is supplied to a clock input terminal CL of the alert signal generator 104 through an OR gate 113, as shown in Fig. 4I. The frequency of an output clock from the clock generator 111 is about 4kHz.

5 The alert signal generator 104 generates as the alert signal the signal received from the clock input terminal CL while the input terminal IN is set to be high, and this alert signal appears at the output terminal OUT thereof, intermittently, for example, about 5 Hz, as shown
10 in fig. 4J. On the other hand, while the input terminal IN is set to be low, the output terminal OUT is kept low. Since outputs Q and $\bar{Q}$ from a T flip-flop 114 are set to be low and high (Fig. 4K), respectively, an AND gate 115 is enabled, and an AND gate 116 is disabled. The alert
15 signal from the alert signal generator 104 drives the loudspeaker 7 through a resistor 5 and a transistor 6, as shown in Fig. 4J. As a result, the user (i.e., pager carrier) is informed of the paging.

When a reset switch 13 is turned off, on and off
20 while the loudspeaker 7 is driven, one end L of a pull-up resistor 126 goes high, low and high (Fig. 4L), and a CL input to the D flip-flop 102 goes low, high and low through an inverter 117. Therefore, the output Q goes low, and the alert signal is stopped (Fig. 4J).

25 As is apparent from the above operation, an audible tone is produced at the loudspeaker 7. The visual alert operation via an LED 10 which is switched from the

96

audio alert operation will be described with reference to Figs. 3 and Figs. 5L to 5S.

The reset switch 13 is turned on at time t1 (Fig. 5L) and is kept ON. An output from an inverter 118 goes high, and then an AND gate 119 is enabled. A clock signal (Fig. 5M) from the clock generator 111 is supplied to a clock input terminal CL of a timer 120. Since a reset input terminal R of the timer 120 is set at low level, the timer 120 is started and kept operated for a predetermined period of time (i.e., 5 seconds). When the predetermined period of time has elapsed, an output from the timer 120 goes high (time t2 in Fig. 5N), and the output Q from the T flip-flop 114 goes high (Fig. 5K). As a result, the AND gates 115 and 116 are disabled and enabled, respectively, so that the visual alert mode via the LED 10 is set. As described earlier, when the output Q from the timer 120 goes high, the output Q from the D flip-flop 105 goes high (Fig. 5D), so that an AND gate 121 is enabled through the OR gate 107 and the output from the clock generator 111 is supplied to a clock input terminal CL of a timer 122, as shown in Fig. 5P. In addition, through the OR gate 107, the output Q from the flip-flop 105 enables the AND gate 110 and disables the AND gate 109. The output from the clock generator 111 is supplied to the clock input terminal CL of the alert signal generator 104 through the AND gate 110 and OR gate 113.

The clock input to the alert signal generator 104

is switched from a low-frequency clock as the output from the frequency divider 112 to a high-frequency clock as the output from the clock generator 111 (Fig. 5I). At the same time, the output Q from the D flip-flop 105 is supplied to the input terminal IN of the alert signal generator 104 through the OR gates 107 and 103. Since the high-frequency clock is received by the clock input terminal CL of the alert signal generator 104, a signal (Fig. 5J) representing a faster flashing pitch so as to confirm the switching operation is generated from the output terminal OUT of the alert signal generator 104. By using this alert signal, the user can check that the alert mode is switched and turns off the switch 13 (time t3 in Fig. 5L). In this case, the reset terminal R of the timer 120 goes high, and the timer 120 is thus reset. At the same time, the AND gate 119 is disabled to supply no clock signals to the clock input terminal CL of the timer 120 (Fig. 5M). When the predetermined period of time preset by the timer 122 has elapsed, the output Q of the timer 122 goes high (time t4 in Fig. 5S), and the D flip-flop 105 is reset (Fig. 5D). At the same time, the timer 122 is reset, and the output Q from the timer 122 goes low (Fig. 5S).

After the reset of the timer 122, since the outputs Q from the D flip-flops 105 and 106 are set to be low, the input terminal IN of the alert signal generator 104 goes low through the OR gates 107 and 103. An output

28

signal J from the alert signal generator 104 goes low, which thereby stops generating the signal for confirming alert mode switching. In the same manner as described above, the AND gate 110 is disabled, and the AND gate 109 is enabled. Therefore, the clock input terminal CL of the alert signal generator 104 receives low-frequency clocks (Fig. 5I). When the comparator 101 generates the coincidence signal after the alert mode is just switched on, as described above, the alert signal generator 104 generates the alert signal by which the LED 10 is turned on because the Q output K (Fig. 5K) from the T flip-flop 114 enables the AND gate 116.

When the alert mode is to be switched from the visual alert mode via the LED 10 to the audio alert mode via the loudspeaker 7, the switch 13 is kept ON for the predetermined period of time as in the audio to visual alert mode switching operation described previously.

An operation for confirming the set alert mode at any time will be described with reference to Fig. 3 and Figs. 6L to 6S. This operation is substantially the same as the alert mode switched on check, except for the operation of the reset switch 13.

When the reset switch 13 is turned on, it is operated in the same manner as described above. At the same time, before the predetermined period of time T of the timer 120 has elapsed, the high level from output from the terminal Q of timer 120 is supplied to an AND gate 124

through an inverter 123, and the high level output from the terminal $\bar{Q}$ of D flip-flop 102 is supplied to the AND gate 124, so that the AND gate 124 is enabled. Under this condition, since the output of an inverter 125 is at high level, the output Q from the D flip-flop 106 goes high. Subsequently, the AND gate 121 is enabled through the OR gate 107 and the timer 122 is started. At the same time, the AND gate 110 is enabled, the clock input terminal CL of the alert signal generator 104 receives the high-frequency clocks (Fig. 6I), and the alert signal generator 104 is started through the OR gate 103. Therefore, the alert function check signal (Fig. 6J) appears at the output terminal OUT of the alert signal generator 104. This check signal is generated for the predetermine period of time T of the timer 122 in the same manner as the alert mode switching check signal. In this manner, the user can always check the current alert mode.

Fig. 7 is a block diagram of a multiple alert pager according to another embodiment of the present invention. The alert mode is switched in the embodiment of Fig. 3 by turning on the reset switch 13 for the predetermined period of time T. However, in the embodiment shown in Fig. 7, the alert mode is switched by repeating on/off operations of a reset switch 13 exceeding a predetermined number of times within a predetermined period of time.

A flip-flop, a counter and a timer are reset in

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the initial state. When the reset switch 13 is turned on, a Q output (Fig. 8U) from a D flip-flop 202 goes high through an inverter 201. A signal from an output terminal OUT of a clock generator 111 is supplied to a timer 204 through an AND gate 203. The output Q from the timer 204 is kept low until a predetermined period of time T' therein has elapsed (Fig. 8V), so that an AND gate 206 is enabled through an inverter 205. Every time the reset switch 13 is turned on, the count of a counter 207 is incremented. When the reset switch 13 is repeatedly turned on/off a predetermined number of times, the output Q from the counter 207 goes high (Fig. 8W). By coupling the output Q from the counter 207 of Fig. 7 instead of the output Q from the timer 120 of Fig. 3, alert mode switching can be performed by repeating the on/off operation of the reset switch 13 in the same manner as in Fig. 3. When the predetermined period of time T' of the timer 204 has elapsed, the output Q from the timer 204 goes high to reset the D flip-flop 202, the counter 207 and the timer 204, thereby causing the multiple alert pager to restore the initial state.

In this embodiment, the timer 204 is started when the reset switch 13 is turned on. However, the timer 204 may be started when the power switch (not shown) of the pager is turned on. In this case, alert mode switching can be performed only after the power switch is turned on. In order to switch the alert mode, the power switch

must be turned off, resulting in inconvenience. However, when the predetermined period of time of the timer 204 has elapsed, erroneous alert mode switching due to an erroneous operation will not occur.

5 In the above two embodiments, the alert mode is switched to one of the audio and visual alert modes. However, when the AND gate 116 is omitted, i.e., the resistor 8 is directly coupled to the output of the alert signal generator 104, the audio and visual alert modes can
10 be simultaneously set, or only the visual alert mode can be set.

When a circuit shown in Fig. 9 is used in place of the T flip-flop 114 and the AND gates 115 and 116 of Fig. 3, the audio and visual alert mode, the audio alert
15 mode or the visual alert mode can be selected.

The operation of the circuit shown in Fig. 9 will be described. When the reset switch 13 is turned on, and a predetermined period time of a timer 120 has elapsed, an output Q from the timer 120 goes high. A binary counter
20 (modulo 4) having two flip-flops 301 and 302 and AND gates 303 and 304 is counted up. One of AND gates 305, 306 and 307 is enabled in accordance with the state of the T flip-flops 301 and 302. One of the alert mode signals representing an audio and visual alert mode, an audio
25 alert mode and a visual alert mode is obtained through an OR gate 308 and/or an OR gate 309.

In the above embodiments, the audio alert mode

via the loudspeaker and the visual alert mode via the LED are exemplified. However, a vibration alert mode using a motor may also be set.

In one embodiment, _____ the reset switch for stopping the alert signal is operated in a predetermined manner to change the alert mode and easily check alert mode switching.

Since the reset switch is used to switch the alert mode, unlike the conventional pager using a movable switch, the multiple alert pager according to the present invention becomes compact and provides a variety of practical applications. _____

CLAIMS

1. A multiple alert pager comprising:

a radio receiver for receiving a carrier wave modulated with at least a paging signal and demodulating the received carrier wave to output the demodulated paging signal;

5 a memory for pre-storing a paging signal assigned to the pager;

a switch means which has a single switch operated by a user of the pager, which stops an alert and which provides an output signal having high and low voltage levels which correspond to first and second operations of the switch, respectively;

10 a plurality of alert means responsive to the alert signal for informing the user in one of a plurality of alert modes that the pager is called; and

15 a decoder responsive to the outputs of the radio receiver, the memory and the switch means for providing the alert signal when the demodulated paging signal coincides with the pre-stored paging signal, and for selecting one of the plurality of alert modes in accordance with a combination of timings of occurrences of the first and second operations of the switch.

2. A pager according to claim 1 wherein the first and second operations are ON and OFF operations of the switch.

25 3. A pager according to claim 1 wherein the decoder comprises :

a comparator for comparing the demodulated paging signal with the pre-stored paging signal to generate the alert signal, representing that the pager is being called, when they coincide with each other, and a logical circuit



for receiving the output signals of the comparator and the switch means to control the plurality of alert means in accordance with the mode of the switch and the alert signal.

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4. A pager according to claim 3 wherein the alert signal generating means comprises a clock signal generator for generating a clock signal from which the alert signal is derived.

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5. A pager according to claim 4 wherein the clock signal generating means comprises a frequency divider for frequency dividing the output signal of the clock signal generator, the output signal of the clock generator or the frequency-divider being supplied to the plurality of alert means in accordance with the selected mode.

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6. A pager according to claim 3 wherein the logical circuit comprises timers for controlling timings of the alert signal and various logical elements.

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7. A pager according to claim 2 wherein the ON operation is continuously performed over a predetermined period of time.

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8. A pager according to claim 2 wherein the ON and OFF operations are alternately repeated a predetermined number of times within a predetermined period of time.

30 9. A pager as claimed in claim 1 substantially as described with reference to Figs. 3-6, Figs 7 and 8 or Fig. 9 of the accompanying drawings.

