

PATENT SPECIFICATION

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(54) ELECTRONIC ALARM TIMEPIECE

(71) We, KABUSHIKI KAISHA DAINI SEIKOSHA a Japanese Company of 31-1 6-chome Kameido Koto-ku Japan do hereby declare the invention for which we

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pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement.

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This invention relates to electronic alarm timepieces, for example, electronic alarm watches.
One conventional electronic alarm timepiece has an automatic alarm stoppage circuitry in which a coincidence signal produced when the actual time of day indication and an alarm time i.e. the time when an alarm is to sound, is terminated after a delay of one minute. However, such automatic alarm stopping circuitry is not practical and is inconvenient to use. Moreover, the life of a battery driving this conventional electronic alarm timepiece is considerably shortened because the alarm producing device will consume a current of, for example, 10mA and consequently, this type of the alarm stopping circuitry cannot be used in wristwatches.

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Another conventional alarm stopping mechanism includes a time constant circuit composed of a capacitor and a resistor and a holding circuit separate from a timekeeping circuit. The capacitor has to have a large capacitance and this, together with the other components increases the size of the integrated circuitry particularly in the case of an electronic alarm wristwatch. Moreover, the time for which the alarm producing device is energised, which time is determined by the time-constant circuit, is affected by temperature and so is unstable.

According to the present invention there is provided an electronic alarm timepiece comprising: timekeeping means for producing an actual time of day indication; alarm time setting means for memorising an alarm time; coincidence circuit means arranged to pro-

duce a coincidence signal when the actual time of day indication and the alarm time coincide; alarm producing means arranged to produce an alarm when the coincidence signal is produced by the coincidence circuit means; a terminating means arranged to block the coincidence signal after a predetermined time to de-energise the alarm producing means, the terminating means being controlled by an output signal from the timekeeping means.

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In the preferred embodiment terminating means includes a wave-shaping circuit for producing an output signal which has the same frequency as a first output signal from the timekeeping means and which has a pulse width the same as a second output signal from the timekeeping means.

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The timepiece may include a memory whose inputs are connected to receive the output signal from the wave-shaping circuit and the coincidence signal from the coincidence circuit means.

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Preferably the memory is a set-reset flip-flop arranged to be set by the coincidence signal from the coincidence circuit means and to be reset by the output signals from the wave-shaping circuit.

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The timekeeping means may include a temperature compensated quartz crystal controlled oscillator.

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The alarm producing means, when energised, may produce an audible warning.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

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Figure 1 is a block diagram of one embodiment of an electronic alarm timepiece according to the present invention; and

Figure 2 illustrates graphically the various wave forms occurring in the electronic alarm timepiece of Figure 1.

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The electronic alarm timepiece as illustrated in the drawings has a timekeeping circuit consisting of a temperature-

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5 compensated quartz crystal controlled oscillator circuit 1, a divider circuit 9, a ten-seconds counter 10 and an hours counter 11. A wave-shaping circuit 15 shapes an output signal *j* produced by the timekeeping circuit to produce a relatively short width pulse signal. A coincidence circuit 14 compares and detects coincidence between the contents of the timekeeping circuit and the contents of an alarm timesetting counter (not shown). A wave-shaping circuit 16 shapes a coincidence signal from the coincidence circuit 14 to produce a relatively short width pulse signal. The coincidence signal is produced by the coincidence circuit 14 when the actual time indication coincides with an alarm time set in the alarm time setting counter.

10 Next, the operation of the above electronic alarm timepiece will be described. The output signal *j* from the ten-second counter 10 is fed to the wave-shaping circuit 15. A relatively high frequency pulsiform control signal *i* from the dividing circuit 9 is also fed to the wave-shaping circuit 15 so that an output signal *k* from the wave-shaping circuit 15 consists of a single pulse having the same width as the output signal *i*. The output signal *k* is fed to a reset terminal R of a memory 17 via an OR circuit 20. The memory 17 is constituted by a set-reset flip-flop having two NOR circuits 21, 22 connected as shown. A terminal S of the memory 17 is normally logical 0 and accordingly an output terminal Q is normally logical 1 and an output terminal Q is normally logical 0. A buzzer 30 is not driven unless a transistor 31 is caused to conduct. When the contents of the timekeeping circuit coincides with the contents of the alarm timesetting counter, i.e. the actual time of day indication and the alarm time coincidence, the output signal from the coincidence circuit 14 changes from logical 0 to logical 1 and is shaped into a short width pulse by the wave-shaping circuit 16. The wave-shaping circuit 16 is constituted by a latch circuit the same construction as the wave-shaping circuit 15, but the pulse width of the output signal from the wave-shaping circuit 16 is longer than the pulse width of the output signal *k* of the wave-shaping circuit 15. When an output signal of logical 1 from the wave-shaping circuit 16 is fed to the terminal S of the NOR circuit 22, the output terminal Q of the NOR circuit 21 changes from logical 0 to logical 1, and accordingly, the transistor 31 becomes conductive and the buzzer 30 is energised. After ten seconds has elapsed, a pulse of the output signal *k* is received by the reset terminal R of the NOR circuit 21 and accordingly, the output terminal Q of the NOR circuit 21 becomes logical 0 with the result that the buzzer 30 is de-energised. The driving frequency of the buzzer 30 is determined by a signal from the

dividing circuit 9 via a gate 13. The output of the gate 13 forms one input of a NAND gate 12, the other input of which is connected to the output terminal Q of the NOR circuit 21. The output of the NAND gate 12 is fed to the base of the transistor 31 via an inverter 34. If it is desired to de-energise the buzzer before ten seconds is elapsed a pulse signal *l* produced by manual operation of a switch (not shown) is fed to an OR circuit 20 and accordingly, the buzzer 30 is immediately de-energised.

The electronic alarm timepiece described above has the advantage that the buzzer can be automatically de-energised after a predetermined time by means of a relatively simple circuit which consumes a relatively small current and without the necessity of any holding circuit. Moreover, since the timekeeping circuit controls the wave-shaping circuit 15 and the memory 17, temperature has little or no influence upon the time for which the buzzer 30 remains energised. Further, the electronic alarm timepieces can be made of semi-conductor integrated circuits and so can be made as a wristwatch.

WHAT WE CLAIM IS:-

1. An electronic alarm timepiece comprising: timekeeping means for producing an actual time of day indication; alarm time setting means for memorising an alarm time; coincidence circuit means arranged to produce a coincidence signal when the actual time of day indication and the alarm time coincide; alarm producing means arranged to produce an alarm when the coincidence signal is produced by the coincidence circuit means; a terminating means arranged to block the coincidence signal after a predetermined time to de-energise the alarm producing means, the terminating means being controlled by an output signal from the timekeeping means.

2. A timepiece as claimed in claim 1 in which the terminating means includes a wave-shaping circuit for producing an output signal which has the same frequency as a first output signal from the timekeeping means and which has a pulse width the same as a second output signal from the timekeeping means.

3. A timepiece as claimed in claim 2 including a memory whose inputs are connected to receive the output signal from the wave-shaping circuit and the coincidence signal from the coincidence circuit means.

4. A timepiece as claimed in claim 3 in which the memory is a set-reset flip-flop arranged to be set by the coincidence signal from the coincidence circuit means to be reset by the output signals from the wave-shaping circuit.

5. A timepiece as claimed in any preceding claim in which the time keeping means

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5 compensated quartz crystal controlled oscil-
lator circuit 1, a divider circuit 9, a ten-
seconds counter 10 and an hours counter 11.
A wave-shaping circuit 15 shapes an output
signal *j* produced by the timekeeping circuit
to produce a relatively short width pulse
signal. A coincidence circuit 14 compares
and detects coincidence between the con-
tents of the timekeeping circuit and the con-
tents of an alarm timesetting counter (not
shown). A wave-shaping circuit 16 shapes a
coincidence signal from the coincidence cir-
cuit 14 to produce a relatively short width
pulse signal. The coincidence signal is pro-
duced by the coincidence circuit 14 when the
actual time indication coincides with an
alarm time set in the alarm time setting
counter.

20 Next, the operation of the above electronic
alarm timepiece will be described. The out-
put signal *j* from the ten-second counter 10 is
fed to the wave-shaping circuit 15. A rela-
tively high frequency pulsiform control
signal *i* from the dividing circuit 9 is also fed
to the wave-shaping circuit 15 so that an
output signal *k* from the wave-shaping circuit
15 consists of a single pulse having the same
width as the output signal *i*. The output signal
k is fed to a reset terminal R of a memory 17
via an OR circuit 20. The memory 17 is con-
stituted by a set-reset flip-flop having two
NOR circuits 21, 22 connected as shown. A
terminal S of the memory 17 is normally
logical 0 and accordingly an output terminal
Q is normally logical 1 and an output termi-
nal Q is normally logical 0. A buzzer 30 is
not driven unless a transistor 31 is caused to
conduct. When the contents of the timekeep-
ing circuit coincides with the contents of the
alarm timesetting counter, i.e. the actual
time of day indication and the alarm time
coincidence, the output signal from the coin-
cidence circuit 14 changes from logical 0 to
logical 1 and is shaped into a short width
pulse by the wave-shaping circuit 16. The
wave-shaping circuit 16 is constituted by a
latch circuit the same construction as the
wave-shaping circuit 15, but the pulse width
of the output signal from the wave-shaping
circuit 16 is longer than the pulse width of
the output signal *k* of the wave-shaping circuit
15. When an output signal of logical 1 from
the wave-shaping circuit 16 is fed to the ter-
minal S of the NOR circuit 22, the output
terminal Q of the NOR circuit 21 changes
from logical 0 to logical 1, and accordingly,
the transistor 31 becomes conductive and the
buzzer 30 is energised. After ten seconds has
elapsed, a pulse of the output signal *k* is
received by the reset terminal R of the NOR
circuit 21 and accordingly, the output termi-
nal Q of the NOR circuit 21 becomes logical
0 with the result that the buzzer 30 is de-
energised. The driving frequency of the buz-
zer 30 is determined by a signal from the

dividing circuit 9 via a gate 13. The output of
the gate 13 forms one input of a NAND gate
12, the other input of which is connected to
the output terminal Q of the NOR circuit 21.
The output of the NAND gate 12 is fed to the
base of the transistor 31 via an inverter 34. If
it is desired to de-energise the buzzer before
ten seconds is elapsed a pulse signal *l* pro-
duced by manual operation of a switch (not
shown) is fed to an OR circuit 20 and accord-
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energised.

The electronic alarm timepiece described
above has the advantage that the buzzer can
be automatically de-energised after a pre-
determined time by means of a relatively
simple circuit which consumes a relatively
small current and without the necessity of
any holding circuit. Moreover, since the
timekeeping circuit controls the wave-
shaping circuit 15 and the memory 17, tem-
perature has little or no influence upon the
time for which the buzzer 30 remains en-
ergised. Further, the electronic alarm
timepieces can be made of semi-conductor
integrated circuits and so can be made as a
wristwatch.

WHAT WE CLAIM IS:-

1. An electronic alarm timepiece com-
prising: timekeeping means for producing an
actual time of day indication; alarm time set-
ting means for memorising an alarm time;
coincidence circuit means arranged to pro-
duce a coincidence signal when the actual
time of day indication and the alarm time
coincide; alarm producing means arranged
to produce an alarm when the coincidence
signal is produced by the coincidence circuit
means; a terminating means arranged to
block the coincidence signal after a pre-
determined time to de-energise the alarm
producing means, the terminating means
being controlled by an output signal from the
timekeeping means.

2. A timepiece as claimed in claim 1 in
which the terminating means includes a
wave-shaping circuit for producing an output
signal which has the same frequency as a first
output signal from the timekeeping means
and which has a pulse width the same as a
second output signal from the timekeeping
means.

3. A timepiece as claimed in claim 2
including a memory whose inputs are con-
nected to receive the output signal from the
wave-shaping circuit and the coincidence
signal from the coincidence circuit means.

4. A timepiece as claimed in claim 3 in
which the memory is a set-reset flip-flop
arranged to be set by the coincidence signal
from the coincidence circuit means to be
reset by the output signals from the wave-
shaping circuit.

5. A timepiece as claimed in any preced-
ing claim in which the time keeping means

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includes a temperature compensated quartz crystal controlled oscillator.

to and as shown in the accompanying drawings.

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6. A timepiece as claimed in any preceding claim in which the alarm producing means, when energised, produces an audible warning.

7. An electronic alarm timepiece substantially as herein described with reference

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