

PATENT SPECIFICATION

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(54) AN ELECTRONIC TIMEPIECE

(71) We, KABUSHIKI KAISHA SUWA SEIKOSHA, a Japanese company of 3—4, 4—Chome, Ginza, Chuo-ku, Tokyo, Japan, do hereby declare the invention for which we 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:—

This invention relates to electronic timepieces.

The electronic timepieces become more and more complicated with improvements in integrated circuit techniques and as they have to perform more and more functions. In a wristwatch, there is a severe limitation on the space available to house the watch movement and if it is desired to simplify the means by which the watch movement is controlled, the watch movement itself is further complicated. For example, in an electronic timepiece displaying date, days, hours, minutes and seconds, five means are required as a control. If such means are constituted merely by five control switches, the electronic timepiece cannot be miniaturized due to insufficient space to house the switches and even if the switches themselves are miniaturized there are problems with regard to reliability.

According to the present invention there is provided an electronic timepiece including: display means which, in a normal running condition of the electronic timepiece, are arranged to display a time indication; selecting means for selectively determining whether the electronic timepiece is in a normal running condition or in a function performing condition in which a function, other than normal display of the time indication, is performed; causing means for causing the selected function to be performed when the electronic timepiece is in the function performing condition; and non-mechanical return means for automatically returning the electronic timepiece to the normal running condition from the function performing condition after a predetermined time has elapsed after operation of the causing means has terminated.

In one embodiment said selecting means comprise a switch which in one position, determines the normal running condition and, in the

second position, determines a time correcting conditions in which operation of the causing means causes the time indication to be corrected or reset. Thus display means may be arranged to display a time indication in hours, minutes and seconds, the causing means comprising a further switch and logic circuitry arranged to enable the hours indication, minutes indication and seconds indication to be selectively corrected.

In the preferred embodiment the logic circuitry includes a pair of flip-flop circuits which, upon application of control signals from said further switch are selectively caused to be in one of four states, in a first of which correction of the hours indication may be performed, in a second of which correction of the minutes indication may be performed, in a third of which correction of the seconds indication may be performed and in a fourth of which the electronic timepiece is in the normal running condition.

In another embodiment of the arrangement is such that, in the function performing condition the electronic timepiece produces an indication or alarm at a predetermined time.

The invention is illustrated, merely by way of example, in the accompanying drawing which is a block diagram of an electronic timepiece according to the present invention.

A quartz crystal oscillator produces a time standard signal at an output terminal O_1 and this standard time signal is applied to an input terminal I_2 of a divider circuit 2. The signal at an output terminal O_2 of the divider circuit 2 has a frequency of 1Hz and is supplied to an input terminal I_3 of 1/60 divider circuit 3. A signal having a frequency of 1/60Hz appears at an output terminal O_3 of the divider circuit 3 and this signal is applied to an input terminal I_4 of a 1/60 divider circuit 4. A signal having a frequency of 1/3600Hz appears at an output terminal O_4 of the divider circuit 4 and this signal is applied to an input terminal I_5 of a 1/12 divider circuit 5. The divider circuit 3, 4, 5 also provides respective BCD coded signals B_1 , B_2 , B_3 which are fed to a decoder 6. The signals each of a plurality of output terminals d_1 to d_n of the decoder 6 is fed

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to a respective exclusive OR gate EX_1 to EX_n respectively. The gates EX_1 to EX_n also receive, as an input, a signal AC from the divider circuit 2, this signal being generally of a frequency between 32Hz and 64Hz. The output signal from gates EX_1 to EX_n are connected to segmented electrodes (not shown) of a liquid crystal display panel 7. The signal AC from the divider circuit 2 is also applied to a common electrode (not shown) of the display panel. If the signals at one of more of the terminals d_1 to d_n of the decoder 6 are of opposite polarity (phase) to the signal AC the corresponding segmented electrodes will generate a display. However, if the signals at one or more of the terminals d_1 to d_n of the decoder 6 are of the same polarity (phase) as the signal AC the corresponding segmented electrodes will not generate a display.

The electronic timepiece has a plurality of

D-type flip-flop circuits FF_1 to FF_n , each of which is such that when a clock signal at a terminal CL is shifted from "0" to "1", data applied to a terminal D appear at a terminal Q. A switch S_1 is a function selection switch. When the switch S_1 is closed the circuits FF_1 and FF_2 are reset and reset terminals R_3 and R_4 of circuits FF_3 and FF_4 become "0". Subsequently the circuits FF_3 and FF_4 become operative and the signal generated by closure of the switch S_1 delayed by a delay circuit 8, is applied simultaneously to terminals CL_3 and CL_4 of the circuits FF_3 and FF_4 .

Thus each time the switch S_1 is closed the circuits FF_3 and FF_4 go into a different state. The fourth time the switch S_1 is closed the circuits FF_3 and FF_4 return to the initial state. The states of the circuits FF_3 and FF_4 are shown in the following table:

State	S_1	Q_3	Q_4
0		0	0
1	the first ON	1	0
2	the second ON	1	1
3	the third ON	0	1
0	the fourth ON	0	0

Corresponding to states "1", "2" and "3", AND gates A_1 , A_2 , A_3 are opened, thereby passing a signal from a switch S_2 . Namely, in state "0", gates A_1 to A_3 are closed, and the signal from the switch S_2 is blocked. In state "1", the gate A_1 is opened, and the signal from the switch S_2 is applied to reset terminals R_3 and R_4 of the divider circuits 2, 3 respectively to reset them, thereby resetting the seconds indication to zero. In state "2", gate A_2 is opened, and the signal from the switch S_2 is applied to the input terminal I_1 of the divider circuit 4 through a gate EX'_1 , thereby advancing the minutes indication by unity. Repeated operation of the switch S_2 thus enables correction of the minutes indication. In state "3", gate A_3 is opened and the signal from the switch S_2 is applied to the input terminal I_2 of the divider circuit 5 through a gate EX'_2 , thereby advancing the hours indication by unity. Repeated operation of the switch S_2 thus enables correction of the hours indication. On the other hand the states of the circuits FF_1 and FF_2 are changed by applying thereto a signal having a frequency of 1/60Hz from the output of the divider circuit 3. Since circuits FF_1 , FF_2 are in the operative state

after the last operation of the switch S_1 , an output Q_2 becomes "1" one or two minutes after, and circuits FF_3 and FF_4 are reset to zero. Namely, whatever the state of circuits FF_3 and FF_4 after correction of the time indication has been performed they always automatically return to the state "0" one or two minutes thereafter. Therefore, even if the switch S_2 is operated by mistake, no function is performed.

The operation of the above described electronic timepiece is extremely easy to control and the more functions the electronic timepiece performs the more advantageous, the feature that automatic return to the normal running state i.e. state "0" is. In an electronic timepiece not provided with this automatic return feature to the normal running state, it is necessary to perform some separate operation, after correction of the time indication has been performed, to return the electronic timepiece to the normal running state. This separate operation is not only troublesome but also may be forgotten causing error or disorder in the electronic timepiece.

Only the correction of the time indication of the electronic timepiece has been described;

but the present invention is applicable to other functions of the electronic timepiece. For example, in an electronic alarm timepiece, where an alarm is displayed by the display panel, the electronic timepiece automatically returns to the normal running state after a predetermined interval. Furthermore, in the case of an electronic universal timepiece, where the time indication in one of a plurality of different time zones is displayed the time indication can be made to return automatically to that of a given time zone after a predetermined time.

WHAT WE CLAIM IS:—

1. An electronic timepiece including: display means which, in a normal running condition of the electronic timepiece, are arranged to display a time indication; selecting means for selectively determining whether the electronic timepiece is in a normal running condition or in a function performing condition in which a function, other than normal display of the time indication, is performed; causing means for causing the selected function to be performed when the electronic timepiece is in the function performing condition; and non-mechanical return means for automatically returning the electronic timepiece to the normal running condition from the function performing condition after a predetermined time has elapsed after operation of the causing means has terminated.

2. An electronic timepiece as claimed in claim 1 in which said selecting means comprise a switch which, in a first position, determines the normal running condition and, in the second position, determines a time correcting condition in which operation of the causing

means causes the time indication to be corrected.

3. An electronic timepiece as claimed in claim 2 in which the display means is arranged to display a time indication in hours, minutes and seconds, the causing means comprising a further switch and logic circuitry arranged to enable the hours indication, minutes indication and seconds indication to be selectively corrected or reset.

4. An electronic timepiece as claimed in claim 3 in which the logic circuitry includes a pair of flip-flop circuits which, upon application of control signals from said further switch are selectively caused to be in one of four states, in a first of which correction of the hours indication may be performed, in a second of which correction of the minutes indication may be performed, in a third of which correction of the seconds indication may be performed and in a fourth of which the electronic timepiece is in the normal running condition.

5. An electronic timepiece as claimed in claim 1 in which the arrangement is such that, in the function performing condition the electronic timepiece produces an indication or alarm at a predetermined time.

6. An electronic timepiece substantially as herein described with reference to the accompanying drawing.

J. MILLER & CO.,
Chartered Patent Agents,
262, High Holborn,
London, WC1V 7EF,
Agents for the Applicants.



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