

PATENT SPECIFICATION

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(54) 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.

Today with the advancement in integrated circuit design and construction wristwatches which will display a time of day indication and a date indication have become popular. However, due to size restrictions the time of day indication and the date indication cannot be displayed simultaneously and the manually operable switch is usually provided to change the display from one to another.

It is found that in such a wristwatch amendment of the time indication is difficult to effect especially since the date indication is usually only displayed when the manually operable switch is operated. This is because only amendment of the indication currently being displayed can be effected and when amendment of the other indication is required it is necessary not only to select a given part of that other indication for amendment but also to cause it to be displayed. This is especially tedious when the battery or cell driving the timepiece is changed because normally all parts of the time indication must then be amended.

According to the present invention there is provided an electronic timepiece comprising time-keeping means, an electro-optical display device connected to be driven by the timekeeping means selectively to display a first time indication and a second time indication, selecting means for selecting parts of the first and second time indications for amendment, and amending means for amending the part of the time indications selected for amendment by the selecting means, the selecting means being such that repeated operation thereof causes parts of the first time indication, when displayed by the display device, to be

sequentially selected for amendment and subsequently, after all parts of the first time indication have been selected for amendment, causes the second time indication to be displayed by the display device prior to sequential selection of parts thereof for amendment by repeated operation of the selecting means, one or a part of one of the time indications being only displayed when selected for amendment.

Preferably the selecting means are such that, after all parts of the second time indication have been sequentially selected for amendments, the first time indication is displayed by the display device.

In the preferred embodiment the selecting means includes a manually operable switch which, each time it is closed, and then opened, selects the next part of the time indication, displayed by the display device, in sequence for amendment.

The amending means may include a manually operable switch which, each time it is closed and then opened, causes the selected part of the time indications to advance by unity.

Preferably the timepiece includes manually operable means which is normally in a first position so that the display device displays the first time indication and which, when moved to a second position causes the display device to display the second time indication.

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

Figure 1 is a schematic view of an electronic timepiece of the type to which the present invention relates;

Figure 2 consisting of Figures 2A and 2B, illustrate the displays produced by the electronic timepiece of Figure 1;

Figure 3 is a table illustrating the operation of a conventional electronic timepiece of the type illustrated in Figure 1;

Figure 4 is a circuit diagram of a control circuit of one embodiment of an electronic timepiece according to the present invention; and

Figure 5 is a timing chart illustrating the operation of the circuit of Figure 4.

Figure 1 is a schematic view of an electronic timepiece, e.g. an electronic wristwatch, of the type to which the present invention relates. The electronic timepiece has a bistable correction-lock button 1 for preventing accidental amendment of a time indication displayed by its liquid crystal display device. The button 1 is usually pushed in and pulled out when the time indication is corrected or amended. A monostable push button 2 determines the time indication displayed by the display device at any one time when the timepiece is in the normal state, that is, when the button 1 is pushed in and also selects parts of the time indication to be amended when the timepiece is in a correction state, that is, when the button one is pulled out. A setting button 3 increases the part of the time indication selected for amendment by unity each occasion it is operated.

Figure 2 illustrates the displays produced by the electronic timepiece shown in Figure 1. In Figure 2A the display device displays a time of day indication consisting of hours, minutes and seconds indications when the button 1 is pushed in and when the button 2 is not operated. When the buttons 1, 2 are pushed in, the display device displays a date indication consisting of months and days indication as shown in Figure 2B. This method of displaying time indications is the so-called "demand display method".

Figure 3 is a table illustrating the operation of a conventional electronic timepiece of the type illustrated in Figure 1. In this table, the symbol L means that the button 1 is pushed in and the symbol H means that it is pushed out. The symbol $\uparrow$ means that the button 2 is pushed in and then released and the symbol H means that it is pushed in and is maintained pushed in. The column headed "Button 3" contains no symbols, but, as mentioned above, the button 3 increases the part of the time indications selected for amendment by the button 2 by unit each time it is operated.

If the timepiece is in the normal state when the button 1 is pushed in (L) the time of day indication is displayed. If the button 2 is pulled out, (H), the date indication is displayed. The timepiece is in the correction state when the button 1 is pulled out (H) and the part of the time indication to be amended is selected by pushing ($\uparrow$) the button 2. Whilst the time of day indication is still displayed, the part thereof selected for amendment flickers.

It must be noted that the part of the time indication to be amended must be displayed. Namely, when the date indication requires an amendment, the button 1 must be pushed in to bring the timepiece into the

normal state and then must be pulled out again with the button 2 pushed in to select the months indication or date indication for amendment. This arrangement is found to be very inconvenient in practice.

This inconvenience occurs not only in the demand display method of displaying time indications, but also in the bistable display method of displaying time indication where display of given indication is triggered by means for changing the display from the time of day indication to the date indication. In the bistable display method the amendment of the months indication and the date indication is performed by returning the timepiece to the normal state from the correction state so that the time of day indication is displayed, changing the display to a date indication, and then causing the timepiece to be in the correction state again.

Although it is possible to provide a separate operating button to change the correction state to make amendment of the time indications easier, the provision of such an operating button has the disadvantage that the design of the electronic timepiece is limited and its cost increased.

Figure 4 shows a control circuit of one embodiment of an electronic timepiece according to the present invention. Figure 5 is a timing chart illustrating the operation of the control circuit of Figure 4. The control circuit of Figure 4 is such that each of the hours, minutes and seconds indications or hours, minutes and days indications can be displayed in the normal state by the operation of a display-change-over means (button 2) and the months indication is displayed only in the correction state.

A control signal LEAD I selectively causes the seconds indication and the days indication to be displayed. The seconds indication is displayed when the signal LEAD I is logic 0 and the days indication is displayed when it is logic 1. A control signal LEAD II selectively causes the hours indication and months indication to be displayed. The hours indication is displayed when the signal LEAD II is logic 0 and the months indication is displayed when it is logic 1. The minutes indication is displayed regardless of the logic condition of the signal LEAD I when the signal LEAD II is logic 0, but when the signal LEAD II is logic 1, the display of the minutes indication is suppressed. Signals SL_1 , SL_2 , SL_3 , when logic 1 selected the part of the time indication to be corrected.

Flip-flops 19 to 22 have outputs Q_4 to Q_7 , respectively. The flip-flops 19, 20 and gates associated therewith constitute a one third or one half divider circuit. A SEL* signal obtained by the operation of the button 2 is

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applied as a clock signal CL to the flip-flops 19, 20. The flip-flop 21 is a one half divider circuit and its clock signal CL is the output Q_s from the flip-flop 20 and its output Q_a controls the division ratio of the divider circuit and also simultaneously controls the signals LEAD I and LEAD II. These actions are performed in the correction state. In the normal state the flip-flops 19 to 22 are reset and the flip-flop 22 is operated to control the signal LEAD I.

In this embodiment as mentioned above, display and correction are automatically changed over by the operation for selecting the parts of the time indication to be amended in the correction state.

As explained above, the embodiment of the present invention described systematically selects parts of the time indications to be amended so that all parts of the time indications can be amended without the necessity for any further operation to change display from a time of day indication to a date indication.

The parts of the time indication are selected for amendment by operating a selecting button and are corrected by a setting button.

WHAT WE CLAIM IS:—

1. An electronic timepiece comprising time-keeping means, an electro-optical display device connected to be driven by the timekeeping means selectively to display a first time indication and a second time indication, selecting means for selecting parts of the first and second time indications for amendment, and amending means for amending the part of the time indications selected for amendment by the selecting means, the selecting means being such that repeated operation thereof causes parts of the first time indication, when displayed by the display device, to be sequentially selected for amendment and subsequently, after all parts of the first time indication

have been selected for amendment, causes the second time indication to be displayed by the display device prior to sequential selection of parts thereof for amendment by repeated operation of the selecting means, one or a part of one of the time indication being only displayed when selected for amendment.

2. A timepiece as claimed in Claim 1 in which the selecting means are such that, after all parts of the second time indication have been sequentially selected for amendments, the first time indication is displayed by the display device.

3. A timepiece as claimed in Claim 1 or 2 in which the selecting means includes a manually operable switch which, each time it is closed and then opened, selects the next part of the time indication, displayed by the display device, in sequence for amendment.

4. A timepiece as claimed in any preceding claim in which the amending means includes a manually operable switch which, each time it is closed and then opened, causes the selected part of the time indications to advance by unity.

5. A timepiece as claimed in any preceding claim including manually operable means which is normally in a first position so that the display device displays the first time indication and which, when moved to a second position causes the display device to display the second time indication.

6. An electronic timepiece substantially as herein described with reference to and as shown in Figures 4 and 5 of the accompanying drawing.

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applied as a clock signal CL to the flip-flops 19, 20. The flip-flop 21 is a one half divider circuit and its clock signal CL is the output Q_6 from the flip-flop 20 and its output Q_6 controls the division ratio of the divider circuit and also simultaneously controls the signals LEAD I and LEAD II. These actions are performed in the correction state. In the normal state the flip-flops 19 to 22 are reset and the flip-flop 22 is operated to control the signal LEAD I.

In this embodiment as mentioned above, display and correction are automatically changed over by the operation for selecting the parts of the time indication to be amended in the correction state.

As explained above, the embodiment of the present invention described systematically selects parts of the time indications to be amended so that all parts of the time indications can be amended without the necessity for any further operation to change display from a time of day indication to a date indication.

The parts of the time indication are selected for amendment by operating a selecting button and are corrected by a setting button.

WHAT WE CLAIM IS:—

1. An electronic timepiece comprising time-keeping means, an electro-optical display device connected to be driven by the timekeeping means selectively to display a first time indication and a second time indication, selecting means for selecting parts of the first and second time indications for amendment, and amending means for amending the part of the time indications selected for amendment by the selecting means, the selecting means being such that repeated operation thereof causes parts of the first time indication, when displayed by the display device, to be sequentially selected for amendment and subsequently, after all parts of the first time indication

have been selected for amendment, causes the second time indication to be displayed by the display device prior to sequential selection of parts thereof for amendment by repeated operation of the selecting means, one or a part of one of the time indication being only displayed when selected for amendment.

2. A timepiece as claimed in Claim 1 in which the selecting means are such that, after all parts of the second time indication have been sequentially selected for amendments, the first time indication is displayed by the display device.

3. A timepiece as claimed in Claim 1 or 2 in which the selecting means includes a manually operable switch which, each time it is closed and then opened, selects the next part of the time indication, displayed by the display device, in sequence for amendment.

4. A timepiece as claimed in any preceding claim in which the amending means includes a manually operable switch which, each time it is closed and then opened, causes the selected part of the time indications to advance by unity.

5. A timepiece as claimed in any preceding claim including manually operable means which is normally in a first position so that the display device displays the first time indication and which, when moved to a second position causes the display device to display the second time indication.

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