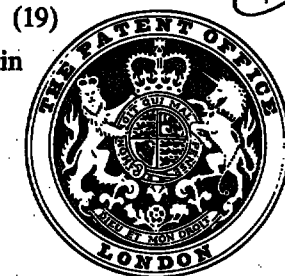


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(54) DIGITAL ALARM TIMEPIECE

(71) We, KABUSHIKI KAISHA DAINI SEIKOSHA, a Japanese Company of 31-1, 6-chome, Kameido, Koto-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 digital alarm timepieces.

In conventional digital alarm timepieces, an alarm sounds at a pre-set alarm time. However, such a conventional timepiece will not provide an indication of remaining time, that is to say the time difference between an actual time of day indication and the pre-set alarm time.

According to the present invention there is provided an electronic digital alarm timepiece comprising: timekeeping means for producing an actual time of day indication; setting means for setting an alarm time at which an alarm is to sound and connectable to the timekeeping means to correct the actual time of day indication; remaining time measuring means capable of being set by the setting means for producing an indication of the time remaining until the alarm time; and display means for selectively displaying the actual time of day indication and the remaining time indication, the arrangement being such that, in operation, the alarm will sound when the alarm time and the actual time of day indication coincide.

Preferably outputs of the remaining time means are permanently connected to alarm means for producing said alarm.

In the preferred embodiment the timepiece includes switch means for selectively switching outputs from the timekeeping means and remaining time measuring means to the display means to display selectively the actual time of day indication and the remaining time indication. The setting means preferably comprise selecting means for

selecting a part of the alarm time to be set and a setting switch for setting the part of the alarm time so set.

In the preferred embodiment a display means is arranged to display the actual time of day indication in at least hours, minutes and seconds and to display the remaining time indication in hours and minutes.

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

A quartz vibrator 1 produces a time standard signal which is fed to a frequency divider 2. The output from the frequency divider has a frequency of 1Hz which is fed to a second counter 3 to drive a seconds display 9. The seconds counter 3 produces an output signal having a frequency of 1/60 Hz which is applied to a minutes counter 4. The minutes counter 4 produces an output signal having a frequency of 1/3600 Hz which is applied to an hours counter 5 to drive an hours display 11. The hours counter 5 produces an output signal having a frequency of 1/86400 Hz which is applied to a days counter 6 to drive a days display 12.

A subtraction counter 7 determines the minutes of a remaining time indication and a subtraction counter 8 determines the hours of the remaining time indication. A change-over switch 16 selectively determines whether the displays 9 to 12 display the actual time of day indication or display the remaining time indication.

When the switch 16 is in contact with a terminal W a signal of a relatively high potential (+) i.e. a high level signal, is fed via a line 17 to a seconds display AND gate 19 and a days display AND gate 26 to pass output signals received thereby from the seconds counter 3 and the days counter 6 respectively to the seconds display 9 and the days display 12 via respective decoders 27, 90

30. A signal of a relatively low potential (-) i.e. a low level signal, is generated on a line 18 from the high level signal by an inverter 18'. An AND gate 20 is opened by the high level signal on the line 17 to pass an output signal from the minutes counter 4 to an OR gate 22. Due to the fact that an AND gate 21, connected to receive an output signal from the counter 7 is closed by the low level signal on the line 18, the output signal from the minutes counter 14 is passed by the OR gate 22 to a decoder 28 which drives the minutes display 10. Similarly an AND gate 23 is opened by the high level signal on the line 17 to pass an output signal from the hours counter 5 to an OR gate 25, which, due to the fact that an AND gate 24 connected to receive an output signal from the counter 8 is closed by the low level signal on the line 18, passes the output signal from the hours counter 5.

When the switch 16 is in contact with a terminal *T* a low level signal is fed via the line 17 to close the AND gates 19, 20, 23, 26 so that the output signals applied thereto from the seconds counter 3, minutes counter 4, hours counter 5 and days counter 6 are blocked. The line 18, on the other hand, passes a high level signal to AND gates 21, 24 so that the OR gates 22, 25 open to pass output signals from the counters 7, 8 respectively to the minutes display 10 and the hours display 11.

When a selecting switch (not shown) is in contact with a terminal 37, a portion of the actual time of day indication can be selected for correction. When the switch 16 is in contact with the terminal *W* outputs *A, B, C*, of a selecting circuit 38 control transmission gates 31, 32, 33 respectively, so that days, hours and minutes of the actual time of day indication can be selectively corrected by means of a signal applied to a terminal 36 by a setting switch (not shown). On the other hand, when the switch 16 is in contact with the terminal *T*, outputs *D, E* of the selecting circuit 8 control transmission gates 34, 35 so that parts of the remaining time indication can be selected for correction, the selected part of the remaining time indication being corrected by a signal applied by the setting switch to the terminal 36.

When the switch 16 is in contact with the terminal *T* the remaining time indication is displayed: days and seconds are not displayed by the days display 12 and the second display 9 but the hours and minutes are displayed by the hours displays 11 and the minutes display 10. The selecting switch connected to the terminal 37 selects the hours of the alarm time for setting and the signal applied to terminal 36 by the setting switch sets a desired hour of the alarm time in the counter 8.

The selecting switch connected to the

terminal 37 then selects the minutes of the alarm time for setting and the signal applied to the terminal 36 by the setting switch sets a desired minute of the alarm time in the counter 7.

When a starting switch (not shown) connected to a terminal 39 is closed after the desired alarm time has been set, the contents of the counters 7, 8 is reduced by unity each minute since the counter 7 receives the output signal having a frequency of one of the 1/60 Hz from the seconds counter. When the contents of the counters 7, 8 becomes equivalent to a remaining time indication of 0:00, a NOR gate 40 opens and feeds a high level signal to a buzzer 41 which sounds to indicate that the alarm time has been reached.

From the above description, it would be appreciated that when the switch 16 is in contact with the terminal *T* the hours display 11 and the minutes display 10 display the remaining time indication and the buzzer 41 sounds when the remaining time indication is 0:00 i.e. the alarm time is reached. Even if the switch 16 is in contact with the terminal *W* and the actual time of day indication is displayed, the buzzer 41 sounds when the alarm time is reached.

The electronic digital alarm timepiece described above has the advantage that the actual time of day indication and the remaining time indication are selectively displayed by means of the switch 16.

WHAT WE CLAIM IS:-

1. An electronic digital alarm timepiece comprising: timekeeping means for producing an actual time of day indication; setting means for setting an alarm time at which an alarm is to sound and connectable to the timekeeping means to correct the actual time of day indication; remaining time measuring means capable of being set by the setting means for producing an indication of the time remaining until the alarm time; and display means for selectively displaying the actual time of day indication and the remaining time indication, the arrangement being such that, in operation, the alarm will sound when the alarm time and the actual time of day indication coincide.

2. A timepiece as claimed in claim 1 in which outputs of the remaining time means are permanently connected to alarm means for producing said alarm.

3. A timepiece as claimed in claim 1 or 2 including switch means for selectively switching outputs from the timekeeping means and remaining time measuring means to the display means to display selectively the actual time of day indication and the remaining time indication.

4. A timepiece as claimed in any preceding claim in which the setting means comprises selecting means for selecting a



30. A signal of a relatively low potential (-) i.e. a low level signal, is generated on a line 18 from the high level signal by an inverter 18'. An AND gate 20 is opened by the high level signal on the line 17 to pass an output signal from the minutes counter 4 to an OR gate 22. Due to the fact that an AND gate 21, connected to receive an output signal from the counter 7 is closed by the low level signal on the line 18, the output signal from the minutes counter 14 is passed by the OR gate 22 to a decoder 28 which drives the minutes display 10. Similarly an AND gate 23 is opened by the high level signal on the line 17 to pass an output signal from the hours counter 5 to an OR gate 25, which, due to the fact that an AND gate 24 connected to receive an output signal from the counter 8 is closed by the low level signal on the line 18, passes the output signal from the hours counter 5.

When the switch 16 is in contact with a terminal *T* a low level signal is fed via the line 17 to close the AND gates 19, 20, 23, 26 so that the output signals applied thereto from the seconds counter 3, minutes counter 4, hours counter 5 and days counter 6 are blocked. The line 18, on the other hand, passes a high level signal to AND gates 21, 24 so that the OR gates 22, 25 open to pass output signals from the counters 7, 8 respectively to the minutes display 10 and the hours display 11.

When a selecting switch (not shown) is in contact with a terminal 37, a portion of the actual time of day indication can be selected for correction. When the switch 16 is in contact with the terminal *W* outputs *A, B, C*, of a selecting circuit 38 control transmission gates 31, 32, 33 respectively, so that days, hours and minutes of the actual time of day indication can be selectively corrected by means of a signal applied to a terminal 36 by a setting switch (not shown). On the other hand, when the switch 16 is in contact with the terminal *T*, outputs *D, E* of the selecting circuit 8 control transmission gates 34, 35 so that parts of the remaining time indication can be selected for correction, the selected part of the remaining time indication being corrected by a signal applied by the setting switch to the terminal 36.

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The selecting switch connected to the

terminal 37 then selects the minutes of the alarm time for setting and the signal applied to the terminal 36 by the setting switch sets a desired minute of the alarm time in the counter 7.

When a starting switch (not shown) connected to a terminal 39 is closed after the desired alarm time has been set, the contents of the counters 7, 8 is reduced by unity each minute since the counter 7 receives the output signal having a frequency of one of the 1/60 Hz from the seconds counter. When the contents of the counters 7, 8 becomes equivalent to a remaining time indication of 0:00, a NOR gate 40 opens and feeds a high level signal to a buzzer 41 which sounds to indicate that the alarm time has been reached.

From the above description, it would be appreciated that when the switch 16 is in contact with the terminal *T* the hours display 11 and the minutes display 10 display the remaining time indication and the buzzer 41 sounds when the remaining time indication is 0:00 i.e. the alarm time is reached. Even if the switch 16 is in contact with the terminal *W* and the actual time of day indication is displayed, the buzzer 41 sounds when the alarm time is reached.

The electronic digital alarm timepiece described above has the advantage that the actual time of day indication and the remaining time indication are selectively displayed by means of the switch 16.

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1. An electronic digital alarm timepiece comprising: timekeeping means for producing an actual time of day indication; setting means for setting an alarm time at which an alarm is to sound and connectable to the timekeeping means to correct the actual time of day indication; remaining time measuring means capable of being set by the setting means for producing an indication of the time remaining until the alarm time; and display means for selectively displaying the actual time of day indication and the remaining time indication, the arrangement being such that, in operation, the alarm will sound when the alarm time and the actual time of day indication coincide.

2. A timepiece as claimed in claim 1 in which outputs of the remaining time means are permanently connected to alarm means for producing said alarm.

3. A timepiece as claimed in claim 1 or 2 including switch means for selectively switching outputs from the timekeeping means and remaining time measuring means to the display means to display selectively the actual time of day indication and the remaining time indication.

4. A timepiece as claimed in any preceding claim in which the setting means comprises selecting means for selecting a



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part of the alarm time to be set and a setting switch for setting the part of the alarm time so set.

5 5. A timepiece as claimed in any preceding claim in which the display means is arranged to display the actual time of day indication in at least hours, minutes and seconds and to display the remaining time indication in hours and minutes.

10 6. An electronic digital alarm timepiece

substantially as herein described with reference to and as shown in the accompanying drawing.

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