

PATENT SPECIFICATION

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(54) A DIGITAL ELECTRONIC 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:—

10 This invention relates to digital electronic timepieces.

According to the present invention there is provided a digital electronic timepiece comprising: an oscillator circuit for producing a relatively high frequency standard time signal; frequency dividing circuitry arranged to produce a plurality of timing signals from the standard time signal; digital display means arranged to be driven by the timing signals and to display the actual time of day; setting means for pre-setting a predetermined time interval in down-counter means connected to receive the or some of the timing signals so that, in operation, the content of the down-counter means is representative of a remaining time interval, the display means being arranged to display the remaining time interval.

30 The digital electronic timepiece may include selecting means for selectively causing the actual time of day and the remaining time interval to be displayed. The selecting means may be a manually operable switch.

35 Preferably the digital electronic timepiece includes alarm means which are energised when the predetermined time interval has elapsed.

40 The display device may have a first portion for displaying the actual time of day, and a second portion for displaying the remaining time interval.

45 The invention is illustrated, merely by way of example, in the accompanying

drawings, in which:—

Figure 1 is a circuit diagram of an embodiment of a digital electronic timepiece according to the present invention;

Figure 2 illustrates one form of display device for a digital electronic timepiece according to the present invention; and

Figure 3 illustrates a second form of display device for a digital electronic timepiece according to the present invention.

Referring first to figure 1, there is shown a circuit diagram of an embodiment of a digital electronic timepiece according to the present invention. The digital electronic timepiece has a quartz crystal controlled oscillator circuit 1 which produces a relatively high frequency standard time signal. The standard time signal is fed to a dividing circuit 2 which produces a relatively frequency pulsiform output signal having a frequency of 1Hz. A seconds counter 3 counts the pulses of the output signal from the dividing circuit 2 and produces a minutes signal having a frequency of 1/60Hz. A minutes counter 4 counts the pulses of the minutes signal and produces an hours signal having a frequency of 1/3600Hz. An hours counter 5 counts the pulses of the hour signal generated by the minutes counter 4.

When a switch lever 6a is in electrical contact with a time display switch contact pin 6 a logical '1' signal opens an AND circuit 9 and the minutes signal from the minutes counter 4 is applied to a decoder/driver circuit 11 via an OR circuit 10 and is displayed by a display device 13. The logic '1' signal also opens an AND circuit 18 so that the hours signal from the hours counter 5 is applied to a decoder/driver circuit 12 via an OR circuit 19 and is displayed by the display device 13. Thus the actual time in hours and minutes is displayed by the display device 13. The logic

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'1' signal is in addition, inverted by an inverter 8 so that AND circuits 20, 21 are closed with the result that no timing function is performed.

5 When the switch lever 6a is in electrical contact with a time interval display switch contact pin 7, a logical '0' signal causes the AND circuit 9 and the AND circuit 10 to close so that the actual time is no longer displayed by the display device 13. The logical '0' signal is converted into a logical '1' signal by the inverter 8, so that AND circuits 20, 21 are opened. Thus an output signal from a minutes-down counter 14 and an output signal from an hours-down counter 15 are applied to the display device 13 via the OR circuits 10, 19 and the decoder/driver circuits 11, 12 so that a predetermined time interval is initially displayed and then remaining time interval in hours and minutes is displayed by the display device 13.

When the switch lever 6a is in electrical contact with the switch contact pin 6, the logical '1' signal is converted into a logical '0' signal by the inverter 8 so that a time interval setting circuit 22 is inoperative. Further, when the switch lever 6a is in electrical contact with the switch contact pin 7, the logical '0' signal is converted into a logical '1' signal by the inverter 8 so that it is possible to set a predetermined time interval in the minutes-down counter 14 and the hours-down counter 15 upon operation of the setting circuit 22, the display device displaying the predetermined time interval. When the predetermined time interval has been set, the minutes signal from the seconds counter 3, applied to the minutes-down counter circuit 14 via OR circuit 25 reduces the count in the minutes-down counter by unity each minute. Similarly, the hours signal from the minutes counter 4, applied to the hours-down counter 15 via OR circuit 26, reduces the count in the hours-down counter 15 by unity each hour. When the contents of the minutes-down counter 14 and the hours-down counter 15 are both zero, i.e. the remaining time interval is 0 hours, 00 minutes, a NOR circuit 23 generates a logical '1' signal so that a driver circuit 16 is energised by an AND circuit 24. The driver circuit 16 drives an alarm device which generates a sound for indicating that the predetermined time interval has elapsed.

The minutes-down counter 14 and hours-down counter 15 are reset by the setting circuit 22 when the switch lever 6a is in contact with the switch contact pin 6. A reset signal is also applied to the AND circuit 24 which is thereby closed so that the alarm device is not operated.

Figure 2 illustrates one form of display

device 30 for a digital electronic timepiece according to the present invention. An hours display 31, a minutes display 32 and a date display 33 is produced by the display device 30 which may be switched to display the remaining time intervals indicated by reference numeral 34. The remaining time interval is displayed in hours as indicated by reference numeral 35 and in minutes is indicated by reference numeral 36. The remaining time interval is reduced by one minute each minute and when the remaining time interval reaches 0 hours and 00 minutes an alarm sounds.

Figure 3 illustrates another form display device of a digital electronic timepiece according to the present invention. This display device displays both the actual time 38 and the remaining time interval 39. The actual time is displayed in hours 40 and minutes 41 and the remaining time interval is displayed in hours 42 and minutes 43. If the remaining time interval is set one hour fifteen minutes, it is reduced by one minute each minute, and an alarm sounds when the remaining time interval is 0 hours and 00 minutes.

An electronic timepiece according to the present invention is very useful for sports events because it is possible to see and appreciate the remaining time interval.

Having regard to the provisions of Section 9 of the Patents Act 1949 we direct attention to the claims of our Patent No. 1,360,932.

WHAT WE CLAIM IS:—

1. A digital electronic timepiece comprising: an oscillator circuit for producing a relatively high frequency standard time signal; frequency dividing circuitry arranged to produce a plurality of timing signals from the standard time signal; digital display means arranged to be driven by the timing signals and to display the actual time of day; setting means for pre-setting a predetermined time interval in down-counter means connected to receive the or some of the timing signals so that, in operation, the content of the down-counter means is representative of a remaining time interval, the display means being arranged to display the remaining time interval.

2. A digital electronic timepiece as claimed in claim 1 including selecting means for selectively causing the actual time of day and the remaining time interval to be displayed.

3. A digital electronic timepiece as claimed in claim 2 in which the selecting means is a manually operable switch.

4. A digital electronic timepiece as claimed in any preceding claim including alarm means which are energised when the predetermined time interval has elapsed.

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'1' signal is in addition, inverted by an inverter 8 so that AND circuits 20, 21 are closed with the result that no timing function is performed.

5 When the switch lever 6a is in electrical contact with a time interval display switch—contact pin 7, a logical '0' signal causes the AND circuit 9 and the AND circuit 10 to close so that the actual time is no longer
10 displayed by the display device 13. The logical '0' signal is converted into a logical '1' signal by the inverter 8, so that AND circuits 20, 21 are opened. Thus an output
15 signal from a minutes-down counter 14 and an output signal from an hours-down counter 15 are applied to the display device 13 via the OR circuits 10, 19 and the decoder/driver circuits 11, 12 so that a predetermined time interval is initially displayed and then remaining time interval in
20 hours and minutes is displayed by the display device 13.

When the switch lever 6a is in electrical contact with the switch contact pin 6, the
25 logical '1' signal is converted into a logical '0' signal by the inverter 8 so that a time interval setting circuit 22 is inoperative. Further, when the switch lever 6a is in electrical contact with the switch contact
30 pin 7, the logical '0' signal is converted into a logical '1' signal by the inverter 8 so that it is possible to set a predetermined time interval in the minutes-down counter 14 and the hours-down counter 15 upon
35 operation of the setting circuit 22, the display device displaying the predetermined time interval. When the predetermined time interval has been set, the minutes signal from the seconds counter 3, applied to the
40 minutes-down counter circuit 14 via OR circuit 25 reduces the count in the minutes-down counter by unity each minute. Similarly, the hours signal from the minutes counter 4, applied to the
45 hours-down counter 15 via OR circuit 26, reduces the count in the hours-down counter 15 by unity each hour. When the contents of the minutes-down counter 14 and the hours-down counter 15 are both zero,
50 i.e. the remaining time interval is 0 hours, 00 minutes, a NOR circuit 23 generates a logical '1' signal so that a driver circuit 16 is energised by an AND circuit 24. The driver circuit 16 drives an alarm device
55 which generates a sound for indicating that the predetermined time interval has elapsed.

The minutes-down counter 14 and hours-down counter 15 are reset by the setting
60 circuit 22 when the switch lever 6a is in contact with the switch contact pin 6. A reset signal is also applied to the AND circuit 24 which is thereby closed so that the alarm device is not operated.

65 Figure 2 illustrates one form of display

device 30 for a digital electronic timepiece according to the present invention. An hours display 31, a minutes display 32 and a date display 33 is produced by the display device 30 which may be switched to
70 display the remaining time intervals indicated by reference numeral 34. The remaining time interval is displayed in hours as indicated by reference numeral 35 and in minutes is indicated by reference
75 numeral 36. The remaining time interval is reduced by one minute each minute and when the remaining time interval reaches 0 hours and 00 minutes an alarm sounds.

Figure 3 illustrates another form display
80 device of a digital electronic timepiece according to the present invention. This display device displays both the actual time 38 and the remaining time interval 39. The actual time is displayed in hours 40
85 and minutes 41 and the remaining time interval is displayed in hours 42 and minutes 43. If the remaining time interval is set one hour fifteen minutes, it is reduced by one minute each minute, and an alarm sounds
90 when the remaining time interval is 0 hours and 00 minutes.

An electronic timepiece according to the present invention is very useful for sports events because it is possible to see and
95 appreciate the remaining time interval.

Having regard to the provisions of Section 9 of the Patents Act 1949 we direct attention to the claims of our Patent No. 1,360,932.

WHAT WE CLAIM IS:—

1. A digital electronic timepiece comprising: an oscillator circuit for producing a relatively high frequency standard time signal; frequency dividing circuitry
105 arranged to produce a plurality of timing signals from the standard time signal; digital display means arranged to be driven by the timing signals and to display the actual time of day; setting means for pre-
110 setting a predetermined time interval in down-counter means connected to receive the or some of the timing signals so that, in operation, the content of the down-counter means is representative of a remaining
115 time interval, the display means being arranged to display the remaining time interval.

2. A digital electronic timepiece as claimed in claim 1 including selecting
120 means for selectively causing the actual time of day and the remaining time interval to be displayed.

3. A digital electronic timepiece as claimed in claim 2 in which the selecting
125 means is a manually operable switch.

4. A digital electronic timepiece as claimed in any preceding claim including alarm means which are energised when the predetermined time interval has elapsed.

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5. A digital electronic timepiece as claimed in any preceding claim in which the display device has a first portion for displaying the actual time of day, and a second portion for displaying the remaining time interval. 10
6. A digital electronic timepiece substantially as herein described with reference to and as shown in the accompanying drawings.

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