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PATENT SPECIFICATION

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(54) DIGITAL WATCH

(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 digital watches. According to the present invention, there is provided a digital watch comprising time indicating means for displaying, in digital form, a time indication, selecting means for selecting a part of the time indication to be corrected, correcting means for correcting the part of the time indication selected for correction, and a crown member capable only of axial movement for operating both the selecting means and the correcting means.

In the preferred embodiment, the arrangement is such that axial movement of the crown member to a first position selects the part of the time indication to be corrected and subsequent axial movement of the crown member to a second position corrects that part of the time indication.

The time indicating means may be arranged to produce an hours indication, a minutes indication and a seconds indication, electronic circuitry being provided so that repeated axial movement of the crown member to the first position sequentially selects the seconds indication, the minutes indication and the hours indication for correction.

The arrangement is preferably such that movement of the crown member to the second position advances the selected part of the time indication stepwise by unity.

The digital watch may include indicating means for indicating the part of the time indication selected for correction. Said indicating means may comprise electronic circuitry for causing the display of the part of the time indication selected for correction to flicker.

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

Figure 1 is an external view of an embodiment of a conventional watch;

Figure 2 illustrates another embodiment of a conventional watch;

Figure 3 illustrates the principle of operation of a digital watch according to the present invention;

Figure 4 illustrates, in block diagram form, a switch mechanism and an electronic circuit associated therewith for a digital watch according to the present invention;

Figure 5 is a plan view of a switching mechanism for a digital watch according to the present invention; and

Figure 6 is a block diagram of an electronic circuit for a digital watch according to the present invention.

Generally speaking, when a time indication of a digital wrist-watch is to be corrected, the hours indication, minutes indication and seconds indication are controlled independently, and internal clock signals or manually generated signals are used as correcting signals.

Figure 1 is an external view of an embodiment of a conventional digital wristwatch, having time correcting switches 1, 2, 3 provided to correct the hours indication, minutes indication and seconds indication, respectively. A switch 4, in a first axial position, permits correction of the time indication and in a second axial position prevents correction of the time indication. When the time indication is to be corrected, the switch is first pulled out axially from the second position to the first position so that correction of the time indication may be performed. Next, the switch 1 is operated to correct the hours indication, the switch 2 is operated to correct the minutes indication, and the switch 3 is operated to correct the seconds indication. In this case either internal clock signals or manually generated signals are used as correcting signals.

This conventional digital wristwatch has the advantage that correction of the time indication is simple to effect, but the disadvantage that four separate switches

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are required and one of those switches, namely the switch 4, is spaced a considerable distance from the remainder of the switches in a position in which the winding crown would normally be located. If the watch is to be made waterproof, it is preferable that it should have as few externally operable members as possible.

Figure 2 illustrates another embodiment of a conventional digital wristwatch in which correction of the time indication is effected solely by means of a crown 5. When the crown 5 is pulled out axially to a position shown in dotted lines, the hours indication and minutes indication can be corrected in response to clockwise rotation or counter-clockwise rotation respectively of the crown. This conventional digital wristwatch has the advantage that only one member, namely the crown 5, is necessary to effect correction of the time indication, however, it is disadvantageous in that a relatively complicated rotary switch mechanism is necessary and such is undesirable from the point of view of reliability. Furthermore, in this conventional digital wristwatch it is difficult, from a practical point of view, to use anything but internal clock signals as the correcting signals, and in consequence, it is difficult to achieve reliable correction of the time indication. Moreover, the crown of a wristwatch is small and manual axial operation gives the operator a responsive feeling when the crown is pulled out axially or pushed in axially so that he can easily know whether the crown has been operated. On the other hand when a crown is rotated, it is so small that the operator cannot determine so easily in which direction and by how much it is being rotated.

Figure 3 illustrates the principle of operation of a digital watch, e.g. a digital wristwatch, according to the present invention. A crown or crown member is displaceable axially between a position N, a position PL and a position PS, being returned automatically from the position PL or the position PS to the position N when released. In Figure 3, the condition indicated by the reference numeral 7 is the normal running condition of the watch in which the time indication is displayed in digital form in hours, minutes and seconds and the crown member is in the position N. If the crown member is then pulled out to the position PL and allowed to return to Position N, the display is changed to a condition indicated by the reference numeral 8 in which the seconds indication flickers to show that correction of the seconds indication may be performed. If the crown member is then repeatedly pushed axially inwards to the position PS

and released, the seconds indication is altered stepwise in units of a second. If in the condition 8 the crown member is pulled to the position PL and released the display is changed to a condition indicated by the reference numeral 9 when the minutes indication flickers showing that correction of the minutes indication may be performed. If the crown member is then repeatedly pushed axially inwards to the position PS and released, the minutes indication is changed stepwise in units of a minute. Similarly, if in the condition 9 the crown member is moved axially outwardly to the position PL and released the display is changed to a condition indicated by the reference numeral 10 when the hours indication flickers to show that correction of the hours indication may be performed. If the crown member is then repeatedly pushed axially inwards to the position PS and released, the hours indication is altered stepwise in units of an hour. If, in the condition 10, the crown member is moved axially outwardly to the position PL and released, the display is changed to a condition indicated by the reference numeral 11, which is the same as the condition 7, i.e. the normal running condition of the watch. As will be appreciated, the part of the display device on which correction may be effected at any given moment is clearly indicated and the correction may be effected stepwise by repeatedly pushing the crown member axially inwards and releasing it. In the condition 11 movement of the crown member inwards causes no correction of any part of the time indication because a locking circuit is provided. Accordingly, the display of the digital watch is in the condition 11 for normal running and, when correction of the time indication is necessary, the conditions 8, 9 or 10 are selected sequentially and the seconds indication, minutes indication and hours indication are corrected respectively.

Figure 4 illustrates, in block diagram form, a switching mechanism and an electronic circuit associated therewith for a digital watch according to the present invention. When the crown member is in the position N, terminals S_1 , S_2 are connected to a negative side of a battery B via respective resistors. When the crown member is moved to the position PL, the terminal S_1 is connected to the positive side of the battery by a movable member S' engaged for movement with the crown member. Similarly, when the crown member is moved to the position PS, the terminal S_2 is connected to the positive side of the battery B by the movable member S' .

Figure 5 is a plan view of a switching mechanism for a digital watch according to

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the present invention. A member 12 is connected for movement with the crown member and is given a positive potential via a plate of the watch. Terminals 13, 14 correspond to terminals S₁, S₂ respectively shown in Figure 4.

Figure 6 is a block diagram of an electronic circuit for a digital watch according to the present invention. Outputs R, S, M, H become logical "1" cyclically in response to positive signals applied to the terminal S₁, and fed to a gate arrangement Q₁, Q₂. When the output R is logical "1", AND gates 15, 16, 17 are locked and positive signals from the terminal S₂ are blocked thereby and not fed to input gates 18, 19, 20, and accordingly no correction of the time indication can be effected. When the output R is logical "0" and the output S is logical "1" the AND gate 15 is opened so that positive signals from the terminal S₂ are passed and change the seconds indication. Similarly, when the output M is logical "1" or the output H is logical "1" the minutes indication and the hours indication, respectively, are advanced. The signals from the outputs S, M, H are also fed to decoder circuits DEC to cause flickering of the seconds indication, minutes indication, and hours indication, respectively.

A watch according to the present invention and described above is simple and pleasing to operate in a manner analogous to that of the conventional mechanical watch, and may be mass produced.

The present invention has been described above with reference to digital watches having an hours indication, a minutes indication and a seconds indication. The present invention can, of course, be applied to a digital watch having, in addition, a day of the week indication and/or a date indication, and a seconds indication need not necessarily be provided. Furthermore, the crown member need not automatically return to position N and may have to be returned thereto manually. Furthermore, manually generated signals, internal clock signals or any other suitable signals may be used as time correcting signals.

Having regard to the Provisions of Section 9 of the Patents Act 1949, we direct attention to the claims of our Patent No. 1,401,776.

WHAT WE CLAIM IS:—

1. A digital watch comprising time indicating means for displaying, in digital form, a time indication, selecting means for selecting a part of the time indication to be corrected, correcting means for correcting the part of the time indication selected for correction, and a crown member capable only of axial movement for operating both the selecting means and the correcting means.

2. A digital watch as claimed in claim 1 in which the arrangement is such that axial movement of the crown member to a first position selects the part of the time indication to be corrected and subsequent axial movement of the crown member to a second position corrects that part of the time indication.

3. A digital watch as claimed in claim 2 in which the time indicating means is arranged to produce an hours indication, a minutes indication and a seconds indication, electronic circuitry being provided so that repeated axial movement of the crown member to the first position sequentially select the seconds indication, the minutes indication and the hours indication for correction.

4. A digital watch as claimed in claim 2 or 3 in which the arrangement is such that movement of the crown member to the second position advances the selected part of the time indication stepwise by unity.

5. A digital watch as claimed in any preceding claim including indicating means for indicating the part of the time indication selected for correction.

6. A digital watch as claimed in claim 5 in which said indicating means comprises electronic circuitry for causing the display of the part of the time indication selected for correction to flicker.

7. A digital watch substantially as herein described with reference to and as shown in Figures 3 to 6 of the accompanying drawings.

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12

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A watch according to the present invention and described above is simple and pleasing to operate in a manner analogous to that of the conventional mechanical watch, and may be mass produced.

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2. A digital watch as claimed in claim 1 in which the arrangement is such that axial movement of the crown member to a first position selects the part of the time indication to be corrected and subsequent axial movement of the crown member to a second position corrects that part of the time indication.

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4. A digital watch as claimed in claim 2 or 3 in which the arrangement is such that movement of the crown member to the second position advances the selected part of the time indication stepwise by unity.

5. A digital watch as claimed in any preceding claim including indicating means for indicating the part of the time indication selected for correction.

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