

[54] TIME-SETTING AND TIME-CORRECTING
DEVICE FOR A DIGITAL CLOCK

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[22] Filed: Nov. 13, 1972

[21] Appl. No.: 305,688

[30] Foreign Application Priority Data

Nov. 22, 1971 Japan..... 46/093066

[52] U.S. Cl..... 58/125 C

[51] Int. Cl. G04b 19/02

[58] **Field of Search** 58/34-37,
85.5, 125 C, 126 E

[56] **References Cited**

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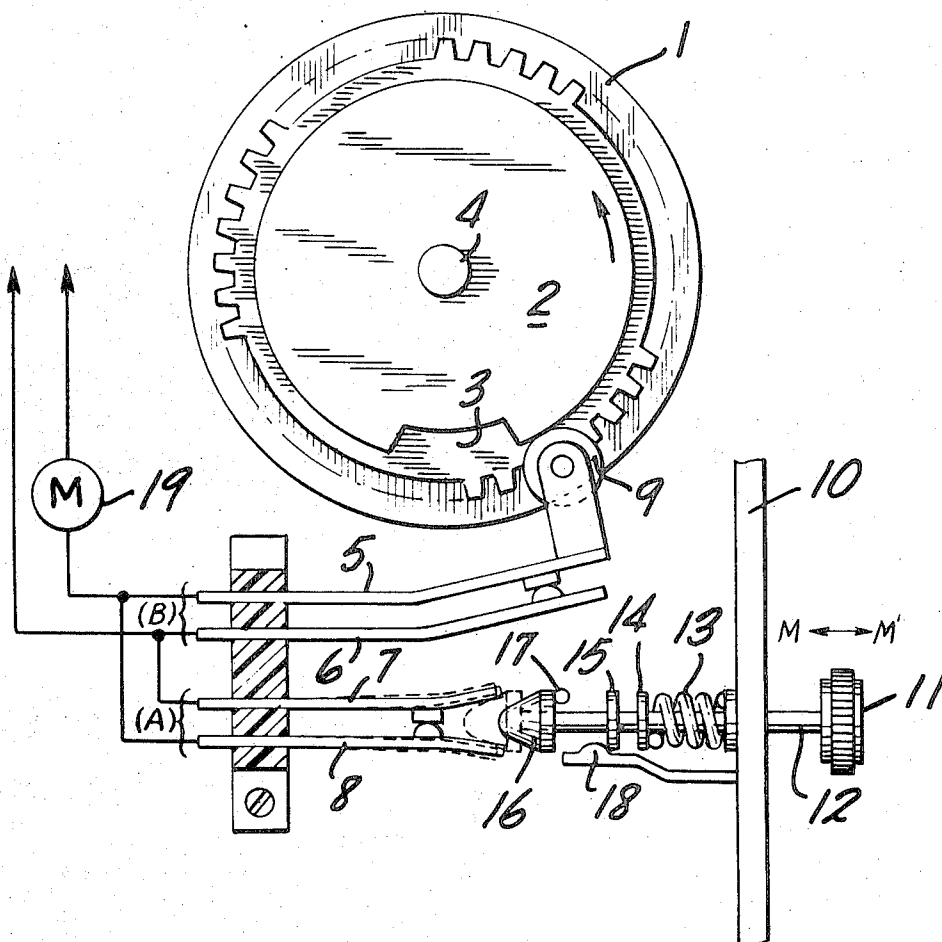
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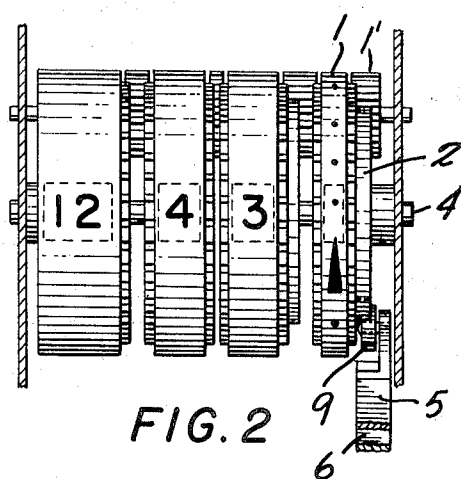
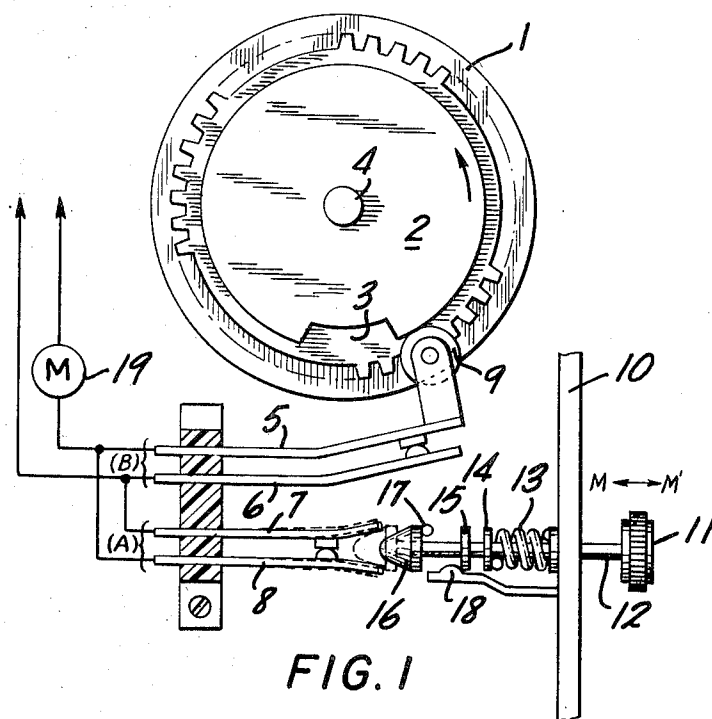
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[57] ABSTRACT

A device for making time settings and time corrections in a digital clock. The time-indicating elements other than the last time unit indicating element are preliminarily set to a time that is to be set in the clock. The clock driving circuit is prepared by manually opening a switch for disabling thereof automatically when the least time unit time-indicating element assumes a selected position. The position of the least time unit element is sensed by a sensor and when it arrives at the selected position a second switch in parallel with the first-mentioned switch is automatically opened by the sensor so that the driving circuit is disabled and the time indicated on the clock least time unit time-indicating element is retained. The driving circuit is enabled by manually controlling or closing of the first-mentioned switch upon coincidence of real time, as indicated by a time standard signal, with the time set into the clock. When the driving circuit is energized under manual control it automatically restores itself for the manual and automatic sequential operations necessary to automatically disable it and enable it in making time settings and corrections.

7 Claims, 2 Drawing Figures





TIME-SETTING AND TIME-CORRECTING DEVICE FOR A DIGITAL CLOCK

BACKGROUND OF THE INVENTION

This invention relates generally to digital timepieces and more particularly to a time-setting and time-correcting device for digital timepieces.

In setting the correct time in timepieces the time is generally set while the driving elements are moving, and consequently the time-indicating elements are driven. The settings for the hour and minute settings are set in accordance with a time standard before the exact or correct time exists. When the exact time is reached, the setting of the time-indicating elements to the exact time has heretofore been impossible because when the correct time is indicated, for example by the sound of a radio signal timed with a time standard, the seconds time indication generally does not coincide with the exact time and the time-indication elements continue to be driven. Thus the corrected time setting set in timepieces, including digital clocks, is generally off from the exact time by at least seconds.

The same problem exists in timepieces if the least time time-indicating elements are minute indicating elements, these are being driven continuously in timepieces where there is no seconds indication so that when the correct time is set the minute time-indicating element can't be set exactly.

SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide a time-setting device for exactly setting the correct time in a digital timepiece.

Another object of the present invention is provision of a device whereby the time-indicating element in a timepiece indicating the least time unit is precisely set to the exact time units possible to be indicated by the timepiece.

In accordance with the invention, a least time unit time-indicating element is driven by an electrical circuit. The time-setting and time-connecting device according to the invention comprises manual means for selectively preparing the electrical circuit to be de-energized and when a precise real time is reached automatic means disable the circuit so that time-indicating elements driven by the electrical circuit temporarily indicate time at the time of disablement thereof. The means for preparing the electrical circuit is then used to enable the circuit at a precise time signal indicated by a time standard.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic side elevation view of a time-setting and time-correcting device, according to the invention, in conjunction with a digital clock; and

FIG. 2 is a diagrammatic, fragmentary front elevation view of time-indicating elements of a digital watch provided with the device in FIG. 1.

Other objects and advantages will appear from the following description of an example of the invention, and the novel features will be particularly pointed out in the appended claims.

DESCRIPTION OF PREFERRED EMBODIMENTS

While the device according to the invention, for setting and correcting time accurately, will be described herein with respect to a digital clock those skilled in the

art will understand that the principles thereof are applicable to other electrically driven timepieces.

In accordance with the drawing a least time unit time-indicating element of a digital clock, illustrated in this instance as a seconds wheel, is rotatably driven in conjunction and coincident with a sensor wheel 2 having a peripheral notch 3. The time-indicating wheel 1 and sensor wheel 2 are rotatably mounted on a shaft 4 on which are rotationally mounted other time-indicating wheels, shown diagrammatically in FIG. 2, that indicate hours, tens of minutes and minutes. In the example shown in the drawing the time-indicating wheels are those of a digital clock and the wheels indicate on a panel twelve hours and forty-three minutes. The seconds wheel has the time indicia shown diagrammatically.

The rotation of the sensor wheel 2 is sensed as later described and is used to prepare the digital clock for disabling thereof automatically at a precise time indicated thereon. When real time corresponds to the time indicated on the timepiece, it is enabled manually and accordingly the time correction or setting made thereon corresponds precisely with the real time. In order to carry this mode of operation, the timepiece is provided with an electrical circuit as shown.

The circuit comprises a pair of sensor elements constructed as switches A and B in parallel. The switches have paired flexible conductive contacts 5, 6, and 7, 8 normally closed. One switch has a position sensor 9 constructed as a cam follower roller sensing the profile of a profiled sensor wheel 2. It can be seen that so long as the follower rides on the periphery of the position sensor wheel 2 the switch B is maintained closed. The spring contact 5 of this switch is biased to maintain the position sensor 9 in contact with the position sensing wheel 2. When the notch 3 presents itself to the cam follower 9, the follower enters the peripheral notch and the switch B is opened. However, since the switch A is closed, the driving circuit of the timepiece continues energized.

Provision is made for disabling automatically the electrical driving circuit at a preselected time. This is accomplished by a time-setting and time-correcting device which includes the sensors already described. The device includes a time-setting knob 11 on an axially displaceable setting shaft 12 extending through a side 10 of the digital clock, not shown in detail. The shaft 12 is biased by a spring 13 toward a position for opening the closed switch A. The spring 13 bears against the side 10 and a first collar 14 on the shaft. A second collar 15 is spaced axially from the first collar. A tapered or conical tip element 16 made of an electrically insulative material is mounted at the inner end of the setting shaft 12. This tip 16 is configured to enter between the flexible contacts 7, 8 of the switch A, which have their free ends flared, as shown, to receive the tip 16 therebetween when it is actuated to the position shown in broken lines. When the tip 16 is inserted between the flared ends, it deflects the contacts 7, 8 of the switch A outwardly and separates them sufficiently to open the switch.

A stop 17 determines the extent that the shaft 12 may be axially withdrawn. The innermost or second collar 15 bears against a flexible and resilient stop or click 18 that retains the shaft 12 from being biased to a position where the tip 16 opens the electrical driving circuit in which a driving motor 19 is connected and energized

from a source of power, not shown, for driving the least time unit time-indicating wheel 1.

The digital clock is set, for example, in accordance with a time standard signal transmitted by radio or TV. Before the exact real time signal is transmitted the real time that the signal will correspond to is generally announced. The circuit is prepared for setting of the time in the clock by manually actuating the knob 11 toward a direction M illustrated by a double arrow M—M'. The flexible stop or click 18 is configured so that the second collar cams it downwardly and it allows the shaft to be moved axially for inserting the tip into the switch A and disabling it. The stop 18 being resilient restores itself as the innermost collar moves past it and it is received in a space between the two collars 14, 15 so that the shaft 12 is held axially maintaining the switch A disabled or open.

Since the sensors or switches A, B are connected in parallel the motor 19 is maintained energized so that it continues to drive the time-indicating wheels. As the sensor wheel rotates, eventually the cam registers with the peripheral notch and the corresponding switch is opened. When the cam follower 9 opens its switch B automatically the electrical circuit is disabled since both electrically parallel switches A, B are now open and the motor 19 is de-energized. The time indicated on the least time unit wheel 1 is maintained, since driving of this time-indicating wheel is interrupted.

The circuit is enabled by manually drawing the knob 11 outwardly in the direction M' so that tip 16 is retracted and the flexible or resilient contacts 7, 8 restore themselves to a closed condition. The clock 18 allows the collar 15 to again cam it downwardly and then restores itself holding the shaft 12 in a retracted position. The enabling, by drawing the setting shaft outwardly, takes place when the time standard signal is received and heard. It can be seen that if the notch 3 corresponds to a position at which the least time time-indicating wheel 1 is stopped at a zero setting, i.e., a zero seconds time indication, the time set in the clock is the exact real time.

The clock may be provided with known means, not shown, for preliminarily setting the time-indicating elements to a time-indicating position in which the time to be exactly set in the clock is preset. Then the circuit is disabled as before described so the time preliminarily set in the time-indicating elements, for example, the hour and minutes time-indicating wheels in the present example as before described, is indicated. The circuit is enabled when the real time corresponds exactly with the time preliminarily set on the clock.

Once the driving circuit has been enabled, the seconds indicating wheel 1 is driven and the sensor wheel 2 driven synchronously therewith is driven. The circuit then restores itself automatically closing the automatically controlled open switch B. The circuit is then in readiness for the sequence of manual — automatic — manual operations necessary to effect a precise time connection and setting in the digital clock provided with the invention.

Those skilled in the art will understand that the drive from the motor 19 to the least time unit indicating wheel 1 is from a gear 1' that is coupled to the motor

through the necessary coupling means, for example, gears not shown. Since the motor is de-energized, the driving is interrupted and there need be no declutching means provided. Furthermore, the drive between the motor 19 and the least time unit indicating wheel may be friction wheels and the like.

What we claim and desire to secure by letters patent is:

1. A time-setting and time-correcting device for a timepiece comprising, a driven time-indicating and time-setting element, an electrical circuit comprising means electrically energized for driving said element, means for selectively preparing said electrical circuit for disabling thereof and to selectively enable it when disabled, means for automatically disabling said electrical circuit only after preparation for disabling thereof and when said element reaches a given position corresponding to a selected unit of time indication.
2. A time-setting and time-correcting device for a timepiece according to claim 1, in which said circuit comprises two parallel switches opened to disable it and in which said means for selectively preparing the circuit for disabling thereof comprises means for opening a first parallel circuit, and said means for automatically disabling said circuit comprises means for opening a second of the parallel switches while the first parallel switch is open.
3. A time-setting and time-correcting device for a timepiece according to claim 1, in which said time-indicating and time-setting element comprises a least time time-indicating element.
4. A time-setting and time-correcting device for a timepiece according to claim 3 in which said time-indicating element comprises a driven wheel for indicating the least unit of time indicated by the timepiece.
5. In a digital timepiece a plurality of driven time-indicating elements indicating different time units, one of said elements being a least time unit time-indicating element, an electrical circuit having drive means for driving said time-indicating elements and two parallel switches closed for energizing said drive means, manual means for manually opening a first switch of said switches at will, automatic means automatically opening the second switch of said switches when said least time unit time-indicating element assumes a given position, means detecting said position, and said manual means including means for closing the first switch at will, said automatic means automatically maintaining the second switch closed when said drive means is energized and said least time unit time-indicating element is driven.
6. In a digital timepiece according to claim 5, in which said means detecting said position comprises a sensor driven synchronously with said least time unit time-indicating element and sensing means sensing the sensor.
7. In a digital timepiece according to claim 5, in which said manual means comprises a setting shaft operable to two operative positions for controlling opening and closing of said first switch.

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