[54] DIGITAL WRIST WATCH HAVING TIMER FUNCTION
[75] Inventor: Kinji Fujita, Suwa, Japan
[73] Assignee: Kabushiki Kaisha Suwa Seikosha, Tokyo, Japan
[22] Filed: Jan. 22, 1973
[21] Appl. No.: 325,697
[30] Foreign Application Priority Data
Jan. 22, 1972 Japan
47-8059
Jan. 22, 1972 Japan 47-8060

Jan. 22, 1972 Japan 47-8061
[52] U.S. Cl
58/152 B, 58/38, 58/57.5
[51] Int. Cl.
[58] Field of Search
G04b 37/12, G04b 23/12
58/23 R, 23 A, 38, 39.5,
$58 / 57.5,152$ B
[56]
References Cited UNITED STATES PATENTS
3,576,099 4/1971 Walton. $\qquad$ 58/50 R

3,646,751 3/1972 Purland............................. 58/50 R
3,664,116 5/1972 Emerson et al....................... 58/23 A
3,672,155 6/1972 Bergey et al....................... 58/50 R
Primary Examiner-Richard B. Wilkinson Assistant Examiner-Edith Simmons Jackmon Attorney, Agent, or Firm-Blum, Moscovitz, Friedman \& Kaplan

## [57]

## ABSTRACT

A digital wrist watch is provided with a quartz oscillator, counting and distribution circuits and a digital electronic display device. The watch is provided with a memory circuit for the performance of a timer function. A switch and selecting circuit is provided for the selective application of either time keeping or timer signals to the display device so that said display device may serve both the time keeping and timer functions. Said switch and selecting circuit also serves to permit the use of a single set of switches for both time correction and setting of the timer function.

5 Claims, 2 Drawing Figures

FIG. 2



## DIGITAL WRIST WATCH HAVING TIMER FUNCTION

BACKGROUND OF THE INVENTION

This invention relates to electronic wrist watches having digital displays of time, and in particular, to such wrist watches provided with a timer function. Digital wrist watches have been provided with digital display devices based on liquid crystal displays, lightemitting diode displays and the like
Generally, an increase in the number of digits of the display is difficult where the size of the watch is to be maintained at a minimum. Further, such an increase increases the problem of reliability of the timepiece. Thus, the provision of separate display devices for performing the timer function on a digital wrist watch would prove extremely difficult and would not provide a practical wrist watch.
Further, push button switches are utilized in digital wrist watches for the correction of time and other functions. Generally, these switches cannot be incorporated in a winding crown where a plurality of switches may be actuated by various pulling and turning operations, as would be the case in a conventional wrist watch. Accordingly, in order to simplify the operation, the number of switches required for normal operation of a digital watch is increased. For example, time correction of such digital watches would be greatly simplified if separate switches were provided for the correction of each of the hour, 10 -minute, minute, 10 -second and second digits of the display. However, in a small-sized wrist watch, it is difficult to provide six switches for this purpose. Where a timer function is also to be performed, additional switches would normally be required for setting the timer function further complicating the construction of the watch
By providing a selecting circuit and switch so that certain switches can perform functions in both the timer and time keeping functions, and so that a single display device can serve both of said functions, the foregoing deficiencies are avoided.
Accordingly, an object of the invention is to provide a digital wrist watch incorporating both time keeping and timer functions in a compact structure.
Another object of the invention is to provide a digital timepiece wherein a single display device serves as the display for both time keeping and timer functions.
A further object of the invention is to provide a digital wrist watch wherein a single set of switches serves as both time-correcting switches for the time keeping function and setting switches for the timer function.
Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification and drawings.
The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:
FIG. 1 is a top plan view of a digital wrist watch in accordance with the invention; and

FIG. 2 is a block circuit diagram of the time keeping and timer circuitry of the wrist watch of FIG. $\mathbb{1}$.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, the digital wrist watch depicted is adapted to perform both time keeping and timer functions. The watch is provided, on its front face, with five switches. Switches 1,2,4 and 5 are push button switches, while switch 3 is a sliding two position switch. As will be more particularly described in connection with FIG. 2, switch 1 is adapted for performing the hour correction and hour timer setting functions, switch 2 is adapted to perform the minute correction and minute timer setting function, switch 4 is a system reset switch, while switch 5 is for starting and stopping the timepiece. Sliding switch 3 is for selecting whether the timepiece is to perform the watch function or the timer function. The watch is provided with a digital display panel 6 which may be formed from either liquid crystal displays, light-emitting diode displays or the like. The circuitry, switches and displays are mounted on a watch case 7 held on the hand of the use by a watch band 8 .
Referring now to FIG. 2, a block diagram of the circuitry of the watch of FIG. 1 is depicted. The watch includes a quartz crystal oscillator 11 adapted to produce a high frequency time standard signal. This signal is applied to counting circuit 12 which divides the high frequency signal into a second signal having a frequency of 1 Hz . Said second signal is applied to counting circuit 13 which counts said second signal and produces a BCD coded signal representative of the count for application to selecting circuit 19 and a minute signal for application to counting circuit 14. Counting circuit 14 counts said minute signal and produces a BCD code representative of said count which is applied to both selecting circuit 19 and coincidence circuit 18. Said counting circuit also produces an hour signal for application to counting circuit 15. Counting circuit 15 counts said hour signal and produces a BCD code representative of the hour count to both selecting circuit 19 and coincidence 18. Counting circuit 15 would, in this embodiment, be adapted to recycle after counting 24 hours.
The timepiece also includes, as part of the timer circuitry, memory circuits 16 and 17 , associated respectively with minute and hour. These memory circuits store either the predetermined time period which begins or ends at a certain time or the predetermined time when a certain time period begins or ends, depending on the specific nature of the timer function to be performed. The output of each of memory circuits 16 and 17 is a BCD code signal respectively representative of the stored minute and hour which is applied to both selecting circuit 19 and coincidence circuit 18.
Sliding switch $\mathrm{S}_{3}$ (corresponding to switch 3 of FIG. 1 ) is coupled to selecting circuit 19 for selectively disposing said selecting circuit so that either the BCD code minute and hour signals from counting circuits 14 and 15 , or the BCD code minute and hour signals from memory circuits 16 and 17 are applied to distributing circuit 20. Said distributing circuit serves to convert the BCD signal applied thereto (including the BCD code second signal from carrying circuit 13 into sevensegment signals suitable for driving the seven-bar display devices 6 . Thus, by the selective position of switch
$S_{3}$, display panel 6 selectively displays either actual time or the contents of memory circuits 16 and 17 representative of the timer function.

Coincidence circuit 18 compares the signal stored in memory circuits 16 and 17 with the ongoing timekeeping signals from counting circuits 14 and 15 , and upon coincidence, sends a signal to an amplifier A which drives an alarm device such as speaker SP, a buzzer or the like.
Switch $\mathrm{S}_{3}$ and selecting circuit 19 serves a further purpose in connection with the use of push button switches $S_{1}$ and $S_{2}$ which correspond respectively to push button switches 1 and 2 of FIG. 1. Specifically, switch $\mathrm{S}_{3}$ and selecting circuit 19 serves to change over the function of switches $S_{1}$ and $S_{2}$, from time keeping to timer functions. Thus, when switch $S$ is disposed in the timer position, display panel 6 provides a visual display of the setting of the timer function. At the same time, switches $S_{1}$ and $S_{2}$ may be utilized to set said timer function, by applying signals through selecting circuit 19 to each of memory circuits 16 and 17 , switch $S_{1}$ setting memory circuit 17 and switch $\mathrm{S}_{2}$ setting memory circuit 16.
When switch $S_{3}$ is in the "watch" setting, display panel 6 indicates actual time, and switches $S_{1}$ and $S_{2}$ perform time correction functions through selecting circuit 19 by applying suitable correction signals to counting circuits 14 and 15 . Switch $S_{1}$ serves to correct counting circuit 15 , while $S_{2}$ serves to correct counting circuit 14.
Switch $\mathrm{S}_{4}$, which corresponds to push button switch 4 is a system reset switch, while switch $S_{5}$, which corresponds to push button switch 5 , serves to stop the count of counting circuit 12 , and at the same time, serves to alternately reset or begin counting, thus providing a means for correcting the second signal.
In the embodiment depicted in FIG. 2, the timer function is performed by setting a time in the memory circuit and sounding an alarm when that time is reached. However, a timer arrangement may be provided wherein the timer circuit includes a presetable counting circuit, the desired time period being set in memory circuits and the output of the memory circuits and the timer counting circuit being compared by a coincidence circuit.
Since the digital wrist watch in accordance with the invention has only five switches, it is possible to provide further functions on the watch since the provision of additional switches in conjunction with such further functions, such as day and date indications, will not unduly complicate the watch.
It will thus be seen that the objects set forth above, and those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.
It is also to be understood that the following claims are intended to cover all of the generic and specific fea-
tures of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A digital wrist watch comprising a quartz oscillator for producing a high frequency time standard signal; counting circuit means coupled to said quartz oscillator for producing time keeping signals from said high frequency time standard signal, said counting circuit means including at least two counters, each said counter being adapted to count a specific unit of time; a display device means adapted for the digital display of time upon the application of driving signals thereto; selecting circuit means coupled to said at least two counters and adapted to receive time keeping signals therefrom; timer circuit means coupled to said selecting circuit means for performing a timer function and adapted to produce timer status signals representative of the setting of the timer circuit means; a manually operable selecting switch coupled to said selecting circuit means, said selecting circuit means being connected to receive said timer status signals and said time keeping signals and adapted to transmit one of said timer signals and said time keeping signals depending on the setting of said selecting switch, distributing circuit means connected intermediate said selecting circuit means and said display means for applying driving signals to said display means in response to the transmitted signals from said selecting circuit means, and at least two manually operable functional switches each of said switches operatively associated with one of said at least two counters and said timer circuit means and coupled through said selecting circuit means to said at least two counters and to said timer circuit means, said selecting circuit means being adapted to selectively couple said at least two functional switches to said timer circuit means for the setting thereof when said selecting switch is in a first position and to each of said associated counting means for the individual correcting thereof when said selecting switch is in a second position whereby said display means selectively displays either the status of said timer circuit means or time.
2. A digital wrist watch as recited in claim 1, wherein said timer circuit means includes at least two memory means each said memory means operatively associated with a one of said functional switches and coupled to said selecting circuit means for applying timer status signals thereto.
3. A digital wrist watch as recited in claim 2 , wherein said functional switches are adapted to store a time period within said memory means, which time period is represented by said timer status signals.
4. A digital wrist watch as recited in claim 3, wherein said functional switches are adapted to store a predetermined time within said memory means, said timer status signals being representative of said particular time.
5. A digital wrist watch as recited in claim 4 wherein 60 said specific units of time are minutes and hours.
