United States Patent [19]

Fujita

[11] **3,796,037**

[45] **Mar. 12, 1974**

[54] **DISPLAY METHOD FOR SOLID STATE ELECTRONIC TIMEPIECE**

[76] Inventor: **Kinji Fujita,** 10616 Takagi, Shimosuwa-machi, Suwa-gun, Nagano-ken, Japan

[22] Filed: **Oct. 28, 1971**

[21] Appl. No.: **193,404**

[52] **U.S. Cl.** ..... **58/4 A,** 40/107, 58/50 R, 58/58

[51] **Int. Cl.** **G04b 19/24,** G04b 19/30

[58] **Field of Search** ..... 58/4 R, 4 A, 23 R, 23 A, 58/23 AC, 50 R, 58; 40/107; 340/336

[56] **References Cited**

UNITED STATES PATENTS

3,691,755	9/1972	Girard	58/23 BA X
3,576,099	4/1969	Walton	58/23 R
3,505,804	4/1970	Hofstein	58/50 R
3,540,209	11/1970	Zatsky et al.	58/50 R
3,333,410	8/1967	Barbella	58/23 R

Primary Examiner—Stephen J. Tomsky
Assistant Examiner—Edith Simmons Jackmon
Attorney, Agent, or Firm—Blum, Moscovitz, Friedman & Kaplan

[57] **ABSTRACT**

A display method for a solid state electronic timepiece wherein separate indicia to be displayed are disposed on a display surface of said watch and means are provided for selectively visually identifying one or more of said indicia. Said indicia are preferably representative of the days of the week. Each of said indicia may have a liquid crystal or luminous diode display associated therewith which may be selectively energized to identify the desired indicia, or may be covered by a liquid crystal screen which, when selectively energized, obscures all but the desired indicia.

3 Claims, 6 Drawing Figures

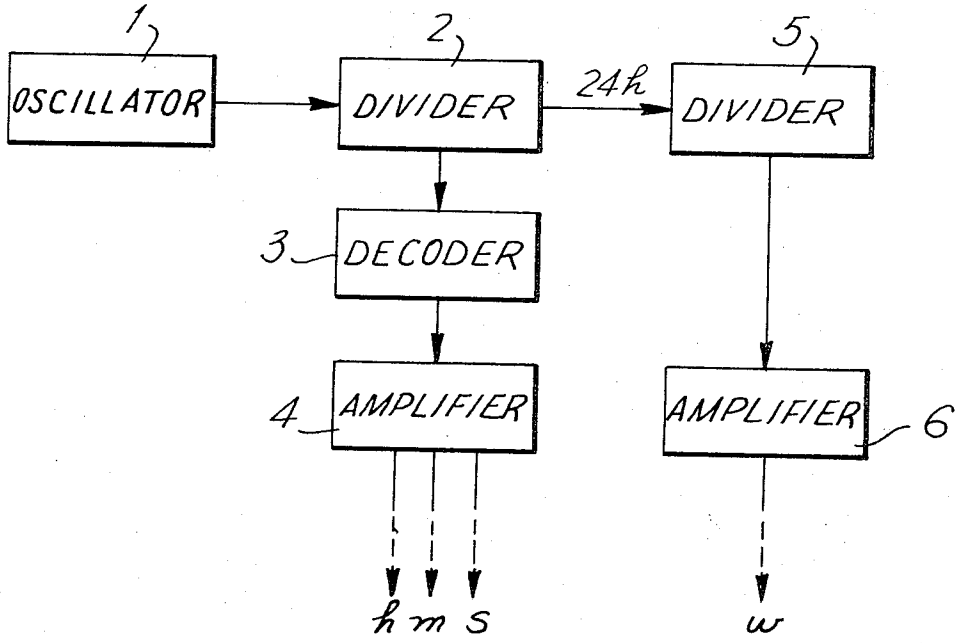


FIG. Ia

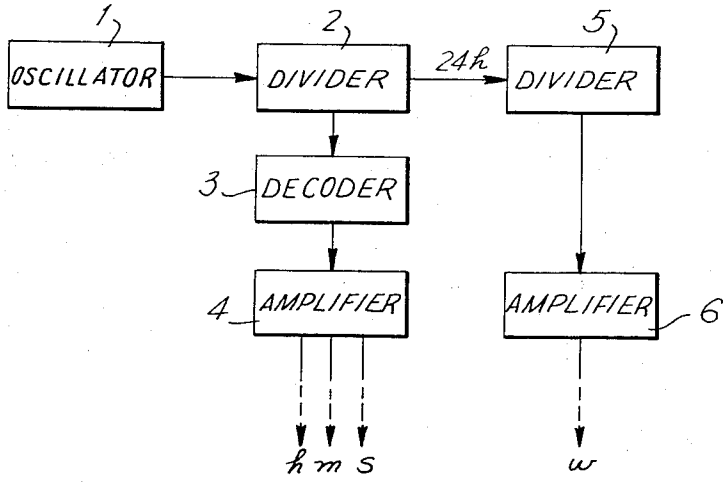

1
OSCILLATOR
2
DIVIDER
24h
5
DIVIDER
3
DECODER
4
AMPLIFIER
AMPLIFIER
6
h m s
w

FIG. Ib

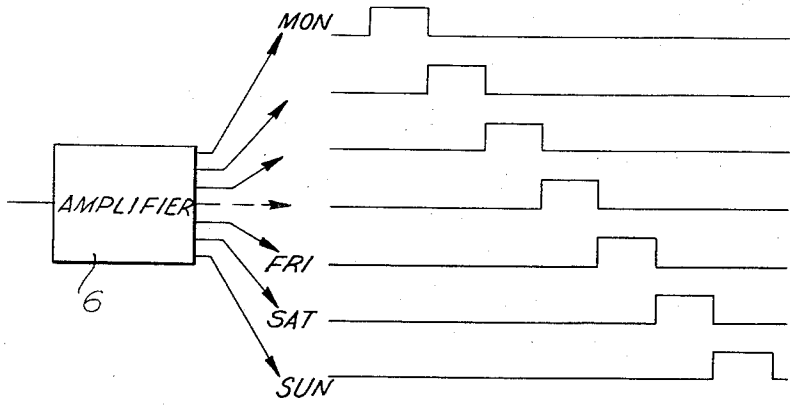

MON
AMPLIFIER
6
FRI
SAT
SUN

FIG. 2

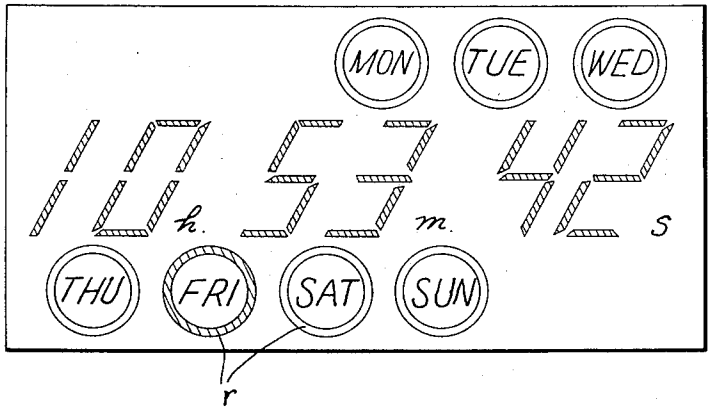

MON
TUE
WED
10 h. 53 m. 42 s
THU
FRI
SAT
SUN
r

FIG. 3

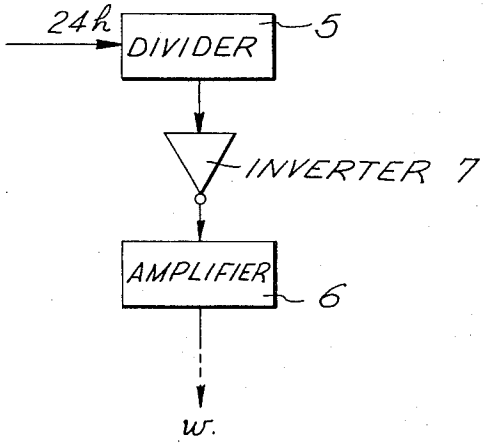

24h
DIVIDER
5
INVERTER 7
AMPLIFIER
6
w.

FIG. 4

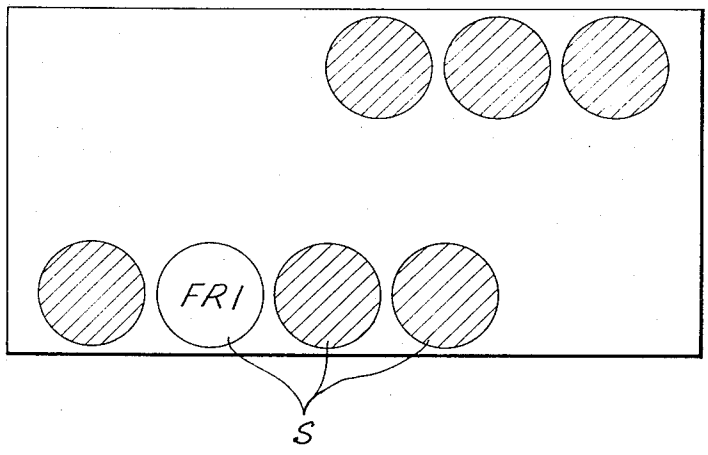
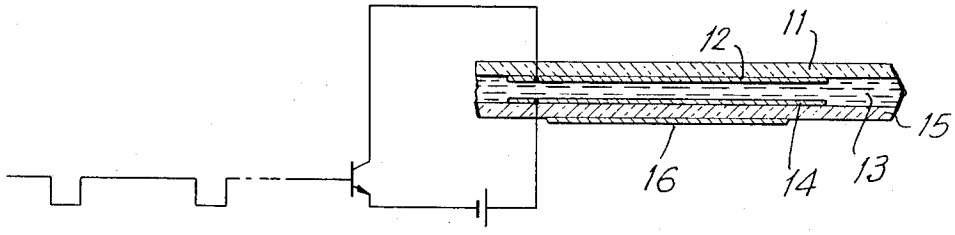


FIG. 5



DISPLAY METHOD FOR SOLID STATE ELECTRONIC TIMEPIECE

BACKGROUND OF THE INVENTION

This application relates to solid state electronic timepieces wherein the conventional mechanical components such as gear trains are not included. Such timepieces incorporate time display arrangements which rely on solid displays such as luminous diodes or liquid crystal displays, in place of the conventional watch hands. Such solid displays are generally driven through an electrical oscillation circuit and a divider circuit.

In such watches, numerals are readily displayed by seven-bar display matrices. Each seven-bar display matrix permits the display of any numeral from 0 – 9 in a single field. This approach permits the display of date, hour, minute and second in a clearly readable format. However, a similar segmented display arrangement cannot be utilized for the display of the day of the week, since neither the Japanese nor the English characters can be reduced to the simple matrix required.

SUMMARY OF THE INVENTION

Generally speaking, in accordance with the invention, a display arrangement for a solid state electronic timepiece is provided consisting of a plurality of separate indicia and means for selectively visually identifying a selected one or more of said indicia in response to the time keeping mechanism of said timepiece.

Said visual identifying means may include a plurality of solid display segments, one of said segments associated with each of said indicia, said segments being adapted to be rendered visible when energized, means being provided for energizing the segment associated with the indicia to be visually identified. In another embodiment, said visual identifying means includes a liquid crystal screen positioned over each of said indicia, each of said liquid crystal screen being adapted to be disposed either in a substantially opaque or substantially transparent state upon the application of an appropriate signal thereto in response to said time keeping mechanism.

Accordingly, it is an object of the present invention to provide a simple and clear method of displaying the day of the week.

A further object of the present invention is to provide a solid state electronic timepiece adapted to display the day of the week through the application of liquid crystal or luminous diode display devices.

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*a* is a block diagram of the solid state electronic timepiece according to the invention;

FIG. 1*b* shows the output wave forms of the arrangement of FIG. 1*a*;

FIG. 2 is a top plan view of a display panel of a solid state electronic timepiece according to the invention;

FIG. 3 is a block diagram of an electronic circuit forming an alternate embodiment of the display method according to the invention;

FIG. 4 is a top plan view of a portion of the display panel of a second embodiment of the electronic timepiece according to the invention; and

FIG. 5 is a fragmentary sectional view of a portion of the display panel of FIG. 4 depicting a portion of the circuit associated therewith.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1*a*, the circuit of the solid state electronic timepiece according to the invention depicted schematically consists of a highly stable oscillator 1 which serves as a time standard and may include a crystal vibrator. The output signal of this oscillator is divided into second, minute, hour and day increments by a frequency divider 2. The time signal output of divider 2 is converted by decoder 3 into the driving signals suitable for driving a seven-bar display associated with each of the desired time indication. Said driving signals are amplified by an amplifier 4 and is coupled to each segment of the seven-bar display constituting the display panel of the timepiece. The 24 hour output signal of divider 2 is applied to a divider 5, which may take the form of a ring counter which is adapted to count seven increments for the purpose of sequentially producing seven separate output signals, one of which is representative of each of the days of the week. The output of divider 5 is applied through an amplifier 6 which amplifies said output signal.

The wave form of the respective output signals produced by divider 5 and amplified by amplifier 6 is depicted in FIG. 1*b*, wherein it is seen that a distinct output is produced for each of the days of the week, each of said outputs being applied to a separate day indicator segment as more particularly shown in FIG. 2.

FIG. 2 depicts one embodiment of a display panel adapted to be driven by the circuitry of FIG. 1. Time is digitally displayed by a liquid crystal or luminous diode display, each of the two digits assigned to hour, minute and second display consisting of a seven bar display matrix. The day of the week indication is provided by day indicator segments *r*, each of which consists of an indicia representative of one of the seven days of the week, in this case the abbreviation thereof, and an indicator ring surrounding said indicia. The indicia are printed on the face or dial of the panel and are fixed. One of the days of the week are identified by energizing the indicator ring in response to the output signal from amplifier 6 associated with that day of the week. Said indicator rings can take the form of a liquid crystal or luminous diode display. The arrangement of FIG. 2 permits the display of the day of the week without the use of a complicated matrix or decoder. In the example of FIG. 2, the indicator ring associated with Friday is energized, providing an indication that the day of the week is Friday.

Referring now to FIG. 3, a second embodiment of the arrangement according to the invention is depicted wherein the 24 hour signal is applied to a divider 5 which may consist of a ring counter, and which produces seven output signals each of which is associated

with one of the days of the week. Said output signals are applied to an inverter **7**, in which the polarity of said output signals is reversed. An amplifier **6** is coupled to the output of inverter **1**. The output of amplifier **6** are applied to the display panel of FIG. **4**. In said panel, wherein an array of indicia representative of the day of the week similar to the array of FIG. **2** are positioned about the periphery of the time indicating display (not shown). The output of amplifier **6** of FIG. **3** is applied to screen electrodes S formed of a liquid crystal, which when energized obscure the indicia on the display panel. Due to the position of inverter **7**, six of the seven day of the week indicia are obscured at any one time, providing a visual indication of the day of the week, only the desired day of the week indicia being visible.

Referring now to FIG. **5**, a cross-section of a portion of the dial or display panel taken through the day indicator segment of FIG. **4** is depicted. In said arrangement, a glass plate **11** defines the upper surface of the dial or panel. A liquid crystal **13** is positioned between said upper glass plate **11** and a lower glass plate **15**. An upper electrode **12** is mounted on upper glass plate **11**, while a lower electrode **14** is mounted on lower glass plate **15**. The day of the week indicia would be printed below said lower electrode, as on member **16** mounted on the outer surface of lower plate **15**. Said upper and lower electrodes are positioned and dimensioned to overlap and cover the indicia on member **16**. When an electric field is applied to the electrodes, the liquid crystal disposed intermediate said electrodes is disturbed and rendered substantially opaque, so that the indicia on member **16** are not visible. Both upper electrodes **12** and lower electrode **14** are normally transparent.

The foregoing arrangement permits the electro-optical display of the day of the week in a solid state electronic timepiece, which display is both inexpensive and compact.

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 features 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. In a solid state electronic timepiece having a time keeping mechanism and a time display mechanism responsive to said time keeping mechanism, the improvement which comprises a plurality of separate indicia other than numerical characters on said timepiece and means in the region of each indicia but not including said indicia for selectively visually identifying a selected one or more of said indicia in response to said time keeping mechanism of said timepiece, said visual identifying means including liquid crystal screen means positioned over each of said indicia, each of said liquid crystal screen means being adapted for alternative disposition in either a substantially opaque state or a substantially transparent state depending on the nature of the signal applied thereto, said time keeping mechanism including circuit means for producing an output signal for application to said liquid crystal screen means for selectively disposing the liquid crystal screen means associated with one or more of said indicia in the transparent state and rendering the other of said liquid crystal screen means in the opaque state.

2. A solid state electronic timepiece as recited in claim **1**, wherein said liquid crystal screen means are adapted to be rendered opaque upon the application of a signal thereto, said circuit means being adapted to apply a signal to all of said liquid crystal screen means except the liquid crystal screen means associated with the one or more indicia to be identified.

3. A solid state electronic timepiece as recited in claim **5**, wherein each of said indicia is representative of a day of the week, said time keeping mechanism including a time standard oscillator means, frequency dividing circuit means coupled to said time standard oscillator means for dividing the output signal of said time standard oscillator means, said divider means being adapted to produce an output signal representative of each of the days of the week, said visual identifying means being responsive to said divider means output signal for providing a visual indication of day of the week.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,796,037 Dated March 12, 1974

Inventor(s) Kinji Fujita

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 36, the claim reference numeral "5" should read --1--.

Signed and sealed this 7th day of January 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,796,037 Dated March 12, 1974

Inventor(s) Kinji Fujita

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 36, the claim reference numeral "5" should read --1--.

Signed and sealed this 7th day of January 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.