

AMENDED SPECIFICATION

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PATENT SPECIFICATION

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(72) Inventors SHIGERU MOROKAWA, KATSUO NISHIMURA
and YASUSHI NOMURA



(54) VISUAL DISPLAY

(71) We, CITIZEN WATCH COMPANY, LIMITED, a Japanese corporate body, of 1—9—18, Nishishinjuku, Shinjuku, 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 a timepiece having a visual display for displaying in a meaningful manner at least the first two letters of the name of any day of the week.

A visual display for indicating the days of the week, for use in timepieces has heretofore been proposed which is provided with an electronically controlled optical element. A feature of such a display device is the provision of day of the week symbols (from MON to SUN), each of these symbols being converted into code by means of one electric control signal, as described in German laid open Specification No. 2,153,637. Provision must be made for the symbols to be permanently mounted on a display surface as shown in Figure 1 of the accompanying drawings. It would be preferable to provide a simple display surface on a timepiece in which the days of the week are indicated by a drum-type electromechanical mechanism, such an arrangement being shown in Figure 2 of the drawings. Such an arrangement has the disadvantage that a space problem arises when the display device indicating the days of the week is applied to a wrist watch having an extremely small display surface.

German laid open Specification 2322141 discloses a timepiece having an electro-optical liquid crystal display mechanism which has a number of separately actuatable regions for the display of the days of the week. The regions are arranged in two or three groups and the

first two letters of the name of each of the days of the week are provided by one or other of the groups. For example, when the regions are arranged in three groups, one group can be selectively actuated to display Su or Sa, a second group can be selectively actuated to display Mo or We and the third group can be selectively actuated to display Tu or Th or Fr.

In order to obviate difficulty with the display design and displace space it would appear desirable to indicate the days of the week with alphabetical letters in various national languages by selectively energising a comparatively small number of individually controllable light transmission devices.

For indicating the days of the week in alphabetical letters, all of the alphabetical letters are not required. Thus in English, all of the days SUN, MON, TUE, WED, THU, FRI and SAT can be indicated by a first group of devices which can indicate S, M, T, W, and F, a second group of devices which can indicate U, O, E, H, R and A, and a third group of devices which can indicate N, E, D, U, I and T, as shown in Figure 3. If the devices are suitably designed in shape and combination, it is possible to indicate the days of the week in letters having a natural form by means of a comparatively small number of devices.

A user of a timepiece which can indicate the days of the week does not need to know what day it is so frequently as what time of day it is. As a result, it is convenient to cause the same groups of light transmission devices to indicate the time and also to indicate the day of the week when required. Such a display must use groups of devices which can indicate both numerical figures and alphabetical letters.

Similarly, provision may be made for groups of a comparatively small number of devices to be constructed so that change-over between at least two national languages for indicating the days of the week is possible.

An object of the invention is to provide a timepiece having a visual display which can indicate the days of the week abbreviated to the first two alphabetical letters by means of groups of a comparatively small number of light transmission devices.

Accordingly the invention resides in a timepiece having a visual display for displaying in a meaningful manner the first two letters of the name of any day of the week, said display comprising first and second dissimilar groups of individually controllable light transmission devices with the number of transmission devices in each group being not greater than eleven, the devices of the first group being shaped and arranged relative to each other such that by selectively energising various devices of the group an alphabetical letter corresponding to the first letter of the name of any day of the week is displayed, and the devices of the second group being shaped and arranged relative to each other such that by selectively energising various devices of the group an alphabetical letter corresponding to the second letter of the name of the day is displayed.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

Figure 1 shows an example of the display of a known timepiece capable of indicating the days of the week, Friday being indicated;

Figure 2 shows another example of a display of a known timepiece capable of indicating the days of the week;

Figure 3 shows the alphabetical letters necessary for indicating the days of the week in English;

Figure 4 shows groups of light transmission devices for a timepiece according to the invention;

Figures 5a and 5b show embodiments of visual displays for a timepiece according to the invention;

Figures 6a and 6b indicate displays obtained from the embodiments of 5a and 5b respectively;

Figure 7 shows a wrist watch according to the invention;

Figures 8a—8c illustrate the operation of wrist watches which make use of the invention;

Figure 9 shows an embodiment of the electrode arrangement of a visual display for a timepiece according to the invention and employing liquid crystal cells;

Figures 10a and 11a show alternative groups of devices for indicating the days of the week indicated in French;

Figures 10b and 11b show examples of the operation of the displays shown in Figures 10a and 11a respectively;

Figures 12, 13a and 13b show examples of wrist watches having a visual display device according to the invention;

Figures 14a and 15a show alternative groups of devices for indicating the days of the week in German;

Figures 14b and 15b show examples of the operation of the displays shown in Figures 14a and 15a respectively;

Figures 16a and 17a show examples of groups of devices for indicating the days of the week in Portuguese and Spanish respectively;

Figures 16b and 17b show examples of the operation of the displays shown in Figures 16a and 17a respectively;

Figures 18a and 19a show examples of groups of devices capable of indicating the days of the week in Dutch and Finnish respectively; and

Figures 18b and 19b show examples of the operation of the displays shown in Figures 18a and 19a respectively.

A visual display for a timepiece and capable of displaying the first three letters of the names of the days of the week is shown in Figure 4.

A first group of individually controllable light transmission devices is arranged to form a pair of quadrilaterals superimposed one upon the other, the intermediate side being common to both the quadrilaterals. As shown in Figure 4I a V-shaped device 21 is positioned in the upper quadrilateral, and an inverted V-shaped device 22 is positioned in the lower quadrilateral. A device 24 may extend rightwardly from the upper side of the upper quadrilateral as shown in Figure 5a or extend leftwardly from the upper side of the upper quadrilateral as shown in Figure 5b.

This first group of devices constructed as described above is capable of indicating all of the numerical figures 0—9 and alphabetical letters S, M, T, W and F as required.

In Figure 4II is shown a second group of light transmission devices arranged in the form of a pair of quadrilaterals superimposed one upon the other, the intermediate side being common to both the quadrilaterals, and a linear device 25 inclined downwardly toward the right is positioned in the lower quadrilateral. This group of devices constructed as above described is capable of indicating all of the numerical figures 0—9 and alphabetical letters U, O, E, H, R and A as required. If it is not necessary to indicate the numerical figures, the two devices on the left hand side of the group may be replaced by a single device as shown in Figures 5a and 5b.

In Figure 4III is shown a third group of light transmission devices arranged to form

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two quadrilaterals superimposed one upon the other, the intermediate side being common to both quadrilaterals, and a linear device 26 inclined downwardly toward the right is positioned in both the upper and lower quadrilaterals, and a device 28 may extend rightwardly from the upper side of the upper quadrilateral as shown in Figure 5a or leftwardly from the upper side of the upper quadrilateral and with a further device extending leftwardly from the lower side of the lower quadrilateral as shown in Fig. 5b. The third group of devices constructed as described with reference to Fig. 4III is capable of indicating all of the numerical figures 0-9 and alphabetical letters N, D, U, I and T. The third group of devices is omitted when the names of the days of the week are to be represented by the first two letters only. In each of the first and second groups there are not more than eleven light transmission devices.

To the above described groups of devices additional devices may be added to make the letter styles clearer so long as not more than eleven devices are present in each of the first and second groups. In particular, it is preferable to add a device extending rightwardly from the common intermediate side of the two quadrilaterals superimposed one upon the other in order to improve the form of the numerical Figure 4. These modifications are also covered by the invention.

Operation of the first two or all three of the groups shown in Figures 5a and 5b is shown in Figures 6a and 6b respectively.

In a display using light-receiving devices such as liquid crystal and the like, enlargement of the width and/or area of each device is desirable in order to obtain a more distinct indication as compared with light-emitting devices under the same conditions since the reflected light of the former is weaker than the emitted light of the latter.

From that point of view, the reduction in the number of devices is considerably effective in obtaining a distinct indication of the numerical figures and alphabetical letters.

In addition, a display using light receiving devices such as liquid crystal, it is necessary to lead out wires from the devices. If the number of devices becomes large, a difficulty arises in leading out the wires and in connecting the wires to the substrate of the electrodes and for connecting the lead wires to the time-counter circuit. From this point of view, the reduction in the number of devices is advantageous with respect to the wiring on the electrode substrate and in the connection of the lead wires to the time-counter circuit.

When using the display in timepieces for indicating the days of the week, if the devices can only be used to indicate the alphabetical letters, separate groups of devices are required for indicating the time and date as shown in Figure 7, while groups of devices capable of

indicating both the numerical figures and the alphabetical letters can be used to indicate the date, days of the week and time as shown in Figures 8a, 8b, and 8c.

In Figure 8a I there is shown a wrist watch to indicate the time. In Figure 8a II there is shown a wrist watch which can additionally indicate the date and the days of the week. In Figure 8a III is shown the arrangement of the devices in each group of the display. In Figure 8a IV there is shown the letters of the days of the week as displayed. The change-over between the date and the days of the week may be effected by a manually operating switch 29 as shown in Figures 8c I and 8c II, or it may automatically be effected as shown in Figures 8a and 8b. The wrist watch shown in Figure 8a I indicates 4 hours 59 minutes and 13 seconds. The wrist watch shown in Figure 8b II indicates December 16 and Friday. The wrist watch shown in Figure 8b I indicates 4 hours 59 minutes. The wrist watch shown in Figure 8b II indicates Tuesday and 24th day. The wrist watch shown in Figure 8c I indicates 0 hour 00 minute. The wrist watch shown in Figure 8c II indicates 31st day and Wednesday.

In Figure 9 are shown examples of the device electrodes and lead electrodes for use with a liquid crystal display.

In Figure 10a is shown another embodiment of a display consisting of three groups of light transmission devices. The first group consists of ten devices, the second group consists of seven devices, and the third group consists of nine devices and the display is capable of indicating the days of the week in the French language.

Particularly, in the display shown in Figure 10a, a device 31, of the first group, is curved upwardly at its right-hand side in order to make the letters D and J look like their respective natural forms. In addition, the first group has a device 32 added thereto in order to make the alphabetical letter M balanced on its left and right sides and has a device 33 added thereto in order to make the letter J look like its natural form.

In Figure 11a there is shown another display capable of indicating the numerical digits 0-9, dates, and times and days of the week in the French language.

The alphabetical letters D, L, J and V indicated by the first group of devices shown in Figure 11a are different from those indicated by the first group shown in Figure 10a.

In Figure 12 is shown an example of a wrist watch which can indicate the time and the days of the week separately. In the present example, use is made of the display shown in Figure 11a to indicate the days of the week as shown by reference numeral 81.

In Figures 13a and 13b there is shown another example of a wrist watch which makes use of the display shown in Figure 10a and

which can shift from indicating the days of the week in French to indicating the numerical digits and vice-versa. The days of the week are indicated by two letters. Figure 13a shows 12 hours 8 minutes and Wednesday in French, while Figure 13b shows 12 hours 8 minutes and 25th day. In the present example, a display 91 can change from the indication of the days of the week in French to the indication of the date and vice-versa. Furthermore if an additional change-over switch is pushed, the indication of the days of the week in French as shown in Figure 13a is shifted to the indication of seconds as shown in Figure 13b. Thus Figure 13b can also show 12 hours 8 minutes 25 seconds.

In Figure 14a there is shown an example of a display for indicating the days of the week in the German language. Figure 14b shows examples of the days of the week indicated by the display shown in Figure 14a.

In Figure 15a is shown another example of a display which can indicate the days of the week in German and the numerical digits such as the dates and times.

In the display shown in Figure 15a, the first group of devices has a device 121 in order to distinguish D from O. Such distinction between D and O is shown by DIE and DON in Figure 15b.

In Figure 16a is shown an example of a display which can indicate the days of the week in the Portuguese language. Figure 16b shows examples of the days of the week indicated by the display of Figure 16a.

In Figure 17a is shown an example of a display which can indicate the days of the week in the Spanish language. The pattern of the display shown in Figure 17b is very similar to that shown in Figure 10b which can indicate the days of the week in French. As a result, it is possible to construct a circuit such that the days of the week indicated in Spanish on the display are changed over to the corresponding days of the week indicated in French and vice-versa.

In Figure 18a is shown an example of a display which can indicate the days of the week in the Dutch language. Figure 18b shows examples of the days of the week indicated by the display shown in Figure 18a.

In Figure 19a is shown an example of a display device which can indicate the days of the week in the Finnish language. Figure 19b shows examples of the days of the week indicated by the display shown in Figure 19a.

A change-over display which can shift from indicating the days of the week in French to indicating time has been described with reference to Figure 11a. A change-over display which can shift from indicating the days of the week in German to indicating time has been described with reference to Figure 15a.

Examples of the light transmission devices used in the above described visual displays

are a Nixie tube, Registered Trade Mark, plasma display tube, fluorescent display tube, incandescent lamp, Braun tube, photodiode, miniature bulb, liquid crystal, PLZT ceramic device, and an electrochromic device.

When desiring to use photodiodes or electric bulbs as the light transmission device, the device is constructed such that the point light source consisting of the photodiode or electric bulb is energised so as to form a rod-shaped segment. As a result, the difficulty encountered when increasing the number of terminals for controlling the point light sources by electric signals can be obviated.

The use of the liquid crystal or electrochromic devices in the display is extremely suitable for a wrist watch which must limit its power consumption.

In a display, a given day of the week, as for example, Sunday, can be indicated by distinguishing it from the other days of the week.

For example it is possible to cause the display to indicate Sunday by transmitted light which is of red colour. Such selective indication may be performed by an electric control system.

As stated hereinbefore the display for a timepiece according to the invention can indicate alphabetical letters by means of dissimilar groups of not more than eleven individually controllable light transmission devices and has the advantages that (1) the days of the week can be indicated in a small space and in good design, (2) the indication can be effected by means of a comparatively small number of devices so that as a result, a display distributor circuit for a time counter circuit can easily be manufactured, terminals connected to circuits can be made small in number, and the display can be manufactured in simple and easy manner, and (3) change-over between the days of the week indicated in one national language and the numeral digits or the days of the week indicated in another national language can be effected, without increasing the number of units in each group to more than eleven.

WHAT WE CLAIM IS:—

1. A timepiece having a visual display for displaying in a meaningful manner the first two letters of the name of any day of the week, said display comprising first and second dissimilar groups of individually controllable light transmission devices with the number of transmission devices in each group being not greater than eleven, the devices of the first group being shaped and arranged relative to each other such that by selectively energising various devices of the group an alphabetical letter corresponding to the first letter of the name of any day of the week is displayed, and the devices of the second group being shaped and arranged relative to each other



which can shift from indicating the days of the week in French to indicating the numerical digits and vice-versa. The days of the week are indicated by two letters. Figure 13a shows 12 hours 8 minutes and Wednesday in French, while Figure 13b shows 12 hours 8 minutes and 25th day. In the present example, a display 91 can change from the indication of the days of the week in French to the indication of the date and vice-versa. Furthermore if an additional change-over switch is pushed, the indication of the days of the week in French as shown in Figure 13a is shifted to the indication of seconds as shown in Figure 13b. Thus Figure 13b can also show 12 hours 8 minutes 25 seconds.

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In Figure 15a is shown another example of a display which can indicate the days of the week in German and the numerical digits such as the dates and times.

In the display shown in Figure 15a, the first group of devices has a device 121 in order to distinguish D from O. Such distinction between D and O is shown by DIE and DON in Figure 15b.

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In Figure 17a is shown an example of a display which can indicate the days of the week in the Spanish language. The pattern of the display shown in Figure 17b is very similar to that shown in Figure 10b which can indicate the days of the week in French. As a result, it is possible to construct a circuit such that the days of the week indicated in Spanish on the display are changed over to the corresponding days of the week indicated in French and vice-versa.

In Figure 18a is shown an example of a display which can indicate the days of the week in the Dutch language. Figure 18b shows examples of the days of the week indicated by the display shown in Figure 18a.

In Figure 19a is shown an example of a display device which can indicate the days of the week in the Finnish language. Figure 19b shows examples of the days of the week indicated by the display shown in Figure 19a.

A change-over display which can shift from indicating the days of the week in French to indicating time has been described with reference to Figure 11a. A change-over display which can shift from indicating the days of the week in German to indicating time has been described with reference to Figure 15a.

Examples of the light transmission devices used in the above described visual displays

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When desiring to use photodiodes or electric bulbs as the light transmission device, the device is constructed such that the point light source consisting of the photodiode or electric bulb is energised so as to form a rod-shaped segment. As a result, the difficulty encountered when increasing the number of terminals for controlling the point light sources by electric signals can be obviated.

The use of the liquid crystal or electrochromic devices in the display is extremely suitable for a wrist watch which must limit its power consumption.

In a display, a given day of the week, as for example, Sunday, can be indicated by distinguishing it from the other days of the week.

For example it is possible to cause the display to indicate Sunday by transmitted light which is of red colour. Such selective indication may be performed by an electric control system.

As stated hereinbefore the display for a timepiece according to the invention can indicate alphabetical letters by means of dissimilar groups of not more than eleven individually controllable light transmission devices and has the advantages that (1) the days of the week can be indicated in a small space and in good design, (2) the indication can be effected by means of a comparatively small number of devices so that as a result, a display distributor circuit for a time counter circuit can easily be manufactured, terminals connected to circuits can be made small in number, and the display can be manufactured in simple and easy manner, and (3) change-over between the days of the week indicated in one national language and the numerical digits or the days of the week indicated in another national language can be effected, without increasing the number of units in each group to more than eleven.

WHAT WE CLAIM IS:—

1. A timepiece having a visual display for displaying in a meaningful manner the first two letters of the name of any day of the week, said display comprising first and second dissimilar groups of individually controllable light transmission devices with the number of transmission devices in each group being not greater than eleven, the devices of the first group being shaped and arranged relative to each other such that by selectively energising various devices of the group an alphabetical letter corresponding to the first letter of the name of any day of the week is displayed, and the devices of the second group being shaped and arranged relative to each other



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Trade Mark display tube, photodiode, L.Z.T. ceramic device.
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such that by selectively energising various
devices of the group an alphabetical letter
corresponding to the second letter of the name
of the day is displayed.
2. A timepiece as claimed in claim 1
wherein said first group consists of nine
devices and said second group consists of
eight devices.
3. A timepiece as claimed in claim 2
wherein said first and second groups each
include six linear devices forming a rectangular
substantially upright frame and a seventh
linear device extending horizontally across
said frame to divide same into an upper and
a lower half, said first group further including
two V-shaped devices disposed in said halves
in mutually inverted relationship with vertices
pointing toward said seventh device, and said
second group further including an eighth
linear device extending obliquely from upper
left to lower right within said lower half.
4. A timepiece as claimed in claim 1
wherein said first group consists of ten devices
and said second group consists of seven
devices.
5. A timepiece as claimed in claim 4
wherein said first and said second groups com-
prise devices arranged as shown in Figure 5a
or 5b or 10a of the accompanying drawings.
6. A timepiece as claimed in claim 1
wherein said first group consists of nine

devices and said second group consists of ten
devices.
7. A timepiece as claimed in claim 6
wherein said first and second groups comprise
devices arranged as shown in Figure 14a of
the accompanying drawings. 35
8. A timepiece as claimed in claim 6
wherein said second group includes five devices
arranged to form a frame and a smaller
number of linear devices arranged to form a
cross within said frame. 40
9. A timepiece as claimed in claim 8
wherein the number of said linear devices is
three. 45
10. A timepiece having a visual display
substantially as hereinbefore described with
reference to Figure 4 or 11a or 15a or 16a
or 17a or 18a or 19a of the accompanying
drawings. 50
11. A timepiece as claimed in claim 1
wherein the devices of each group are shaped
and arranged relative to each other such that
by selectively energising various devices of the
group any one of the numbers 0-9 is dis-
played. 55

BATCHELLOR, KIRK & BYLES,
Chartered Patent Agents,
100 Great Russell Street,
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For the Applicants.

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