

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) A TIMEPIECE HAVING A LIQUID CRYSTAL DISPLAY

(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:—

The invention relates to timepieces having liquid crystal displays, and in particular although not so restricted, to wrist watches having liquid crystal displays.

The life of a liquid crystal display is fairly short, for example, it may be between 5,000 and 7,000 hours, so that a liquid crystal display in a timepiece needs replacement relatively frequently. Furthermore, a liquid crystal display may have a power consumption of the order of between 15 microwatts and 30 microwatts. In the case of a wrist watch the power source therefor is usually a small battery of limited capacity. It is, however, desirable that the wrist watch has a low power consumption so that the battery will have a life of a year or more.

According to the present invention there is provided a timepiece having a liquid crystal display comprising an oscillator for generating a time standard, a drive circuit for driving the liquid crystal display in response to the time standard, and switch means for controlling the operation of the liquid crystal display whilst not affecting the operation of the oscillator or the drive circuit.

Thus, the switch means will control the operation of the liquid crystal display so that, for example, at night-time the liquid crystal display does not operate. This will increase the lifetime of the liquid crystal display since its working time per day is reduced. Furthermore, in a wrist watch driven by a small battery, the life of the battery is extended because the power consumption per day is also reduced.

The oscillator may be a quartz crystal oscillator.

Preferably, the drive circuit includes complementary-symmetry type metal oxide semiconductor means.

Said liquid crystal display preferably comprises a plurality of segments each of which has first and second electrodes, each first electrode being connected to an inverter forming part of the drive circuit and the second electrode being common.

The timepiece may include photoelectric means arranged to control the switch means in dependence upon the amount of light falling thereon.

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

Figure 1 is a diagrammatic illustration of one embodiment of a timepiece having a liquid crystal display according to the present invention;

Figure 2 is a diagrammatic illustration of a second embodiment of a timepiece having a liquid crystal display according to the present invention; and

Figure 3 shows explanatory circuit diagrams of the symbols used in Figures 1 and 2.

Referring to the drawings and in particular to Figure 1 there is diagrammatically shown one embodiment of a timepiece, for example, a wrist watch, according to the present invention. The timepiece comprises a quartz crystal oscillator (not shown) for generating a time standard, a liquid crystal display comprising a plurality (three shown) of liquid crystal segments 1, 2, 3 disposed on a dial (not shown) of the timepiece, and a drive circuit for driving the liquid crystal segments in response to the time standard. The drive circuit comprises respective complementary-symmetry type metal oxide semiconductor (hereinafter referred to as COS—MOS) inverters 4, 5, 6 connected to respective first terminals of the liquid crystal segments. The second terminals of the liquid crystal segments are connected in common. Input signals derived from the quartz crystal

[Price 25p]

Price 33p

oscillator are provided at terminals 7, 8, 9. Respective NAND gates 10, 11, 12 are provided between the terminals 7, 8, 9 and the COS—MOS inverters 4, 5, 6.

5 An indication control switch 10' is so arranged that when it is OFF, the outputs of the COS—MOS inverters 4, 5, 6 are at a relatively low voltage which is insufficient to drive the liquid crystal segments 1, 2, 3
10 respectively even when there is an input signal at one or more of the terminals 7, 8, 9. When the indication control switch 10' is ON the outputs of the COS—MOS inverters 4, 5, 6 are at a relatively high voltage which
15 is sufficient to drive the liquid crystal segments selectively when there is an input at one or more of the terminals 7, 8, 9. That is to say, when the indication control switch 10' is OFF, the liquid crystal segments will
20 not provide a display even though there are input signals to one or more of the terminals 7, 8, 9 but the indication control switch does not affect the operation of the quartz crystal oscillator or the drive circuit. On the other
25 hand, when the indication control switch 10' is ON, the liquid crystal segments will provide a display in response to input signals to the terminals 7, 8, 9. It will be appreciated, therefore, that when the indication control switch 10' is OFF the power
30 consumption of the timepiece is reduced, because the liquid crystal segments are not consuming power.

35 Referring now to Figure 2 there is shown a second embodiment of a timepiece, for example, a wrist watch, according to the present invention. Like parts of the timepieces of Figures 1 and 2 have been designated by like reference numerals. In
40 the timepiece of Figure 1, the indication control switch 10' is manually operated, whereas in the timepiece of Figure 2 the indication control switch is controlled in dependence upon the amount of light falling
45 upon a photoelectric element 11. The photoelectric element is arranged so that the indication control switch is OFF when the photoelectric element is not illuminated and is ON when the photoelectric element is
50 illuminated.

Figure 3 shows a circuit diagram of one of the COS—MOS inverters and a circuit

diagram of one of the NAND gates shown in Figures 1 and 2. These circuit diagrams are self-explanatory.

By providing the indication control switch 10' which controls the operation of the liquid crystal display, a timepiece is obtained in which a battery driving the timepiece may have a life of a year or more. Furthermore, the liquid crystal display element does not need replacement as frequently as would be necessary if it was operating continuously.
operating continuously.

WHAT WE CLAIM IS:—

1. A timepiece having a liquid crystal display comprising an oscillator for generating a time standard, a drive circuit for driving the liquid crystal display in response to the time standard, and switch means for controlling the operation of the liquid crystal display whilst not affecting the operation of the oscillator or the drive circuit.

2. A timepiece as claimed in claim 1 in which the oscillator is a quartz crystal oscillator.

3. A timepiece as claimed in claim 1 or 2 in which the drive circuit includes complementary-symmetry type metal oxide semiconductor means.

4. A timepiece as claimed in any preceding claim in which said liquid crystal display comprises a plurality of segments each of which has first and second electrodes, each first electrode being connected to an inverter forming part of the drive circuit and the second electrode being common.

5. A timepiece as claimed in any preceding claim including photoelectric means arranged to control the switch means in dependence upon the amount of light falling thereon.

6. A timepiece having a liquid crystal display substantially as herein described with reference to and as shown in Figures 1 and 2 of the accompanying drawings.

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Referring now to Figure 2 there is shown a second embodiment of a timepiece, for example, a wrist watch, according to the present invention. Like parts of the timepieces of Figures 1 and 2 have been designated by like reference numerals. In the timepiece of Figure 1, the indication control switch 10' is manually operated, whereas in the timepiece of Figure 2 the indication control switch is controlled in dependence upon the amount of light falling upon a photoelectric element 11. The photoelectric element is arranged so that the indication control switch is OFF when the photoelectric element is not illuminated and is ON when the photoelectric element is illuminated.

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