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PATENT SPECIFICATION

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(54) TIMEPIECE

(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:—

This invention concerns a timepiece provided with a field effect liquid crystal display device.

According to the present invention, there is provided a timepiece provided with a field effect liquid crystal display device, the said device comprising a sealed enclosure containing field effect liquid crystal material and two light polarising members at least one of which is not secured to the said enclosure so that its disposition with respect to the other light polarising member may be varied.

Thus in the case of a timepiece in accordance with the present invention it is possible to change the plane of polarisation so as to vary the contrast between the display provided by the said device and the background thereof.

Preferably the said one light polarising member is stuck or otherwise secured to a part of the timepiece whose orientation with respect to the case of the timepiece may be varied.

Manually operable means, such for example as a winding crown, may be provided for rotating the said part with respect to the case of the timepiece.

The said part may be mounted within the case of the timepiece. For example, the said one light polarising member may be secured to a glass of the timepiece, the term "glass" being understood to include transparent members made from materials other than natural glass.

Alternatively, the said part may be mounted externally of the case of the timepiece.

Means may be provided for releasably

retaining the said part in a predetermined orientation with respect to the case of the timepiece.

The said enclosure may be disposed between an upper and a lower light polarising member, the upper light polarising member constituting the said one polarising member. In this case the lower light polarising member may be secured to the said enclosure.

Preferably the timepiece is a wrist-watch.

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

Figure 1 is a sectional view of a part of a previously suggested timepiece provided with a field effect liquid crystal display device,

Figure 2 is a broken-away sectional view of a timepiece according to the present invention provided with a field effect liquid crystal display device,

Figures 3 and 4 are plan views of the display device of Figure 2 illustrating variations of contrast between the display and background thereof, and

Figures 5 and 6 are broken-away sectional views respectively of two further embodiments of a timepiece according to the present invention.

In Figure 1 there is shown a field effect liquid crystal display device of a previously suggested timepiece. The display device of Figure 1 comprises two adjacent panels 1 between which there is disposed field effect liquid crystal material (not shown) the panels 1 being secured to and sealed to each other to form an enclosure which is sandwiched between upper and lower light polarising members 2 one of which is stuck to the upper surface of the upper panel and the other of which is stuck to the lower surface of the lower panel.

Accordingly, in the case of the display device shown in Figure 1, once the light polarising members 2 have been stuck in position to the panels 1 it is impossible to

vary the plane of polarisation, so as to vary the contrast between the display provided by the display device and the background thereof, without breaking the seal between the panels 1.

In Figure 2 there is shown a timepiece according to the present invention which is constituted by a wrist-watch provided with a field effect liquid crystal display device. The said device comprises upper and lower panels 3 between which there is disposed field effect liquid crystal material, the panels 3 being secured to and sealed to each other to form an enclosure. The panels 3 are disposed between an upper light polarising disc 4a (which may be made of the material sold under the Registered Trade Mark "Polaroid") and a lower light polarising disc 4b. The lower light polarising disc 4b is stuck or otherwise secured to the lower surface of the lower panel 3, but the upper light polarising disc 4a is spaced from and is thus not secured to the upper panel 3.

The light polarising disc 4a is stuck or otherwise secured to the upper surface of an annular part 6 which is rotatably mounted within a watch-case 5. The lower surface of the annular part 6 is provided with gear teeth 6a which mesh with a driving wheel 8 secured to a winding crown 7. The winding crown 7 may be manually rotated so as to alter the angular orientation of the annular part 6 with respect to the case 5 and thus simultaneously alter the disposition of the upper light polarising disc 4a with respect to the lower light polarising disc 4b.

Thus as the winding crown 7 is rotated, the angle between the planes of polarisation of the upper light polarising disc 4a and the lower light polarising disc 4b can be varied as desired. When this angle is 90°, the display may be as shown in Figure 3, in which the time is indicated by black numerals 11 against a white background 12. When, however, the winding crown 7 is rotated so that the said angle is 0°, the display may be as shown in Figure 4 in which the numerals 11 are white, while the background 12 is black. Moreover, by rotating the winding crown 7 so that the said angle is between 0° and 90° varying contrast may be obtained between the display constituted by the numerals 11 and background 12.

In the embodiment of the invention shown in Figure 5, the upper light polarising disc 4a is mounted above a watch glass 10. The upper light polarising disc 4a is stuck or otherwise secured to the upper surface of an annular part 9 which is rotatably mounted externally of the base 5, the lower light polarising disc 4b being stuck or otherwise secured to the lower surface of the lower panel 3. The part 9 is provided with knurling or the like 9a to enable the part 9 to be

rotated with respect to the case 5, whereby simultaneously to vary the disposition of the upper light polarising disc 4a with respect to the other light polarising disc 4b.

If desired, the part 9 may be arranged to be readily removable from and engageable with the watch.

In the embodiment of the present invention shown in Figure 6 the upper light polarising disc 4a is stuck or otherwise secured to the lower surface of the watch glass 10. The watch glass 10 is secured to the case 5 by means of a bezel 13, but it is nevertheless possible to remove the watch glass 10, with the upper light polarising disc 4a stuck thereto, from the case 5, and to replace the watch glass 10 in the case 5 in a different angular position so as to vary the disposition of the upper light polarising disc 4a with respect to the lower light polarising member 4b. A convenient relative disposition of the light polarising discs 4a, 4b will of course be selected when the watch is assembled during manufacture, but nevertheless the possibility of removing the watch glass 10 enables this relative disposition to be varied, and this can be effected irrespective of whether the watch glass 10 is circular or square.

Although not shown in the drawings, it is possible to arrange that the rotatable part 6 or 9 of Figures 2 and 5 respectively, or the watch glass 10 of Figure 6, is provided with a projection or a recess or the like so that it may be releasably retained in a predetermined orientation with respect to the case 5.

WHAT WE CLAIM IS:—

1. A timepiece provided with a field effect liquid crystal display device, the said device comprising a sealed enclosure containing field effect liquid crystal material and two light polarising members at least one of which is not secured to the said enclosure so that its disposition with respect to the other light polarising member may be varied.

2. A timepiece as claimed in claim 1 in which the said one light polarising member is secured to a part of the timepiece whose orientation with respect to the case of the timepiece may be varied.

3. A timepiece as claimed in claim 2 in which the said one light polarising member is stuck to the said part.

4. A timepiece as claimed in claim 2 or 3 in which manually operable means are provided for rotating the said part with respect to the case of the timepiece.

5. A timepiece as claimed in claim 4 in which the said means comprises a winding crown.

6. A timepiece as claimed in any of claims 2 to 5 in which the said part is mounted within the case of the timepiece.

7. A timepiece as claimed in any of claims

vary the plane of polarisation, so as to vary the contrast between the display provided by the display device and the background thereof, without breaking the seal between the panels 1.

In Figure 2 there is shown a timepiece according to the present invention which is constituted by a wrist-watch provided with a field effect liquid crystal display device. The said device comprises upper and lower panels 3 between which there is disposed field effect liquid crystal material, the panels 3 being secured to and sealed to each other to form an enclosure. The panels 3 are disposed between an upper light polarising disc 4a (which may be made of the material sold under the Registered Trade Mark "Polaroid") and a lower light polarising disc 4b. The lower light polarising disc 4b is stuck or otherwise secured to the lower surface of the lower panel 3, but the upper light polarising disc 4a is spaced from and is thus not secured to the upper panel 3.

The light polarising disc 4a is stuck or otherwise secured to the upper surface of an annular part 6 which is rotatably mounted within a watch-case 5. The lower surface of the annular part 6 is provided with gear teeth 6a which mesh with a driving wheel 8 secured to a winding crown 7. The winding crown 7 may be manually rotated so as to alter the angular orientation of the annular part 6 with respect to the case 5 and thus simultaneously alter the disposition of the upper light polarising disc 4a with respect to the lower light polarising disc 4b.

Thus as the winding crown 7 is rotated, the angle between the planes of polarisation of the upper light polarising disc 4a and the lower light polarising disc 4b can be varied as desired. When this angle is 90°, the display may be as shown in Figure 3, in which the time is indicated by black numerals 11 against a white background 12. When, however, the winding crown 7 is rotated so that the said angle is 0°, the display may be as shown in Figure 4 in which the numerals 11 are white, while the background 12 is black. Moreover, by rotating the winding crown 7 so that the said angle is between 0° and 90° varying contrast may be obtained between the display constituted by the numerals 11 and background 12.

In the embodiment of the invention shown in Figure 5, the upper light polarising disc 4a is mounted above a watch glass 10. The upper light polarising disc 4a is stuck or otherwise secured to the upper surface of an annular part 9 which is rotatably mounted externally of the base 5, the lower light polarising disc 4b being stuck or otherwise secured to the lower surface of the lower panel 3. The part 9 is provided with knurling or the like 9a to enable the part 9 to be

rotated with respect to the case 5, whereby simultaneously to vary the disposition of the upper light polarising disc 4a with respect to the other light polarising disc 4b.

If desired, the part 9 may be arranged to be readily removable from and engageable with the watch.

In the embodiment of the present invention shown in Figure 6 the upper light polarising disc 4a is stuck or otherwise secured to the lower surface of the watch glass 10. The watch glass 10 is secured to the case 5 by means of a bezel 13, but it is nevertheless possible to remove the watch glass 10, with the upper light polarising disc 4a stuck thereto, from the case 5, and to replace the watch glass 10 in the case 5 in a different angular position so as to vary the disposition of the upper light polarising disc 4a with respect to the lower light polarising member 4b. A convenient relative disposition of the light polarising discs 4a, 4b will of course be selected when the watch is assembled during manufacture, but nevertheless the possibility of removing the watch glass 10 enables this relative disposition to be varied, and this can be effected irrespective of whether the watch glass 10 is circular or square.

Although not shown in the drawings, it is possible to arrange that the rotatable part 6 or 9 of Figures 2 and 5 respectively, or the watch glass 10 of Figure 6, is provided with a projection or a recess or the like so that it may be releasably retained in a predetermined orientation with respect to the case 5.

WHAT WE CLAIM IS:—

1. A timepiece provided with a field effect liquid crystal display device, the said device comprising a sealed enclosure containing field effect liquid crystal material and two light polarising members at least one of which is not secured to the said enclosure so that its disposition with respect to the other light polarising member may be varied.

2. A timepiece as claimed in claim 1 in which the said one light polarising member is secured to a part of the timepiece whose orientation with respect to the case of the timepiece may be varied.

3. A timepiece as claimed in claim 2 in which the said one light polarising member is stuck to the said part.

4. A timepiece as claimed in claim 2 or 3 in which manually operable means are provided for rotating the said part with respect to the case of the timepiece.

5. A timepiece as claimed in claim 4 in which the said means comprises a winding crown.

6. A timepiece as claimed in any of claims 2 to 5 in which the said part is mounted within the case of the timepiece.

7. A timepiece as claimed in any of claims



2 to 6 in which the said one light polarising member is secured to a glass of the timepiece.

5 8. A timepiece as claimed in any of claims 2 to 4 in which the said part is mounted externally of the case of the timepiece.

10 9. A timepiece as claimed in any of claims 2 to 8 in which means are provided for releasably retaining the said part in a pre-determined orientation with respect to the case of the timepiece.

15 10. A timepiece as claimed in any preceding claim in which the said enclosure is disposed between an upper and a lower light polarising member, the upper light polarising member constituting the said one polarising member.

11. A timepiece as claimed in claim 10 in which the lower light polarising member is secured to the said enclosure.

12. A timepiece as claimed in any preceding claim in which the timepiece is a wrist watch.

13. A timepiece substantially as hereinbefore described with reference to and as shown in any of Figures 2, 5 and 6 of the accompanying drawings.

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