

PATENT SPECIFICATION

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(54) ELECTRONIC WATCH

(71) I, HANS ULRICH KLINGENBERG, a Citizen of the Swiss Confederation of 3274 St. Niklaus bei Merzligen, Canton of Berne, Switzerland, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:

10 This invention relates to electronic watches. More particularly, it relates to electronic watches of the type having a static timekeeping module.

In mechanical wrist watches, the main part of the watchcase is generally provided with an opening, the plane of which is perpendicular to the axis of the hands. It is through this opening that the movement is inserted in the case and secured to the elements which support it. In general, casing-up takes place from the back, and the case is then closed by fitting the back cover in place. In watchcases having an integral back, however, the movement is inserted from the dial side, and the case is closed by fitting the glass in place.

Ever since recent developments in the field of electronics have made it possible to produce completely static timekeeping modules, i.e., such as have no moving parts, the design and production of watchcases intended for use with such modules may meet other requirements. The elements of a watchcase are called upon to perform different functions depending upon whether it is intended to contain a completely static timekeeping module or a movement comprising outer moving parts, such as hands, or an automatic winding weight. Moreover, since the production of completely static timekeeping modules involves in most instances, the adoption of a display system differing from the conventional one, particularly a digital or alphanumeric display, 45 problems connected with the outer appearance

of the watch and its esthetic aspects must also be considered from another standpoint.

Generally speaking, the surface portion on which the indication of the time is read 50 may be much smaller in the case of a digital or alphanumeric display than in the case of an analog-type display. It is a well-known fact that this surface portion may be situated in a different place from that 55 occupied by conventional dials, for it may, for example, be placed crosswise near one end of the case.

Most mechanical watch movements are circular in plan, for the circular arrangement is the one which is best suited to distributing the elements of such a movement about the central axis of the hands. However, the necessity of producing a circular module no longer exists in the case 65 of completely electronic watches and display devices, and in many instances, there are advantages in producing rectangular or square modules. Furthermore, the arrangement of these modules does not necessarily 70 require their being accessible from all sides. Certain circuit elements may be inserted in recesses in the circuit support, so that the latter may be designed in such a way as to exhibit at least one face completely devoid of visible functional elements. 75

In the light of all the foregoing considerations, it has been realized that there is no need to retain the same arrangement and the same structural design for the watch- 80 cases of watches having static timekeeping modules as for those of watches having mechanical movements.

There is provided according to the present invention an electronic watch comprising a static timekeeping module having a display device with no moving parts and a watchcase having an interior cavity for accommodating the module and a transparent or translucent wall element for 90

viewing a time indication displayed on the panel, wherein the watchcase comprises a case body including the cavity and the wall element and having a lateral entrance to the cavity for insertion of the module.

Preferred embodiments of the invention will now be described in detail with reference to the accompanying drawing, the sole figure of which is a perspective view of the watchcase, the module, and the power cell of an electronic wrist watch having a static timekeeping module and a static display device.

The module of the watch to be described is shown at the left-hand side of the drawing. It essentially comprises a circuit support 1, which will be a rigid part made of insulating material having recesses and other portions for receiving the various connections and functional members of the module. These functional members are, for example, a quartz crystal suspended in a vacuum within a capsule, a chip containing an oscillator circuit in integrated form, a frequency-divider circuit, a decoder circuit and, if need be, control circuits, a regulating element, and control device elements. These components are known *per se* and need not be described in detail. Also affixed to the circuit support 1 is a display panel 2 which will include, for example, light-emitting diodes or liquid-crystal display cells, these display elements being connected to the above-mentioned decoder. As may be seen in the drawing, the circuit support 1 has the shape of a rectangular parallelepiped and bears the panel 2 on its upper face. In one of its side faces 3 is a recess 4 intended to receive a cell 5 constituting the power source for supplying the circuits. When the cell 5 is inserted in the recess 4, it comes in contact with connection elements, e.g., resilient blades, which conduct the current to the circuits of the module.

The circuit support 1 is made in one piece with raised edges 6a, 6b, and 6c extending along three of its sides so as partially to frame the panel 2. In addition, the raised edge 6b, extending along the front of the circuit support 1, forms a continuation of a front face 7, into which no functional elements of the circuits issue except for contact elements (not shown) which are permanently connected to two push buttons 8 and 9, shown schematically. The push buttons 8 and 9 are mounted on the front face 7 of the support 1. They control various functions of the module, such as the correction of the time indication or the appearance and disappearance of the display, or the appearance of indications which are not normally displayed and which may be substituted for the usual indications.

The watchcase of the watch being described is shown at the right-hand side of

the drawing. As may be seen, it is composed of two parts: a case body 10 and a glass 11. The case body 10 is rectangular in shape. At each of its two ends, it has an undercut portion, such as the undercut 12, limited at each side by projections 12a for supporting a bar intended to attach the watchcase to one end of a band or bracelet. The case body 10 also includes a rectangular cavity 13 which opens out into a side face 14, which is one of the longitudinal faces of the case body 10. The transverse rectangular cavity 13 communicates with a rectangular aperture in the upper face 15 of the case body 10, which aperture is covered by the glass 11. The glass 11 is fixed on the face 15 of the case body 10 by means (not shown) which may consist in cementing it in a snap or securing it by other means known *per se*.

Casing up the module described is carried out very simply by inserting the module into the cavity 13, the entrance to which is fitted to the dimensions of the front face 7 of the circuit support 1. The edges of the module will slide along the inside faces of the cavity 13 until the back of the module rests against the back of the cavity 13. The face 7 will then be flush with the face 14 of the case body 10, and the panel 2 appears in the aperture covered by the glass 11. In order to secure the module in this position, provision may be made, for example, of one or two packing rings, such as the ring 16, which will be fitted about the front face 7, possibly in one or two grooves made in the circuit support 1 about the face 7. This gasket or gaskets will, upon insertion of the module, be compressed against the inside faces of the cavity 13. They ensure the fixing and the fluid-tightness of the module.

Instead of securing the module by means of one or more packing rings, it would also be possible to dispose a resilient blade, for example, in the inside face of the cavity 13 opposite the glass 11, which blade would press against the corresponding face of the module and hold it in place. However, the arrangement of a gasket ring disposed about the visible face 7 of the circuit support 1 presents the advantage of being less space-consuming and of allowing more leeway for the arrangement of the circuit on the face opposite the display.

In another embodiment, the raised edges 6a and 6c might be eliminated, while the face 7 would have a surface area slightly greater than the cross-section of the circuit support 1. At the time of casing, the module would be suspended in cantilever fashion from the wall element on the side of it bearing the control members 8 and 9. In certain embodiments, this arrangement might have significant advantages, as will

be seen further on. As the face opposite the control members 8 and 9 would then not be in contact with the back of the cavity 13, a shoulder set slightly back from the entrance to this cavity would have to be provided in order to ensure the proper position of the module.

In other embodiments, however, where the module is in contact with the wall of the case body 10 opposite the entrance to the cavity 13, that wall might also bear one or more control members 17, in the form of push buttons or contacts, each member 17 then being operatively connected to a control device in the module by means of a respective element 17a of the module arranged to be pressed against the member 17 when the module is fitted in place.

The entrance to the cavity provided for the module could, of course, also be situated on one of the end faces of the case body 10, as indicated in dot-dash lines and designated by reference numeral 18. The face 7 would then be masked by the undercut 12 and associated means for attaching the band or bracelet when the watch is worn. The control members 8 and 9 should then be situated on one of the longitudinal walls of the case body 10 and should be arranged to actuate control devices in the module by a lateral movement, rather than by a movement perpendicular to the surface of the wall on which they are situated.

In another embodiment, the case body 10 could be made in one piece with the wall element through which the time indication displayed by the panel 2 is visible. Thus the case body might be made of a slightly translucent material, e.g., a metallic oxide of a certain color. It would then suffice for the wall limiting the top of the cavity 13 to be thin enough, at least in the area situated immediately above the panel 2, for the energized zones, in the case of a light-emitting display, to become visible through this wall element, thus enabling the time indication to be read. The entire case body 10 might also be made of a completely transparent material coated on the inside or outside with an opaque layer except for the wall element above the panel 2, which would be left transparent so that the displayed time indication could be read through it.

In the module illustrated in the drawing, the circuit support 1 is a part made of plastics or ceramic material, constructed as a single unit, its outer portion forming the wall element limited by the face 7. In another embodiment, however, this wall element might take the form of a separate part, either permanently fixed to the circuit support or independent of it. This part might be metallic provided it were fixed to the circuit support in such a way as to avoid

any unfavorable electrical contact. The circuit support would be attached to the visible wall by cementing, for example.

It should be noted as well that instead of having the recess 4 in the circuit support 1, it would be possible to provide a second cavity or recess in the case body 10 alongside the cavity 13, for instance. This auxiliary cavity or recess could open out in one of the end faces of the case body 10. Like the recess 4, it would be intended to accommodate the cell 5, the latter then being connected to the module by connection means mounted in the wall separating the cavity 13 for the module from the cavity 80 for the cell.

In all the various embodiments described above, provision may also be made for a special arrangement wherein the module as a whole is immersed in an insulating liquid. This liquid will fill the spaces between the inner walls of the cavity 13 and the module. It will also extend into the thin gap between the lower surface of the glass 11 and the panel 2. This liquid, e.g. a silicone, a paraffin, or some other organic liquid, may be tinted, if so desired. Particularly in the case of an embodiment in which the module is suspended within the cavity 13 in cantilever fashion, the liquid will protect the module against shocks and thus improve the reliability of the watch. In an embodiment designed to contain a buffer of liquid between the module and the watchcase, the module will be fitted within the cavity in the case body in such a way as to be able to slide slightly under the effect of variations in the volume of the liquid owing to temperature fluctuations. This sliding of the module as a function of the temperature will be particularly simple to achieve in an embodiment where the module is suspended in cantilever fashion within its cavity.

My copending patent application No. 22107/76 (Serial No. 1546218) describes and claims an electronic wrist watch comprising a watchcase having an interior space and at least one rigid portion, a static electronic module, and a static display device fixed to said module, said module and said display device being secured within said interior space, and said watchcase being fluid-tightly closed, further comprising a module-protecting liquid completely filling said interior space, the case being designed to permit variation of the volume of said interior space, whereby said liquid is enabled to expand and contract as a function of the temperature.

WHAT I CLAIM IS:

1. An electronic watch comprising a static timekeeping module having a display device with no moving parts and a watchcase having an interior cavity for accommodating said module and a transparent or trans-

be seen further on. As the face opposite the control members 8 and 9 would then not be in contact with the back of the cavity 13, a shoulder set slightly back from the entrance to this cavity would have to be provided in order to ensure the proper position of the module.

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In another embodiment, the case body 10 could be made in one piece with the wall element through which the time indication displayed by the panel 2 is visible. Thus the case body might be made of a slightly translucent material, e.g., a metallic oxide of a certain color. It would then suffice for the wall limiting the top of the cavity 13 to be thin enough, at least in the area situated immediately above the panel 2, for the energized zones, in the case of a light-emitting display, to become visible through this wall element, thus enabling the time indication to be read. The entire case body 10 might also be made of a completely transparent material coated on the inside or outside with an opaque layer except for the wall element above the panel 2, which would be left transparent so that the displayed time indication could be read through it.

In the module illustrated in the drawing, the circuit support 1 is a part made of plastics or ceramic material, constructed as a single unit, its outer portion forming the wall element limited by the face 7. In another embodiment, however, this wall element might take the form of a separate part, either permanently fixed to the circuit support or independent of it. This part might be metallic provided it were fixed to the circuit support in such a way as to avoid

any unfavorable electrical contact. The circuit support would be attached to the visible wall by cementing, for example.

It should be noted as well that instead of having the recess 4 in the circuit support 1, it would be possible to provide a second cavity or recess in the case body 10 alongside the cavity 13, for instance. This auxiliary cavity or recess could open out in one of the end faces of the case body 10. Like the recess 4, it would be intended to accommodate the cell 5, the latter then being connected to the module by connection means mounted in the wall separating the cavity 13 for the module from the cavity for the cell.

In all the various embodiments described above, provision may also be made for a special arrangement wherein the module as a whole is immersed in an insulating liquid. This liquid will fill the spaces between the inner walls of the cavity 13 and the module. It will also extend into the thin gap between the lower surface of the glass 11 and the panel 2. This liquid, e.g. a silicone, a paraffin, or some other organic liquid, may be tinted, if so desired. Particularly in the case of an embodiment in which the module is suspended within the cavity 13 in cantilever fashion, the liquid will protect the module against shocks and thus improve the reliability of the watch. In an embodiment designed to contain a buffer of liquid between the module and the watchcase, the module will be fitted within the cavity in the case body in such a way as to be able to slide slightly under the effect of variations in the volume of the liquid owing to temperature fluctuations. This sliding of the module as a function of the temperature will be particularly simple to achieve in an embodiment where the module is suspended in cantilever fashion within its cavity.

My copending patent application No. 22107/76 (Serial No. 1546218) describes and claims an electronic wrist watch comprising a watchcase having an interior space and at least one rigid portion, a static electronic module, and a static display device fixed to said module, said module and said display device being secured within said interior space, and said watchcase being fluid-tightly closed, further comprising a module-protecting liquid completely filling said interior space, the case being designed to permit variation of the volume of said interior space, whereby said liquid is enabled to expand and contract as a function of the temperature.

WHAT I CLAIM IS:

1. An electronic watch comprising a static timekeeping module having a display device with no moving parts and a watchcase having an interior cavity for accommodating said module and a transparent or trans-





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lucent wall element for viewing a time indication displayed on said panel, wherein said watchcase comprises a case body including said cavity and said wall element and having a lateral entrance to said cavity for insertion of said module.

2. A watch in accordance with claim 1, wherein said case body is made in one piece with said wall element.

10 3. A watch in accordance with claim 1, further comprising a wall part for closing off said entrance.

4. A watch in accordance with claim 3, wherein said case body is rectangular or square in plan.

15 5. A watch in accordance with claim 4, wherein said case body comprises watch-bracelet attachment means on two opposite sides thereof, said lateral entrance being situated on a third side thereof.

20 6. A watch in accordance with claim 4, wherein said case body comprises watch-bracelet attachment means on two opposite sides thereof, said lateral entrance being situated on one of said two sides.

25 7. A watch in accordance with claim 3, wherein said module comprises a circuit support of insulating material, said wall part for closing off said entrance being formed integrally with said circuit support.

30 8. A watch in accordance with claim 3, wherein said module comprises a circuit support of insulating material and said wall part for closing off said entrance is formed separately from said circuit support but is rigidly secured thereto.

35 9. A watch in accordance with claim 7,

wherein said module extends into said cavity in cantilever fashion, only said wall part being fastened to said watchcase.

40 10. A watch in accordance with claim 3, further comprising gasket means surrounding said wall part for engagement in said entrance upon insertion of said module into said cavity, thereby securing said module fluid-tightly within said watchcase.

45 11. A watch in accordance with claim 3, further comprising at least one control member projecting from said wall part outside said watchcase.

50 12. A watch in accordance with claim 1, further comprising at least one control member mounted on said case body and a control device incorporated in said module, said control member being operatively connected to said control device when said module is inserted within said cavity.

55 13. A watch in accordance with claim 12, further comprising contact elements associated with said control member and with said control device, respectively, said control member being mounted on a face of said case body opposite said lateral entrance and being connectible to said control device by means of said contact elements.

60 14. An electronic watch substantially as hereinbefore described with reference to the accompanying drawing.

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