

DESCRIPTION

The present invention relates to an electronic timepiece having an analog display that can be worn in various ways, notably as a wristwatch for the left- or right-handed, or as a pocket watch.

Patent CH 56 635 describes a pocket watch, the control shaft of which, provided with a loop, is at 12 hrs and which has at 6 hrs a sliding ring making it possible to mount this watch on a wristlet passing through this loop and this sliding ring. A similar design, with the control shaft at 6 hrs, is described in Patent CH 220 795.

It is cumbersome to use these two designs in the form of a wristwatch since the control shaft, which is at 6 hrs or 12 hrs, is difficult to reach whereas, in a normal wristwatch, i.e. one worn on the left wrist, the control shaft is at 3 hrs.

A wristwatch that can be worn either on the left wrist or the right wrist is also known, in particular from Patent CH 548 633. According to this document, the watch case is mounted on a false base to which the wristlet is fitted, and this case is rotatably orientatable in relation to the false base. This makes it possible to transform a watch normally worn on the left wrist (control shaft at 3 hrs) into a watch that can be worn on the right wrist (control shaft at 9 hrs) by turning the case by 180° in relation to the false base. A very similar device is described in document CH 499 816 relating to a watch case

with a rotatable caseband optionally provided with a pivoting bezel. Such a mechanical device should allow a correct adjustment of the superimposition of the hands and of a predetermined time reference, but should have the drawback to impose an unusual value to the angle made by the control means and said time reference.

Furthermore, document DE 21 11 657 discloses a wristwatch, the dial of which can be turned by 180°, which also makes it possible to use this wristwatch on the left wrist or the right wrist and always have the control shaft at the correct place, i.e at 3 hrs and 9 hrs respectively.

However, these designs are not entirely satisfactory for the wearer since the time is not accurately displayed. Indeed, when the watch is worn on the left wrist (normal watch for the right-handed), the hour and minute hands are superimposed at 12 hrs at noon and midnight. However, when the watch is worn on the right wrist (watch for left-handed people with control shaft at 9 hrs), the hands which are always superimposed at the same place in relation to a fixed point of reference such as the watch movement or the watch case, now do so at 6 hrs. And, in contrast, the hands are never superimposed at 12 hrs when the watch is worn on the right wrist because, as can be seen, the hands are not superimposed at 6 hrs in a normal watch, i.e. one worn on the left wrist.

These display errors, which are inherent in this type of design, are sufficiently significant to impair the wearer's perception of time when the watch is worn on the

right wrist, with the result that, in practice, these watches can only be used when worn on the left wrist.

The object of the invention is to overcome these disadvantages and to provide a watch which could in fact be worn on the left wrist or the right wrist, or used as a pocket watch and which, in each case, displays the time correctly.

It is therefore an object of the invention to provide an electronic timepiece having an analog display with an hour hand, a minute hand, a watch movement to drive said hands, a printed circuit and external control means to control the position of the hands, whereby to indicate a determined time reference the said hands occupy a determined position, which is characterized in that it also comprises adjustment means to reorient the position of said predetermined time reference with respect to the position of this external control means, said adjustment means being constituted by a microprogrammed processor of the printed circuit.

The adjustment means are preferably activated by a special manipulation of the control means and, in this mode, the said time reference can be indicated by one of the hands or by the two superimposed hands.

It will thus be understood, for example, that, taking noon as the time reference, it is sufficient to set this time reference at 12 hrs (read on the dial - fixed - of a watch designed to be worn normally on the left wrist)

for the time to be read normally when the watch is worn on the left wrist, at 6 hrs (read on the same dial) for the time to be read normally when the watch is worn on the right wrist, and at 3 hrs (read on the same dial) for the time to be read normally when the watch is used as a pocket watch.

The features and advantages of the invention will be better understood with reference to the following description given by way of non-limiting explanation, with reference to the enclosed drawings, in which:

- Figure 1 shows a timepiece in accordance with the invention in the form of a block diagram,

- Figure 2 is a flow chart showing the working of the adjustment means,

- Figures 3a to 3d show how a timepiece of the invention, designed to be worn normally on the left wrist, can be converted into a wristwatch which can be worn on the right wrist, and

- Figures 4a to 4d show how a timepiece of the invention, designed to be worn normally on the left wrist, can be converted into a pocket watch.

Figure 1 shows a timepiece of the invention in the form of a block diagram. This timepiece comprises in series a quartz oscillator 2, a divider 4 delivering a signal of 1 Hz, a second counter 6 and a minute counter 8. It also comprises a divider by twelve 10, receiving the output signal from the second counter 6, and an hour counter 12,

the input of which is connected to the output of the divider 10. Counters 6, 8 and 12 are counters by sixty which define, in the normal manner, the position of the second, minute and hour hands in relation to the hour-circle of the dial of the timepiece.

In the embodiment shown, the timepiece has two motors 14, 16 controlled by power circuits 18, 20 respectively to drive the minute hand and the hour hand respectively. The circuits 18, 20 receive in the normal manner pulses applied to the inputs of the minute counter 8 and the hour counter 12 respectively.

In a conventional watch, the position of a given reference time, for example noon or midnight, is fixed in relation to the control shaft (or, which comes to the same thing, in relation to the watch movement or in relation to the case). This position is at 90° in the anticlockwise direction in relation to the control shaft.

In accordance with the invention, the timepiece has adjustment means 22 which make it possible to change the position of the hands for a time reference. These adjustment means 22 have inputs MN and H to receive the contents of the minute counter 8 and the hour counter 12, an activation input EN and an input D for data on the displacement of the hands.

The signals applied to the inputs EN and D are supplied by an interpretation circuit 24 as a function of the position and displacement (direction and speed) of the control shaft.

The adjustment means 22 also have two outputs Mmn and Mh to deliver pulses to the motors 14 and 16, and a control output C to control the state of the two reversing switches 26, 28 arranged at the input of the power circuits 18, 20 and disposed to transmit thereto either pulses applied to the inputs of the minute counter 8 and hour counter 12 or pulses delivered by the adjustment means.

The adjustment means may advantageously take the form of an integrated circuit comprising a microprogrammed processor.

In the normal time display mode, the adjustment means are inactive and the motors 14, 16 receive pulses applied to the inputs of the minute and hour counters 8, 12.

Activation of the adjustment means 22 is achieved, for example, by special manipulation of the control shaft which induces the interpretation circuit 24 to emit an activation signal towards the input EN of the adjustment means 22.

The adjustment means 22 then successively execute an initialization phase, an adjustment phase and a display phase, according to the flow chart in Figure 2.

Initialization phase

The adjustment means 22 emit a signal to the output C to bring the switches 26 and 28 into state b, that is to block the pulses applied to the counters 8 and 12 and

simultaneously read the contents of the counters 8 and 12 to register the position of the minute and hour hands. They then emit the requisite number of pulses to the outputs Mmn and Mh to bring the hands into the position corresponding to the said time reference (this does not affect the operation of counters 6, 8 and 12). For example, if the time reference is noon, the hands are brought to the position which they would have if the contents of counters 8 and 12 were equal to zero.

Adjustment phase

In this phase, the user defines the new position for the time reference by marking, using the hands, the position chosen for this time reference. Displacement of the hands is controlled by the control shaft, the movement thereof being interpreted by the circuit 24 which sends corresponding pulses to the input D of the adjustment means 22 which, in turn, emit to their outputs Mmn and Mh control pulses towards motors 14 and 16.

During this phase the hands preferably constantly remain superimposed. In other words, the adjustment means 22 or the user send the same pulses towards the two motors 14 and 16. This enables the user to see more clearly that the timepiece is in the adjustment mode.

It is of course also possible to make the adjustment means in such a way that only one of the hands is used to show the position of the time reference.

It is also possible to choose a time reference corresponding to different positions for the minute hand and the hour hand. For example, taking six hours (or eighteen hours) as the time reference, the hands are exactly opposite each other.

Display phase

When the user has marked the new desired position for the time reference he leaves the adjustment mode by manipulating the control shaft in a special way. The adjustment means 22 then read the contents of the minute counter 8 and the hour counter 12 which define the current time and emits the appropriate number of pulses to motors 14 and 16 to transfer the hands from the reference position towards the position displaying the current time.

For example, if the said time reference is noon or midnight, (which corresponds to the zero position in counters 8 and 12), it suffices to move each hand by a number of steps equal to the contents of the associated counter in order that the time is normally displayed in relation to the new position indicating noon or midnight.

The two following adjustment examples illustrate the functioning of the timepiece of the invention.

Figure 3a shows a wristwatch designed to be worn on the left wrist. The control shaft is therefore on the right. The dial is provided with four different indices at

12 hrs, 3hrs, 6 hrs and 9 hrs. The minute and hour hands each move 60 steps for each revolution round the dial.

In the conventional manner, noon and midnight are shown by the superposition of the two hands at 12.00. This time is chosen as the time reference. The current time is thus 16 hrs 18 mins. The contents CP_{mn} of the minute counter are thus equal to 18 and the contents CP_H of the hour counter equal 21.

When the user goes into the adjustment mode, the two hands move until they reach the position marking the time reference (initialization phase). They are therefore superimposed at 12 hrs (see Figure 3b).

The user then defines the new desired position for the time reference by marking this position with the hands (adjustment phase). In Figure 3c, the new position for the time reference is at 6 hrs. This means that, at noon or at midnight, the hands are in the position shown in Figure 3c.

The user then goes out of the adjustment mode. At this moment, the adjustment means move the hands (display phase) so that they show the current time, taking into account the new position of the time reference. In the example shown, where the time reference is noon or midnight, it is sufficient to move each hand forward by a number of steps equal to the contents of the corresponding counter (see Figure 3d).

It should be noted that during every adjustment operation the counters continue to increase normally by the time base, with the result that the number of steps by

which it is necessary to move the hands forward is not necessarily equal to the contents of the counters at the beginning of the adjustment operation.

The wristwatch can now be worn on the right wrist with the control shaft on the left. Adjustment of the position of the time reference makes it possible for the two hands to be superimposed at noon or midnight.

Using the same principle it is easily possible to convert a wristwatch, designed for example to be worn on the left wrist, into a pocket watch. Figures 4a to 4d illustrate this transformation.

In Figure 4a the wristwatch is intended to be worn on the left wrist with the control shaft on the right. The time reference chosen is noon / midnight and the position thereof is at 12 hrs.

Thus, when the user goes into the adjustment mode, the two hands move until they reach the position marking the time reference position (initialization phase) i.e. they are superimposed at 12 hrs (see Figure 4b).

To transform the wristwatch into a pocket watch, the user then moves the hands to 3.00 hrs (see Figure 4c) to indicate the new desired position for the time reference.

Returning to the normal mode, the adjustment means reposition the hands to display the current time, taking into account the new position of the time reference (see Figure 4d).

In the above-described embodiments, the time reference is indicated by the position of the superimposed hands in the adjustment phase. It is clear that, to be able to superimpose the hands and to move them together, the watch movement must have one motor for each hand.

When there is a single motor to drive the two hands, it is possible to use the determined position of one hand to mark the position of the time reference. To adjust this time reference position it is of course necessary to have a disengaging system to break the kinematic connection between the two hands, at least during the display phase. This is easily done by coupling a wheel of the kinematic chain to the control shaft.

It is advantageously possible to provide the adjustment means with a table listing a limited number of permitted positions for the time reference. This table is preferably completed in the factory by the manufacturer of the timepiece.

In particular, when the time reference is noon / midnight, it is possible to stipulate that the possible positions are the four positions which, in a normal watch, indicate 3 hrs, 6 hrs, 9 hrs and 12 hrs.

CLAIMS

1. Electronic timepiece having an analog display with an hour hand, a minute hand, a watch movement to drive said hands, a printed circuit and external control means to control the position of the hands, whereby to indicate a determined time reference the said hands occupy a determined position, characterized in that it comprises adjustment means (22) to reorient the position of said predetermined time reference with respect to the position of the external control means, said adjustment means (22) being constituted by a microprogrammed processor of the printed circuit.

2. Timepiece according to claim 1, characterized in that the adjustment means (22) are actuated by a specific manipulation of the external control means.

3. Timepiece according to any one of claims 1 or 2, characterized in that, when the adjustment means (22) are actuated, the position of the time reference is defined by the position of a predetermined hand, fixed using said external control means.

4. Timepiece according to any one of claims 1 or 2, characterized in that, when the adjustment means (22) are actuated, the hour and minute hands are superimposed, and in that the time reference is defined by the position, fixed using said external control means, of said hour and minute hands.

5. Timepiece according to claim 4, characterized in that it comprises driving means (14) for the hour hand and



driving means (16) for the minute hand which are independent, at least when the adjustment means are actuated.

6. Timepiece according to any one of claims 1 to 5, characterized in that it comprises a counter for the position of the hour hand (12) and a counter for the position of the minute hand (8), the content of each counter being representative of the distance between the current position of the associated hand and the time reference.

7. Timepiece according to claim 6, characterized in that the content of each counter (8, 12) equals zero when the hands are at the time reference.

8. Timepiece according to any one of claims 1 to 7, characterized in that the time reference is midnight.

9. Timepiece according to any one of claims 1 to 8, characterized in that the adjustment means have a table memorizing a predetermined number of allowable positions for the time reference which can only be chosen when the adjustment means are actuated.

10. Timepiece according to claim 9, characterized in that the said predetermined permissible positions contained in said table are spaced apart at 90° from one another.

