(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 506 094 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.10.2012 Bulletin 2012/40

(21) Application number: **11002659.8**

(22) Date of filing: **31.03.2011**

(51) Int Cl.:
G04C 17/00 *(2006.01)* ***G04G 9/00*** *(2006.01)*
G04G 21/00 *(2010.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **Artstate Technology Limited**
Hong Kong (HK)

(72) Inventor: **Kwog Hung, Kel**
Shatin N.T.
Hong Kong (HK)

(74) Representative: **Prinz & Partner**
Esplanade 31
20354 Hamburg (DE)

(54) Analog electronic timepiece with perpetual calender information

(57) The invention relates to an analog timepiece comprising: at least one hand for indicating the current time, a calendar data indicator for indicating a date, a power supply, a microprocessor, an oscillator for generating a time reference signal for the microprocessor for internal time keeping, at least one pushbutton, a setting stem for adjusting the at least one hand, a stepping motor, a mechanical clockwork for driving the at least one hand and/or the calendar data indicator, and an interface to an external signal generator for receiving an initial current time and calendar data through the interface.

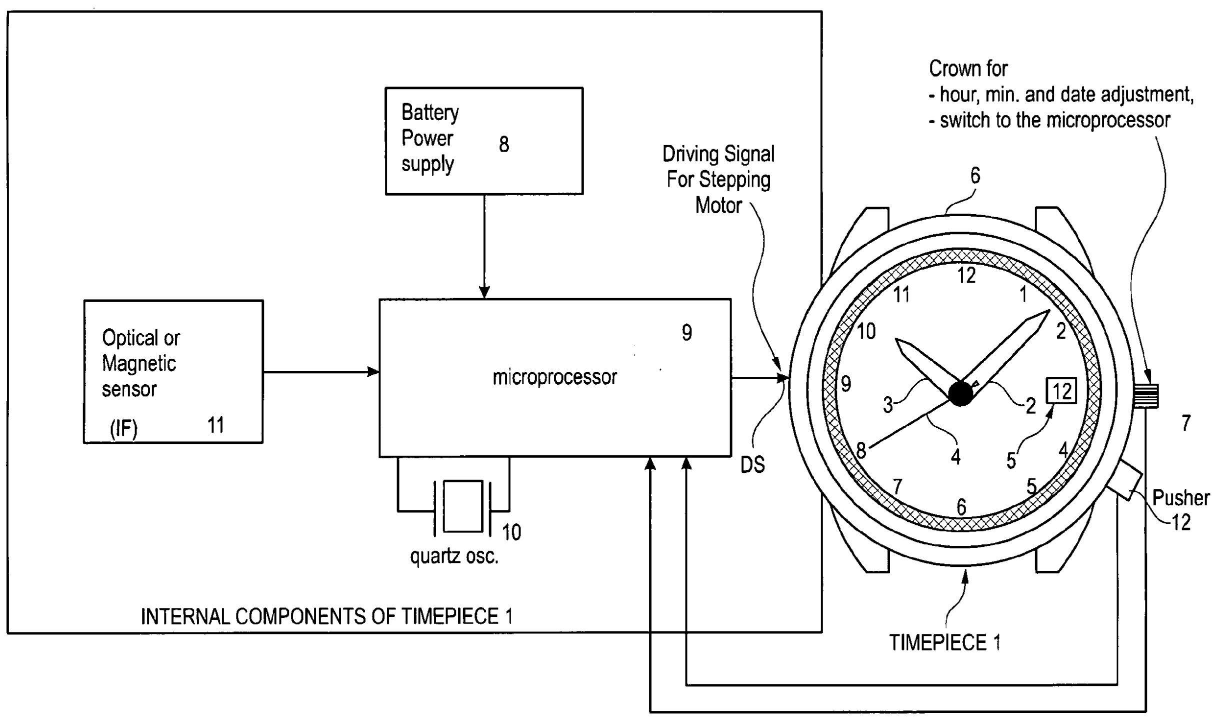

Fig. 1

EP 2 506 094 A1

Description

Field of Invention

[0001] The invention relates to an analog electronic timepiece, for example an analog electronic wrist watch with an adjustable internal calendar data and a method for adjusting the internal calendar data of an analog electronic timepiece. The invention also relates to a method for manufacturing and assembling analog electronic timepieces and to a system for adjusting the time of analog electronic timepieces.

Background of invention

[0002] Analog wrist watches are a still widespread and well accepted as time information devices. These analog wrist watches typically have three hands for indicating the time and a calendar wheel train for displaying calendar information. The originally merely mechanically clockworks of the old-style analog wrist watches are supplemented by various initernal electronic components, as for example microprocessors, memories etc. When these analog wrist watches are manufactured and assembled, calendar information is usually programmed into an internal memory, so that the time and calendar information is correctly indicated by the hands and the calendar wheel train is synchronized with a specific local time and date of a time zone of a location where the wrist watch is supposed to be used.

[0003] If the owner of a wrist watch changes the time zone, the local time may change by a few hours and the hands of the wrist watch are usually manually adjusted. However, since the calendar information is programmed during an early assembly step of the wrist watch, this calendar information is usually not correctly adjusted.

[0004] In order to enter correct calendar data into the wrist watch, the most conventional types of writs watches require a series of complex manual setting steps involving the pushbuttons and/or setting stems of the analog writs watches. These steps are uncomfortable for the user and often require specific knowledge which is not at hand when the adjustment of time and calendar data is required.

[0005] Furthermore, even if the calendar wheel train is manually adjusted in order to display the correct day, mistakes may occur due to a discrepancy between the time and the calendar information. This can become even more relevant, if a wrist watch is configured to automatically perform some time and/or calendar information adjustments.

[0006] Automatic adjustment to different time zones can also be performed by radio wave time signals, which are received by the watch. The watch must then be configured to automatically adjust time and date in accordance with the received radio signals. However, this means that the watches have to be equipped with a rather complex receiver and some further electronic components, which makes them more complex and expensive. Furthermore, the worldwide coverage with the required radio time signal is rather poor and in many areas the radio time signals cannot be received.

Summary of Invention

[0007] It is an object of the invention to provide an analog timepiece having perpetual calendar information and a method for providing perpetual calendar data in an analog timepiece without a need for radio wave signals or complex manual adjustment by pushbuttons.

[0008] In an aspect of the invention an analog timepiece is provided that includes at least one hand for indicating the current time, a calendar data indicator for indicating a date, a power supply, a microprocessor, an oscillator for generating a time reference signal for the microprocessor for internal time keeping, at least one pushbutton, a setting stem for adjusting the at least one hand, a stepping motor, and a mechanical clockwork for driving the at least one hand and/or the calendar data indicator. Furthermore, there is an interface to an external signal generator for receiving an initial current time and calendar data through the interface.

[0009] If an analog timepiece has an interface for receiving digital data representing calendar time information, this allows the analog timepiece to be adjusted to a specific time zone either at a late stage of manufacturing and assembling the timepiece or even later during operation. The combination of interface, microprocessor, memory and rather conventional components like hands being driven by a mechanical clockwork, advantageously combine analog and digital electronic components. Conventional timepieces with a perpetual calendar have a rather complicated internal mechanical gearing and control. However, the combination of an interface, electronic components and mechanical components according to aspects of invention provides a timepiece which can use a rather simple clockwork still having a precise and perpetual calendar.

[0010] In an aspect of the invention, the calendar indicator may be a hand of the timepiece. Furthermore, the calendar data indicator may be one of the hands which are also used for indicating the time. This aspect of the invention provides that no additional hand for displaying calendar information is required.

[0011] In another aspect of the invention, the calendar data indicator may be a calendar wheel train. Accordingly, the invention also applies to a two unitarily conventional configuration of a timepiece, in particular an analog wrist watch.

[0012] In an embodiment of the invention, the interface may comprise a magnetic sensor. The magnetic sensor may be a sensor configured to receive magnetic or electromagnetic signals. More specifically, the magnetic sensor may be a Hall-effect integrated circuit. Using a magnetic sensor and in particular a Hall sensor is advantageous as the size of this kind of sensors is very small.

[0013] In another embodiment of the invention a photo sensor may be used. The interface of the analog timepiece may then comprise a photo sensor which is configured to receive respective optical signals representing calendar and time data of a specific time zone.

[0014] The timepiece according to aspects of the invention may further include a solar cell. The solar cell may then be configured to power the analog timepiece. The solar cell may be used as unique or as a supplementary power supply for the timepiece.

[0015] Furthermore, being powered by a solar cell combined with a battery, the timepiece can always and perpetually run until the end of the lifetime of the mechanical gearing, in particular, the solar cell may render superfluous to exchange the battery.

[0016] The solar cell may be combined with a rechargeable or non-rechargeable battery or with a long life battery such as a Li/MnO2 battery.

[0017] In still another embodiment of the invention, the interface may be configured as a direct electrical connection for connecting the signal generator.

[0018] In advantageous embodiment of the invention, the timepiece may be an analog wrist watch.

[0019] Furthermore, the timepiece may then comprise a mechanical clockwork for a second hand, a minute hand, an hour hand and/or a date wheel train. A stepping motor may be provided for driving the clockwork.

[0020] The microprocessor can then be configured to control the stepping motor and to keep the time and date counter correctly updated.

[0021] The invention also provides a method for setting time and date of an analog timepiece. This method may advantageously be used during manufacturing and/or assembling timepieces. Accordingly, time and calendar data may be generated in a signal generator. The time and calendar data may then be related to a first time zone. The time and calendar data of the first time zone may then be transmitted through an interface into a first analog timepiece. The time and calendar data of the first time zone can then be stored in the first analog timepiece. One or more hands of the first analog timepiece may then be adjusted in accordance with a stored time and calendar data of the first time zone. This method can be very well applied during manufacturing and assembling of analog timepieces. The method according to these aspects of the invention improves the manufacturability of the timepiece by eliminating the workmanship of manually inputting the time and calendar data into the timepiece.

[0022] In another aspect of the invention, the signal generator may be configured to generate time and calendar data of a second (or different) time zone. This time and calendar data of the second time zone may then be transmitted through the interface into the first analog timepiece. The time and calendar data of the first time zone may then be stored in the first analog timepiece and at least one hand of the first analog timepiece may be adjusted in accordance with the stored time and calendar data of the second time zone. Accordingly, a timepiece can be programmed and reprogrammed in accordance with different time zones without a need for manual interaction of the user.

[0023] Time and calendar data of the first or second time zone may be transmitted into a second analog timepiece through an interface of the second analog timepiece. The respective time and calendar data may then be stored in the second analog timepiece and at least on hand of the second analog timepiece may then be adjusted in accordance with the stored analog time data of the first time zone. Manufacturing and assembling of analog timepieces can then be substantially simplified, as time and calendar data can be programmed for different destinations of the timepieces.

[0024] The timepiece may then have a crown or setting stem configured to manually adjust the time (hours and minutes and/or seconds) and to optionally set the date wheel train or date hand. This manual adjustment of time and calendar data displayed by the hands may be performed by using a switch being connected the crown or the setting stem. This switch may then be coupled to the microprocessor in order to trigger the microprocessor to perform the respective configuration steps.

[0025] The required time and calendar data for a specific time zone may then be transmitted through an interface of the timepiece as a coded signal through the microprocessor in order to set up the timing of the internal system of the timepiece. The internal oscillator in particular a quartz crystal oscillator, can then provide a standard timing signal to the microprocessor for internal time keeping. The position of the second hand may then initially be set to a preset position. This can be a zero second position that is assumed by pushing a corresponding pushbutton.

[0026] The display of minutes, hours, dates or day may then initially adjust either automatically by the microprocessor or manually by the user. Manually adjustment may then involve the crown or setting stem. Once these initial settings and steps are performed, the time and calendar display of the timepiece are synchronized with the time and data. After the initial programming through the interface and adjustment of hands and/or calendar data indicator, the time and/or calendar data information is perpetually updated by the stepping motors which are driven by the microprocessor.

[0027] In an aspect of the invention there may be an additional stepping motor for driving the date wheel train of the timepiece. In an aspect of the invention only one stepping motor may be provided in the timepiece. The singly stepping motor may then be configured to drive the hands of the timepiece in order to display time and date. If there is no date wheel train for the calendar display, the second hand may be used for indicating the date. Indicating the date may then be initiated by pushing a pushbutton on the timepiece. The second hand may then move to a position indicating a day and/or month and even the year and the second hand may then return into a position where it indicates the time for example minutes or hours).

[0028] The aspects of the invention can be used during a manufacturing, assembling and/or shipping procedure for timepieces, in particular for wrist watches. Signal generators may be used for generating the date and time signals which are then applied to the interfaces of the timepieces. If the sensor in the interface of the timepiece is a Hall-effect sensor, the signal generator may be coupled to an electromagnet and a timepiece may be placed in an air gap of a solenoid of the electromagnet for programming the timepiece. The dimensions and external shape and style of the signal generators and the coupling mechanisms (for example light emitting diodes and/or electromagnets dependent on the type of sensor in the interface) may be adapted.

[0029] In an aspect of the invention, the signal generators for programming time and calendar information into timepieces according to the invention may be provided at various service points all over the world. The service points may be located at airports, train stations or at shopping malls or the like. The signal generators with the respective coupling means may be portable and even small enough to be carried around by the user or service personnel. In this regard, the invention also provides a distributed time and calendar data updating system and method that is particularly useful for regions without radio time signals.

Brief description of drawings

[0030] Further aspects and characteristics of the invention will ensue from the following description of preferred embodiments of the invention with reference to the accompanying drawings, wherein

FIG. 1 is a simplified block diagram of an embodiment of the invention,

FIG. 2 is a simplified flow chart illustrating the operation of the invention for the embodiment shown in FIG. 1,

FIG. 3 is a flow chart supplementing the flow chart shown in FIG. 2,

FIG. 4 is a simplified representation of a coding format of time data and calendar data in accordance with aspects of the invention,

FIG. 5 shows detailed timing information for the signals of FIG. 4,

FIG. 6 shows an embodiment of a photo sensor to be used in the embodiment of the inventions,

FIG. 7 is a simplified diagram illustrating the properties of a Hall-effect sensor in an embodiment of the invention,

FIG. 8 is a simplified diagram illustrating characteristics of a Hall-effect sensor in an embodiment of the invention,

FIG. 9 is a simplified circuit diagram of the interconnection of a Hall-effect sensor and a microprocessor in an embodiment of the invention.

FIG. 10 is a simplified illustration of a setup in which a signal generator is used for transmitting time and calendar information to the analog electronic timepiece through an interface with a magnetic sensor,

FIG. 11 is a simplified illustration of a setup in which a signal generator is used for transmitting time and calendar information to the analog electronic timepiece through an interface with a photo sensor,

FIG. 12 is simplified top view on a timepiece according to another embodiment of the invention.

Detailed description of the embodiments

[0031] FIG. 1 shows a simplified block diagram and a top view on a timepiece according to an embodiment of the invention. The timepiece 1 has a conventional substantially round case 6, a minute hand 2, an hour hand 3 and a second hand 4. In this embodiment, the timepiece 1 has a date wheel train 5 for indicating the actual date (it this example the date is 12). Furthermore, there is a pushbutton 12 and a crown or setting stem 7.

[0032] FIG. 1 also shows some internal components of the timepiece 1. There is a battery power supply 8, a microprocessor 9, a quartz oscillator 10 and an interface 11 that can comprise an optical sensor or magnetic sensor. The battery power supply 8 is coupled to supply the microprocessor 9, and if required, the optical or magnetic sensor 11.

[0033] The interface 11 (comprising, for example an optical or a magnetic sensor) receives time and calendar data which is then passed on from the sensor in the interface 11 as a coded signal to microprocessor 9. The calendar and/or time data is then either temporarily or permanently stored in a memory (not shown). The memory is not shown in FIG. 1. There may also be an internal memory of microprocessor 9 for storing the time and calendar data. The time and calendar data may be stored as a counter value. The time and calendar data may be used as preset value for one or more internal electronic counters. Based on the stored time and calendar data, the microprocessor provides a driving signal DS to a stepping motor (not shown).

[0034] The timepiece 1 further includes a mechanical clockwork (not shown) which is driven by the stepping motor and coupled to the three hands 2, 3, 4 and the date wheel train for displaying the time and date in accordance with the data received through the interface 11.

[0035] In this embodiment, there may be only one stepping motor for driving the gear train (clockwork) for the second hand 4, the minute hand 2 and the hour hand 3 as well as the date wheel train 5.

[0036] FIG. 2 shows a flow chart illustrating the operation of the timepiece 1 shown in FIG. 1. In step S0, the timepiece 1 is not supplied with power. In step S1 a suitable supply voltage is supplied to the internal system of timepiece 1 and microprocessor 9 starts driving the stepping motor continuously, for example one step per second. In this initial stage of the procedure, the internal time and calendar data may be arbitrary and the data is most likely not related to any specific time zone. However, the internal time and calendar data is then updated by data received through the interface 11.

[0037] In step S2, timepiece 1 assumes the normal operation during which the stepping motor is incremented every second.

[0038] In step S3, the microprocessor determines whether or not the setting stem or crown 7 of the timepiece 1 is pulled out. If the crown or setting stem 7 is pulled out the procedure continues with step S4.

[0039] Step S4 includes a whole procedure which is shown in FIG. 3.

[0040] If the microprocessor 9 determines that the crown or setting stem 7 is not pulled out, the procedure continues with step S5. In step S5, the microprocessor 9 issues a request whether or not the calendar data will be indicated by the second hand. This request can be answered by pushing the pushbutton 12 once. If the pushbutton is pressed, the procedure continues with steps S6 and S7.

[0041] In step S6 the second hand is rotated to a predefined position in order to indicate the current date.

[0042] After having indicated the current date with the second hand the procedure continues with step S7 in which the second hand is stopped or rotated backwards to the correct position for indicating the current time. After step S7 the procedure continues with step S2, i.e. the stepping motor increments every second.

[0043] If in step S5, the pushbutton 12 is not pushed at least once. The microprocessor assumes a state in which it expects to receive data through the interface 11 (for example through a magnetic or optical sensor in the interface). If data is received through the interface 11 in step S8, the microprocessor continues with step S9 by updating the internal counters (or memory) with received calendar and time data. If no data is received through the interface 11, the microprocessor 9 requests in step S10 to manually set the internal calendar and time data.

[0044] If the request answered positively, this is done manually in step S11. Manual adjustment is not further explained.

[0045] If the request for manual adjustment is denied, the microprocessor proceeds to step S12. In step S12, the microprocessor 9 expects an adjustment of the end of the month data. If an adjustment of the end of month calendar data is necessary, a calendar adjustment is performed by rotating the stepping motor in a faster speed in step S13. If no end of month calendar data adjustment is required in step S12, the procedure continues with step S2.

[0046] Also after steps S4, S9, S11 and S13, the procedure continues with step S2.

[0047] FIG. 3 shows the procedure of step S4 of FIG. 2 in more detail. The procedure in FIG. 3 starts in step S30 if the crown or setting stem is pulled out. In step S31, the second hand 4 of the timepiece 1 is manually adjusted by pressing the pushbutton 12.

[0048] This means that the second hand 4 is calibrated by the user by repeatedly pushing the pushbutton 12 in order to rotate the second hand 4. This is electronically supported by the microprocessor and the stepping motor. This preset position. Each time the pushbutton12 is pressed, the microprocessor 9 triggers the stepping motor to advance the second hand step by step to the a preset position, which usually is the zero second position

[0049] In step S32 the microprocessor determines whether or not an external time and calendar signal is provided through the interface 11. If external time and calendar information is expected, the microprocessor 9 proceeds with step S33 in which the display of minutes and hours is adjusted to 00:00 and the calendar is adjusted to the current date. In step S34, the time and date information is received from the sensor. After step S34, the microprocessor 9 waits until the crown or setting stem is pushed in (step S35). Once the setting stem or crown 7 is pushed in, the internal counter is adjusted to the received sensor data and the stepping motor is controlled in order to synchronize the external display with the internal time and calendar counter in step S36. If in step S36 and external calendar signal is received at interface 11, the hands 2, 3 of the timepiece 1 are moved in order to display time 00:00 (zero hours and zero minutes). The date wheel train 5 is manually adjusted by the user to the current date. This is done by turning the crown or setting stem 7. If data reception through interface 11 is completed, setting stem/crown 7 is pushed back into its normal position and microprocessor 9 drives the stepping motor in high speed in order to synchronize the external display with the internal time and calendar data (in accordance with the information contained in the internal time and calendar counters). After the display of the timepiece 1 has been synchronized to the internal time and calendar data, timepiece 1 returns to normal operation.

[0050] If however in step S32, no external time and calendar data is received through interface 11, the display of minutes and hours and the date wheel train is to be adjusted manually by rotating the crown or setting stem 7. This occurs in step S37. In step S38 the previous internal counter data of time and calendar information is maintained. After either automatic synchronization (step S36) or manual adjustment (step S38) normal operation is assumed in step S39. Accordingly, the procedure continues with step S2 shown in FIG. 2.

[0051] The display of the timepiece 1, i.e. the hour hand 3, the minute hand 2, the second hand 4 and the date wheel train 5 can be adjusted at any time by the user. If the microprocessor 9 fails to receive any new time and calendar data through interface 11, the previous internal time and calendar data will be maintained. Microprocessor 9 assumes that the display of time and calendar information was entered by the user and synchronizes the display with the internal counters.

[0052] If the user manually adjusts the time and date in steps S37 and S38, the internal time and external display may not be fully synchronized. However, this may affect the time, when the date is changed at the end of each month. This means that the date wheel train 5 may change the date display on or before midnight at the end of a month. If the accuracy of the internal timer is very high, if for example a quartz oscillator is used, this may cause a few minutes difference with respect to the standard time per year.

[0053] FIG. 4 shows a possible coding format of the time and calendar data to be transmitted through interface 11. The time and calendar data can be generated in a signal generator. According to this embodiment, the data received through interface 11 may comprise 35 segments representing the code of binary data of the current year, the month, the date, the hour and the minute as well as the seconds. Accordingly, after a start bit, the first 7 bits may represent the year, the next 4 bits may represent the month, the next 5 bits may represent the date, the next 5 bits may represent the hour, the next 6 bits may represent the minute and the next 6 bits may represent the seconds. The sequence may then be followed by an end bit. The year may be represented by the last two digits of the dominical year.

[0054] FIG. 5 shows wave forms and the timing of the wave forms that can be used in order to represent a logic '1', and a logic '0'. In this embodiment, a logic '0' is represented by a 20 ms high pulse and 80 ms low pulse. A logic '1' may be represented by a 40 ms high pulse and a 60 ms low pulse. Start bit and end bit may be coded by a 80 ms high pulse and 20 ms low pulse. The duration of each bit is equal and 100 ms.

[0055] This time and calendar data in form of the respective time and calendar signal may then be transmitted to the microprocessor 9 through the interface 11 either through direct electrical and mechanical connections or preferably through a contactless sensor, as for example a photo sensor, a magnetic sensor.

[0056] FIG. 6 shows a photo sensor 14 and its possible dimensions according to an embodiment of the invention. This photo sensor 14 may be integrated into the timepiece 1 in order to form the interface 11. The photo sensor 14 may then have dimensions between 2,7 mm and 2,3 mm length, 2,2 mm to 1,8 mm width and 3,0 to 2,6 mm height. It can be electrically coupled as a typically photo diode as shown in the second diagram in the upper right corner shown in FIG. 6. The photo sensor 14 is configured as a photo diode FT which is coupled with a collector to a resistor R (for example 100kΩ) which is coupled with the other side to supply voltage. The emitter of the photo sensor 14 is then coupled to ground. The signal that represents the sensor output is then tapped between the resistor R and the collector of the photo sensor 14.

[0057] In another advantageous embodiment, the sensor is a Hall-effect sensor. A possible embodiment integrated circuit to be used as Hall-effect sensor 13 is shown in FIG. 7. The dimensions of the sensor are about 1,5 mm (width) by 1,2 mm (length). The Hall-effect IC is therefore very advantageous for the embodiments of the invention due to its rather small size. The signals generated in the signal generator have to be transformed into magnetic signals by, for example an electromagnet 21. A magnetic field B is then generated which corresponds to the time and data information. In accordance with the magnitude and direction of the magnetic field B, the output signal of the Hall-effect IC 13 is changed (switched on and off) so that the output signal (output voltage) of this Hall-effect sensor 13 can be detected and decoded by the microprocessor 9. Another advantage of the Hall-effect sensor consists in the use of the magnetic field, which is less sensitive to disturbances than electromagnetic fields of higher frequencies. Furthermore, the case of a timepiece equipped with the Hall-effect sensor does not need any transparent areas as, for example required for photo sensors (optical interfaces). T

[0058] FIG. 8 shows the electrical characteristics of the typical Hall-effect IC 13, which is used in the embodiments of the invention. The output voltage VOUT of the Hall-effect sensor 13 varies in response to a varying B-field (magnetic field). The sensor 13 has a hysteresis of BHYS which improves the functionality of the sensor and thereby data integrity of the interface 11.

[0059] FIG. 9 shows a simplified circuit diagram of a possible interconnection of a Hall-effect IC (or Hall-effect sensor) 13. Hall-effect IC 13 is coupled between supply voltage VDD and VSS. A power source VS provides the required supply voltage level to the microprocessor 9 and the Hall-effect sensor 13. The chip enable signal CE of the Hall-effect sensor 13 is pulled to high. The sensed signal is then provided at the output OUT of the Hall-effect sensor 13 and passed on to an input IN of the microprocessor 9.

[0060] FIG. 10 shows a simplified block and circuit diagram of a configuration that may be used for transmitting date and time data into the timepiece 1. The timepiece has an interface IF 11 which includes a Hall-effect sensor 13 as previously described. There is an electromagnet 20 which is driven by the signal generator 15 through wires 17 which are coupled as a coil 18 around a metallic guide for the magnetic field. A simple electromagnet 20 may be used, consisting of a coil 18 of insulated wire wrapped around an iron core 19. The strength of the generated magnetic field is then proportional to the amount of current.

[0061] The timepiece 1 is placed in the air gap AG of the electromagnet 20. Current pulses in accordance with time and calendar data are transmitted as a current pulse train 16 through wires 17. This generates a corresponding change of the magnetic field in the air gap AG which is sensed by the Hall sensor 13 at interface 11 of the timepiece 1.

[0062] The dimensions of the air gap are adapted to the smallest dimension (here thickness) of the timepiece 1. This provides that the magnetic field is as strong as possible.

[0063] FIG. 11 shows another set up for programming the timepiece 1 through the interface 11. In this embodiment, a photo sensor 14 is provided at interface 11. A light emitting diode 20 is electrically coupled to the output of the signal generator 15. Light pulses at the light emitting diode 20 are generated in accordance with the time and calendar data in the signal generator 15. These varying light pulses are sensed by the photo sensor 14 in the interface 11 of timepiece 1 and passed as electrical signals through the microprocessor 9 (not shown).

[0064] The settings of FIG. 10 and FIG. 11 may advantageously be used during a manufacturing, assembling and/or shipping procedure for timepieces, in particular wrist watches. The dimensions and external shape and style of the signal generators 15 and coupling mechanisms (light emitting diode 20 and/or electromagnet 21) may be adapted. In an aspect of the invention, the signal generators 15 for programming time and calendar information into timepieces 1 according to the invention may be provided at various service points all over the world. The service points may be located at airports, train stations or at shopping malls or the like. The signal generators with the respective coupling means may be portable and even small enough to be carried around by the user or service personnel. In this regard, the invention also provides a distributed time and calendar data updating system that is particularly useful for regions without radio time signals.

[0065] FIG. 12 shows an embodiment of the timepiece 1 according to aspects of the invention. In this embodiment, the timepiece 1 has no date wheel train. The second hand 4 is used to indicate the date, or other calendar information. If the user pushes the pushbutton 12 once, the second hand 4 is rotated to a specific position in order to indicate the date, month and year. Subsequently the second hand indicates whether the time is A.M. or P.M (ante meridiem or post meridiem). For example, if the pushbutton 12 is pushed, the second hand 4 is rotated quickly to the 25 seconds position in order to indicate the day, which is the 25th of the months. The second hand 4 stops for a few seconds and then rotates to the 33 second position in order to indicate Sunday (as shown in FIG. 12). Finally, the second hand 4 stops at the 53th second position for indicating A.M. Finally, the second hand may stop or wait or rotate backwards in order to resynchronize with the current time.

[0066] For time zones and countries in which the time changes between summertime and wintertime, the microprocessor 9 may be configured to automatically adjust the time in accordance with summer and wintertime.

Claims

1. An analog timepiece comprising: at least one hand for indicating the current time, a calendar data indicator for indicating a date, a power supply, a microprocessor, an oscillator for generating a time reference signal for the microprocessor for internal time keeping, at least one pushbutton, a setting stem for adjusting the at least one hand, a stepping motor, a mechanical clockwork for driving the at least one hand and/or the calendar data indicator, and an interface to an external signal generator for receiving an initial current time and calendar data through the interface.

2. The analog timepiece according to claim 1, wherein the calendar data indicator is the at least one hand.

3. The analog timepiece according to claim 1, wherein the calendar data indicator is a calendar wheel train.

4. The analog timepiece according to any previous claim, wherein the interface comprises a magnetic sensor.

5. The analog timepiece, wherein the interface comprises a photo sensor.

6. The analog timepiece according to any previous claim, further comprising a solar cell for powering the analog electronic timepiece.

7. The analog electronic timepiece according to any previous claim, wherein the interface comprises a direct electrical connection for connecting the signal generator.

8. A method for setting time and date of an analog timepiece, the method comprising: generating time and calendar data of a first time zone in a signal generator, transmitting the time and calendar data of the first time zone through an interface into a first analog timepiece, storing the time and calendar data of the first time zone in the first analog timepiece and adjusting at least one hand of the first analog timepiece in accordance with the stored time and calendar data of the first time zone.

9. The method according to claim 8, further comprising: generating time and calendar data of a second time zone in the signal generator, transmitting the time and calendar data of the second time zone through the interface into the first analog timepiece, storing the time and calendar data of the first time zone in the first analog timepiece and adjusting the at least one hand of the first analog timepiece in accordance with the stored time and calendar data of the second time zone.

10. The method according to claim 8, further comprising: transmitting the time and calendar data of the first time zone through an interface into a second analog timepiece, storing the time and calendar data of the first time zone in the second analog timepiece and adjusting the at least one hand of the second analog timepiece in accordance with the stored time and calendar data of the first time zone.

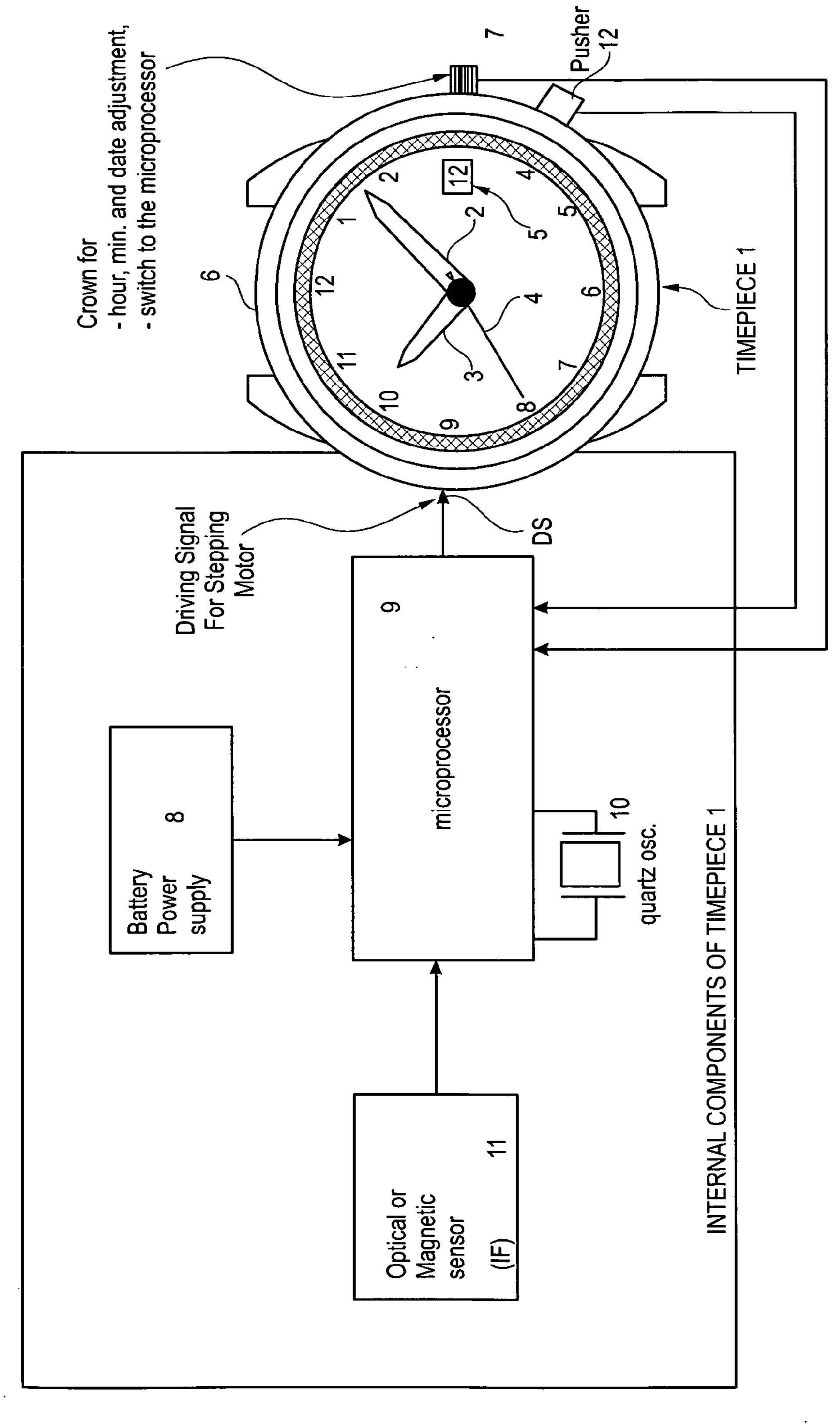
Crown for
- hour, min. and date adjustment,
- switch to the microprocessor
Pusher
12
7
6
2
5
4
3
8
TIMEPIECE 1
Driving Signal
For Stepping
Motor
DS
9
microprocessor
Battery
Power
supply
8
10
quartz osc.
Optical or
Magnetic
sensor
(IF)
11
INTERNAL COMPONENTS OF TIMEPIECE 1

Fig. 1

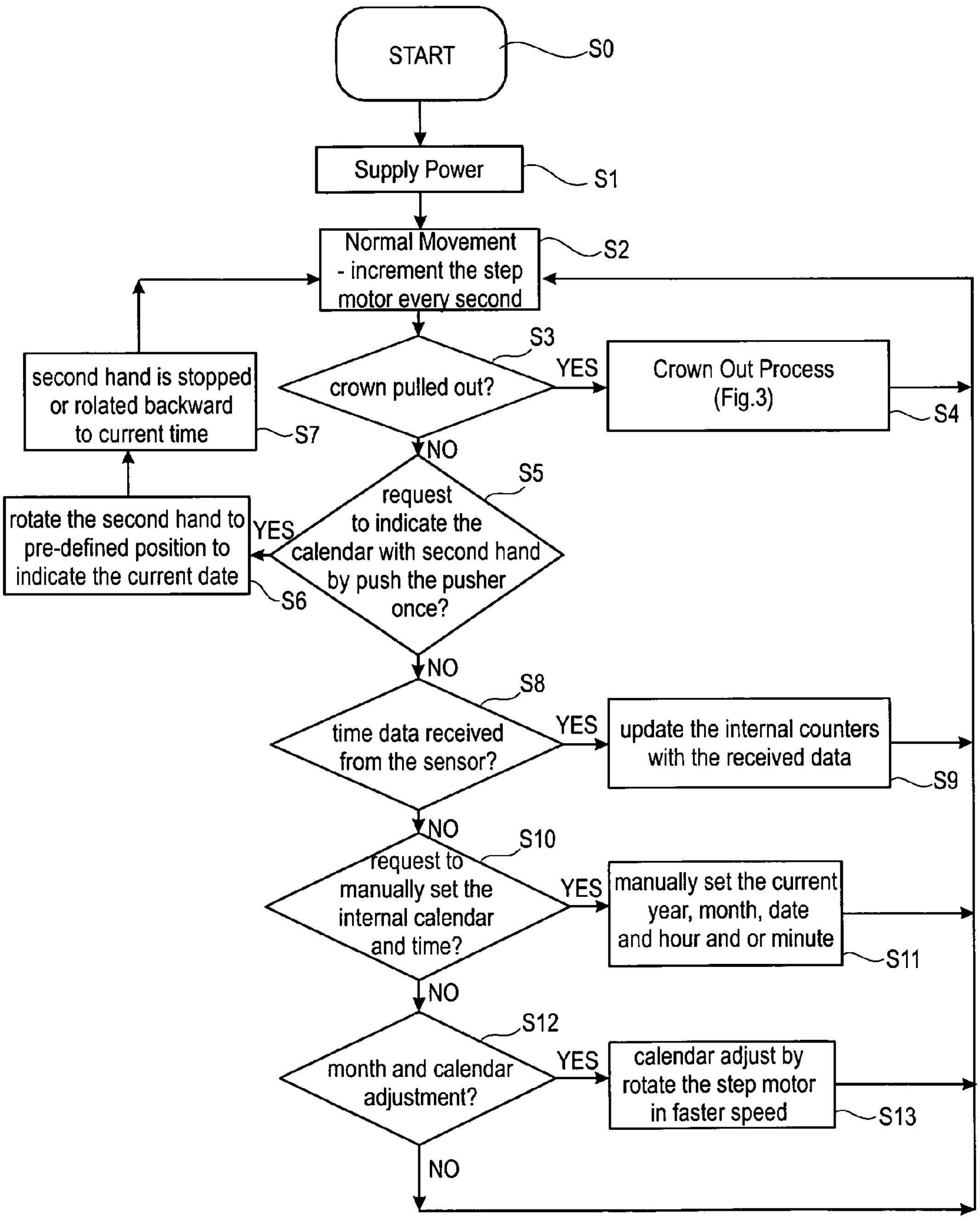
START
S0
Supply Power
S1
Normal Movement - increment the step motor every second
S2
crown pulled out?
S3
YES
Crown Out Process (Fig.3)
S4
NO
second hand is stopped or rolated backward to current time
S7
request to indicate the calendar with second hand by push the pusher once?
S5
YES
rotate the second hand to pre-defined position to indicate the current date
S6
NO
time data received from the sensor?
S8
YES
update the internal counters with the received data
S9
NO
request to manually set the internal calendar and time?
S10
YES
manually set the current year, month, date and hour and or minute
S11
NO
month and calendar adjustment?
S12
YES
calendar adjust by rotate the step motor in faster speed
S13
NO

Fig. 2

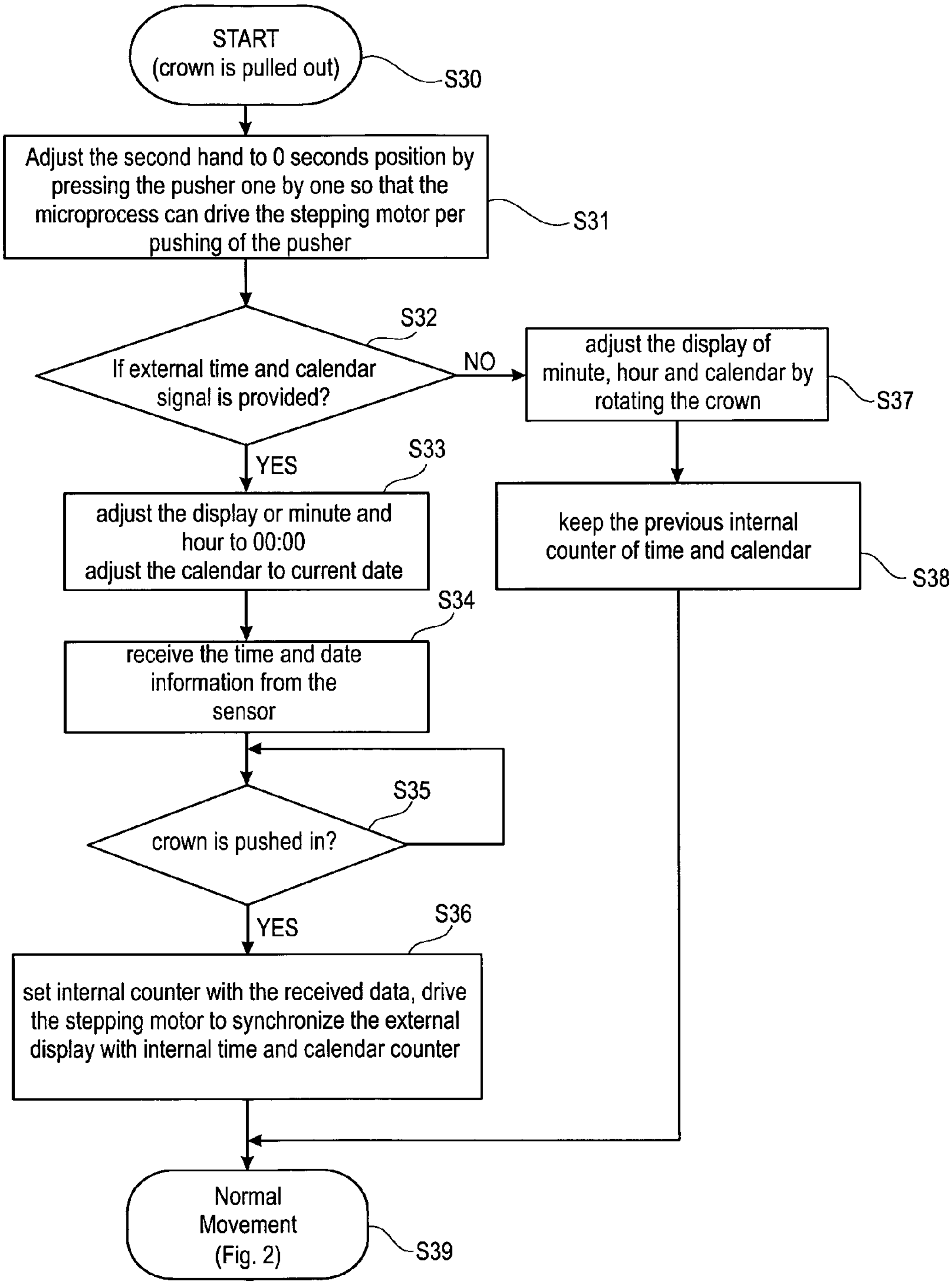
START
(crown is pulled out)
S30
Adjust the second hand to 0 seconds position by pressing the pusher one by one so that the microprocess can drive the stepping motor per pushing of the pusher
S31
S32
If external time and calendar signal is provided?
NO
adjust the display of minute, hour and calendar by rotating the crown
S37
YES
S33
adjust the display or minute and hour to 00:00
adjust the calendar to current date
keep the previous internal counter of time and calendar
S38
S34
receive the time and date information from the sensor
S35
crown is pushed in?
YES
S36
set internal counter with the received data, drive the stepping motor to synchronize the external display with internal time and calendar counter
Normal
Movement
(Fig. 2)
S39

Fig. 3

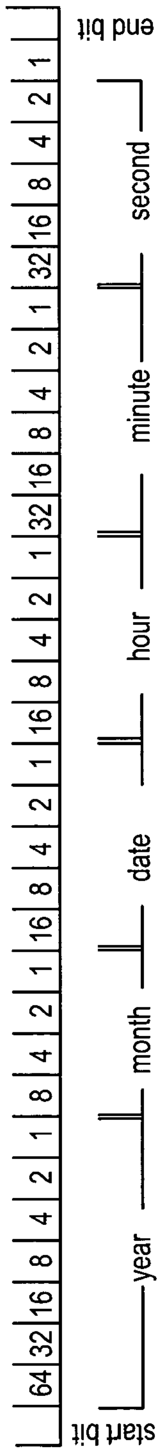
start bit
64
32
16
8
4
2
1
year
8
4
2
1
month
16
8
4
2
1
date
16
8
4
2
1
hour
32
16
8
4
2
1
minute
32
16
8
4
2
1
second
end bit

Fig. 4

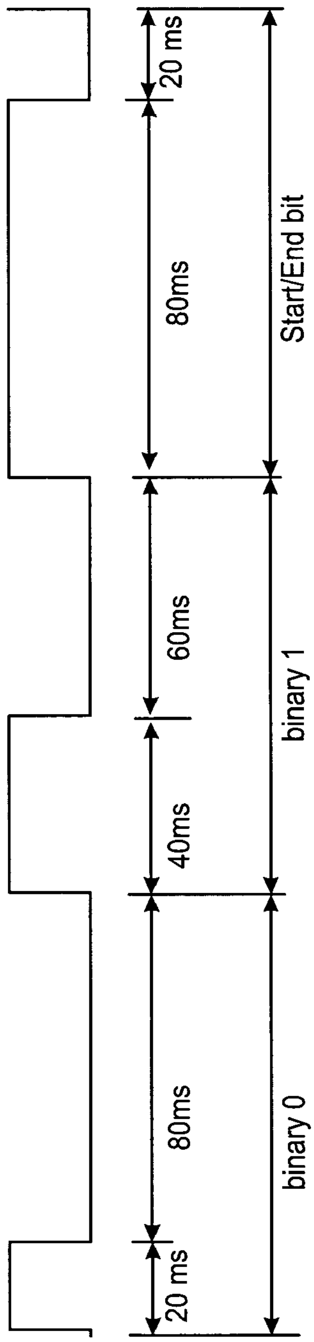
20 ms
80ms
40ms
60ms
80ms
20 ms
binary 0
binary 1
Start/End bit

Fig. 5

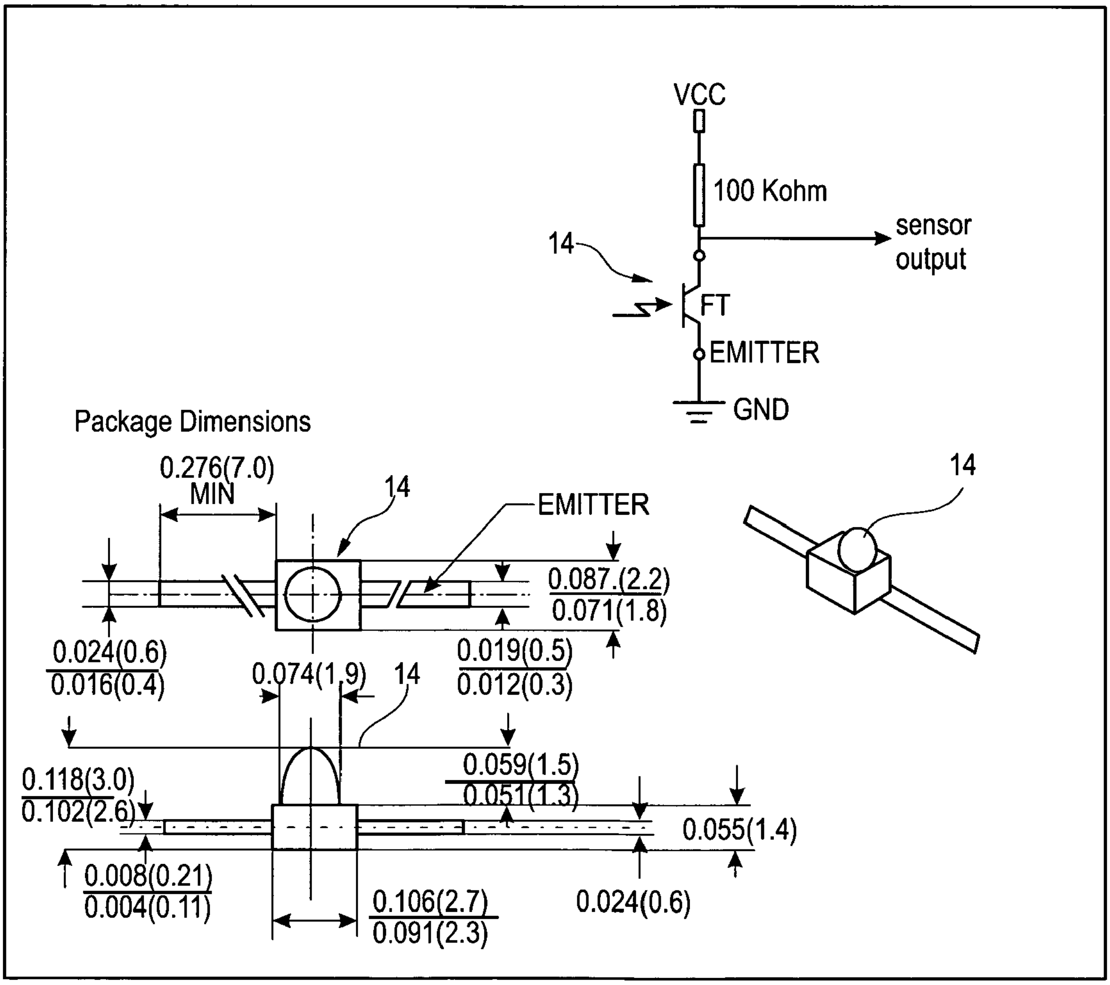
VCC
100 Kohm
sensor output
14
FT
EMITTER
GND
Package Dimensions
0.276(7.0) MIN
14
EMITTER
0.087.(2.2)
0.071(1.8)
0.024(0.6)
0.016(0.4)
0.074(1.9)
14
0.019(0.5)
0.012(0.3)
0.059(1.5)
0.051(1.3)
0.118(3.0)
0.102(2.6)
0.055(1.4)
0.008(0.21)
0.004(0.11)
0.106(2.7)
0.091(2.3)
0.024(0.6)
14

Fig. 6

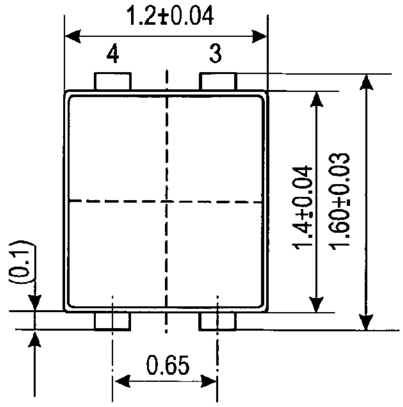

Fig. 7

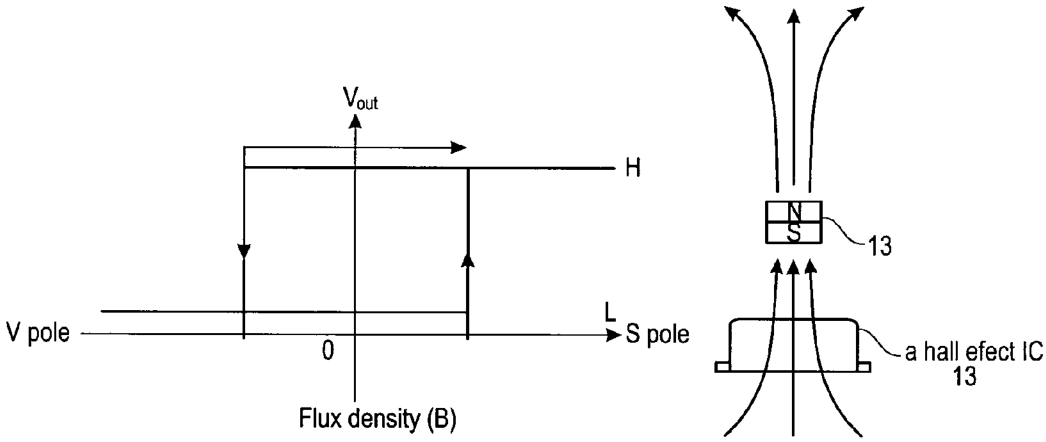

Fig. 8

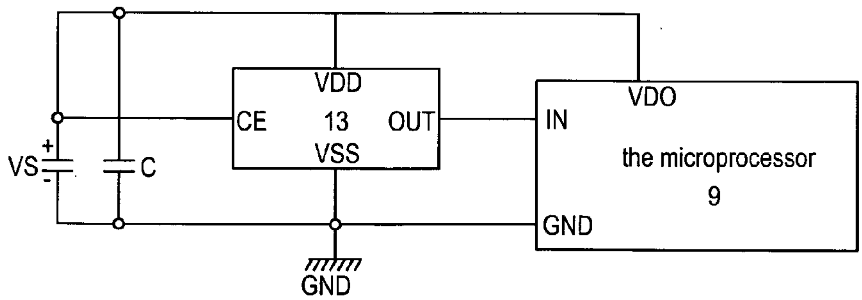

Fig. 9

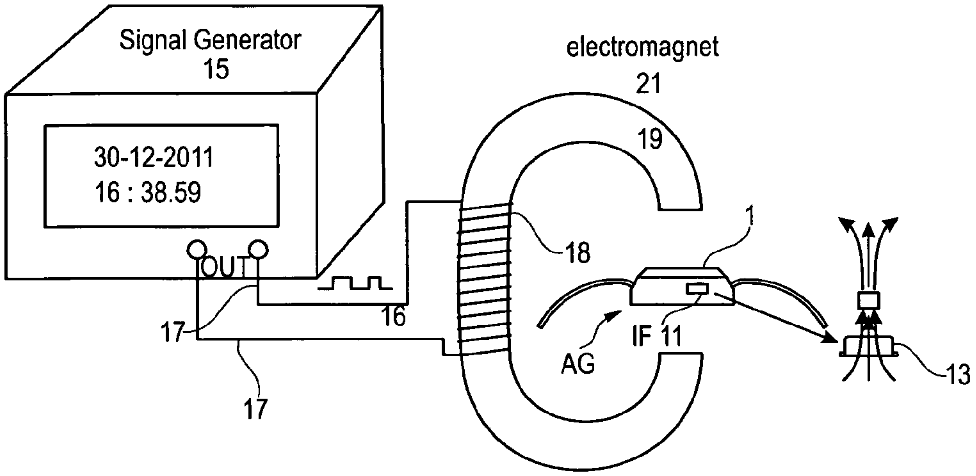
Signal Generator
15
30-12-2011
16 : 38.59
OUT
electromagnet
21
19
18
1
16
17
17
AG
IF 11
13

Fig. 10

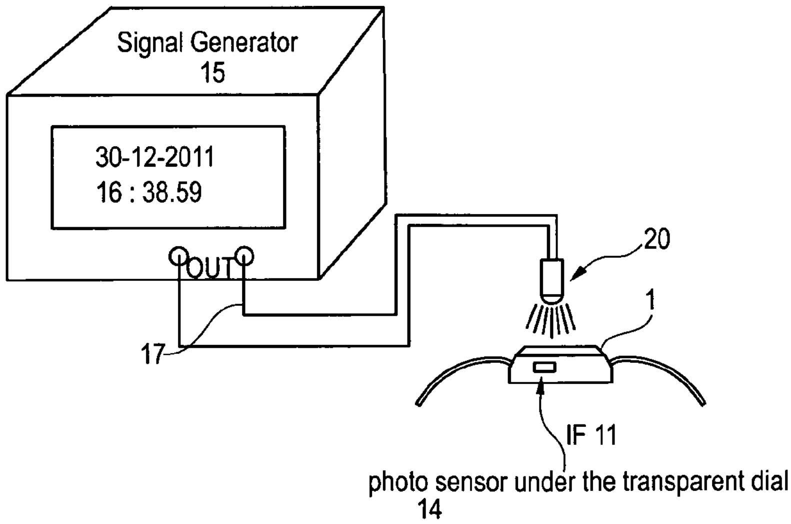
Signal Generator
15
30-12-2011
16 : 38.59
OUT
20
1
17
IF 11
photo sensor under the transparent dial
14

Fig. 11

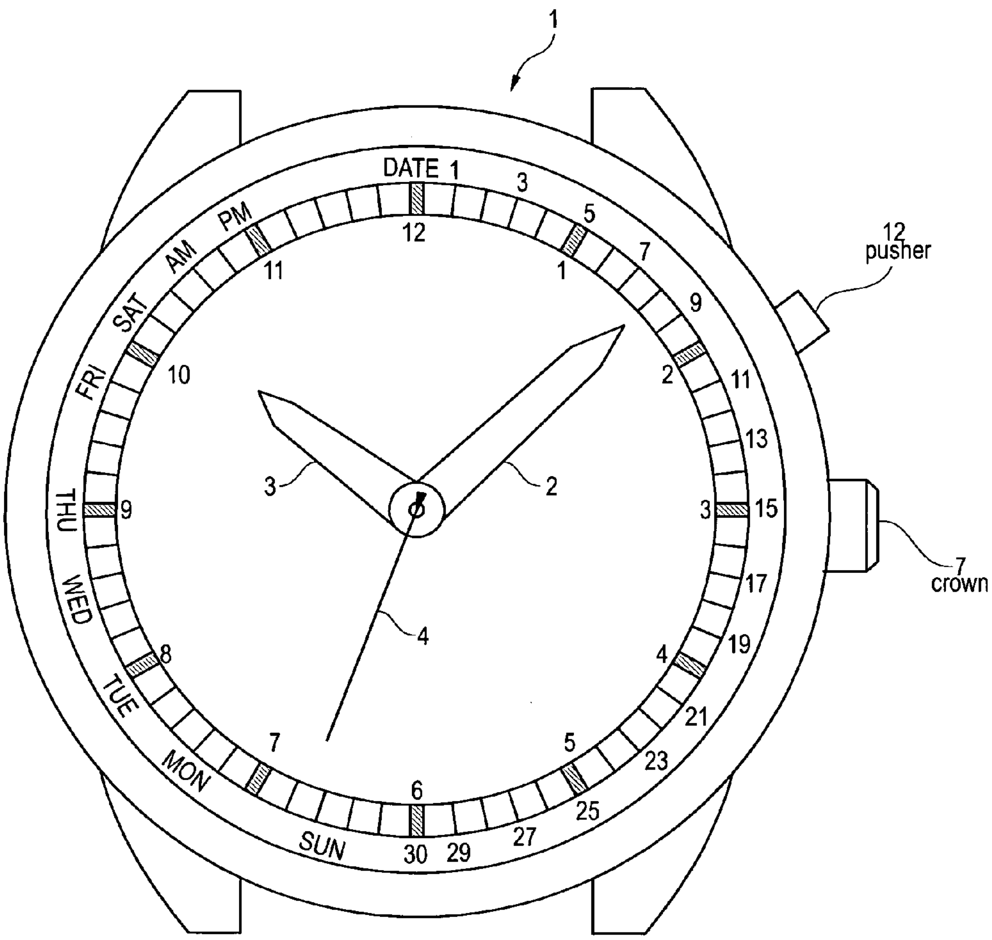
1
DATE
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
30
12
1
2
3
4
5
6
7
8
9
10
11
PM
AM
SAT
FRI
THU
WED
TUE
MON
SUN
12
pusher
7
crown
2
3
4

Fig. 12

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 00 2659

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 722 286 A1 (CITIZEN WATCH CO LTD [JP] CITIZEN HOLDINGS CO LTD [JP]) 15 November 2006 (2006-11-15) * paragraphs [0044], [0045], [0047], [0179], [0213], [0298]; figures 1,14 * -----	1,3,8	INV. G04C17/00 G04G9/00 G04G21/00
X	EP 1 349 022 A2 (SEIKO EPSON CORP [JP]) 1 October 2003 (2003-10-01) * paragraphs [0065] - [0071]; figure 1 * -----	1	
Y	EP 1 553 469 A1 (SEIKO EPSON CORP [JP]) 13 July 2005 (2005-07-13) * paragraphs [0153] - [0155]; figures 1-7 * -----	1,3-7	
Y	EP 1 118 915 A1 (CITIZEN WATCH CO LTD [JP]) 25 July 2001 (2001-07-25) * paragraph [0059]; figures 1-3 * -----	1,3-7	
X	WO 98/14842 A1 (H P M TECHNOLOGIES PTY LTD [AU]) 9 April 1998 (1998-04-09) * page 11, line 11 - page 13, line 14; figure 1 * -----	8-10	TECHNICAL FIELDS SEARCHED (IPC)
A	DE 10 2008 032124 A1 (GEHRING BERND [DE]) 14 January 2010 (2010-01-14) * abstract; figures 1-7 * -----	1-10	G04G G04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 August 2011	Mérimèche, Habib

1

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 00 2659

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-08-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1722286 A1	15-11-2006	CN 1918520 A	21-02-2007
		JP 2005227203 A	25-08-2005
		WO 2005078536 A1	25-08-2005
		US 2007164903 A1	19-07-2007
EP 1349022 A2	01-10-2003	AT 396438 T	15-06-2008
		CN 1447198 A	08-10-2003
		HK 1058404 A1	30-01-2009
		JP 3454269 B1	06-10-2003
		JP 2004003927 A	08-01-2004
		US 2003198140 A1	23-10-2003
EP 1553469 A1	13-07-2005	CN 1701283 A	23-11-2005
		WO 2005003867 A1	13-01-2005
		US 2005105401 A1	19-05-2005
EP 1118915 A1	25-07-2001	BR 0006967 A	12-06-2001
		CN 1318160 A	17-10-2001
		WO 0106329 A1	25-01-2001
		US 6751164 B1	15-06-2004
WO 9814842 A1	09-04-1998	AU 4372397 A	24-04-1998
		CA 2187063 A1	03-04-1998
		NZ 314712 A	26-08-1998
DE 102008032124 A1	14-01-2010	CH 699126 A2	15-01-2010

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82