US 20200026244A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2020/0026244 A1**

GUHL et al. (43) **Pub. Date: Jan. 23, 2020**

(54) **CONNECTED, MECHANICAL WINDING WATCH**

(71) Applicant: **Sequent SA**, Zug (CH)

(72) Inventors: **Harry GUHL**, Basel (CH); **Adrian BUCHMANN**, Henley-on-Thames (GB)

(21) Appl. No.: **16/510,425**

(22) Filed: **Jul. 12, 2019**

(30) **Foreign Application Priority Data**

Jul. 20, 2018 (CH) CH00895

Publication Classification

(51) **Int. Cl.**

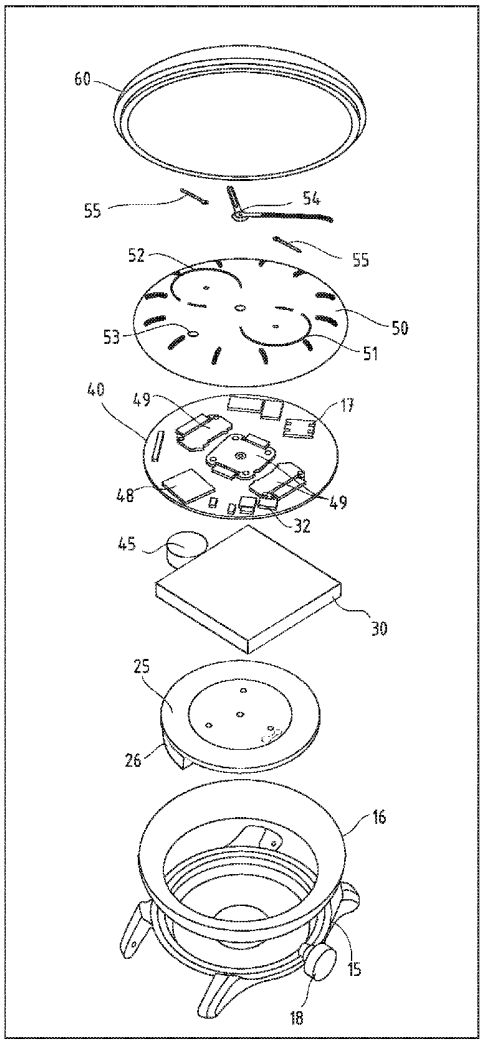
G04G 19/00	(2006.01)
H04W 4/38	(2006.01)
G04G 21/02	(2006.01)
G04G 21/04	(2006.01)
G04G 9/00	(2006.01)
G04C 10/04	(2006.01)
A61B 5/11	(2006.01)
A61B 5/0205	(2006.01)
A61B 5/00	(2006.01)

(52) **U.S. Cl.**

CPC ***G04G 19/00*** (2013.01); ***H04W 4/38*** (2018.02); ***G04G 21/025*** (2013.01); ***G04G 21/04*** (2013.01); ***G04G 9/007*** (2013.01); *H02K 35/00* (2013.01); ***A61B 5/1118*** (2013.01); ***A61B 5/0205*** (2013.01); ***A61B 5/1112*** (2013.01); ***A61B 5/681*** (2013.01); ***A61B 5/486*** (2013.01); ***G04C 10/04*** (2013.01)

(57) **ABSTRACT**

An electronic watch comprising a timekeeper logic unit (**42**) set to control a display (**50**,**54**) of the time, and a controller (**48**), in communication with an external device (**90**) or with Internet (**99**) through a wireless interface (**68**) of the watch, and a mechanical energy harvester system (**25**) set to transform mechanical energy deriving from the movements of a wearer to electrical energy, a power manager circuit for storing the electrical energy in a battery (**30**) and/or in a capacitor (**32**), and to supply the logic unit (**42**), the controller (**48**) and the wireless interface (**68**) with energy stored in the battery (**30**) and/or in the capacitor (**32**).



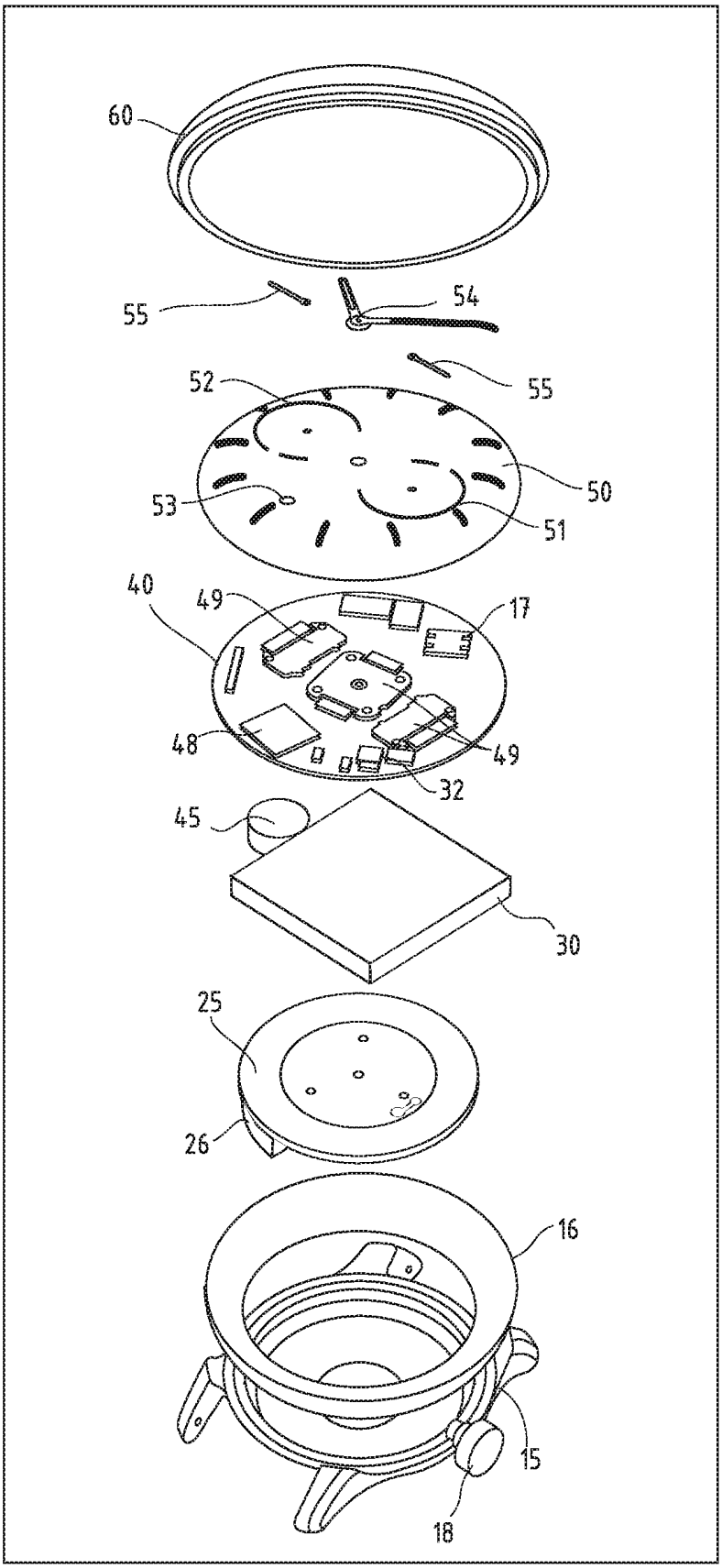


Fig. 1

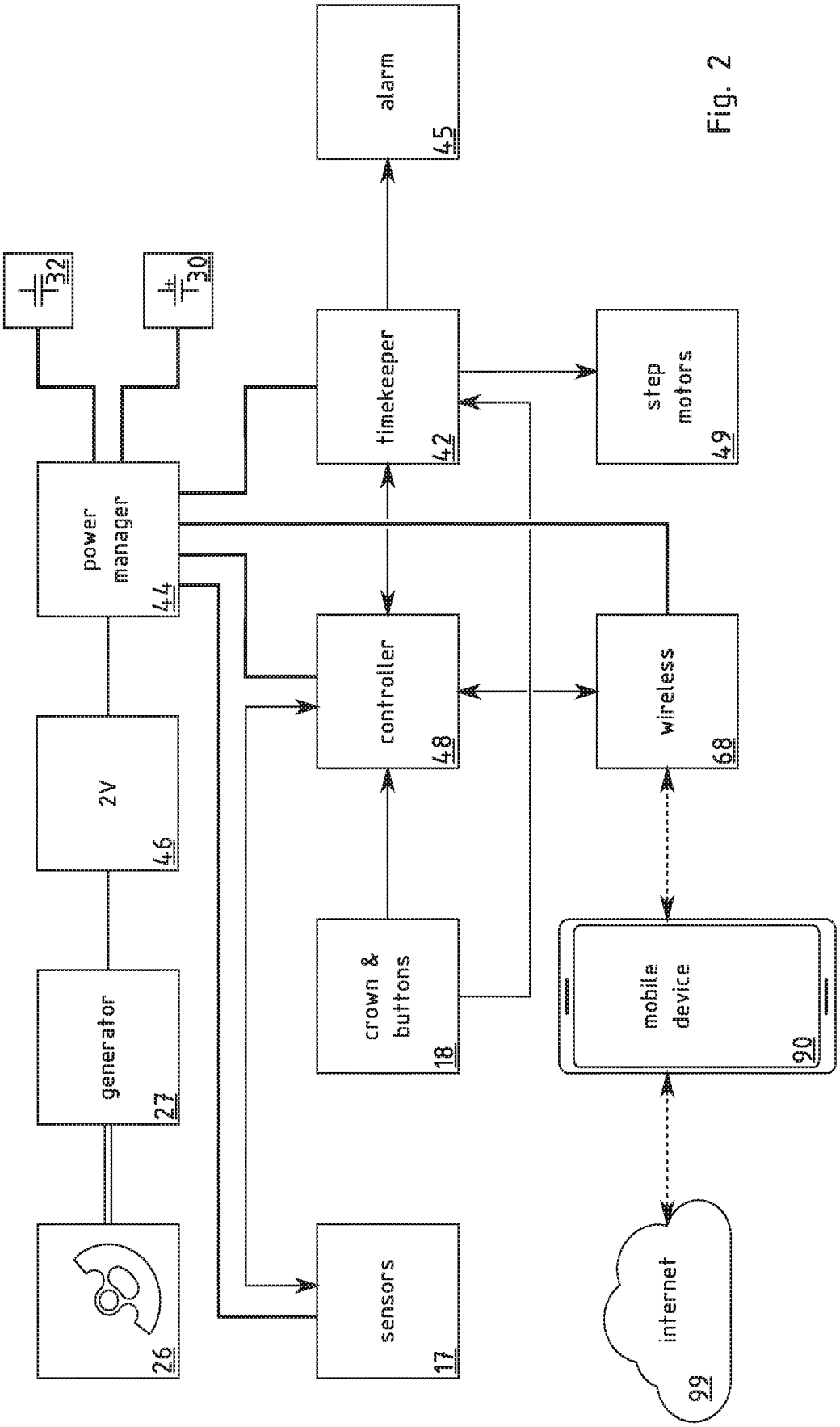

alarm
45
timekeeper
42
step motors
49
power manager
44
controller
48
wireless
68
2V
46
generator
27
crown & buttons
18
mobile device
90
sensors
17
internet
99
26
32
30

Fig. 2

CONNECTED, MECHANICAL WINDING WATCH

REFERENCE DATA

[0001] The present application claims priority of Swiss Patent Application 00895/18 of Jul. 20, 2018, in the name of Sequent SA, the contents whereof are hereby incorporated.

TECHNICAL FIELD

[0002] The invention relates to an electronic watch comprising sensors and a communication interface connectable to an information technology network, capable of displaying indications determined on the database coming from the network or from the sensors.

RELATED ART

[0003] Electronic mobile devices are commonly used and widely known. Devices such as laptops, tablets, mobile telephones, games consoles and music players are used in all the sectors of the industry and the entertainment sector and offer an infinity of services integrating information coming from a network interface to internet, from specific sensors, and from instruments for computing and elaborating information technology data.

[0004] Miniaturization efforts have enabled the creation of ever smaller and more practical mobile devices, and many examples are already known of "connected" or "smart" wrist watches capable of exchanging elements of information on Internet and displaying for example notifications to the wearer based on this information. Several wireless data exchange interfaces are used for this purpose, comprising, among others, cellular telephone networks, for example according to GSM, GPRS, UMTS, or any other suitable standard, and local wireless networks (WiFi, Bluetooth®, etc.).

[0005] Also known are wrist watches or devices, connected to a network or independent, equipped with all kinds of sensors, for example, GPS sensors, accelerometers etc., and processing modules set to provide indications of physical, sporting activity or state of health, integrating information coming from these sensors. These connected watches can use any suitable wireless communication system. However, they are more often based on a ow consumption local network, typically Bluetooth® LE, to be connected to a smartphone or to another device acting as a gateway.

[0006] Despite all the efforts implemented to limit the consumption of connected watches, battery capacity remains a factor limiting their use. Autonomy between two battery charges is often limited to a few days, or a few hours when the GPS or other functions are in high demand.

[0007] For example, through EP0295744, EP0547083, EP1239349, EP1821163 and other publications, electronic watches are also known that derive the energy necessary to their functioning from an electricity generator driven by the movements of the wearer.

BRIEF SUMMARY OF THE INVENTION

[0008] An aim of the present invention is to propose a connected watch whose use is not as limited by battery capacity as in the known devices.

[0009] According to the invention, these aims are achieved in particular by means of the object of the independent claim, preferred embodiment variants being covered by the dependent claims.

BRIEF DESCRIPTION OF THE FIGURES

[0010] Examples of implementation of the invention are indicated in the description illustrated by the attached figures, in which:

[0011] FIG. **1** illustrates the possible structure of a watch according to the invention.

[0012] FIG. **2** illustrates, through a block diagram, the possible functional elements of a watch according to the invention and their interactions

DETAILED DESCRIPTION

[0013] Referring to FIG. **1**, a possible embodiment of the invention consists in a wristwatch comprising an analog face **50** with two hands **54** in the center, as well as two small analog indicators, for example an indicator **51** at three o'clock and an indicator **52** at nine o'clock, with two small hands **55**.

[0014] The main function of the hands **54** in the center is that, conventional, of indicating what time it is. The use of hands in the center for other indications can also be envisaged within the context of the invention.

[0015] The small indicators **51**, **52** can be used for any function. In a preferred variant an indicator, for example the indicator **52** is used to indicate at any time the available energy reserve, which is linked, as will be better seen later, with the state of charge of the watch battery while the other indicator, for example the indicator **51**, can be used to indicate any kind of information. One of the small indicators preferably displays a "biofeedback" corresponding to a physical activity accumulated in a determined time interval relative to a given target.

[0016] So as to define the ideas, the indicator **51** can be programmed to indicate a physical activity determined by one or more movement and/or physical activity sensors **17**, The invention can include any kind of sensor comprising for example a step counter, an accelerometer, a GPS receiver or a heart rate monitor. The sensors **17** are preferably included in the watch itself, but the invention also relates to variants in which the movement sensors are integrated in an external device with which the watch communicates, for example a mobile telephone or a chest belt.

[0017] The face preferably also comprises one or more LED **53** diodes or elements usable for displaying a visual alert. These elements can be activated to notify predetermined situations to the user, such as for example the arrival of a message or a pre-registered appointment. The visual alert can also include a sound signal and/or a vibration through the vibrator **45**.

[0018] The watch of the invention preferably also includes an electronic module **40**, in the shape of a printed circuit for example, preferably comprising the sensors **17** mentioned above, step motors **49** for activating the hands **54**, **55**, and one or more logic circuits for controlling the watch and performing its different functions.

[0019] The electrical energy necessary to the functioning of the watch is provided by an energy harvester unit **25**. In a preferred variant, the energy harvester unit **25** includes an eccentric oscillating weight **26** moved by the movements of the wearer of the watch, like the oscillating weight of an automatic clock movement, and an electricity generator **27**

(schematically illustrated on FIG. **2**) for transforming these movements into electrical energy.

[0020] The generator module preferably comprises a spring, tensioned by the movement of the oscillating weight and an automatic dutch device for activating the generator when the spring tension exceeds a predetermined threshold. Once the spring is relaxed, the generator stops and this cycle, which can be repeated several times a minute if the wearer is very active, starts again.

[0021] This variant is advantageous because it enables the generator to be turned very fast, thus reducing part of the energy loss that takes place if it turns too slowly. It is possible nevertheless to drive the generator directly through the oscillating weight, with a transmission synchronous with an appropriate reduction ratio, still engaged. Suitable energy recovery devices are produced by Kinetron (Tilburg, The Netherlands), among others.

[0022] The invention also approves variants with manual rewinding in which the energy harvester unit can be driven by a crown of the watch, or by another element of the watch on which the user can act, a bezel for example. The ability to drive the energy harvester unit **25** manually does not exclude the presence, in the same watch, of an oscillating weight for performing the same function automatically.

[0023] FIG. **2** schematically illustrates the elements involved in the functioning of a watch according to the invention. This illustration is proposed solely in a descriptive aim and it should not be understood that all the drawn elements are essential, or that they must be physically embodied as distinct elements. As it is a question of functioning blocks, several functions can be ensured by a single multifunctional device, or by software elements as the case may be.

[0024] Importantly, the watch includes a power manager circuit **44** whose function is to transform, for example, the alternating current produced by the generator into direct current suitable for charging accumulators, and to store this energy. In many cases, the production of electrical energy by the generator **27** is discontinuous; the power manager **44** advantageously uses one or more capacitors or ultra-capacitors **32** to handle production peaks as well as a rechargeable battery **30**, for example a Li-ion, Li-poly or NiMH accumulator.

[0025] Another function of the charger is that of supplying a stable power supply for the other electronic components of the watch. Advantageously, the charger circuit includes a voltage multiplier **46** for raising the voltage level present at the output of the generator **27**. Several circuits can be used for this purpose, for example doublers with diodes or charge pumps.

[0026] Importantly, the watch of the invention includes two logic units that can be activated selectively, depending on the immediate availability of energy. A first logic unit **42** has a timekeeping function and can be an electronic quartz watch movement. The timekeeper **42** controls among others the step motors **49** that activate the hands **54**, **55**. This component of the watch is embodied with ultra--low consumption integrated circuits specially designed for watchmaking applications.

[0027] A second logic unit **48** oversees the "smart" functions of the watch. This unit could be embodied by an ultra-low consumption microcontroller, or by any other suitable component. The computing performance and resources of this second logic unit are clearly superior to those of the first timekeeper unit **42** and its energy consumption is naturally greater. The second logic unit is preferably in charge of managing the sensors **17** and the wireless communication interface **68**, and is active, and activates the peripherals it manages according to a defined program and the immediate availability of energy.

[0028] The wireless communication interface **68** enables the watch of the invention to be linked to any service or source of data available on internet. Although a direct connection could be envisaged, a local low consumption network interface like Bluetooth® LE for example is preferable for energy reasons. A telephone or another mobile device **90** endowed with an internet connection is then used as a communication intermediary. The telephone **90** is also used, through a specific application, to control the functions of the watch and to choose the information to display.

[0029] The watch of the invention preferably has several functioning modes that differ for the number of activated functions, the wealth of the displayed information and by their energy consumption.

[0030] The basic function of the watch, that of displaying what time it is, is entrusted entirely to the first timekeeper logic circuit **42** and does not require any activation of the second logic circuit **48**, the sensors **17** or the wireless interface **68**. The watch of the invention thus includes a minimum consumption functioning mode; the "time" mode, in which the time is displayed by the hands **54**, is active, and the "smart" functions are inactive. The rechargeable battery **30** is preferably dimensioned so that the autonomy of the watch in this state is several days, preferably longer than 100 days. This autonomy corresponds to the maximum time during which, starting from a full state of charge of the battery, the watch can keep time without being worn.

[0031] When the watch is worn, the energy produced by the generator **27** allows the battery to be recharged and additional functions linked with the sensors **17** and/or information from the internet to be activated through the wireless interface **68**. These functions can include, for example:

[0032] a. monitoring of the level of physical activity and/or the asleep/awake state by one or more sensors, for example an accelerometer, a vibration sensor or a movement sensor;

[0033] b. heart monitoring by an optical or electric sensor;

[0034] c. tracking of geographical position through a GPS/Galileo or any other positioning system;

[0035] d. display of notifications triggered by Internet events, for example e-mails, text messages or appointments.

[0036] These functions can be combined in several functioning modes, for example:

[0037] 1. the "time" mode with aforementioned maximum autonomy;

[0038] 2."activity" mode in which the watch determines and periodically saves, with a predetermined frequency, the level of physical activity, and/or the state of wakefulness;

[0039] 3. a first "sport" mode in which the watch, in addition to physical activity, determines and also saves the heart rate, for example once each minute;

[0040] 4. a second "sport" mode with monitoring and simultaneous recording of the activity and geographical position;

[0041] 5. a third "sport" mode combining the sport modes I and II;

[0042] 6.a "connected" mode with monitoring of physical activity and display of notifications;.

[0043] 7. In the "connected" mode, the watch can also receive and transmit through the wireless interface **68** all kinds of data that do not result in a notification, but are useful to the functioning of the watch and/or to the implementation of "smart" functions. For example, the watch can receive updates of its embedded software, synchronize on time servers to set the time and/or to adjust its operation, download geopositioning assistance data (GPS assistance) and so on.

[0044] The functioning modes 1-6 can be selected through a deliberate action of the user, for example pressure on the crown **18** or on a push button (not illustrated) or through an app executed on the mobile device **90**.

[0045] The watch of the invention is preferably programmed to change automatically to a least consumption functioning mode according to the state of charge of the battery **30** and the capacitors **32**, and the electric power supplied by the generator **27**. This way, if the energy generated by the wearer is insufficient to maintain an activated mode indefinitely, the watch changes automatically to a least consumption mode, for example the "time" mode, so that the time display is maintained.

[0046] In a variant, the least consumption functioning mode provides that the analog display of the time—for example the two hands **54** in the center that indicate the hours and the minutes—is stopped when the watch is immobile for a more or less prolonged period and starts again when the watch is moving. When the display is restored, the hour and minute hands move rapidly ("trot") until the position corresponding to what time it is reached, as it has been maintained by the timekeeper logic circuit **42**.

[0047] As was seen above, the small hand at nine o'clock is preferably used to display the state of charge of the battery **30**, while the other gives a "biofeedback" indication corresponding to a physical activity accumulated in a determined time interval, relative to a given target. This function can include the following steps for example:

[0048] a. The user defines, through an app executed on the mobile device **90**, a physical activity objective and an interval of time during which the activity should be completed: for example 10,000 steps in 24 hours.

[0049] b. The mobile device **90** transfers these instructions to the controller **48** of the watch through the Bluetooth® interface **68**.

[0050] c. The controller **48** activates a functioning mode in which the step counting function is active, for example, the above "activity" mode. The steps of the user are counted and accumulated in a variable.

[0051] d. The controller **48** periodically calculates the percentage of activity relative to the target to be attained and controls (potentially through the intermediary action of the timekeeper **42**) the movement of the small hand to three o'clock as a consequence. For example, the hand will move to the middle of its travel when the wearer has accumulated 5000 steps, and will reach its upper limit if and when the wearer has accumulated 10,000 steps.

[0052] e. At the end of a 24 hour period, the accumulator variable is reset to zero and the hand moved to the start of the scale. The cycle is repeated every 24 hours.

REFERENCE NUMBERS USED ON THE FIGURES

[0053] **15** back cover
[0054] **16** caseband
[0055] **17** movement and/or physical activity sensors
[0056] **18** crown
[0057] **25** energy harvester
[0058] **26** energy source
[0059] **27** generator
[0060] **30** battery
[0061] **32** capacitors
[0062] **40** printed circuit
[0063] **42** timekeeper logic unit
[0064] **44** power manager
[0065] **45** vibrator
[0066] **46** voltage multiplier
[0067] **48** controller
[0068] **49** step motors
[0069] **50** face
[0070] **51** function indicator
[0071] **52** energy reserve indicator
[0072] **53** visual alert
[0073] **54** center hands
[0074] **55** small hand
[0075] **60** glass
[0076] **68** wireless interface
[0077] **90** mobile telephone
[0078] **99** Internet

1. A wristwatch, comprising a mechanical energy harvester device, set to transform mechanical energy deriving from the movements of a wearer to electrical energy, a controller in communication with an external device or with Internet through a wireless interface of the watch.

2. The wristwatch of claim **1**, comprising a logic unit set to control a display of the time, a power manager for storing the electrical energy in a battery and/or in a capacitor, and to supply the logic unit, the controller and the wireless interface with energy stored in the battery and/or in the capacitor.

3. The wristwatch of claim **1**, comprising one or more sensors supplied in energy by the power manager, the sensors comprising one or more among: physical activity sensor, accelerometer, receiver for satellite geopositioning, heart rate monitor.

4. The wristwatch of claim **1**, in which the mechanical energy harvester module includes an oscillating weight and/or a crown, and/or a bezel, driving a generator.

5. The wristwatch of claim **1**, comprising a display component, controllable by the controller, for providing a biofeedback indication corresponding to a physical activity accumulated in a determined time interval.

6. The wristwatch of claim **1**, comprising a display component, controllable by the controller, for providing an energy reserve indication.

7. The wristwatch of claim **1**, comprising a display component, controllable by the controller, for providing the wearer with a notification triggered by Internet events.

8. The wristwatch of claim **1**, in which the time display is analog.

9. The wristwatch of claim **1**, said controller being programmed to have several functioning modes having different energy consumptions, and to select automatically a lower consumption functioning mode according to the state of

charge of the battery and/or the capacitors, and the electric power supplied by the energy harvester system.

10. The wristwatch of claim **1**, having a low consumption functioning mode with timekeeping function in which the logic unit is active, while the controller, the sensors and the wireless interface are deactivated.

11. The wristwatch of claim **10**, in which an analog display of the time is stopped when the watch is immobile and in the low consumption functioning mode and started again when the watch is moving.

12. The wristwatch of claim **11**, comprising a battery and/or a capacitor dimensioned to ensure an autonomy longer than 100 days in the low consumption mode, the autonomy corresponding to the maximum time during which, starting from a full state of charge of the battery, the watch can keep time without being worn.

13. The wristwatch of claim **3**, the watch being set to transmit information obtained from the sensors to an electronic device connectable to the wireless interface of the watch; the information received by the sensors can comprise, among others, one or more among: physical activity of the wearer of the watch, geographical position, heart rate or vascular rhythm.

14. The wristwatch of claim **13** combined with a device connectable to the wireless interface of the watch, in particular a telephone, the device being programmed to display the information obtained, for example in the form of an activity indicator, or a biofeedback indication corresponding to a physical activity accumulated in a determined time interval.

* * * * *

专利名称(译)	已连接，机械上弦手表		
公开(公告)号	US20200026244A1	公开(公告)日	2020-01-23
申请号	US16/510425	申请日	2019-07-12
[标]发明人	GUHL HARRY BUCHMANN ADRIAN		
发明人	GUHL, HARRY BUCHMANN, ADRIAN		
IPC分类号	G04G19/00 H04W4/38 G04G21/02 G04G21/04 G04G9/00 G04C10/04 A61B5/11 A61B5/0205 A61B5/00		
CPC分类号	A61B5/681 G04G9/007 H02K35/00 G04G19/00 G04G21/025 H04W4/38 A61B5/0205 G04G21/04 A61B5/486 A61B5/1112 A61B5/1118 A61B2562/0219 A61B5/024 G04C10/04 G04G19/02 G06F1/3212 G04C10/00 G04G19/10		
优先权	00895 2018-07-20 CH		
外部链接	Espacenet USPTO		

摘要(译)

一种电子表，包括与外部设备90或与Internet通讯的计时器逻辑单元42和控制器48，计时器逻辑单元42用于控制时间的显示50,54 。 99通过手表的无线接口68和机械能收集器系统25进行设置，以将由佩戴者的运动产生的机械能转换为电能，用于 将电能存储在电池30和/或电容器32中，并为逻辑单元42，控制器48和无线接口68供电 ））的能量存储在电池（30）和/或电容器（32）中。