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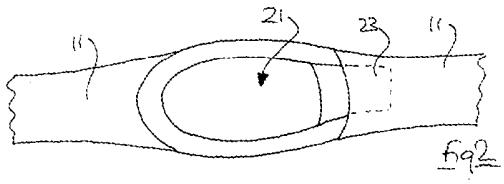
(56) Documents Cited:
**EP 2116181 A2** **WO 2009/033034 A1**
**WO 2008/073140 A2** **DE 202004012072 U1**

(58) Field of Search:
INT CL **A61F, G06F**
Other: **Online: WPI, EPODOC**

(54) Title of the Invention: **Physiological monitor**
Abstract Title: **Physiological monitor**

(57) A physiological monitor 21 is detachably attached to a strap 11. The monitor incorporates non-volatile memory for recording a physiological parameter and a USB connector (22, Fig 4) to allow direct coupling to a computer or the like. The USB connector may be aligned in the circumferential direction. The strap may include a pocket 23 to protect the USB connector whilst attached thereto. The USB connector may be retractable. A sensor for sensing the physiological parameter may be incorporated in the device. A source of power may be incorporated in the device which may be contained within an opening which is covered by a strap when in use. The device may include a latch which is engageable with the strap, the latch including a projection extending orthogonally to the USB connector. The projection may be adapted for snap fitting in a corresponding aperture of the strap. The device may include a front facing on/off switch which is operable by successive push. The device may include a wireless transmission and receiving means for communication between a sensor and the device. The strap may comprise two parts connectable together at respective ends and connected at opposite respective ends to the device.

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

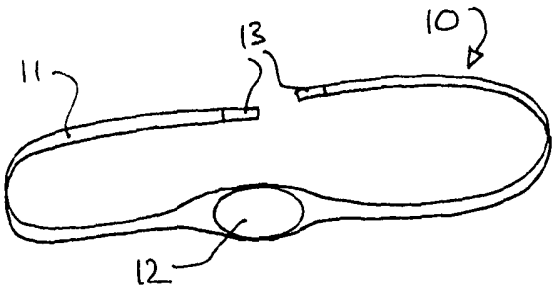



fig1

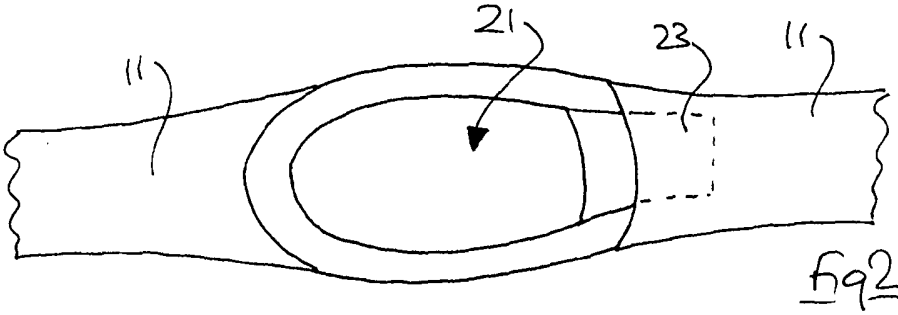



fig2

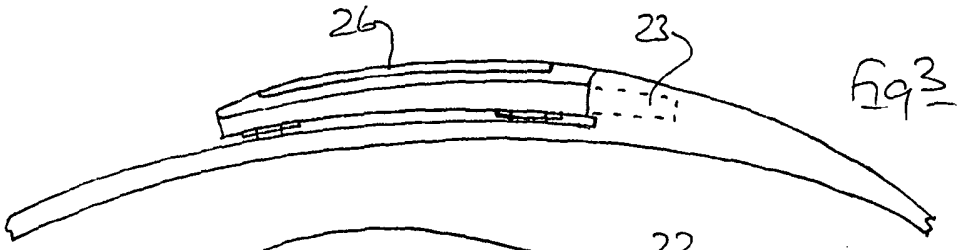



fig3

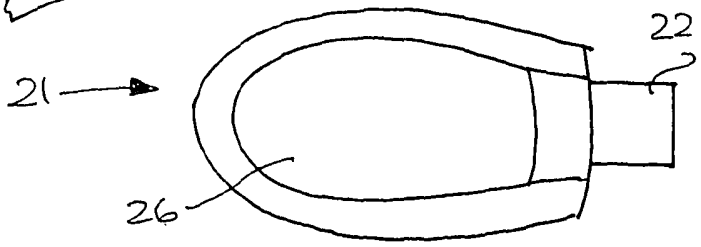



fig4

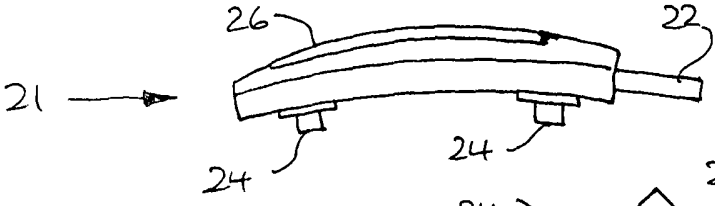



fig5

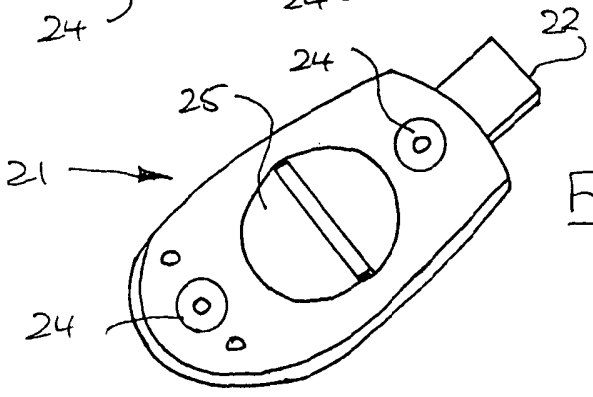



fig6

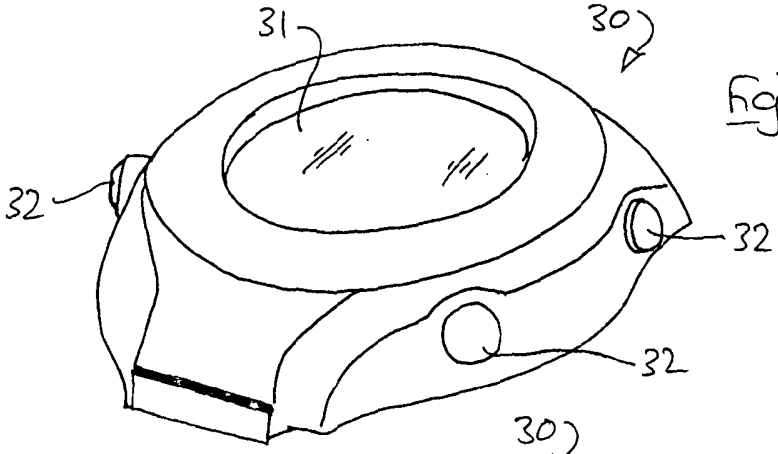



Fig 7

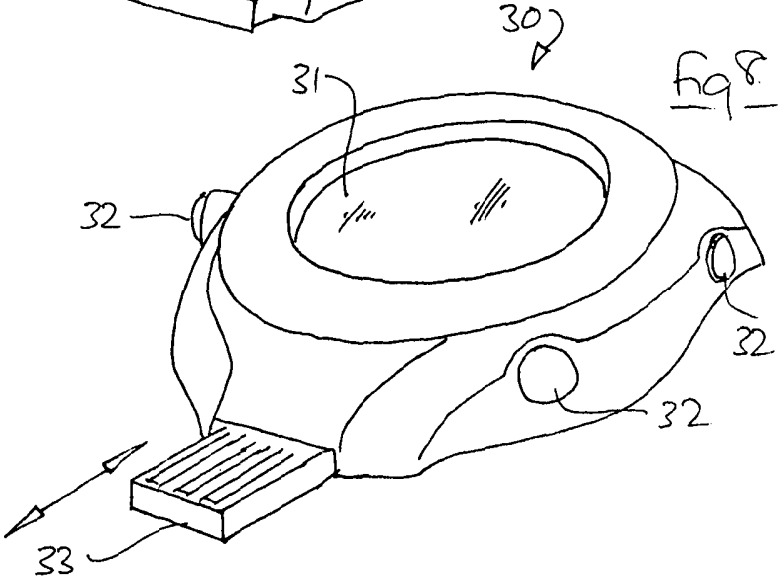



Fig 8

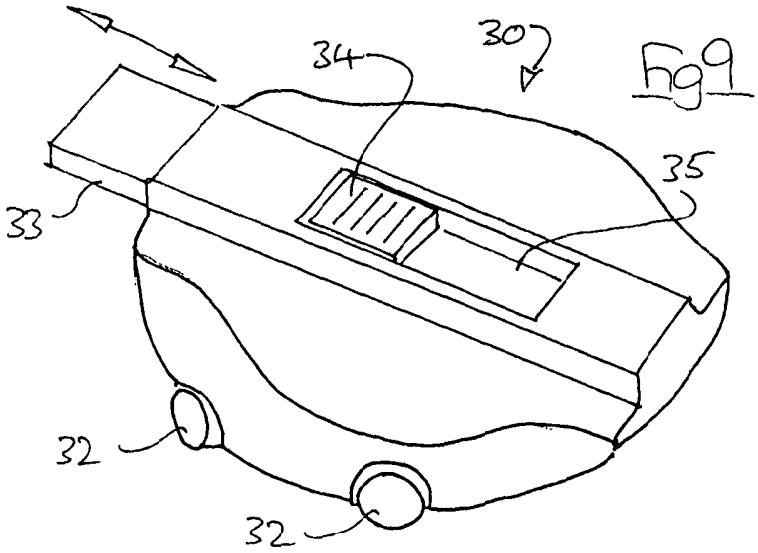



Fig 9

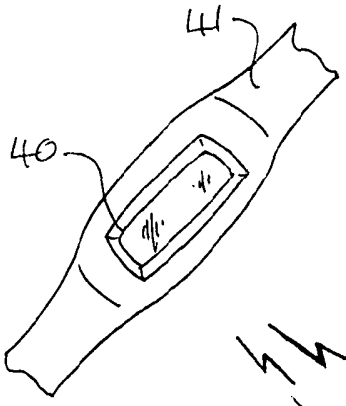
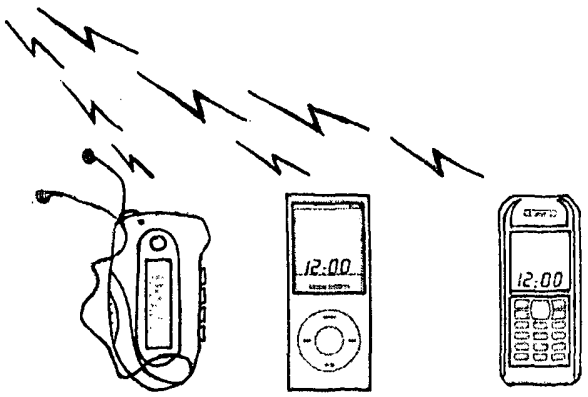
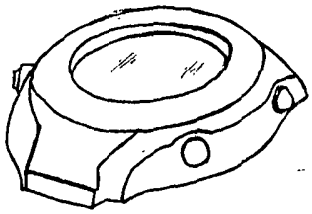



Fig 10



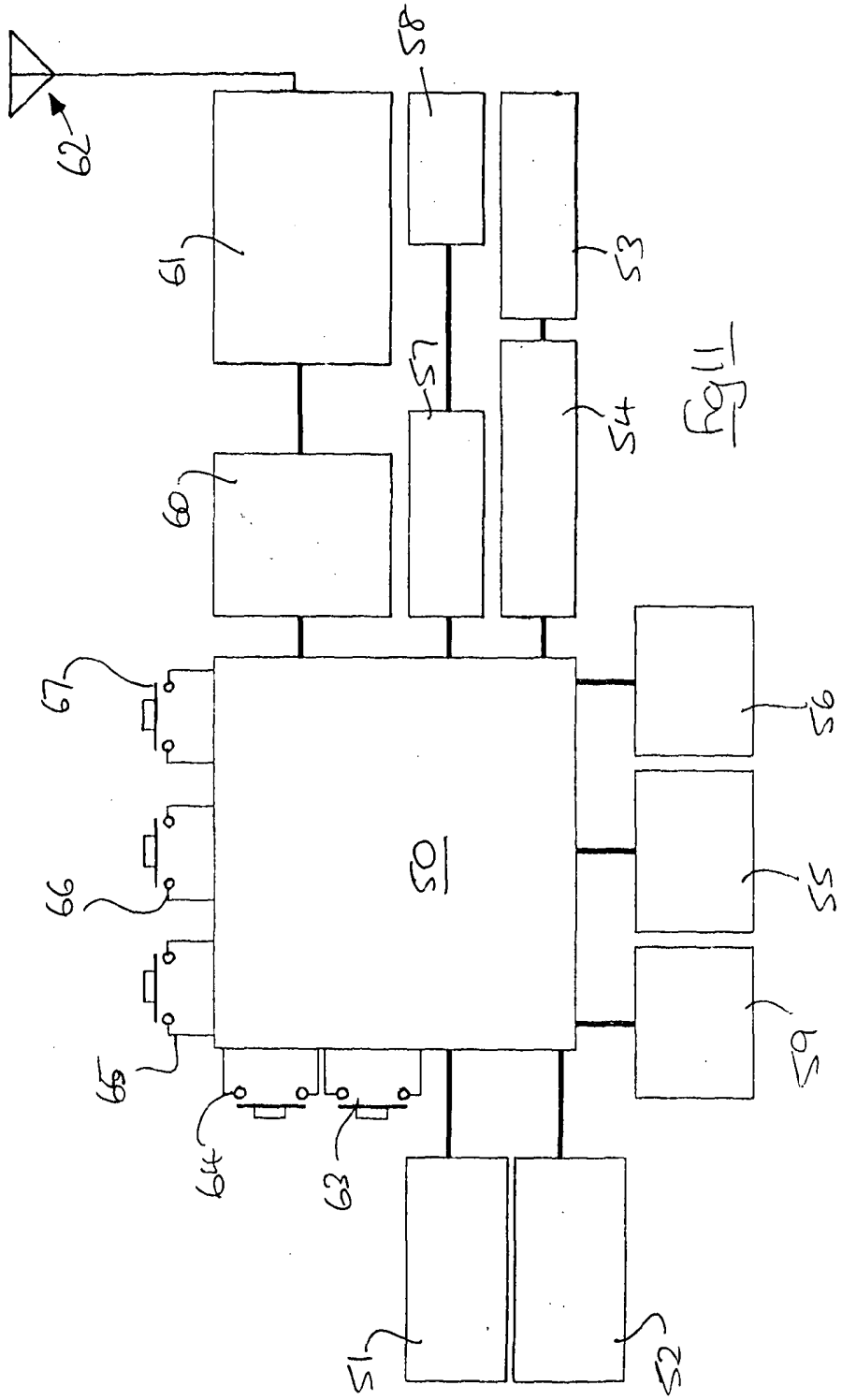



Fig 11

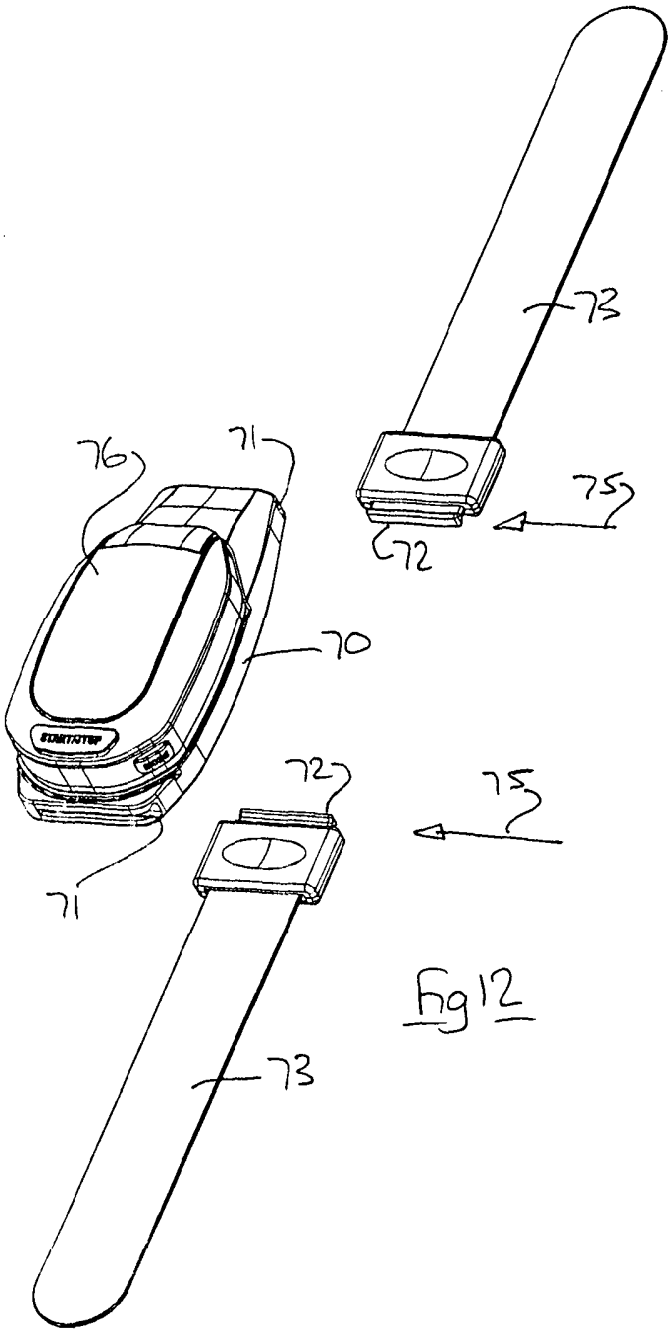



Fig 12

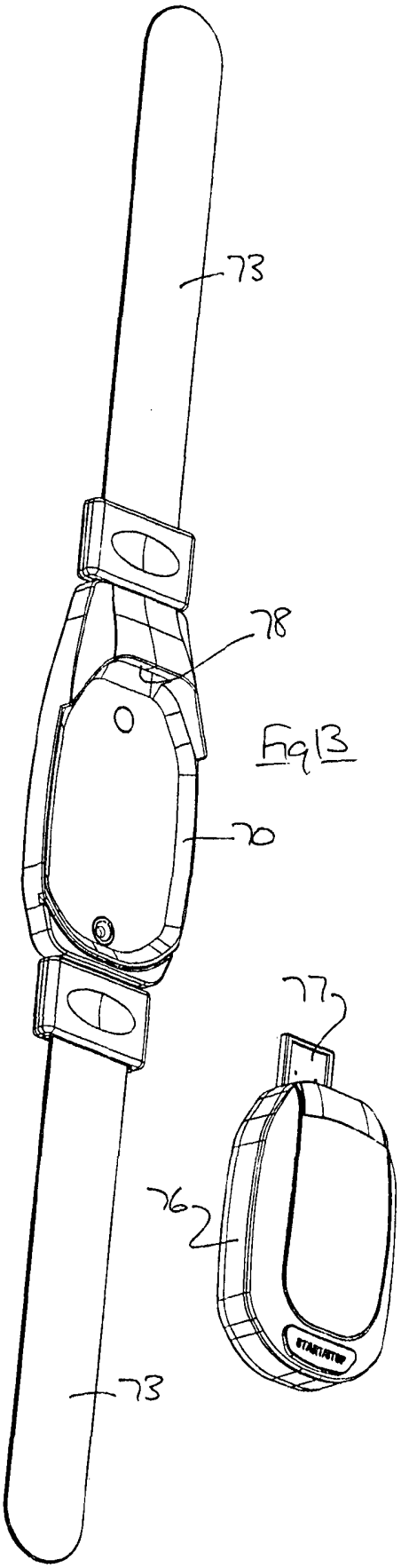



Fig 13

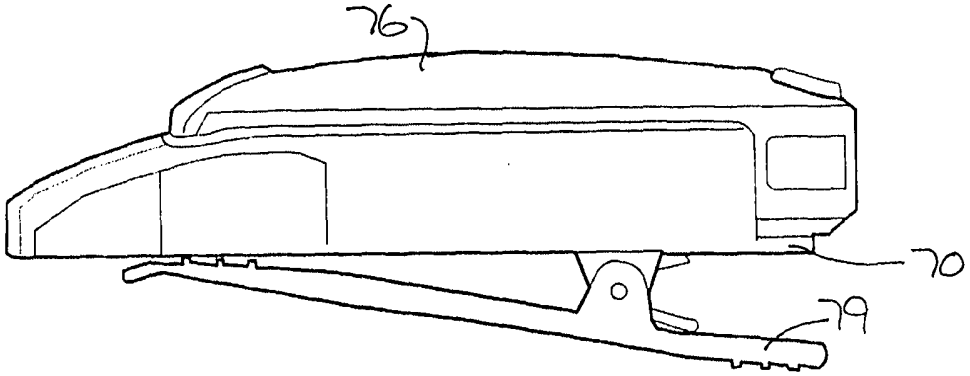



Fig14

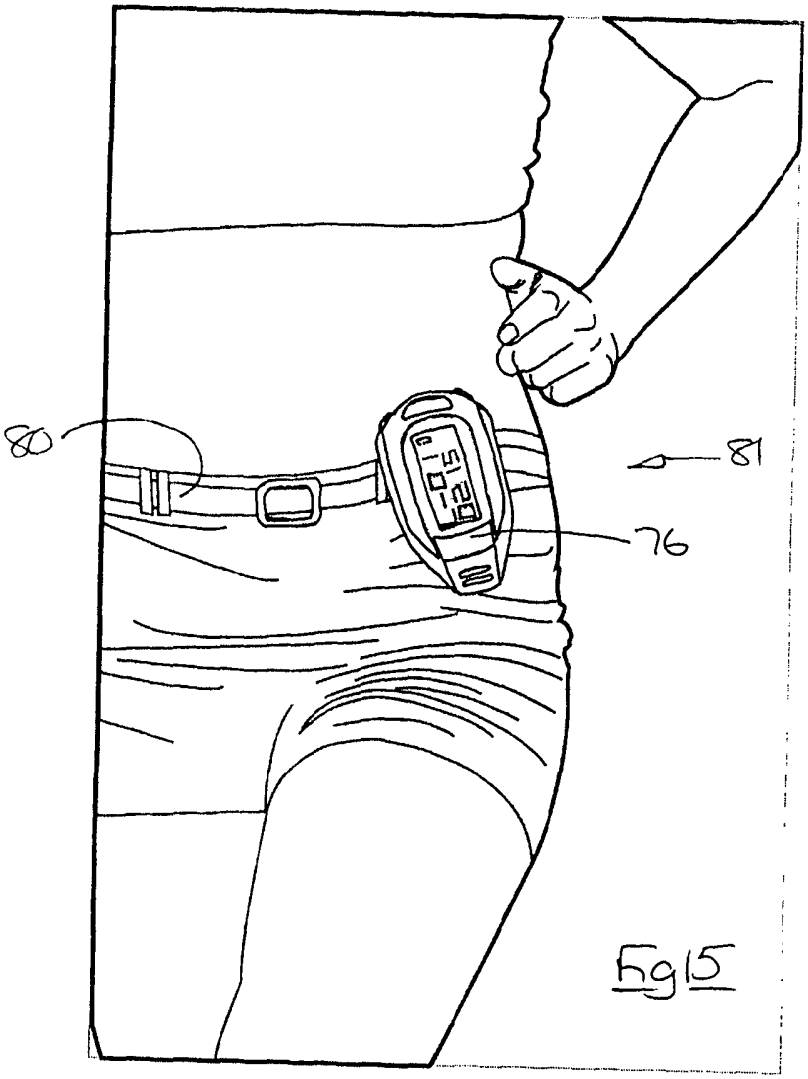



Fig15

# Physiological Monitor

This invention relates to a physiological monitor, and particularly to a monitor for incorporation in a chest or wrist strap, watch or gadget. The monitor may for example record heart rate, speed and distance.

Conventional heart rate monitors usually comprise a chest strap to sense successive heart beats, and a watch-like display device or gadget for showing visually the current rate of heart beat. Communication between the belt and display device or gadget is usually by a suitable wireless transmission, for example by radio frequency signal. A hard-wired connection is also possible, but generally undesirable because it is an impediment to free movement of the user. The display device or gadget is typically adapted for wrist mounting or for mounting on a handlebar of a bicycle or exercise machine.

Typically such a strap type monitor is a real time device, so that if used during exercise, the wearer can immediately respond to keep heart rate at a desired level. If the monitor is used in healthcare, for example in a hospital, the output may be associated with an alarm and responsive to heart rate below a desired level.

Particularly for athletes and others taking voluntary exercise it would be useful to incorporate within the strap a non-volatile memory capable of recording data during an exercise session. Such data may be useful to a trainer or to others interested in physiological effects. Clearly such data may be useful in a hospital environment.

By incorporating a memory within the strap, a lead is not required for connection to an external memory device. Such leads are especially inconvenient during physical exercise. Nevertheless downloading of memory contents would generally require a lead to connect the strap to, for example, a computer for display and analysis. Such leads are easily mislaid or damaged, and generally inconvenient.

According to a first aspect of the present invention there is provided a strap having a sensor for measuring a physiological parameter, and a device incorporating a non-volatile memory for recording said parameter, said device being detachable and having a USB connector for output of data from said memory. The sensor may be incorporated within the device.

By making the device detachable, it can easily be plugged into a socket of a computer or other device. This overcomes the difficultly of manipulating a chest or wrist strap with integral device so that the device can be reliably connected for downloading data without a connecting lead.

Furthermore by making the device detachable, the orientation of the USB connector is selectable, whereas with an integral device a USB connector must always point outwardly so that it can freely be plugged into a computer; such a protruding connector may cause injury or be susceptible of damage.

According to a preferred embodiment the USB connector is aligned in the circumferential direction of the strap so as to be substantially flat. Preferably the USB connector is housed in use within a pocket of the chest or wrist strap, watch or gadget, so as to be protected, and to be invisible in use.

In the alternative, the USB connector may be retractable so as to be protected in use from damage yet be moved to an extended condition for connection to another device.

In the preferred embodiment the retractable USB connector is movable along a single axis, and is preferably latchable in the withdrawn and extended conditions. Preferably the USB connector is fully within the device when in the withdrawn condition.

The USB connector may comprise a thumb slider located within a guide channel of the underside of the device.

Suitable snap-fitting or hook like retention protrusions may be provided on the device for location in corresponding apertures of the strap.

According to a second aspect of the invention there is provided a memory device for detachable fixing to a wrist or chest strap, watch or gadget and having a USB connector for output of data from said memory. Preferably said USB connector is retractable, and most preferably is fully retractable.

Other features of the invention will be apparent from the following description of a preferred embodiment, illustrated with reference to the following drawings, in which:-

Fig. 1 is an illustrative view of a chest strap assembly according to the invention;

Fig. 2 is a plan view of the device of the invention on a chest strap;

Fig. 3 is a side elevation corresponding to Fig. 2;

Fig. 4 is a plan view of the device of the present invention when detached from a chest strap;

Fig. 5 is a side elevation of Fig. 4; and

Fig. 6 is a view of the underside of the device of Fig. 4.

Fig. 7 is a top perspective view of an alternative device.

Fig. 8 is a top perspective view of an alternative device showing the USB connector in an advanced condition.

Fig. 9 corresponds to Fig. 8, and illustrates the device from the underside.

Fig. 10 illustrates a system of audible reports.

Fig. 11 shows a circuit diagram of the invention.

Fig. 12 illustrates a holder for a device of the invention with attached device.

Fig. 13 corresponds to Fig. 12 and shows the device detached.

Fig. 14 illustrates a device holder and optional clip; and

Fig. 15 shows the device of Fig. 14 attached to the belt of a runner.

With reference to the drawings, Fig. 1 illustrates a schematic chest strap assembly 10 having a strap 11 to which is attached a sensor 12 for measuring a physiological parameter such as

heart rate, speed and distance. The strap includes a releasable fastener 13 comprising for example a hook and loop fabric such as VELCRO™.

In use the strap is fixed around the chest of person for whom monitoring is desired, such as a hospital patient or an athlete; such chest strap assemblies are well known and need not be further described here.

The invention comprises a removable device 21 having an integral USB connector 22 for coupling to the USB port of a computer (not shown).

The device 21 incorporates the sensor and a non-volatile memory so that one or physiological parameters can be recorded over time. Typically the parameter(s) may also be displayed in real time, for example on a watch or on a monitor or a small gadget. Wireless transmission is desirable.

The USB connector 22 is aligned with the circumferential direction of the strap 11 and lies generally flat against a surface thereof so as to be protected from contact damage and to prevent the connector itself causing damage to the wearer. Such damage could occur if the connector 21 was arranged to protrude from the strap 11.

In the preferred embodiment illustrated, the strap is provided with a pocket 23 in which the connector is placed when attached to the strap. Such a pocket further protects the connector against damage, and also ensures against foreign bodies blocking the aperture thereof. Typically the strap, at least in the region of the device 21, comprises a plastics moulding, for example of a relatively soft pliable material suitable for lying against human skin.

The underside of the device includes protruding buttons 24 which may comprise latches engageable within the strap 11. The buttons may also comprise electrical contacts for recording the physiological parameter(s).

Fig. 6 illustrates a removable battery cover 25 for a watch type battery, so that the device can be self powered. The cover is on the underside so as to be covered by the strap 11 and thus retained against accidental release.

A face 26 of the device may comprise a display indicative for example of mode of operation, and may also comprise a push on/off switch.

The features which may be incorporated in the device are:

1. Time and Date: - Time displays as hour, minute and second. It may have 12/24 hour formats. Date displays as day, month and year.

2. Daily Alarm: - It will ring if reaching the set alarm time.

3. Chronograph: - stopwatch with 1/100 second recording.

4. PC Link Upload & Download: - USB Link for uploading and downloading information to a computer.

5. Key Tone: - a sound when a key is pressed.

6. Alert Alarm for Target Zone: - an alert alarm when recorded parameter is above or below a pre-set target zone.

7. Memory: - records to show all the data which has been recorded.

8. Total Step, Calories and Fat Burn: -
   - Total step: How many steps walked.
   - Total calories: How many calories burnt.
   - Total fat burn - Fat burnt during an exercise session.

9. Target Step, Calories & Fat Burn: - A target for calories and fat burn with an alarm once the target is reached.

10. Total Exercise Time.

11. Current Heart Rate: - current (instant) heart rate data.

12. Maximum, Minimum & Average Heart Rate: - a selectable report of exercise.

13. BMI Data: - Body mass index data.

14. Speed and Distance: - shows average or maximum speed and distance for an exercise period.

15. Data Viewing with a Wrist Monitor: - Data or a report can be transmitted and read on a watch-like or gadget device.

These features may be adjusted by inserting the device into the USB port of a computer, thus avoiding complex setting routines requiring multiple depressions of buttons on the device. Mode setting may be automatic, or triggered by a wrist mounted device or directly selected by one or more push buttons of the device.

Figs. 7-9 show a watch type device 30 for mounting on a wrist strap, and having a display 31 for visually indicating selected parameters.

The device includes the usual buttons 32 to select functions, and includes suitable snap or hook fitting protrusions (not shown) to permit secure attachment to a wrist strap.

A USB connector 33 is movable from a retracted condition (illustrated in Fig. 7) to an extended condition (illustrated in Figs. 8 and 9) in which connection to the USB port of another device is enabled.

In this embodiment the USB connector 33 forms part of a thumb slider 34 mounted in a track 35 in the underside of the device, as illustrated in Fig. 9.

It will be noted that the retractable USB connector may also be provided in the chest strap embodiment of Figs. 2-6, in which case a protective pocket is not required. Furthermore a display may not be required in a chest mounted device.

It will further be understood that the device 30 may or may not include a sensor for measuring a physiological parameter, and may not include a display. Typically four possibilities of wrist mounted device 30 are envisaged, namely a memory device having retractable USB connector, the same memory device having a display, and/or the same memory device having a sensor for measuring a physiological parameter.

For a chest mounted device, a fixed USB connector and pocket is more practicable, because of the reduced radius of curvature as compared with a wrist. Nevertheless a retractable USB connector is a practicable alternative for the device 21.

The device of the invention may further include a wireless transmitter for transmitting signals to another electronic device incorporating an FM radio. Such an arrangement permits sensed data to be made audible in real time.

Thus a chest mounted device may transmit signals wirelessly to a radio incorporated in a wrist mounted device, or in a portable FM radio, an MP3 player incorporating an FM radio, or a cell phone incorporating an FM radio. A wrist mounted display device may relay wireless signals from a chest mounted device to a radio. In the alternative a wrist mounted sensor device may communicate directly with the radio.

Fig. 10 illustrates schematically a device 40 mounted on a strap 41 for transmitting wireless FM signals to one of an FM radio 42, an MP3 player 43, a cell phone 44, or a watch device 30.

Any strap-mountable device described in relation to this invention may include a digital display chronograph, particularly the wrist mounted device of Figs. 7-9.

Fig. 11 illustrates a circuit diagram suitable for a device of the invention, incorporating sensor inputs and FM output.

A 4-bit electronic control unit 50 is driven by a lithium iron coin cell 51 - typically type CR2032. A heart rate detection circuit 52 is connected to a suitable input sensor. A 3 axis accelerometer 53 has a driver circuit 54, and can be used to detect pacing.

The control unit 50 has a liquid crystal display 55, a vibrator 56 for signalling, and a USB controller 57 with USB socket 58. An electronic programmable read only memory 59 provides reference information to the 4-bit processor.

Voice signal output is via a selectable seven language voice chip 60, and an FM transmitter 61 with aerial 62; the transmitter typically operates in the range 76-108 MHz.

The usual push control buttons are provided, namely frequency down 63, frequency up 64, talk select 65, mode select 66, and stop/start/reset 67.

Figs. 11 and 12 show a strap mounted display device holder 70 having hammer head slots 71 at either end to receive respective hammer head 72 end portions of respective strap ends 73. The strap ends 73 engage the device 70 by sliding perpendicularly to the extension thereof, in a direction 75. As illustrated the strap ends can engage from one side only, and may include a latch, such as a snap-fitting bulge. The hammer head form ensures engagement of the strap ends when under tension.

The length of the strap ends 73 is selected to suit e.g. a chest or wrist. The strap ends 73 and the holder 70 together define a strap, the free ends of which are secured in any suitable fashion, for example by the use of a hook/loop fastener.

Mounted to the holder 70 is a detachable device 76 having a protruding USB connector 77. A pocket 78 of the holder 70 protects the USB connector when attached to the holder.

As illustrated in Figs. 14-15, the device holder 70 may further include a spring-closed clip 79 for attachment to a conventional belt 80 of a runner 81, in a position that is comfortable and safe. The device 76 is itself attached to the holder, as previously described, and the corresponding USB connector is housed in a pocket, which is hidden from view in Fig. 14.

It will be understood that the embodiments of Figs. 12-15 may comprise a retractable USB connector.

## Claims

1. A device for human attachment, and having a sensor adapted to monitor a physiological parameter and a strap, said device incorporating a non-volatile memory for recording said parameter, said device being associated with said strap and being detachable, said device having a USB connector protruding therefrom for output of data from said memory.

2. An assembly according to claim 1, wherein said USB connector is aligned in the circumferential direction of said strap and substantially flat thereon.

3. An assembly accordingly to claim 1 or claim 2, wherein said strap comprises a pocket for housing said USB connector in use.

4. An assembly according to claim 1 or claim 2, wherein said USB connector is retractable.

5. An assembly according to any preceding claim, wherein said sensor is incorporated in said device.

6. An assembly according to any preceding claim and incorporating a source of power.

7. An assembly according to claim 5, wherein said source is contained within an opening of said device, said opening being covered by said strap in use.

8. An assembly according to any preceding claim, wherein said device includes a latch engageable with said strap, said latch including a projection extending orthogonally to said USB connector.

9. An assembly according to claim 8, wherein said projection is adapted for snap fitting in a corresponding aperture of said strap.

10. An assembly according to any preceding claim, wherein said device includes a front facing on/off switch operable by successive push.

11. An assembly according to any preceding claim, and further including wireless transmission and receiving means for communicating between said sensor and device.

12. An assembly according to any preceding claim, wherein said strap comprises two parts connectable together at respective ends, and connectable at the opposite respective ends to said device.

13. A strap assembly substantially as described herein with reference to the accompanying drawings.

| | | | |
|---|---|---|---|
| **Application No:** | GB0916755.2 | **Examiner:** | Mr Christopher Smith |
| **Claims searched:** | 1 - 13 | **Date of search:** | 12 January 2010 |

## Patents Act 1977: Search Report under Section 17

**Documents considered to be relevant:**

| Category | Relevant to claims | Identity of document and passage or figure of particular relevance |
|---|---|---|
| X | 1 - 4, 8 - 12 | WO 2009/033034 A1 (NIKE) See whole document |
| X | 1 - 4, 6, 7 & 10 | EP 2116181 A2 (WEINMANN) See whole document, especially Fig 4 |
| X | 1 - 6, 8 & 10 | DE202004012072 U1 (STAMM LOTHAR) See whole document, especially Figures 8 and 14 |
| X | 1 - 5, 6 & 10 | WO 2008/073140 A2 (EMPIRICAL TECHNOLOGIES CORP) See whole document, especially paragraph 006 and Fig 5 |

Categories:

| | | | |
|---|---|---|---|
| X | Document indicating lack of novelty or inventive step | A | Document indicating technological background and/or state of the art. |
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**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC$^{X}$ :

Worldwide search of patent documents classified in the following areas of the IPC

A61F; G06F

The following online and other databases have been used in the preparation of this search report

Online: WPI, EPODOC

**International Classification:**

| Subclass | Subgroup | Valid From |
|---|---|---|
| A61B | 0005/024 | 01/01/2006 |
| A61B | 0005/00 | 01/01/2006 |
| A61B | 0005/103 | 01/01/2006 |
| A63B | 0069/00 | 01/01/2006 |
| G06F | 0013/38 | 01/01/2006 |