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(54) **MONITORING AND ALERT SYSTEM AND METHOD FOR LATCHING MECHANISMS**

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(71) Applicant: **Lockliv Holdings Pty. Ltd.**, New South Wales (AU)

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(72) Inventors: **Richard Aplin**, Sydney (AU); **William Trieu**, Sydney, New South Wales (AU); **Matthew Redding**, Sydney, New South Wales (AU); **Lili Bykerk**, Sydney, New South Wales (AU); **Andrew Leary**, Sydney, New South Wales (AU)

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(57) **ABSTRACT**

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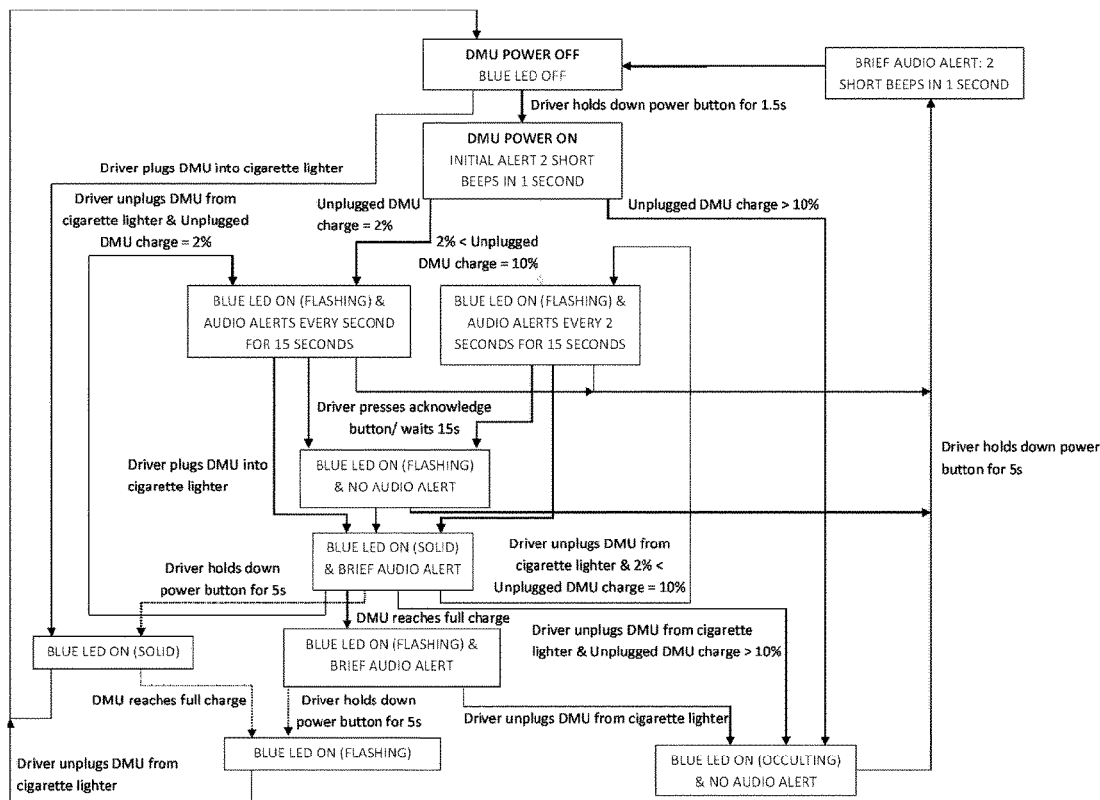
Publication Classification

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G07C 9/00 (2006.01)

A monitoring and alert system for retro-fitting to latching mechanisms. A master control unit is located proximate to an operator of the system. It includes a user interface having: an input enabling an operator to arm the system and then allow it to operate with minimal interaction of the operator. It also includes an output alerting the operator as to the status of the system in relation to a plurality of prescribed conditions. One or more slave units having sensing units detecting a latched and unlatched state are attached to a discrete latching mechanism for detecting the latching status thereof. Each slave unit comprises sensing means to detect whether the latching mechanism is in a latched state or an unlatched state.



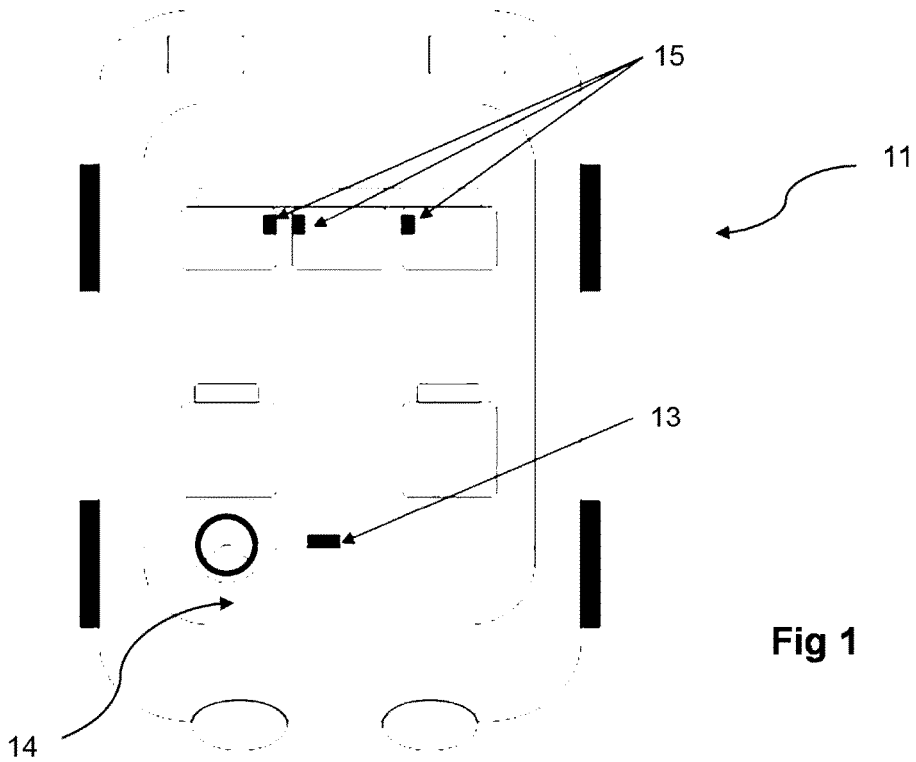


Fig 1

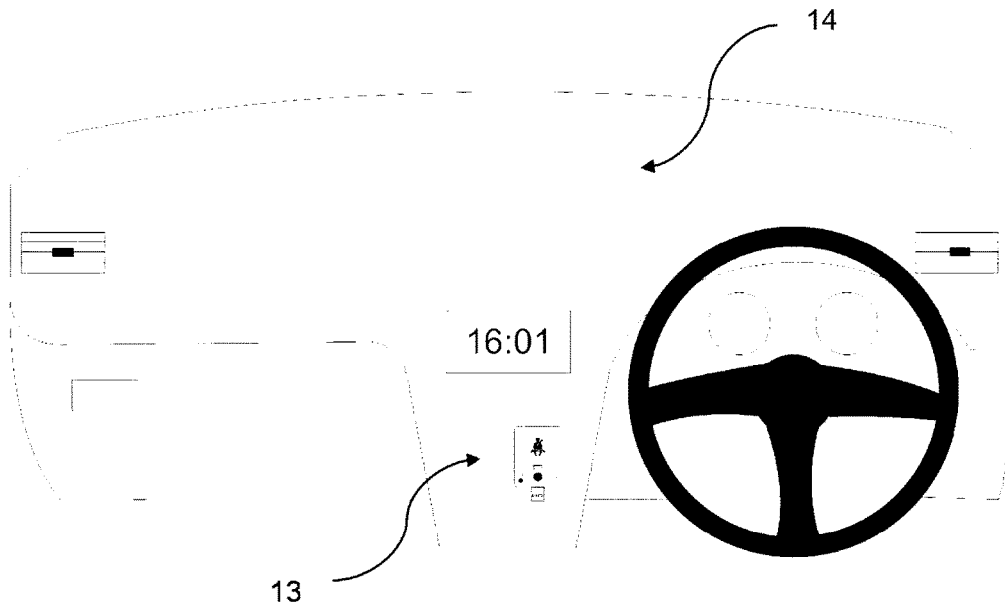


Fig 2

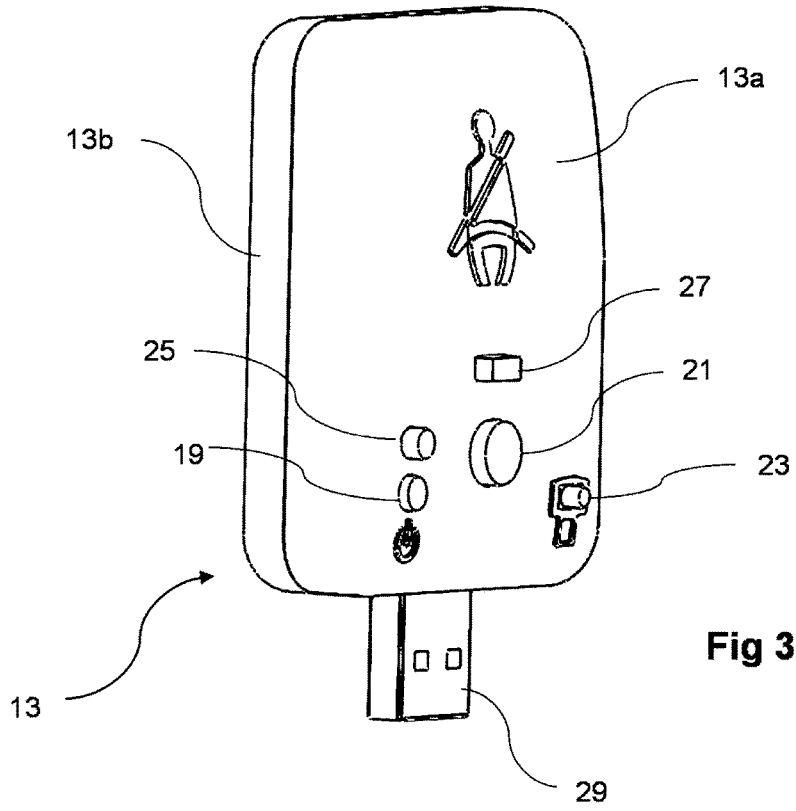


Fig 3

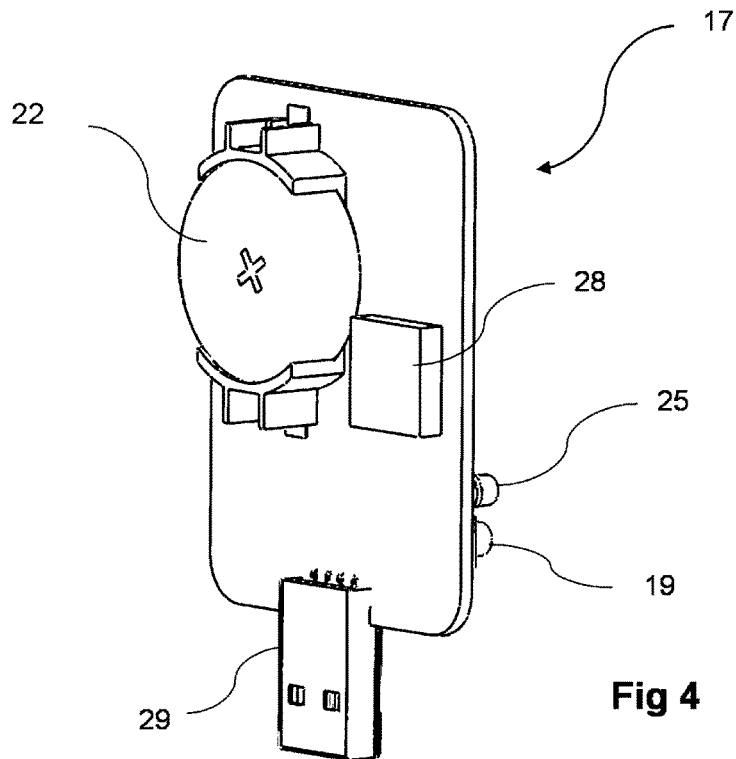
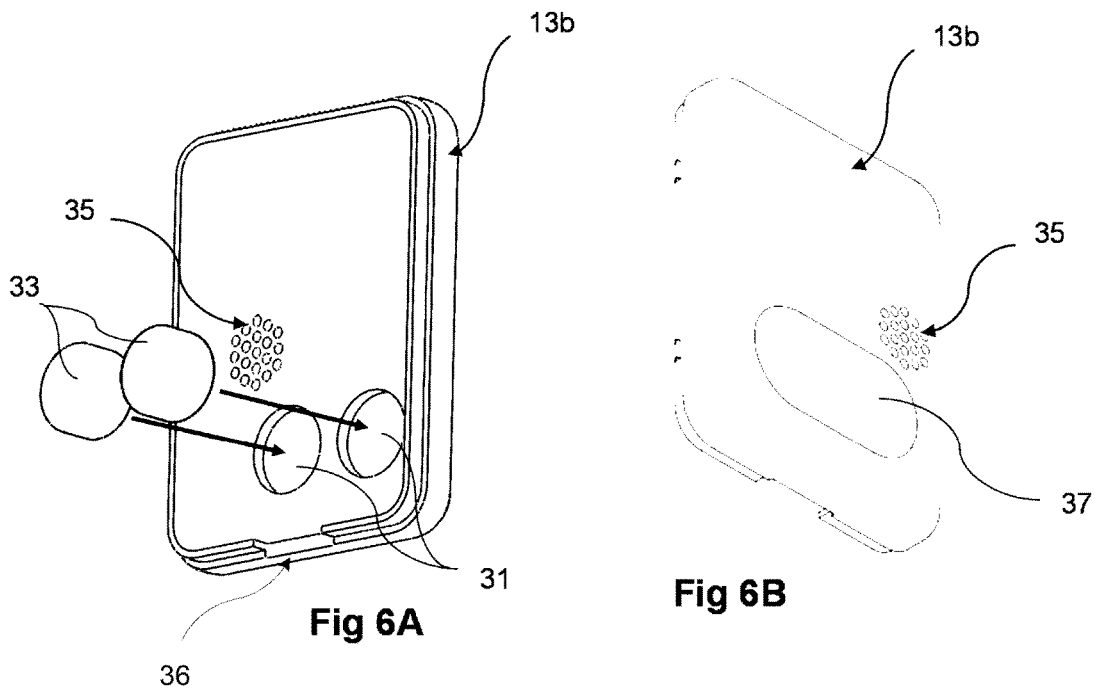
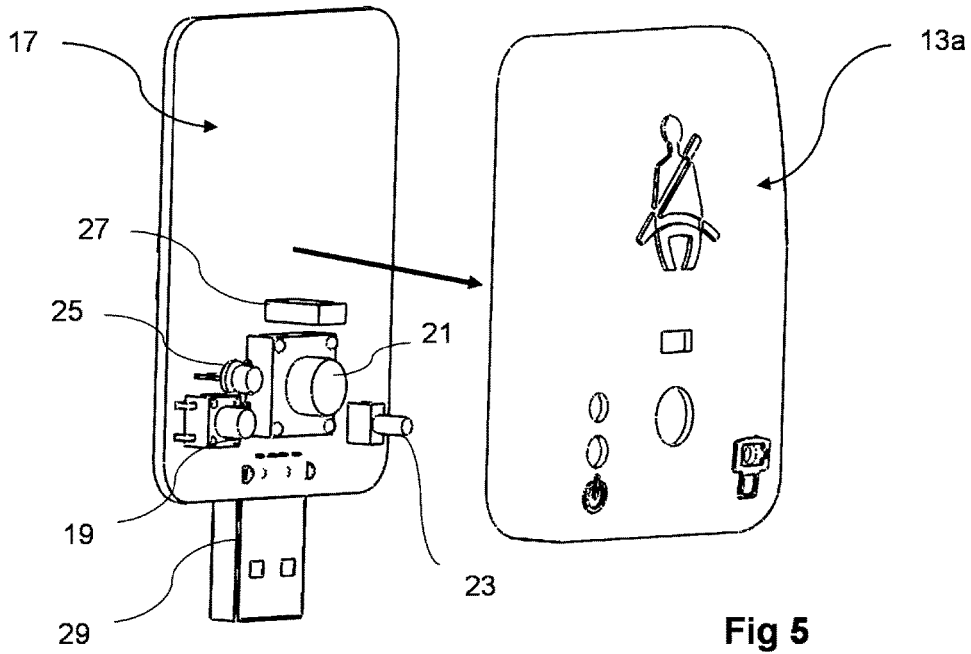


Fig 4



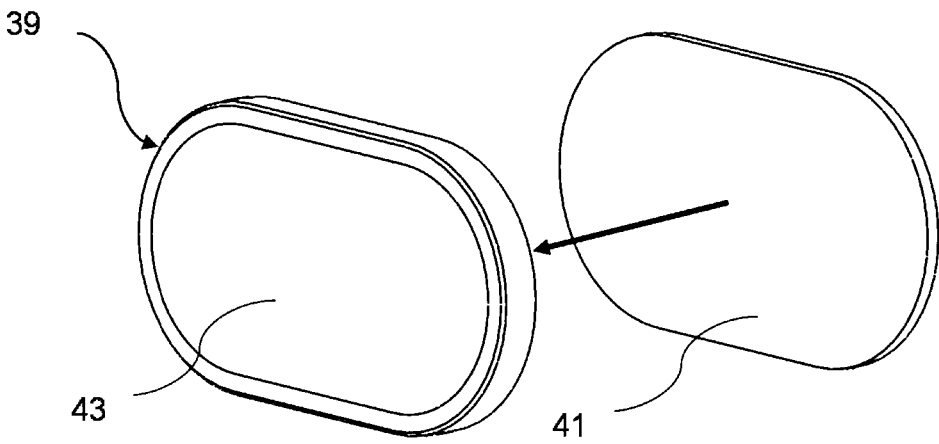
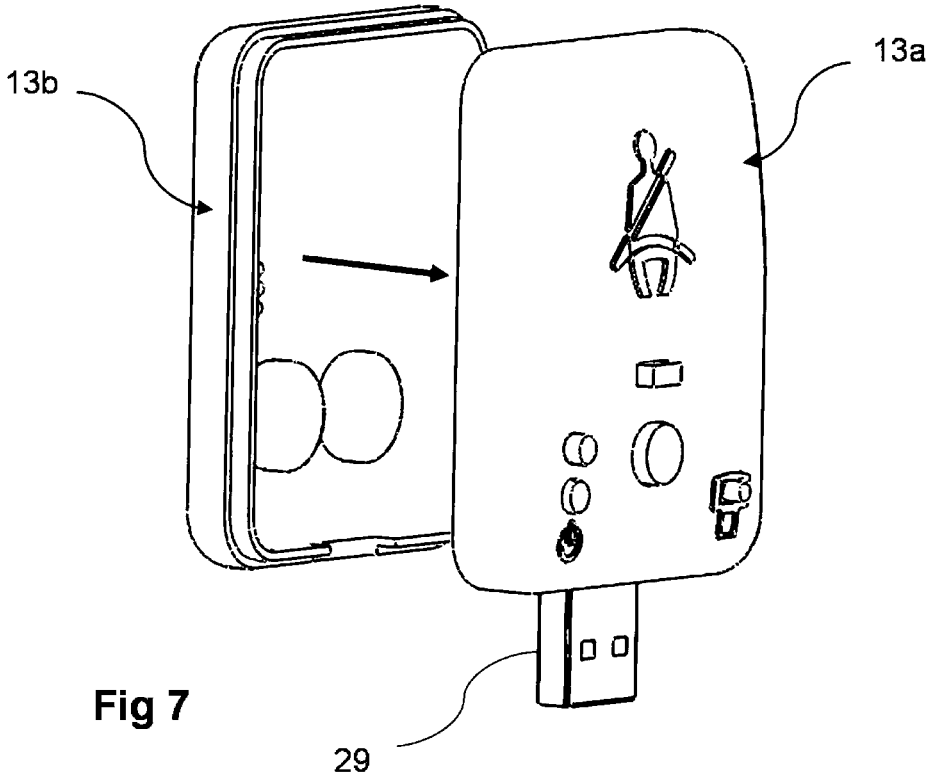


Fig 8

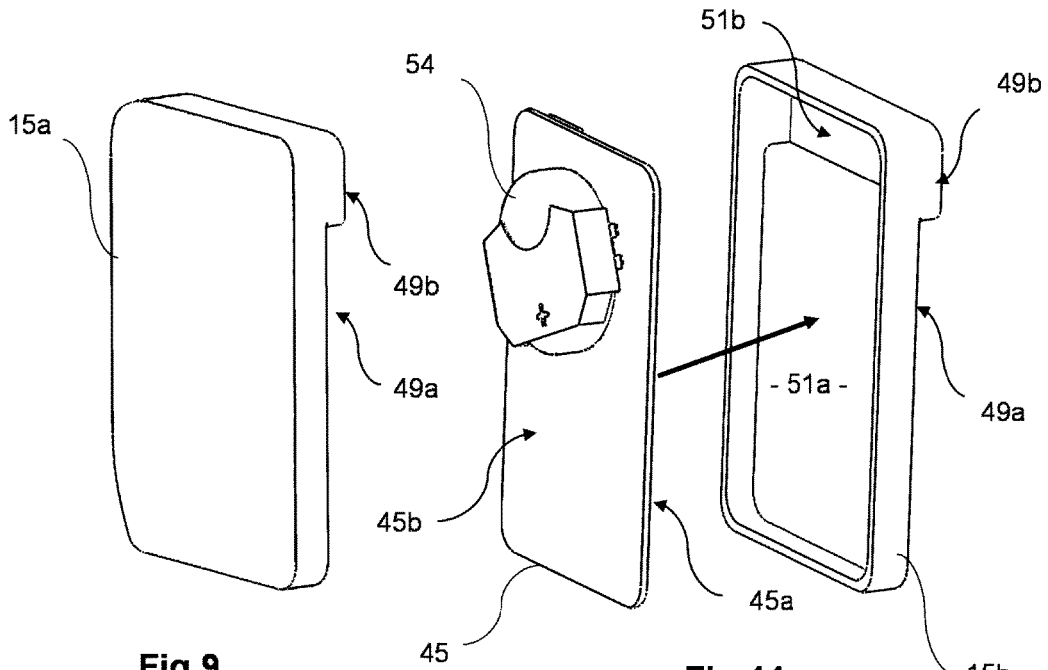


Fig 9

Fig 11

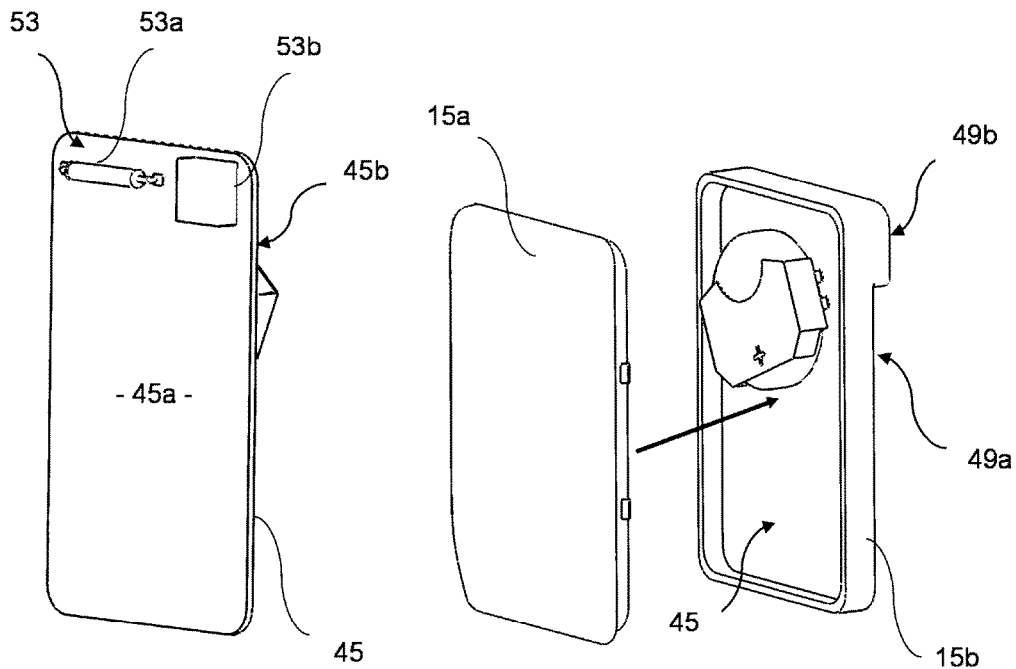
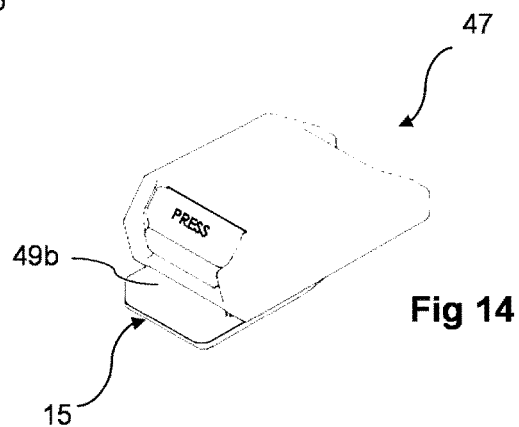
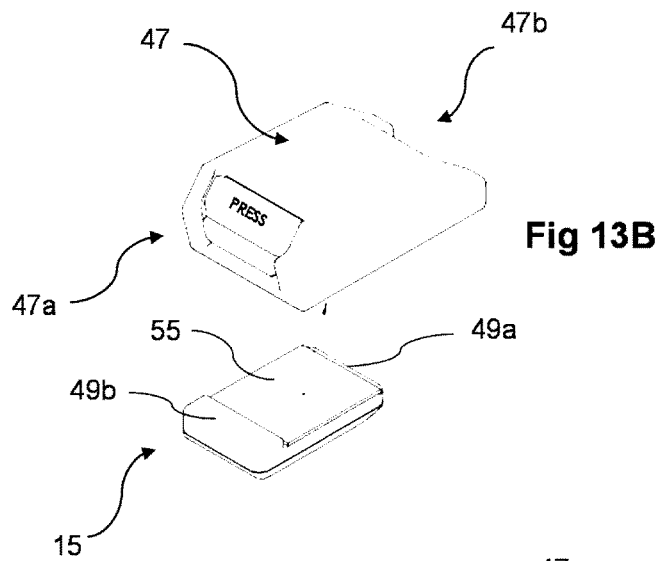
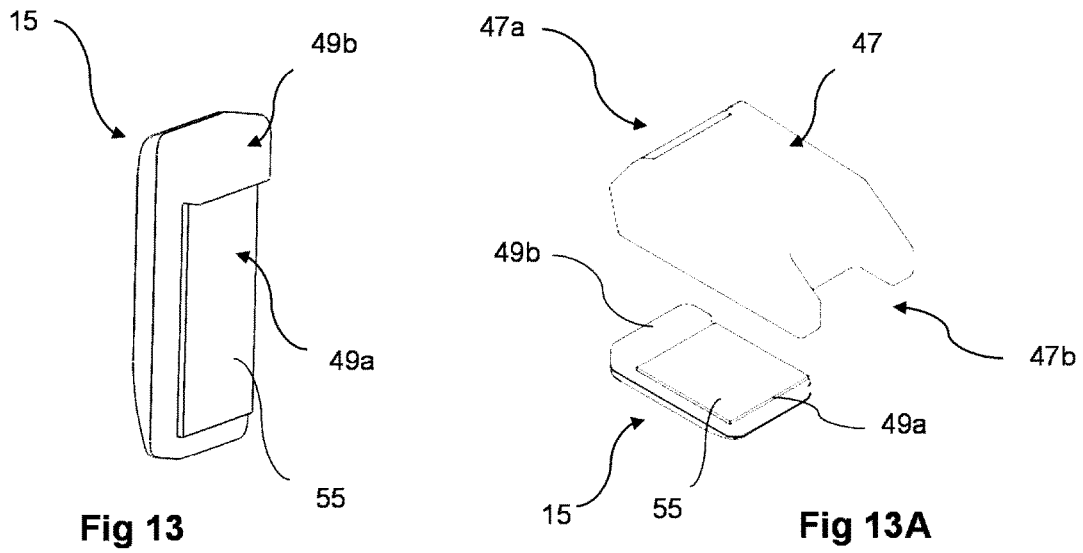


Fig 10

Fig 12



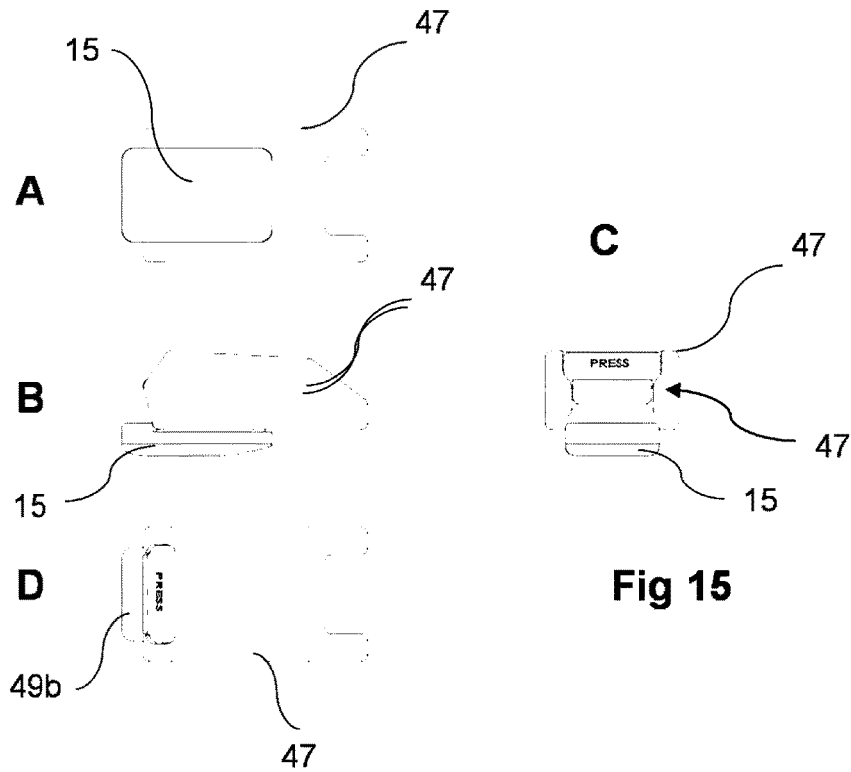


Fig 15

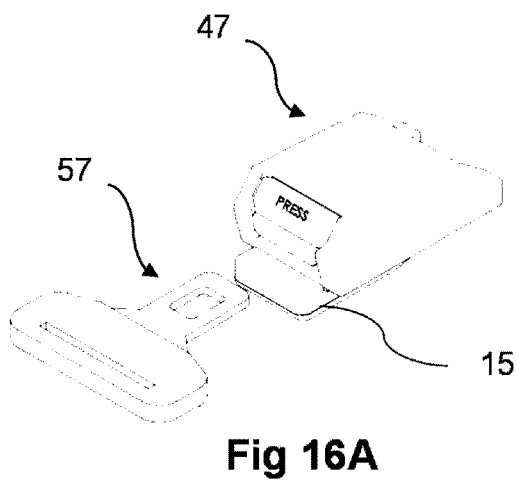


Fig 16A

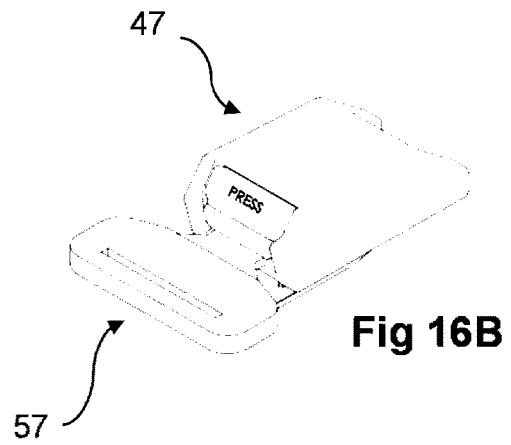


Fig 16B

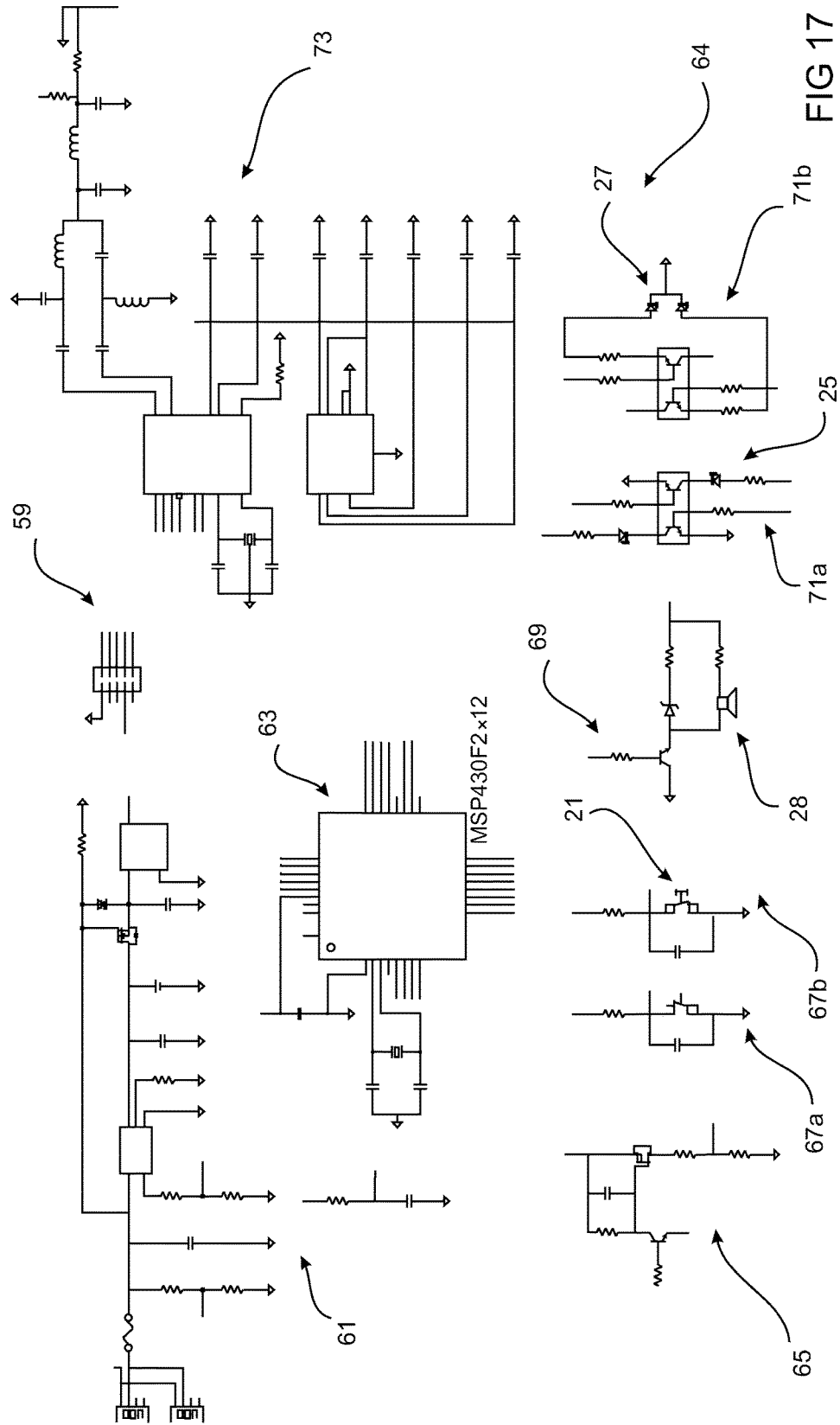


FIG 17

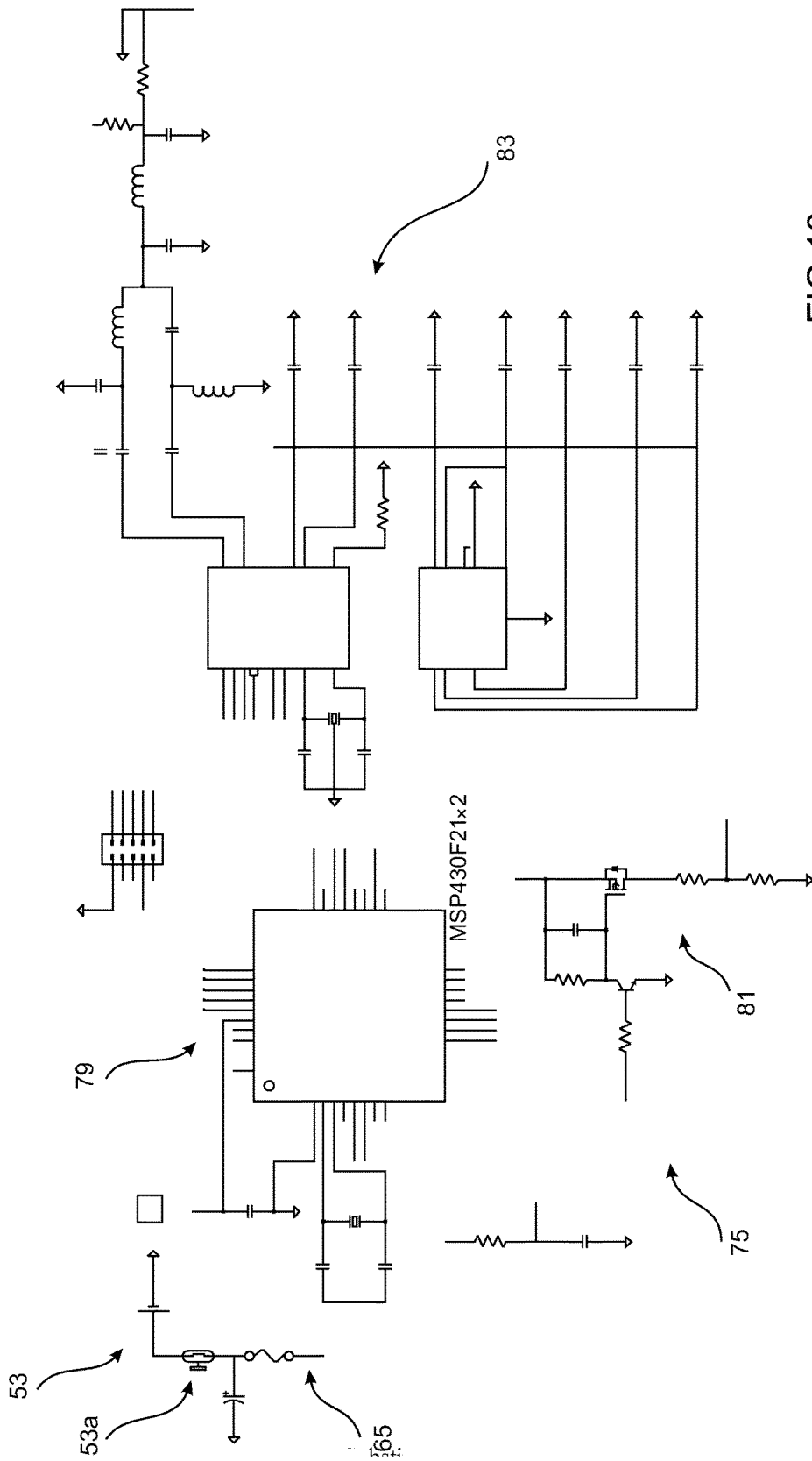


FIG 18

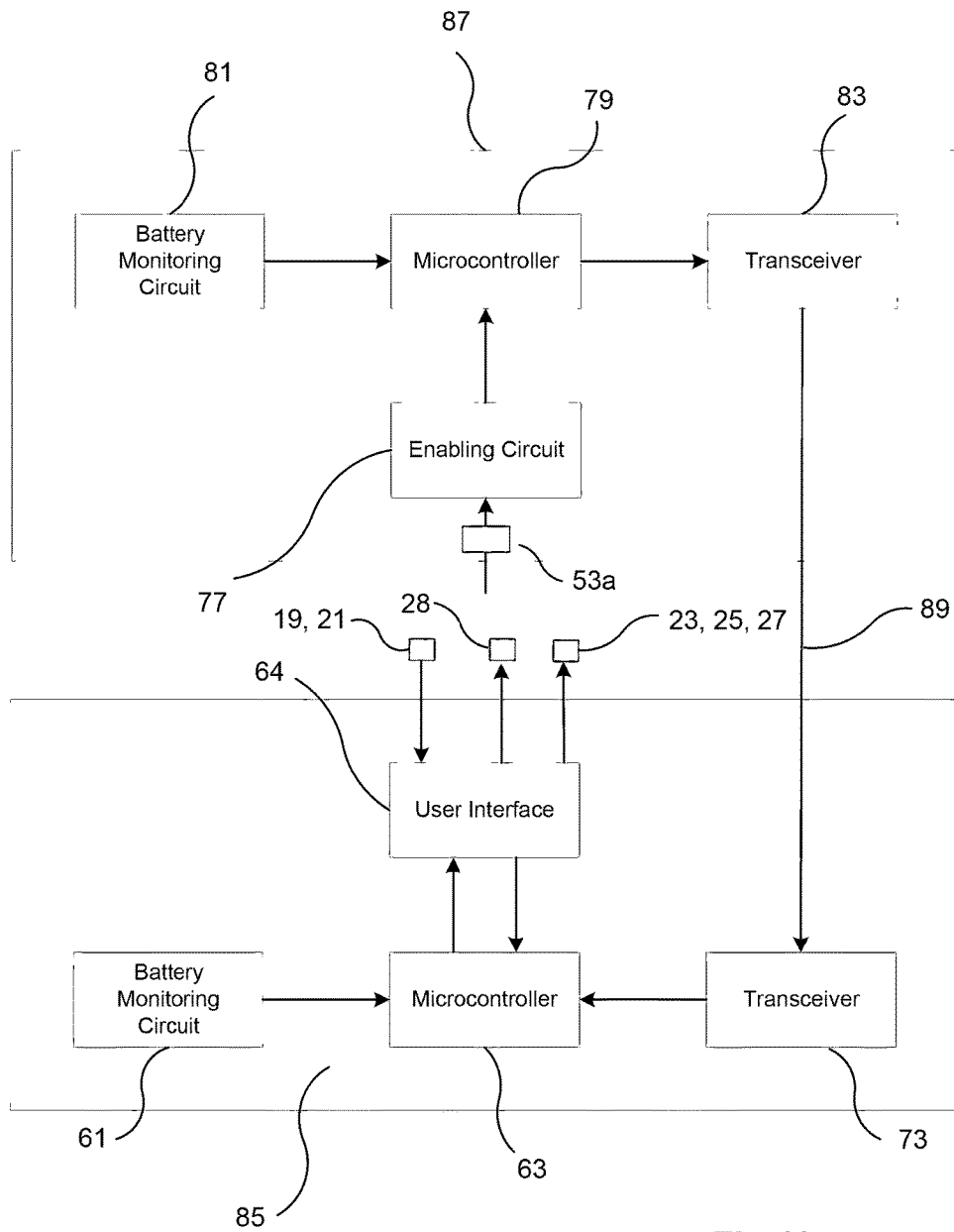


Fig 19

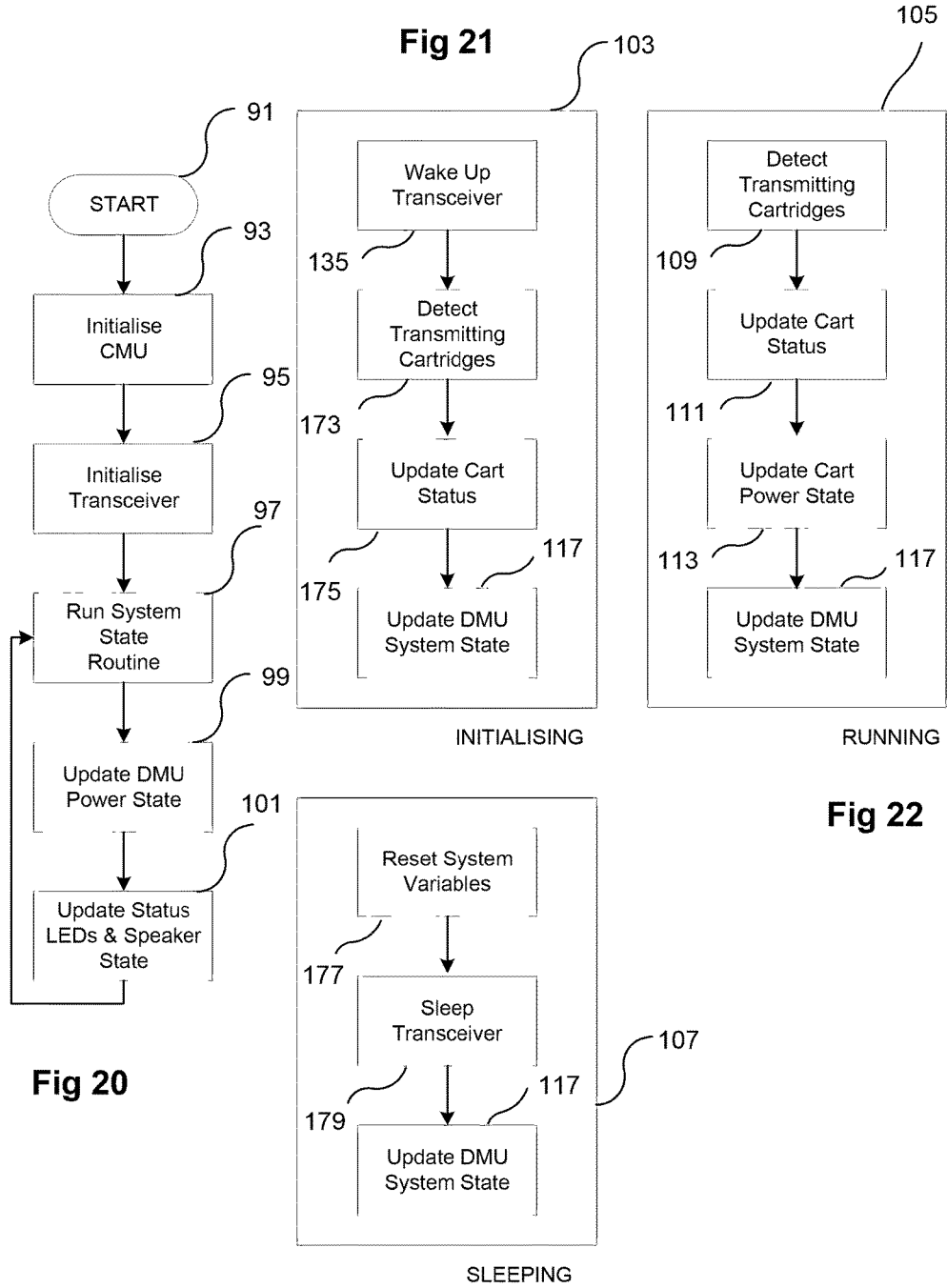


Fig 20

Fig 21

Fig 22

Fig 23

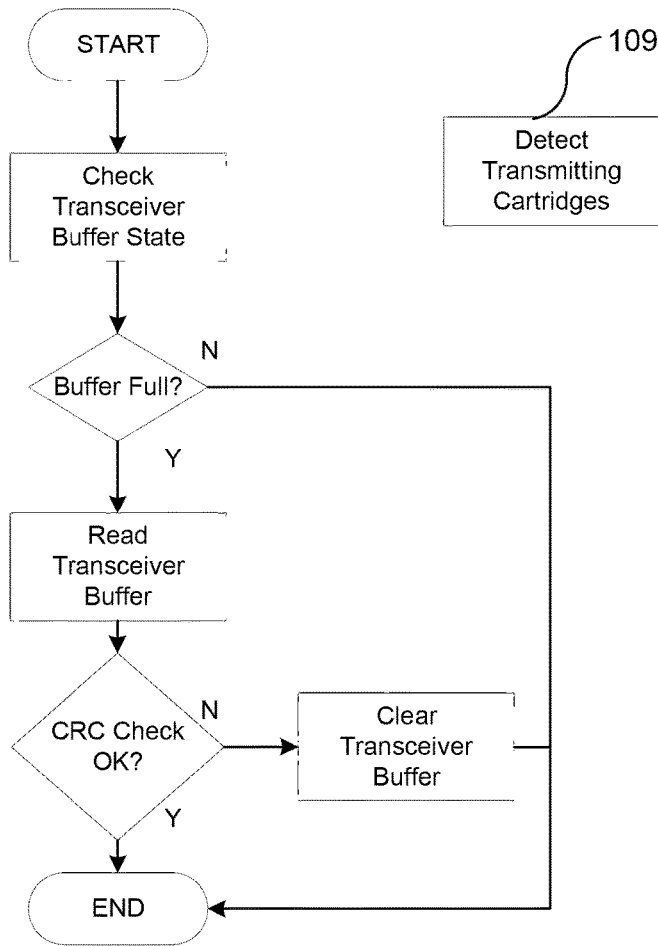


Fig 24

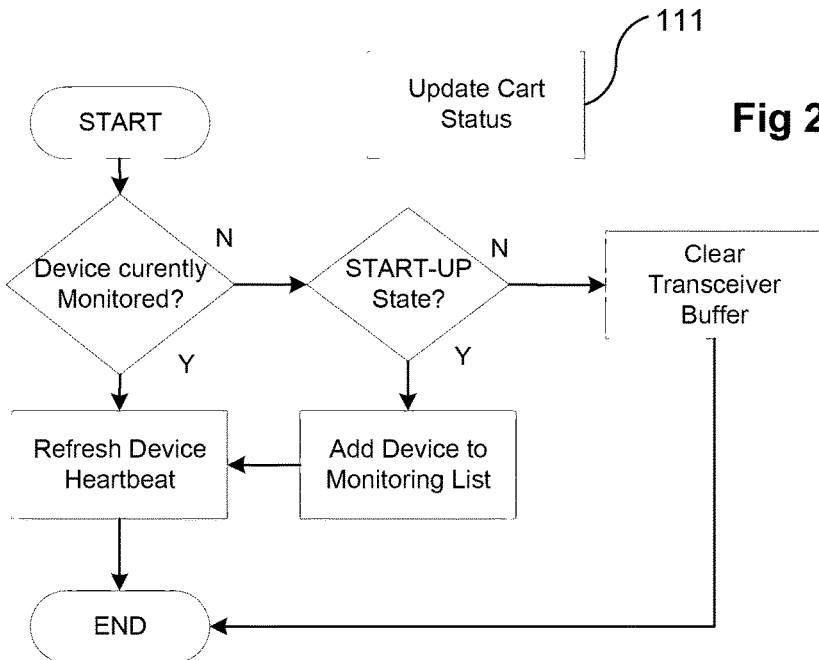


Fig 25

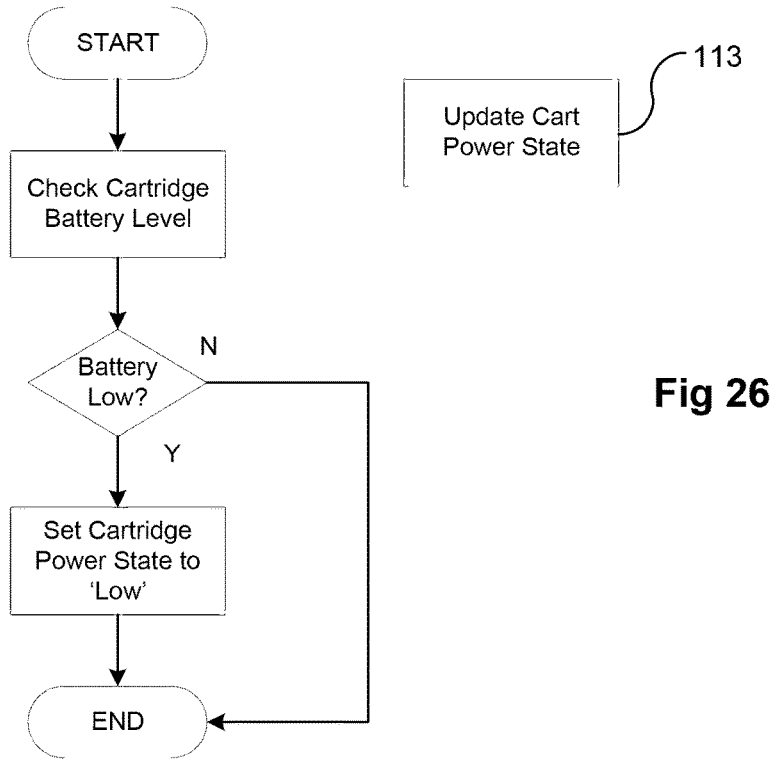


Fig 26

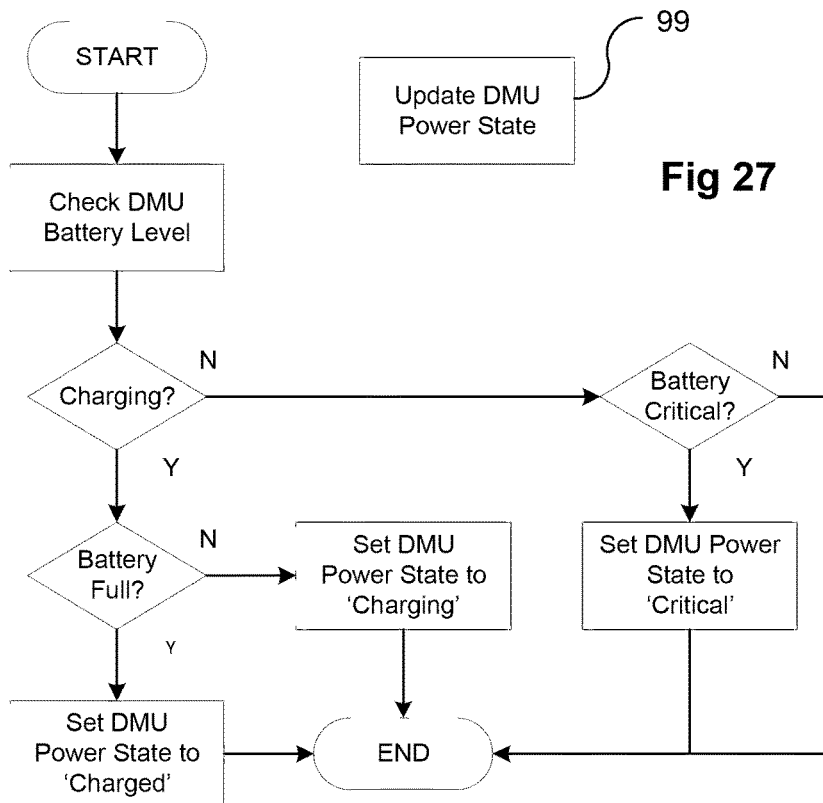
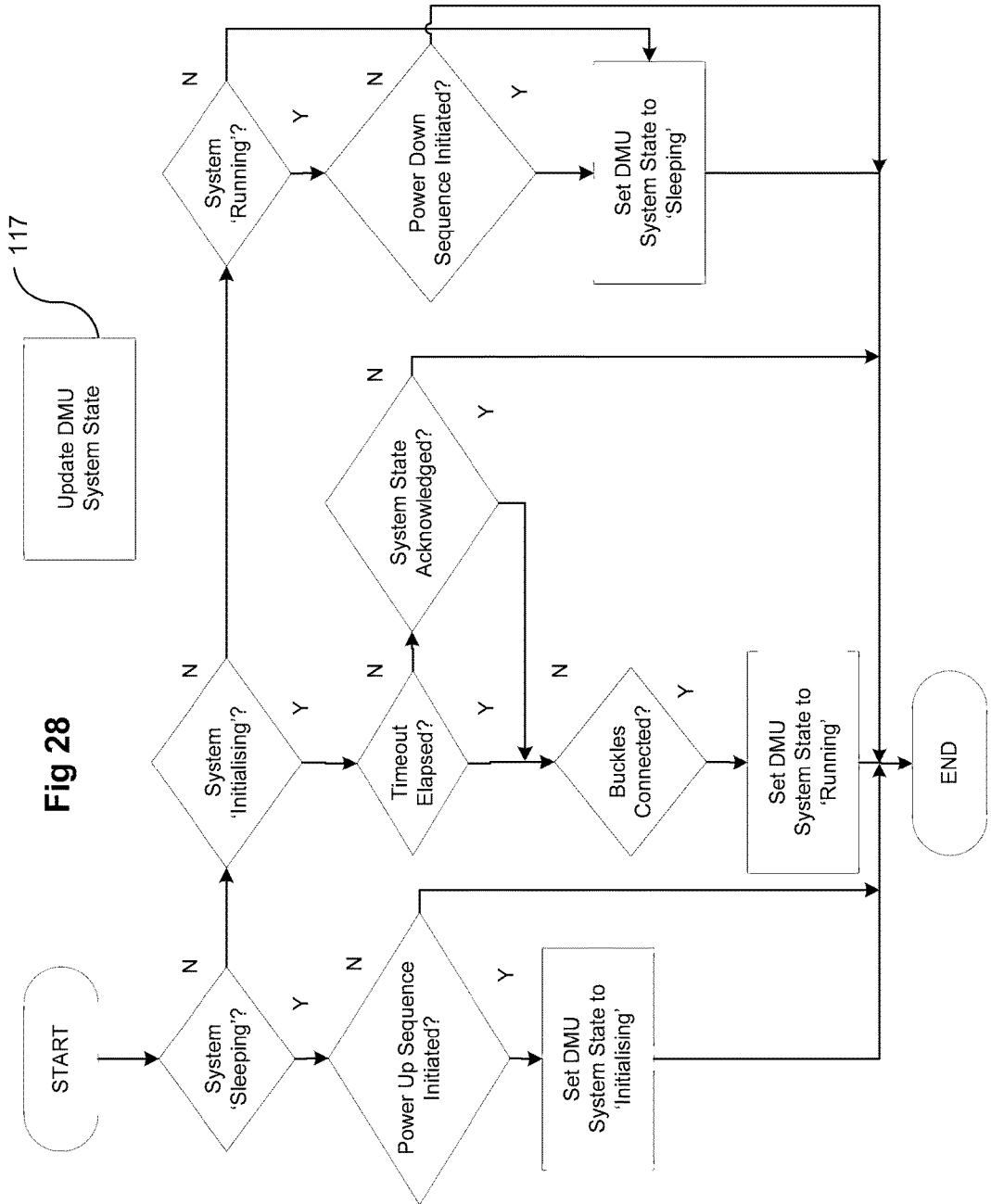


Fig 27



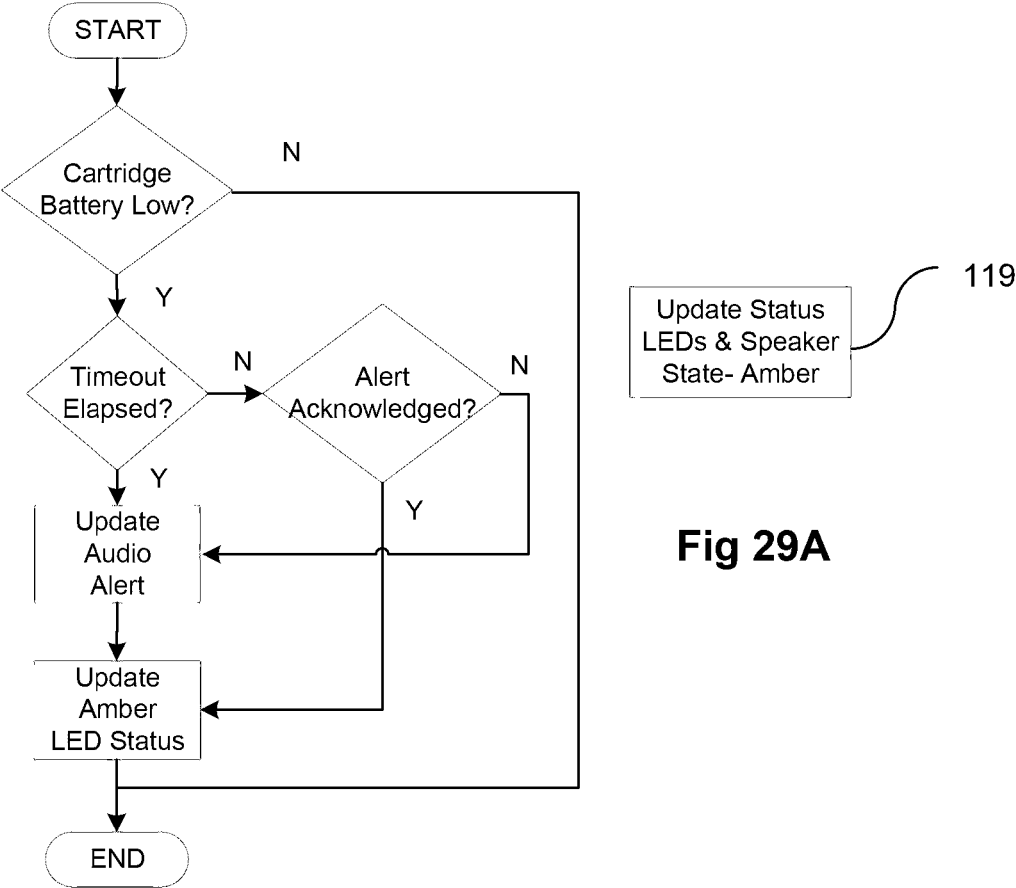


Fig 29A

Fig 29B

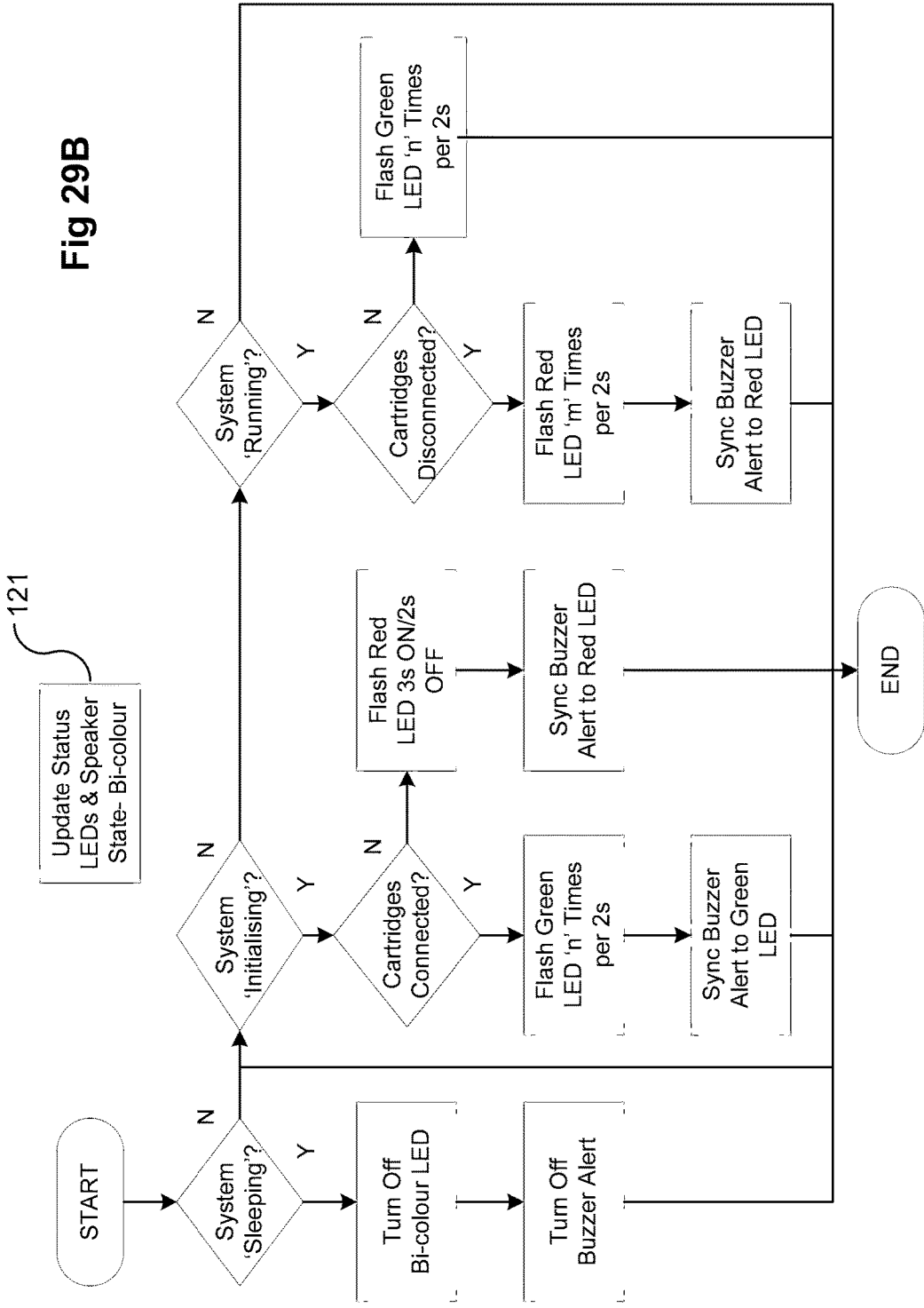
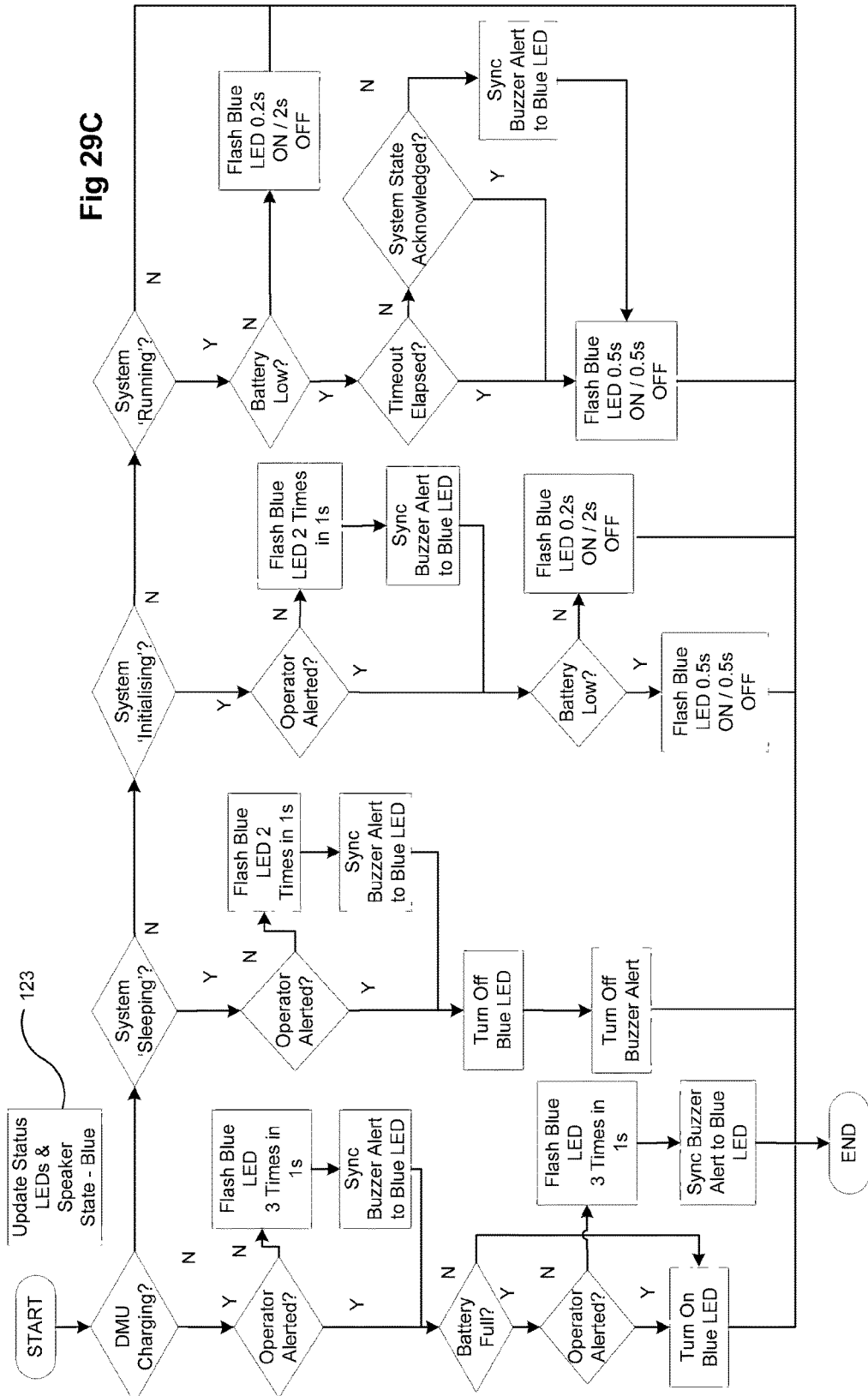
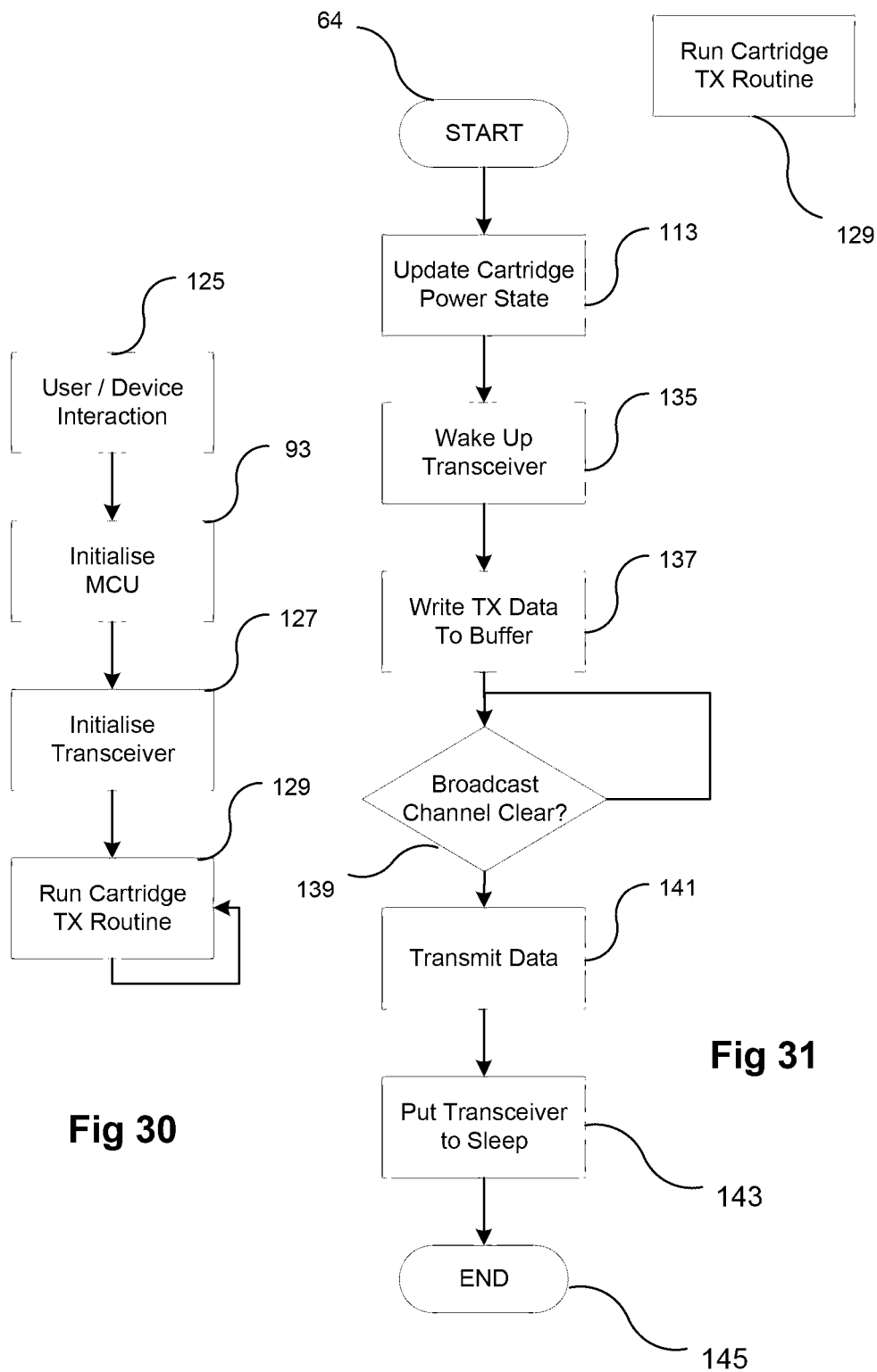


Fig 29C





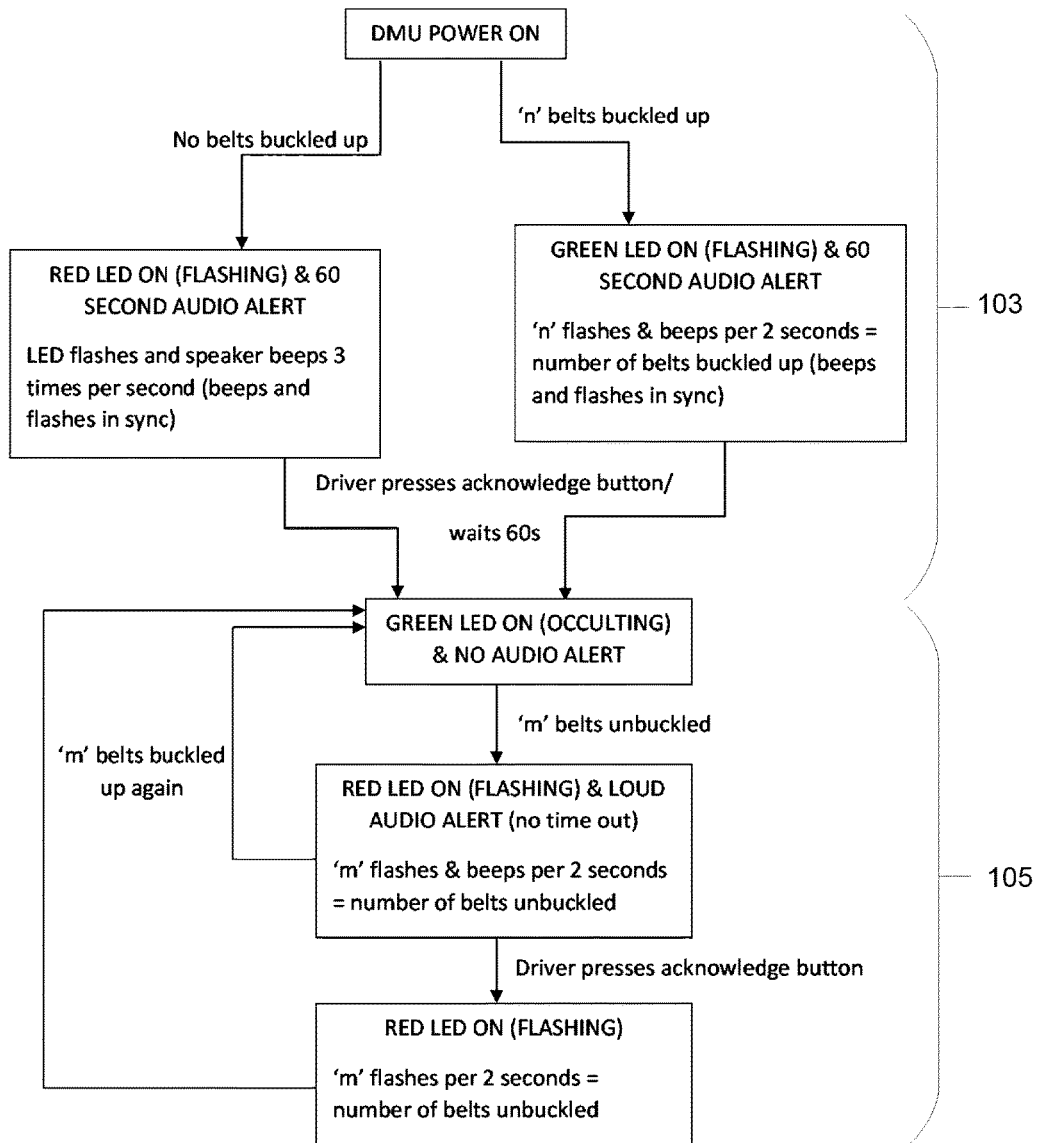


Fig 32

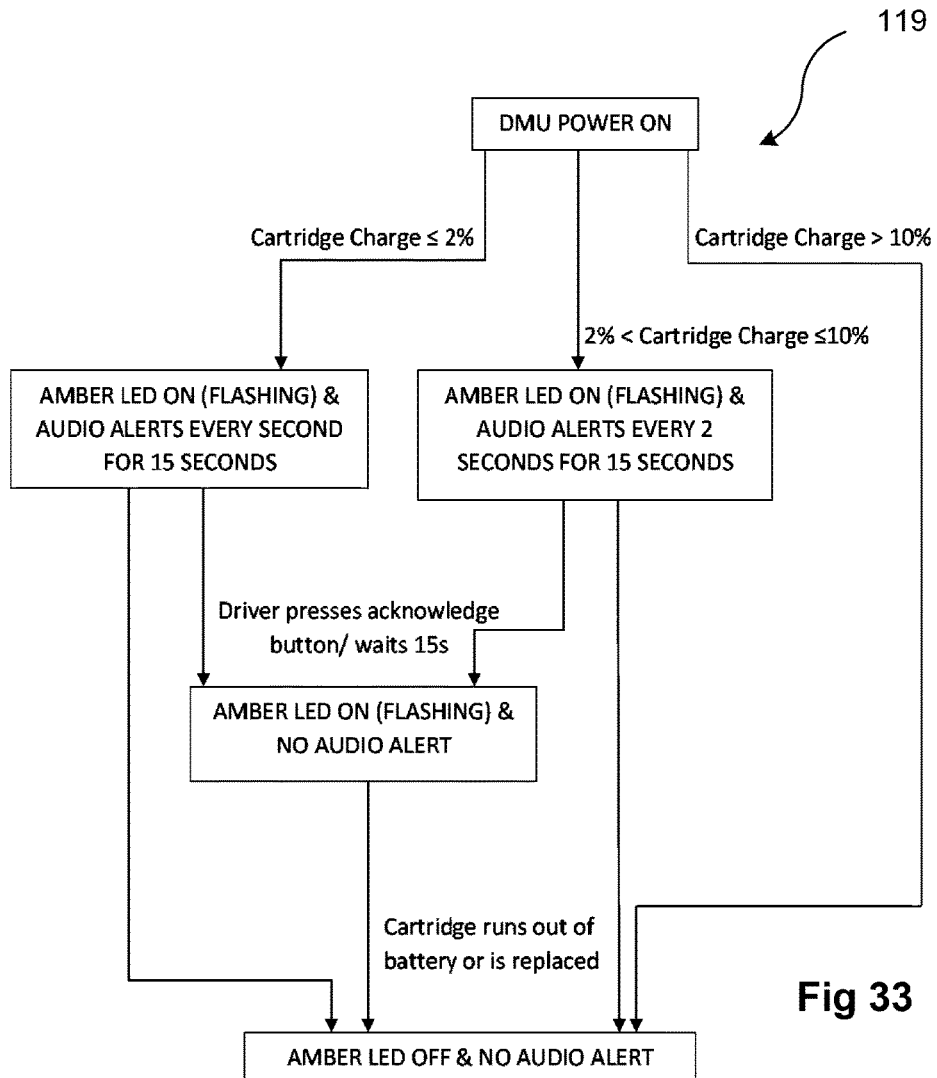


Fig 33

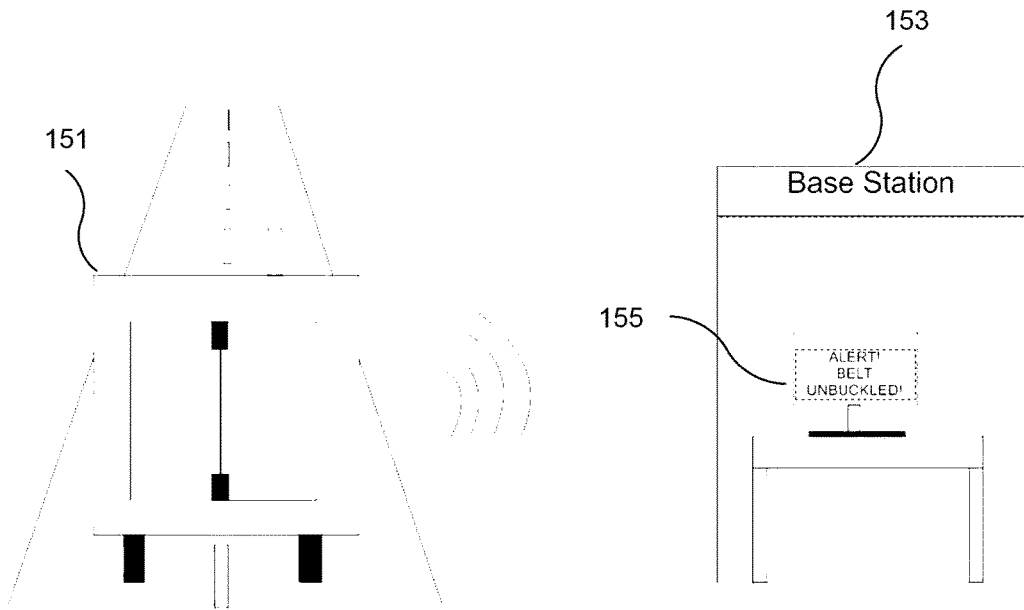


Fig 35A

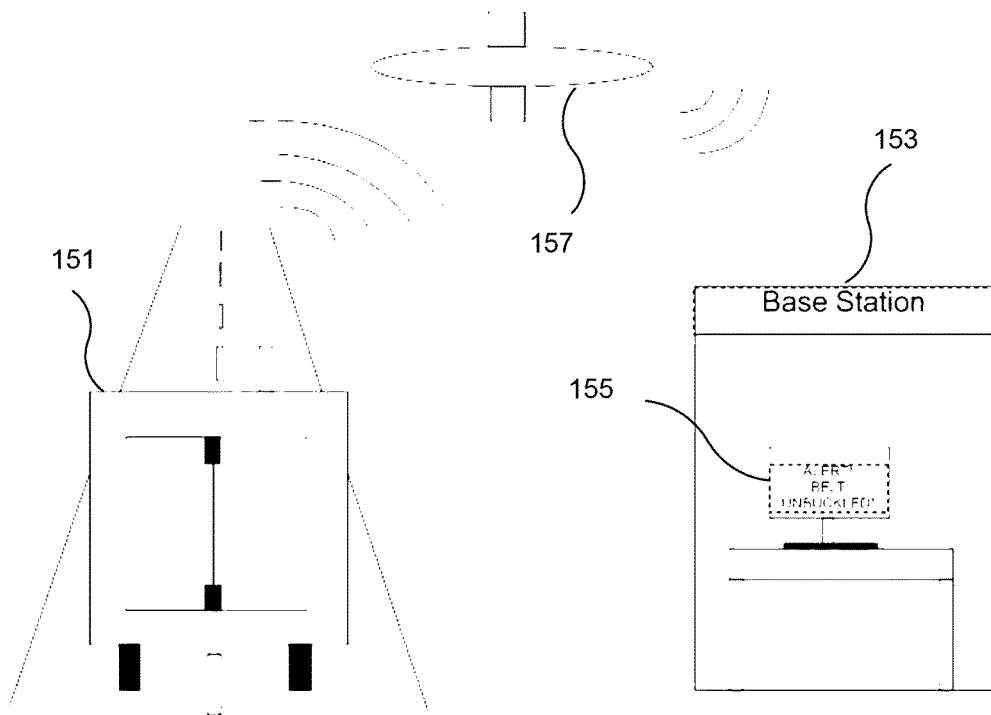


Fig 35B

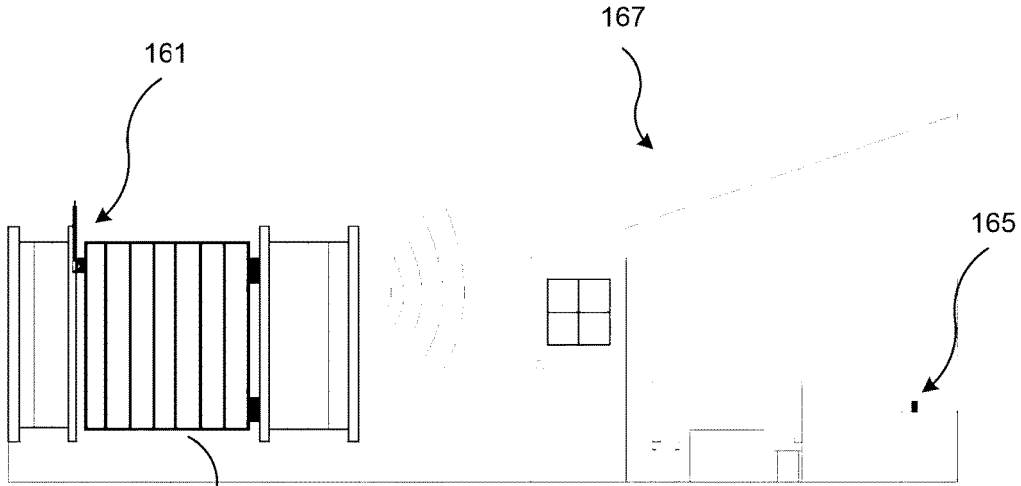


Fig 36A

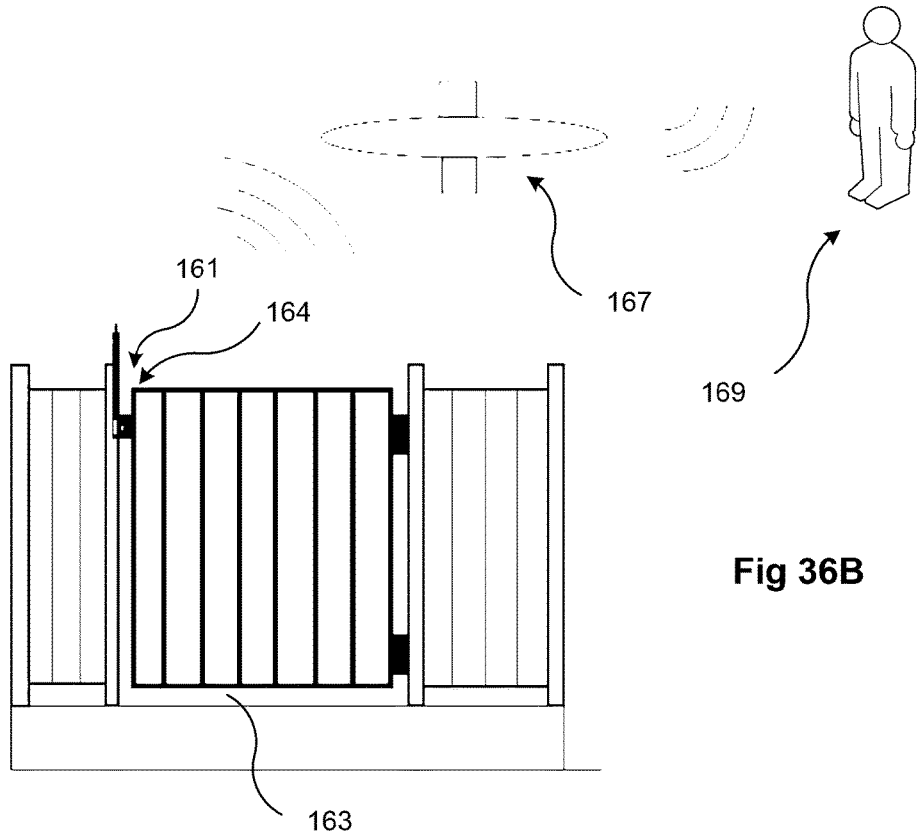


Fig 36B

MONITORING AND ALERT SYSTEM AND METHOD FOR LATCHING MECHANISMS

CLAIM OF PRIORITY

[0001] This application is a National Stage continuation of Australian PCT/AU2015/050163 filed Apr. 10, 2015, which is incorporated herein by reference in its entirety, which claims priority to Australian Application 2014901322 filed Apr. 10, 2014.

FIELD OF THE INVENTION

[0002] This invention relates to monitoring and alert systems and methods for latching mechanisms. More particularly it is related to retro-fitted systems that have utility in providing monitoring and alert functionality for detecting and alerting a person when the latching mechanism is released, after the latching mechanism has been originally installed without such functionality.

[0003] The invention has particular utility with the installation of latching mechanisms for safety purposes, such as seat belts in all types of vehicles and swimming pool gates, especially where young children are concerned and the purpose of the latching mechanism to ensure the safety of children.

[0004] Throughout the specification, unless the context requires otherwise, the word “comprise” or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

BACKGROUND ART

[0005] The following discussion of the background art is intended to facilitate an understanding of the present invention only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was part of the common general knowledge as at the priority date of the application.

[0006] In one area of activity involving the restraint of persons where the invention has particular, but not exclusive, utility, there is increasing awareness of the importance of safety for persons where a latching mechanism is relied upon for restraining a person to an object such as a seat when travelling in a motor vehicle or the like. There is a similar awareness of the importance of safety in another area of activity involving the restriction of access of particular persons to an enclosed area via a gate, where the invention also has particular, but not exclusive, utility. In this area strict regulations have been introduced into society to ensure compliance with the installation and operation of latching mechanisms to prevent or limit the access of children to the area.

[0007] However, despite the best intentions of adults to whom such regulations are directed, where young children are involved who are not well equipped to understand issues of safety and adherence to regulations, extra vigilance is required by adults to monitor the activity of their children constantly and ascertain when a latching mechanism restraining a child or restricting access of a child to an area is released, thereby creating a dangerous situation for the child and potentially causing the adult to breach regulatory compliance requirements. Oftentimes the adult is unable to exercise this extra vigilance due to their requirement to

focus on other activities from their own safety perspective and could benefit from some additional prompting.

[0008] For example, in the case of motor vehicle safety and seatbelt use, an adult driving a motor vehicle may not be able to monitor the latching status of seatbelts in the rear of the vehicle during driving. This may be despite the adult ensuring passengers in the rear are buckled up at the onset of the journey, and due to the attention required to focus on driving the vehicle safely and complying with road regulations. Hence, if a child finds occasion to release the latching mechanism of their seatbelt, even if intended only momentarily during the journey, the seatbelt may not be re-buckled due to the poor attention span of the child, exposing the child to a dangerous state if an accident was to occur.

[0009] Original equipment manufacturers (OEMs) of motor vehicles have improved seatbelt monitoring systems over the years to address these safety requirements; however, it is only in recent times that these systems have been developed with enough sophistication to detect the latching status of seatbelts in the rear. One of the problems confronting designers in this area is that the rear seatbelts are not always used, and therefore relatively expensive sensing equipment is required to determine the presence of a passenger as well as the latching status of the belt itself to determine whether a seatbelt has become unbuckled during travel, exposing the passenger to a dangerous state.

[0010] These sophisticated systems generally entail the use of weight sensing devices integrated into the structure of the seat base and sense whether a person is seated in a particular seat before the latching status of the seatbelt for the seatbelt is monitored. These devices are bulky and expensive, and are impractical to retro-fit into vehicles that were not originally fitted with such sensing devices by the OEM.

[0011] Consequently, there are a large number of vehicles that do not have OEM designed rear seatbelt monitoring systems, or if they do, these devices are not adequate to provide the requisite level of monitoring required.

[0012] Some attempts have been made to develop retro-fitted monitoring and alert systems for rear seatbelts in the past, however, these systems have proven to be of inferior quality, suffering power failure, unreliable communication and flimsy design, allowing them to be relatively easily disassembled or bypassed.

[0013] Another example of latching mechanisms requiring monitoring of access to potentially dangerous areas are those fitted to gates of swimming pool enclosures. These gates involve a latching mechanism that is operated from an elevated position on the gate so as to be out of reach of children. However, given their industrious and innovative nature, children can often find ways of climbing up and operating the mechanism, allowing them access through the gate.

[0014] Presently there is no regulatory requirement to have a monitoring and alert system installed with these types of latching mechanisms and consequently virtually all swimming pool gates will rely simply on the physical operation of the latching mechanism to deter children from accessing swimming pool enclosures.

[0015] Clearly having regard to the above circumstances, there is a need for a well-designed and highly functional monitoring and alert system that is capable of being retro-fitted to sense the status of latching mechanisms such as rear

seatbelts and gates for swimming pool enclosures that is not being met at the present time.

DISCLOSURE OF THE INVENTION

[0016] An object of the present invention is to overcome at least some of the problems associated with prior art monitoring and alert systems that attempt to provide retro-fitting functionality but which have not attained market acceptance due to inadequacies in design and operation, or at least provide a viable alternative to such systems that may meet with market acceptance.

[0017] In accordance with one aspect of the present invention, there is provided a monitoring and alert system for retro-fitting to latching mechanisms including:

[0018] a master control unit to be located proximate to an operator of the system, comprising a user interface having:

[0019] (a) an input or input means to enable an operator to arm the system and then allow it to operate with minimal interaction of the operator;

[0020] (b) an output or output means for alerting the operator as to the status of the system in relation to a plurality of prescribed conditions; and

[0021] (c) a master processor or master processing means to provide the functionality of the master control unit;

[0022] one or more slave units each being fixedly attached to a discrete latching mechanism for detecting the latching status thereof, each slave unit comprising:

[0023] (i) a sensor or sensing means to detect whether the latching mechanism is in a latched state or an unlatched state; and

[0024] (ii) a slave processor or slave processing means to provide the functionality of the slave unit; and

[0025] a communicator or communication means for communicating periodically status and alert signals between the master control unit and each of the slave units;

[0026] wherein the master processor and the slave processor are designed to invoke various initialising processes and running processes for the master control unit and running phase respectively, involving interaction with the operator via the user interface, the initialising processes including a detect slave process and an update slave process to identify the latching status of each of the slave units.

[0027] Preferably, a said slave unit also comprising: a slave power supply or slave power supply means for providing local power to the slave unit; and a slave power supply monitor or slave power supply monitoring means to monitor the level of local power supplied to the slave unit and indicate when the level is below a prescribed threshold for reliable operation thereof; and wherein during a running phase the master processing means is designed to invoke:

[0028] (A) a system state process to ascertain the latest latching status of each of the slave units whilst ensuring minimal power consumption by the master control unit;

[0029] (B) a power state process to check with the slave power supply monitor that the local power level is not below the prescribed threshold;

[0030] (C) a user interface process to process input signals from the input and update the output to convey the latest latching and power state status to the operator;

[0031] Preferably, the slave processor is designed to invoke a slave unit status routine to transmit a power alert signal if the slave power supply monitor indicates that the

local power is below the prescribed threshold, and the latching status of the slave unit, whilst ensuring minimal power consumption by the slave unit.

[0032] Preferably, the communicator comprises a master transceiver forming part of the master control unit and a slave transceiver forming part of each slave unit for wirelessly communicating status and alert signals between the master control unit and each of the slave units.

[0033] Preferably, the master control unit includes:

[0034] (a) a master power supply or master power supply means for providing local power to the master control unit; and

[0035] (b) a master power supply monitor or master power supply monitoring means to monitor the level of the local power supplied to the master control unit and indicate when this is below a prescribed threshold for reliable operation thereof.

[0036] Preferably, the slave processor invokes sleep processes for a slave unit during a sleeping phase that cycle through a hibernating low power state and high power transmitting state, to communicate an update of the latching status to the master control unit.

[0037] In accordance with another aspect of the present invention, there is provided a master control unit for a retro-fitted monitoring and alert system for latching mechanisms including one or more slave units each being fixedly attached to a discrete latching mechanism for detecting the latching status thereof, each slave unit comprising:

[0038] a sensor or sensing means to detect whether the latching mechanism is in a latched state or an unlatched state; and

[0039] (i) a slave transceiver forming part of the communicator wirelessly communicating periodically status and alert signals between the slave unit and the master control unit;

[0040] the master control unit to be located proximate to an operator of the system and comprising:

[0041] (a) a user interface having: an input enabling an operator to arm the system and then allow it to operate with minimal interaction of the operator; and an output alerting the operator as to the status of the system in relation to a plurality of prescribed conditions;

[0042] (b) a master processor providing the functionality of the master control unit; and

[0043] (c) a master transceiver forming part of the communication means for wirelessly communicating status and alert signals between the master control unit and each of the slave units;

[0044] wherein the master processor and the slave processor are designed to invoke various initialising processes for the master control unit and each of the slave units during a start-up mode involving interaction with the operator via the user interface, these initialising processes including identifying the latching status of each of the slave units.

[0045] Preferably, each slave unit further comprises: a slave power supply providing local power to the slave unit; and a slave power supply monitor monitoring the level of local power supplied to the slave unit and indicate when this is below a prescribed threshold for reliable operation thereof; and wherein during a running phase: the master processor is designed to invoke:

[0046] (A) a system state process to ascertain the latest latching status of each of the slave units whilst ensuring minimal power consumption by the master control unit;

- [0047] (B) a power state process to check with the slave power supply monitor to verify that the local power level is not below the prescribed threshold;
- [0048] (C) a user interface process to process input signals from the input and update the output to convey the latest latching and power state status to the operator.
- [0049] Preferably, the slave processing means is designed to invoke a slave unit status routine to transmit a power alert signal if the slave power supply monitor indicates that the local power is below the prescribed threshold, and the latching status of the slave unit, whilst ensuring minimal power consumption by the slave unit.
- [0050] Preferably, the master control unit includes a master power supply providing local power to the master control unit; and a master power supply monitor monitoring the level of local power supplied to the master control unit and indicate when this is below a prescribed threshold for reliable operation thereof.
- [0051] Preferably, the master transceiver communicates status and alert signals between the master control unit and each of the slave units wirelessly via the communication means.
- [0052] In accordance with a further aspect of the present invention, there is provided a slave unit for a retro-fitted monitoring and alert system for latching mechanisms including a master control unit to be located proximate to an operator of the system, the master control unit comprising:
- [0053] (a) a user interface having: input means to enable an operator to arm the system and then allow it to operate with minimal interaction of the operator; and output means for alerting the operator as to the status of the system in relation to a plurality of prescribed conditions; and
- [0054] (b) a master transceiver forming part of a communication means for wirelessly communicating status and alert signals from the slave unit;
- [0055] the slave unit being fixedly attached to a discrete latching mechanism for detecting the latching status thereof, each slave unit comprising:
- [0056] (i) sensing means to detect whether the latching mechanism is in a latched state or an unlatched state,
- [0057] (ii) slave processing means to provide the functionality of the slave unit; and
- [0058] (iii) a slave transceiver forming part of a communication means for communicating periodically status and alert signals to the master control unit;
- [0059] wherein the slave processing means is designed to invoke various initialising processes for the slave unit during an initialisation phase involving interaction with the master control unit to communicate the latching status of the slave unit.
- [0060] Preferably, the slave unit includes: slave power supply means for providing local power to the slave unit; and slave power supply monitoring means to monitor the level of local power supplied to the slave unit and indicate when the level is below a prescribed threshold for reliable operation thereof; and wherein during a running phase the slave processing means, in response to the master processing means, is designed to invoke:
- [0061] (A) an update status process to provide the latest latching status of the slave unit whilst ensuring minimal power consumption;
- [0062] (B) an update power state process to indicate that the local power level is not below the prescribed threshold.
- [0063] Preferably, the slave processing means is designed to invoke a slave unit status routine to transmit a power alert signal if the slave power supply monitoring means indicates that the local power is below the prescribed threshold, and the latching status of the slave unit, whilst ensuring minimal power consumption by the slave unit.
- [0064] Preferably, the slave transceiver communicates status and alert signals to the master control unit wirelessly via the communication means.
- [0065] Preferably, the slave processing means invokes sleep processes for a slave unit during a sleeping phase that cycle through a hibernating low power state and high power transmitting state, to communicate an update of the latching status to the master control unit.
- [0066] Further still, in accordance with another aspect of the present invention, there is provided a method for monitoring and alerting the latching status of a latching mechanism including:
- [0067] (i) initialising during a start up mode, a locally powered master control unit located proximate to an operator to determine the latching status of the latching mechanism, and a locally powered slave unit to be attached to the latching mechanism, involving interaction with the operator to identify the latching status of the latching mechanism;
- [0068] (ii) during a running phase:
- [0069] (A) ascertaining the latest latching status of the latching mechanism whilst ensuring minimal power consumption by the master control unit and the slave unit;
- [0070] (B) checking that the local power supply level for master control unit and the slave unit is not below a prescribed threshold;
- [0071] (C) wirelessly communicating periodically status and alert signals between the slave unit and the master control unit; and
- [0072] (D) conveying the latest latching and power state status to the operator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0073] The invention will be better understood in the light of the following description of the best mode for carrying out the invention. The description is made with reference to the following drawings that consist of schematic diagrams of various aspects of a system according to different embodiments of the present invention, and its operation and use; wherein:

[0074] FIG. 1 is a schematic plan view showing the general spatial location of a dash mounted unit (DMU) and cartridge units (CMU) that constitute the monitoring and alert system in accordance with the first specific embodiment of the invention;

[0075] FIG. 2 is a schematic drawing showing the location of the DMU on the dashboard of the motor vehicle shown in FIG. 1;

[0076] FIG. 3 is a front perspective view showing the DMU of FIG. 1;

[0077] FIG. 4 is a front perspective view showing the DMU printed circuit board (PCB) that is encapsulated within the casing of the DMU of FIG. 3;

[0078] FIG. 5 is an exploded view showing the assembly of the DMU PCB into the front casing of the DMU of FIG. 3;

[0079] FIG. 6A is an inner perspective view of the rear casing of the DMU of FIG. 3 showing the assembly of the magnet units into the magnet recesses of the casing;

[0080] FIG. 6B is an outer perspective view of the rear casing of FIG. 6A;

[0081] FIG. 7 is a front perspective view showing the assembly of the rear casing to the front casing of the DMU of FIG. 3, encapsulating the DMU PCB therein;

[0082] FIG. 8 is a front perspective view showing the DMU mounting plate for the DMU of FIG. 3 and adhesive for mounting the DMU mounting plate to the dashboard;

[0083] FIG. 9 is a front perspective view of the CMU of FIG. 1;

[0084] FIG. 10 is a rear perspective view of the CMU PCB that is encapsulated within the casing of the CMU of FIG. 9, showing the configuration of the reed switch and magnet;

[0085] FIG. 11 is an exploded view showing the assembly of the CMU PCB into the rear casing of the CMU of FIG. 9;

[0086] FIG. 12 is an exploded view showing the assembly of the front casing to the rear casing of the CMU of FIG. 9, encapsulating the CMU PCB therein;

[0087] FIG. 13 is a rear perspective view of the CMU of FIG. 9 showing the adhesive tape in position for mounting the CMU to the seat belt latch;

[0088] FIG. 13A is an exploded view of the rear top of the seat belt latch showing the assembly of the CMU shown in FIG. 13 to the bottom of the seat belt latch;

[0089] FIG. 13B is a similar view to FIG. 13A, but showing the assembly from the front top of the seat belt latch;

[0090] FIG. 14 is a front top perspective view of the seat belt latch shown in FIGS. 13A and 13B with the CMU fully fitted ready for operation;

[0091] FIG. 15 is a series of orthogonal views of FIG. 14, wherein:

[0092] A is a top view;

[0093] B is a side view;

[0094] C is an end view; and

[0095] D is a bottom view;

[0096] FIG. 16A is a similar view to FIG. 14 showing the latching plate of the seat belt in an unfastened position;

[0097] FIG. 16B is a similar view to FIG. 16A, but showing the latching plate in a fastened position;

[0098] FIG. 17 is a circuit diagram of the DMU PCB of FIG. 4; FIG. 18 is a circuit diagram of the CMU PCB of FIG. 10;

[0099] FIG. 19 is schematic block diagram showing the general hardware structure of the monitoring and alert system;

[0100] FIG. 20 is a high level flow chart showing the main processes performed by the master control unit and the slave units;

[0101] FIG. 21 is a high level flow chart showing the main processes performed during the initialising phase;

[0102] FIG. 22 is a high level flow chart showing the main processes performed during the running phase;

[0103] FIG. 23 is a high level flow chart showing the main processes performed during the sleeping phase;

[0104] FIG. 24 is a lower level flow chart showing the detect transmitting cartridges process of the initialising phase;

[0105] FIG. 25 is a lower level flow chart showing the update cartridge status process of the initialising phase and running phase;

[0106] FIG. 26 is a lower level flow chart showing the update cartridge power state process of the running phase;

[0107] FIG. 27 is a lower level flow chart showing the update DMU power state of the running phase;

[0108] FIG. 28 is a lower level flow chart showing the update DMU system state of the initialising phase and the running phase;

[0109] FIGS. 29A, 29B and 29C are lower level flow charts showing the update status LEDs and speaker state process of the master control unit and the slave units shown in FIG. 4, wherein:

[0110] FIG. 29A shows the process flow for the update status LEDs and speaker state process for the amber LED;

[0111] FIG. 29B shows the process flow for the update status LEDs and speaker state process for the bi-coloured LEDs; and

[0112] FIG. 29C shows the process flow for the update status LEDs and speaker state process for the blue LED;

[0113] FIG. 30 is a high level flow chart showing the main processes performed by the slave units;

[0114] FIG. 31 is a lower level flow chart showing the run cartridge Tx routine process of the slave units shown in FIG. 14;

[0115] FIG. 32 is a relatively high level flow chart showing the alert LED operation during the start-up mode and the running mode with respect to the first specific embodiment;

[0116] FIG. 33 is a lower level flow chart showing the cartridge battery LED process with respect to the first specific embodiment;

[0117] FIG. 34 is a lower level flow chart showing the DMU power LED process with respect to the first specific embodiment;

[0118] FIG. 35A is a schematic diagram showing the conceptual arrangement of the monitoring and alert system as described with respect to the second specific embodiment;

[0119] FIG. 35B shows a variation of the second specific embodiment;

[0120] FIG. 36A is a schematic diagrams showing the conceptual arrangement of the monitoring and alert system as described with respect to the third specific embodiment; and

[0121] FIG. 36B shows a variation of the third specific embodiment.

BEST MODE(S) FOR CARRYING OUT THE INVENTION

[0122] The best mode for carrying out the invention is described with respect to several specific embodiments all directed towards a retro-fitted monitoring and alert system for latching mechanisms and a method for operating same that allows a person to arm the system and alert a person in the vicinity or remotely of the latching mechanism, when the mechanism is released.

[0123] The first specific embodiment is adapted for retrofitting the monitoring and alert system to a set of latching mechanisms in the form of rear seat belt assemblies in a

motor vehicle **11**. In this embodiment, a driver of the vehicle may arm the system after buckling up the passengers in the rear seats, and then have the system monitor the rear seat belts and alert the driver when a seat belt is unbuckled, i.e. when the latching mechanism is released.

[0124] The monitoring and alert system generally comprises a master control unit and a plurality of slave units. In the present embodiment, the master control unit is mounted within a Dashboard Mounted Unit (DMU) **13** for retro-fitted mounting to a dashboard **14** of the motor vehicle **11** as shown in FIGS. **1** and **2** of the drawings. The slave units in the present embodiment are Cartridge Mounted Units (CMUs) **15** that are retro-fitted in a fixed mounting arrangement to each of the rear seatbelt latches as shown in FIG. **1** of the drawings.

[0125] As shown in FIGS. **3** to **8**, the DMU **13** comprises a front-casing **13a** and a rear-casing **13b** that encapsulates a DMU Printed Circuit Board (PCB) **17**.

[0126] The front-casing **13a** is embossed with various indicia and is provided with various apertures to accommodate and provide access to a various inputs, outputs, and input/output means, which are surface-mounted onto the DMU PCB **17**.

[0127] The input may include a power push-button **19**, an acknowledge button **21**, and a DMU battery **22**. The output may include a yellow (amber) cartridge battery indicator light emitting diode (LED) **23**, a blue power LED **25**, a bi-coloured LED (i.e. red and green) **27**, indicating whether the rear seatbelts are in an unbuckled condition (red) or a buckled condition (green), and a speaker **28**. The input/output means may include a male USB connector **29** for providing a remote power source to charge the DMU battery **22** and a DMU transceiver.

[0128] The rear DMU casing **13b** includes recesses **31** accommodating mounting magnets **33**, apertures **35** to allow the propagation of sound waves from the speaker **28**, and an aperture **36** for accommodating the USB connector **29**, as shown in FIG. **6A**. The outer casing **13b**, as shown in FIG. **6B** of the drawings includes a convex-shaped protrusion **37** which forms a backing plate for accommodating the mounting magnets **33** to facilitate retro-fitting location of the DMU **13** at a convenient location on the dashboard **14**. This is achieved in conjunction with a mounting plate **39**, as shown in FIG. **8** of the drawings. The DMU **13** is assembled by positioning the DMU PCB **17** within the front casing **13a** as shown in FIG. **5** of the drawings and snapping the rear casing **13b** into locking engagement with the remainder of the assembly as shown in FIG. **7**.

[0129] The mounting plate **39** is made of a suitable ferromagnetic substance and is positioned at a convenient place on the dashboard **20** by a double-sided adhesive strip **41** being adhered on one side to the dashboard; and then to the rear of the mounting plate on the other side.

[0130] The mounting plate includes a correspondingly concave-shaped recess **43** complementary to the shape and configuration of the protrusion **37**. In this manner, the DMU **13** may be positioned so that the protrusion **37** snaps into magnetically locking engagement with the mounting plate **39** for releasable positioning on the dashboard **14**.

[0131] The CMU **15** is shown in FIGS. **9** to **13** and comprises a top casing **15a**, a rear casing **15b** and an encapsulated CMU PCB **45**. The CMU casing is specially designed to be retro-fitted to a seatbelt latch **47** as shown in FIGS. **13** to **16**. Moreover, the rear case **15b** is L-shaped in

side elevation, having a recessed portion **49a** and a cantilevered portion **49b**. This arrangement presents an inner stepped configuration on the inside of the rear casing, whereby the CMU PCB **45** can be mounted on an inner landing surface **51a** of the stepped configuration and a recessed portion **51b** can accommodate sensing components **53** forming part of a sensor surmounted on the confronting face **45a** of the CMU PCB **45**.

[0132] The sensor of the CMU PCB **45** may comprise a reed switch **53a** and an in-line magnet **53b**, which constitute the sensing components **53** and are mounted towards the top of the confronting face **45a**. A CMU battery **54** is mounted on the opposite face **45b** of the CMU PCB **45** that confronts the inner side of the front CMU casing **15a**. The sensing components **53** can be disposed towards the top end of the CMU PCB **45** and are particularly configured so that they are fully accommodated within the recessed portion **51b** of the rear casing **15b**.

[0133] As shown in FIGS. **11** & **12**, the CMU **15** is assembled by positioning the CMU PCB **45** in the manner indicated within the rear casing **15b** and snap locking the front casing **15a** in position to encapsulate the CMU PCB **45** therein.

[0134] The recessed portion **49a** is shaped to receive a two-sided layer of adhesive tape **55** to fixedly adhere the CMU **15** to the underside of a rear seatbelt latch **47** so that the cantilevered portion **49b** marginally protrudes over the front end **47a** of the latch **47**, adjacent to the slot for receiving a plate **57** of the seatbelt, and the recessed portion **49a** is adhered firmly to the bottom of the seatbelt latch **47** extending toward the rear end **47b** of the latch. The particular mounting arrangement is well shown in FIGS. **13** to **15**.

[0135] The mounting arrangement enables the sensing components **53** to be disposed directly beneath the socket at the front end **47a** of the seatbelt latch, so that when the seatbelt plate **57** comes into fastening engagement with the seatbelt latch **47** the reed switch **53a** is actuated, enabling the sensor or sensing means to signify to the CMU circuit that the seatbelt is in a fastened status, as shown in FIG. **16B** of the drawings. When the seatbelt plate **57** is disposed remotely of the seatbelt latch **47** as shown in FIG. **16A** of the drawings, the reed switch **53a** is switched to an opposing state signifying that the seatbelt is in an unfastened state, as shown in FIG. **16A**.

[0136] The DMU PCB **17** incorporates a DMU circuit **59** as shown in FIG. **17** of the drawings. The DMU circuit **59** includes a battery monitoring circuit **61** connected to the USB; a microcontroller circuit **63**; and a user interface **64** including a battery-powered circuit **65**; push button circuits **67a** for the power button **19** and **67b** for the acknowledge button **21**; a speaker circuit **69** for the speaker **28**; lighting circuits **71a** for the yellow (amber) LED **23** and the blue LED **25**, and **71b** for the bi-coloured LED **27**; and DMU transceiver **73** for communicating with the CMU **15**.

[0137] A CMU circuit **75** is incorporated into the CMU PCB **45**, and as shown in FIG. **18**. The CMU circuit includes an enabling circuit **77** incorporating the sensing components **53**; a CMU microcontroller circuit **79**; a battery monitoring circuit **81**; and CMU transceiver **83** to communicate with the DMU transceiver **73**.

[0138] The software processors operating the monitoring and alert system in both the DMU **13** and the CMU **15** are described in FIGS. **19** to **31**.

[0139] As shown in FIG. 19 and described in relation to FIG. 17, the DMU 13 which functions as the master control unit 85 of the monitoring and alarm system includes the battery monitoring circuit 61; the DMU microcontroller circuit 63; the DMU transceiver 73; and the user interface 64, that connects with the pushbuttons 19 and 21, speaker 28 and LEDs 23, 25 and 27.

[0140] The slave units 87 each in the form of a CMU 15 and described with reference to FIG. 18, include the enabling circuit 77 to be actuated by the reed switch 53a, the CMU microcontroller circuit 79, the battery monitoring circuit 81 and the CMU transceiver 83. Importantly, the master control unit 85 and slave units 87 are in constant communication via an RF transmission link 89 arising from the ‘transmit’ and ‘receive’ signals sent between the DMU transceiver 73 and CMU transceiver 83.

[0141] The main processes performed by the monitoring and control system are shown in FIG. 20, whereupon following start-up at 91 various slave initialisation processes are invoked, including an initialise CMU process 93, followed by an initialise transceiver process 95, followed by a run system state routine 97. The run system state routine invokes an update DMU power state process 99, which is shown in more detail in FIG. 27, followed by an update status LEDs & speaker state process 101, which is shown in more detail for each type of LED in FIGS. 29A, 29B and 29C. The system returns to the run systems state routine 97 and loops through the latter processes as indicated in the drawing.

[0142] The main processes performed by the DMU 13 are essentially broken down into: the initialising phase 103 shown in FIG. 21, which includes a series of master initialisation processes; the running phase 105 shown in FIG. 22; and the sleeping phase 107 shown in FIG. 23.

[0143] The series of master initialisation processes that are run during the initialising phase 103 include a Wake Up Transceiver process 135, a Detect Transmitting Cartridges Process 173, an Update Cartridge Status process 175 and an Update DMU System State process 117.

[0144] The running phase 105 includes a series of running processes that are run by the system according to the program flow indicated by, and shown in more detail in FIGS. 24 to 29. These include a Detect Transmitting Cartridges process 109, an Update Cartridge Status process 111, an Update Cartridge Power State process 113 and the Update DMU System State process 117 to complete the running phase.

[0145] The sleeping phase 107 includes a series of sleep processes that are run by the system when invoked, including a Reset System Variables process 177, a Sleep Transceiver process 179 and the Update DMU System State process 117 to complete the sleeping phase.

[0146] The Detect Transmitting Cartridges process 109 is shown in more detail in FIG. 24; the Update Cartridge Status process 111 is shown in more detail in FIG. 25; the Update Cartridge Power State process 113 is shown in more detail

in FIG. 26; and the Update DMU System State process 117 is shown in more detail in FIG. 28.

[0147] The update status LEDs & speaker state processes including more particularly:

[0148] an Update Status LEDs & Speaker State—Amber process 119 for the amber LED shown in FIG. 29A;

[0149] an Update Status LEDs & Speaker State—Bi-colour process 121 for the bi-colour LED shown in FIG. 29B; and

[0150] an Update Status LEDs & Speaker State—Blue process 123 for the blue LED shown in FIG. 29C.

[0151] These flow charts are shown in low-level detail in the drawings and will not be described further.

[0152] The slave units 87 generally follow an operating process as shown in FIG. 30 after initialising. Moreover, after the master control unit 85 initialises it causes the DMU 13 to interact with the CMU 15 at step 125 and invokes the Initialise CMU process 93 as previously described with respect to FIG. 20. The Initialise CMU process 93 then initialises the CMU transceiver at 127 and runs a Cartridge Transmission Routine at step 129. The Run Cartridge Transmission Routine 129 loops as indicated, for the time that it is operating.

[0153] The Run Cartridge Transmission Routine 129 is shown in more detail in FIG. 31 and starts at 131, invoking the Update Cartridge Power State process 113, The Wake Up Transceiver process 135 and a Write Transmission Data To Buffer process 137. It then ascertains whether the broadcast channel is clear to transmit data at step 139 and if so, proceeds with invoking a Transmit Data process at 141. The routine proceeds with invoking a Put Transceiver to Sleep process 143 and ends at step 145.

[0154] Importantly, the Run Cartridge Transmission Routine 129 is designed to conserve power by operating mainly in a hibernating low power state, given that the duration of the routine typically takes 675 ms to loop and the transmit data process 141 when invoked to transmit at high power to the DMU 13 takes 1-2 ms to do so.

[0155] Similarly, the DMU is normally in a hibernating low-power state and only switches to high power when transmitting data to the CMU 15.

[0156] FIG. 32 of the drawings, shows how the bi-coloured LED 27 on the DMU 13 operates to signify different functions performed by the alert and monitoring system and the state of the rear seatbelts with respect to whether they are fastened (buckled up) or not. As indicated, two LED flashing and speaker beeping functions are performed during start-up mode, depending on whether no belts are buckled up (red flashing) or whether some seatbelts are buckled up (green flashing). The DMU 13 interacts with the driver or person arming the system by this means, and after receiving an input signal via the acknowledge button 21, the DMU invokes three different modes that are cycled through during the running mode, namely a green LED on (occulting) & no audio alert mode, a red LED on (flashing) & loud audio alert mode, and a red LED on (flashing) mode, which operate as indicated.

TABLE A

| State | Visual | Audio | Comments |
|-------------------------|--|---|--|
| Power on (battery >10%) | BLUE LED occulting Duty cycle: ON 0.2 s OFF 2 s | Initial alert: Speaker emits 2 short beeps in 1 s to notify the driver that the unit is powered on. | Driver has no option to acknowledge the audio alert. |
| Power off | BLUE LED off | Speaker emits 2 short beeps in 1 s before the unit powers down. | Driver has no option to acknowledge the audio alert. |

TABLE A-continued

| State | Visual | Audio | Comments |
|---|--|--|---|
| Power low (2% < battery ≤ 10%) | BLUE LED flashing for 15 s ON 1 s OFF 1 s | Speaker emits 1 short beep every 1 s for 15 s. | Driver has the option to acknowledge the audible alerts. Visual alerts will continue until the unit is placed on charge. |
| Power level critical (battery ≤ 2%) | BLUE LED flashing for 15 s ON 0.5 s OFF 0.5 s | Speaker emits 2 short beeps every 1 s for 15 s. | Driver has the option to acknowledge the audible alerts. Visual alerts will continue until the unit is placed on charge. |
| Unit charging (Unit ON) | BLUE LED on (solid) | Speaker emits 3 short beeps in 1 s when first connected to charge. | Driver has no option to acknowledge the audio alert. |
| Unit charging (Unit OFF) | BLUE LED on (solid) | — | — |
| Unit reaches full charge (Unit ON) | BLUE LED flashing ON 2 s OFF 2 s | Speaker emits 1 long beep for 1 s when the unit is fully charged. | Driver has no option to acknowledge the audio alert. |
| Unit reaches full charge (Unit OFF) | BLUE LED flashing ON 2 s OFF 2 s | — | — |

[0157] FIG. 33 signifies the operation of the amber LED 27 insofar as the battery status of the CMU 15 is concerned, in the manner indicated in the flow chart.

[0158] FIG. 34 signifies the operation of the blue LED in response to the different states of power supply and battery charge for the DMU in the manner indicated in the flow chart.

[0159] The operation of the power indicator LED 25 is outlined in more detail in Table A, the cartridge battery

indicator LED 27 in Table B, and the bi-coloured LEDs in the initialisation phase in Table C and in the running phase with the belts unbuckled in Table D and belts buckled up in Table E.

[0160] Various examples of the operation of the bi-coloured LED 27 arising from different contingencies involving different numbers of rear seat passengers is shown in Tables F, G and H. Table F shows a manner of operation if the vehicle has no passengers in the back seat and the driver turns on the DMU.

TABLE B

| State | Visual | Audio | Comments |
|---------------------------------|---|---|--|
| Adequate power (>10%) | AMBER LED off | None | |
| Power low (2% < power ≤ 10%) | AMBER LED flashing for 15 s ON 1 s OFF 1 s | Speaker emits 1 short beep followed by 1 longer beep every 2 s for 15 seconds. | Driver has the option to acknowledge audible alerts. Visual alerts will continue until the cartridge completely runs out of battery or is discarded and replaced. |
| Power level critical (≤ 2%) | AMBER LED flashing for 15 s ON 0.5 s OFF 0.5 s | Speaker emits 1 short beep followed by 1 longer beep every 1 s for 15 seconds. | Driver has the option to acknowledge audible alerts. Visual alerts will continue until the cartridge completely runs out of battery or is discarded and replaced. |

[0161] In the case of the vehicle having one rear passenger and two back seat sensors and the single back seat passenger buckled up before the DMU is turned on; or if the vehicle has 2/3/4/5 rear seat passengers, all with sensors installed, and they are buckled up before the engine starts, Table G shows a manner of operation of the LED 27.

TABLE C

| State | Visual | Audio | Comments |
|---------------------------|--|--|---|
| No belts buckled up | RED LED flashing (3 times per second) ON 0.16 s OFF 0.16 s | Speaker emits a 60 second audio alert. | Flashes and beeps are in sync. |
| 'n' seat belts buckled up | Green LED flashing ('n' times per 2 seconds) | Speaker emits an alert in 2 second successions for 60 seconds. | Flashes and beeps are in sync. Number of flashes/beeps per 2 seconds = number of belts buckled up |

TABLE D

| State | Visual | Audio | Comments |
|--------------------------|--|---|--|
| 'm' seat belts unbuckled | RED LED flashing ('m' times per 2 seconds) | Speaker emits an alert in 2 second successions with no alert timeout. | Flashes and beeps are in sync. Number of flashes/beeps per 2 seconds = number of belts unbuckled |
| All belts buckled up | RED LED off | None | |

TABLE E

| State | Visual | Audio | Comments |
|-----------------|---|-------------------------------|--|
| Belt buckled up | GREEN LED occulting Duty cycle: ON 0.2 s OFF 2 s | None | Flashing will continue until belts are unbuckled - belts unbuckled alerts will be triggered. |
| Belt unbuckled | GREEN LED off | (See belts unbuckled section) | |

TABLE F

| Engine Status | DMU status | Number of belt buckles with units | Number of belts buckled up | Audio Alert | Visual Alert | Driver Option |
|---------------|------------|-----------------------------------|----------------------------|-------------------------------|---|---|
| ON | ON | n | 0 | Flashes and beeps are in sync | RED LED flashes 3 times per second for 60 seconds | Wait until alarm stops Press acknowledge button on DMU |

[0162] If after the engine of the vehicle is going and the DMU has registered seat belt(s) that are buckled up in the rear of the vehicle and then a seat belt or seat belts are then unbuckled while the engine is going, the manner of operation of the LED 27 is shown in Table H.

[0163] An important aspect of the present embodiment is that each of the slave units 87 has a unique identifier that is incorporated into the transmission packet sent from the

CMU transceiver 83 to the DMU transceiver 73. This enables the specific seatbelt buckle being monitored to be identified by the DMU, and distinguished from other seatbelt buckles. In this manner, the DMU has sufficient intelligence to distinguish between a fastened and unfastened state of the seatbelt relative to the initial arming of the system during start up, so that only the state of the belt that is being used by a passenger is being monitored.

TABLE G

| Engine Status | DMU status | Number of belts which were buckled up | Number of belts currently buckled up | Audio Alert | Visual Alert | Driver Option |
|---------------|------------|---------------------------------------|--------------------------------------|--|--|--|
| ON | ON | n | n - m | 'm' beeps in 2 second successions for 60 seconds to show 'm' belts are unbuckled | RED LED flashes in sync with audio alert to indicate belts are unbuckled | Wait until alarm stops Press acknowledge button on DMU |

TABLE H

| Engine Status | DMU status | Number of belt buckles with units | Number of belts buckled up | Audio Alert | Visual Alert | Driver Option |
|---------------|------------|-----------------------------------|----------------------------|---|---|--|
| OFF | ON | 2 | 1 | Single audio alert in 2 second successions for 60 seconds to show one belt is buckled up. | GREEN LED is on (flashing) | Wait until alarm stops Press acknowledge button on DMU |
| OFF | ON | 2/3/4/5 | 2/3/4/5 | Alert in 2 second successions for 60 seconds. Number of beeps per 2 seconds = number of belts buckled up. (Different tone to the belt unbuckled tone) | GREEN LEDs (depending on number of belts buckled) are on (flashing) | Wait until alarm stops Press acknowledge button on DMU |

[0164] Another aspect of the present embodiment is addressing a notorious problem with previous types of retro-fitted monitoring and alarm systems being their unreliability due to inferior design of the transmission system. The particular monitoring and alarm system of the present embodiment provides for the continuous monitoring of the power state of both the DMU 13 and all CMUs 15, so that if the power state of either falls below a prescribed threshold that may affect transmission signal strength by the respective transducers at the relevant time, an alarm status is triggered at the DMU 13 signifying the problem.

[0165] Also, the particular signal transmitted in the present embodiment is of the heartbeat pulse type, which provides a higher tolerance to noise or other electrical interference that may degrade the signal transmission.

[0166] Furthermore, as has been described, the operation of the CMU 15 involves looping to repeat signal transmission when activated, which is another way of overcoming transmission interference problems.

[0167] The second specific embodiment is substantially the same as the preceding embodiment except that it is

directed towards an application where the status of various seatbelts in a vehicle is transmitted to a base station in order to allow remote monitoring. As shown in FIGS. 35A and 35B, a vehicle 151, which may comprise a prime mover or bus requiring monitoring of the driver and/or passengers with regard to the status of their seatbelt latching, includes a transmitter attached to each seatbelt latch of the vehicle. This transmitter communicates with a transponder (not shown) that continually transmits the seatbelts latching status of each of the occupied seat of the vehicle to a base station 153. The base station 153 includes a receiver and monitor 155 that displays an alert when an active seatbelt becomes unbuckled after arming.

[0168] With monitoring vehicles in built up areas where the cellular telephone network has coverage, WiFi communication can be used. However, in situations where the vehicle may travel into the country and outside cellular telephone coverage, use can be made of satellite communication systems. FIG. 39B shows the use of a satellite 157 to receive messages from the transponder of the vehicle 151 for relaying seatbelt status information back to the base station

153 when the vehicle is unable to access a cellular communication system. This provides particular utility of the system for monitoring long-haul and tourist bus applications.

[0169] The third specific embodiment entails a different application of the monitoring and alarm system **11** to a swimming pool enclosure.

[0170] As shown in FIGS. **36A** and **36B**, the same concept generally applies whereby a slave unit **161** is adapted for operation with the latching mechanism of a swimming pool gate **163** and communicates with a receiving unit **165** located within a dwelling **167** remote of the swimming pool enclosure.

[0171] Consequently, when the sensing components are actuated by the opening of the latch mechanism of the gate **163**, an alert signal is sent to the receiving unit **165**, signifying that the pool gate **163** has been unlatched and may be open. Alternatively when the latching mechanism is closed, the sensing component **164** disables generation of the alert signal and returns the transmitting unit to a hibernating mode, signifying to the receiving unit **165** that the latching mechanism is in a closed state and that the pool gate is locked.

[0172] With monitoring a pool gate **163** from a dwelling in relatively close proximity, as shown in FIG. **36A**, a local WiFi network can be used. However, in an application where more remote communications are desirable to a mobile phone or someone travelling overseas for example, as shown in FIG. **36B** the transceiver arrangement is designed to communicate with a cellular telephone network or via a satellite **167** to receive messages from the transmitter unit **161** of the pool gate **163** for relaying latching mechanism status information to a remote user **169** or receiver unit **165**.

[0173] Obviously, the design and circuitry of the transmitter unit and receiving unit are different to that of the first embodiment, but those aspects of the process flow as outlined in FIGS. **19** to **31** will remain largely unchanged.

[0174] In the above description and illustrations, the DMU **13** has a male USB plug **29** as illustrated in FIG. **3**. However, it will be understood that a female USB socket or similar socket can be provided which will allow a patch cord to connect having a male USB end to connect to it, so as to plug such a female socket into a power source to recharge the one or more batteries in the DMU**13**.

[0175] It should be appreciated that the scope of the present invention is not limited to the particular embodiments described herein. Thus, the monitoring and alert system may find utility with other applications requiring only slight modification or configuration of the system described to adapt it for use in these applications, without departing from the spirit or scope of the invention.

1. A monitoring and alert system for retro-fitting to latching mechanisms including:

- a master control unit to be located proximate to an operator of the system, comprising a user interface having:
 - (a) an input enabling an operator to arm the system and then allow it to operate with minimal interaction of the operator;
 - (b) an output alerting the operator as to the status of the system in relation to a plurality of prescribed conditions; and
 - (c) a master processor providing the functionality of the master control unit;

one or more slave units each being fixedly attached to a discrete latching mechanism for detecting the latching status thereof, each slave unit comprising:

- (i) a sensor detecting whether the latching mechanism is in a latched state or an unlatched state, and
- (ii) a slave processor providing the functionality of the slave unit; and

a communicator communicating periodically status and alert signals between the master control unit and each of the slave units;

wherein the master processor and the slave processor are designed to invoke various initialising processes and running processes for the master control unit and each of the slave units during an initialising phase and running phase respectively, involving interaction with the operator via the user interface, the initialising processes and running process including a detect slave process and an update slave process to identify the latching status of each of the slave units.

2. A system as claimed in claim **1**, wherein a said slave unit also comprising: a slave power supply providing local power to the slave unit; and a slave power supply monitor monitoring the level of local power supplied to the slave unit and indicate when the level is below a prescribed threshold for reliable operation thereof; and wherein during a running phase the master processor is designed to invoke:

- (A) a system state process to ascertain the latest latching status of each of the slave units whilst ensuring minimal power consumption by the master control unit;
- (B) a power state process to check with the slave power supply monitor that the local power level is not below the prescribed threshold;
- (C) a user interface process to process input signals from the input and update the output to convey the latest latching and power state status to the operator.

3. A system as claimed in claim **1**, wherein the slave processor is designed to invoke a slave unit status routine to transmit: a power alert signal if the slave power supply monitor indicates that the local power is below the prescribed threshold; and the latching status of the slave unit, whilst ensuring minimal power consumption by the slave unit.

4. A system as claimed in claim **1**, wherein the communicator comprises a master transceiver forming part of the master control unit and a slave transceiver forming part of each slave unit for wirelessly communicating status and alert signals between the master control unit and each of the slave units.

5. A system as claimed in claim **1**, wherein the master control unit includes:

- (a) a master power supply providing local power to the master control unit; and
- (b) a master power supply monitor monitoring the level of the local power supplied to the master control unit and indicate when this is below a prescribed threshold for reliable operation thereof.

6. A system as claimed in claim **1**, wherein the slave processor invokes a sleep processes for a slave unit during a sleeping phase that cycle through a hibernating low power state and high power transmitting state, to communicate an update of the latching status to the master control unit.

7. A master control unit for a retro-fitted monitoring and alert system for latching mechanisms including one or more

slave units each being fixedly attached to a discrete latching mechanism for detecting the latching status thereof, each slave unit comprising:

- (i) a sensor detecting whether the latching mechanism is in a latched state or an unlatched state; and
- (ii) a slave transceiver forming part of a communicator for communicating periodically status and alert signals to the master control unit;

the master control unit to be located proximate to an operator of the system and comprising:

- (a) a user interface having: an input enabling an operator to arm the system and then allow it to operate with minimal interaction of the operator; and an output alerting the operator as to the status of the system in relation to a plurality of prescribed conditions;
- (b) a master processor providing the functionality of the master control unit; and
- (c) a master transceiver forming part of the communicator for communicating status and alert signals between the master control unit and each of the slave units;

wherein the master processor is designed to invoke various master initialising processes for the master control unit during an initialisation phase involving interaction with the operator via the user interface, the master initialising processes including a detect slave process to communicate with each slave unit and identify the latching status of each of the slave units.

8. A master control unit as claimed in claim 7, wherein each slave unit further comprises: a slave power supply providing local power to the slave unit; and a slave power supply monitor monitoring the level of local power supplied to the slave unit and indicate when this is below a prescribed threshold for reliable operation thereof; and wherein during a running phase the master processor is designed to invoke:

- (A) a system state process to ascertain the latest latching status of each of the slave units whilst ensuring minimal power consumption by the master control unit;
- (B) a power state process to check with the slave power supply monitor that the local power level is not below the prescribed threshold;
- (C) a user interface process to process input signals from the input and update the output to convey the latest latching and power state status to the operator.

9. A master control unit as claimed in claim 7, wherein the slave processor is designed to invoke a slave unit status routine to transmit: a power alert signal if the slave power supply monitor indicates that the local power is below the prescribed threshold; and the latching status of the slave unit, whilst ensuring minimal power consumption by the slave unit.

10. A master control unit as claimed in claim 7, having a master power supply for providing local power to the master control unit; and a master power supply monitor monitoring the level of local power supplied to the master control unit and indicate when this is below a prescribed threshold for reliable operation thereof.

11. A master control unit as claimed in claim 7, wherein the master transceiver communicates status and alert signals between the master control unit and each of the slave units wirelessly via the communicator.

12. A slave unit for a retro-fitted monitoring and alert system for latching mechanisms including a master control unit to be located proximate to an operator of the system, the master control unit comprising:

- (a) a user interface having: an input enabling an operator to arm the system and then allow it to operate with minimal interaction of the operator; and an output alerting the operator as to the status of the system in relation to a plurality of prescribed conditions; and
- (b) a master transceiver forming part of a communicator communicating status and alert signals from the slave unit;

the slave unit being fixedly attached to a discrete latching mechanism for detecting the latching status thereof, each slave unit comprising:

- (i) a sensor detecting whether the latching mechanism is in a latched state or an unlatched state,
- (ii) a slave processor providing the functionality of the slave unit; and
- (iii) a slave transceiver forming part of the communicator communicating periodically status and alert signals between the slave unit and the master control unit;

wherein the slave processor is designed to invoke various slave initialising processes for the slave unit during an initialisation phase involving interaction with the master control unit to communicate the latching status of the slave unit.

13. A slave unit as claimed in claim 12, further comprising: a slave power supply providing local power to the slave unit; and a slave power supply monitor monitoring the level of local power supplied to the slave unit and indicate when the level is below a prescribed threshold for reliable operation thereof; and wherein during a running phase the slave processor, in response to the master processor, is designed to invoke:

- (A) an update status process to provide the latest latching status of the slave unit whilst ensuring minimal power consumption;
- (B) an update power state process to indicate that the local power level is not below the prescribed threshold.

14. A slave unit as claimed in claim 12, wherein the slave processor invokes a slave unit status routine to transmit a power alert signal if the slave power supply monitor indicates that the local power is below the prescribed threshold, and the latching status of the slave unit, whilst ensuring minimal power consumption by the slave unit.

15. A slave unit as claimed in claim 12, wherein the slave transceiver communicates status and alert signals to the master control unit wirelessly via the communicator.

16. A slave unit as claimed in claim 12, wherein the slave processor invokes sleep processes for a slave unit during a sleeping phase that cycle through a hibernating low power state and high power transmitting state, to communicate an update of the latching status to the master control unit.

17. A method for monitoring and alerting the latching status of a latching mechanism including:

initialising during an initialisation phase, a locally powered master control unit located proximate to an operator to determine the latching status of the latching mechanism, and a locally powered slave unit to be attached to the latching mechanism, involving interaction with the operator to identify the latching status of the latching mechanism;

during a running phase:

- (a) ascertaining the latest latching status of the latching mechanism whilst ensuring minimal power consumption by the master control unit and the slave unit;

- (b) checking that the local power supply level for master control unit and the slave unit is not below a prescribed threshold;
- (c) wirelessly communicating periodically status and alert signals between the slave unit and the master control unit; and
- (d) conveying the latest latching and power state status to the operator.

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