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

(11) **EP 2 495 381 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.09.2012 Bulletin 2012/36

(21) Application number: **11382056.7**

(22) Date of filing: **03.03.2011**

(51) Int Cl.:
E05B 65/00 *(2006.01)* ***E05B 63/00*** *(2006.01)*
E05B 51/02 *(2006.01)* ***B61D 35/00*** *(2006.01)*

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

(71) Applicant: **ALTE TRANSPORTATION S.L.**
08185 Lliça de Vall (ES)

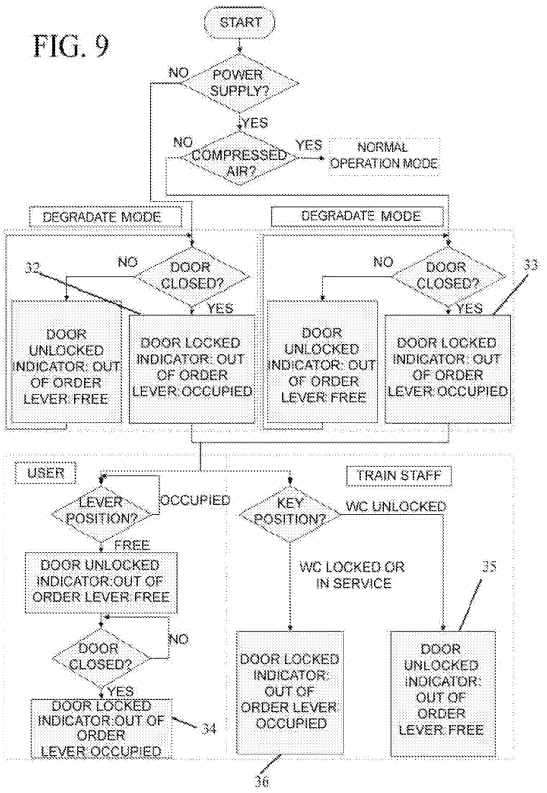
(72) Inventors:
- **Tuset Mestre, Miquel**
  08185, Lliça de Vall (ES)
- **Pich Martínez, David**
  08185, Lliça de Vall (ES)
- **Escura Sabaté, Jordi**
  08185, Lliça de Vall (ES)
- **Marín García, Francisco**
  08185, Lliça de Vall (ES)
- **Sarsanedas Millet, Pau**
  08185, Lliça de Vall (ES)
- **Puebla Ribas, Dídac**
  08185, Lliça de Vall (ES)

(74) Representative: **Ponti Sales, Adelaida**
Oficina Ponti
C. Consell de Cent, 322
08007 Barcelona (ES)

(54) **A system and method for locking and unlocking a door of a toilet module of a public transport vehicle and a programming product for carrying out said method**

(57) It is characterised in that second means of detection (19,20,21,22,23,24) of an order to lock or unlock the door (1) from the exterior of said module (2) are included, these said second means of detection (19,20,21,22,23,24) being associated with said means of processing and control to provide a signal to lock said door (1) to said means of locking (3,4,5,6,7,8,9), and said means of processing and control being configured to allow the unlocking of said door (1) from the interior of said module (2) when said means of processing and control receive a signal to unlock coming from said first means of detection (11,12,13,14), it being possible to lock said door (1) again to leave the module (2) out of order when the signal to lock persists from the exterior of the module (2). Fig.9 and Fig.10.

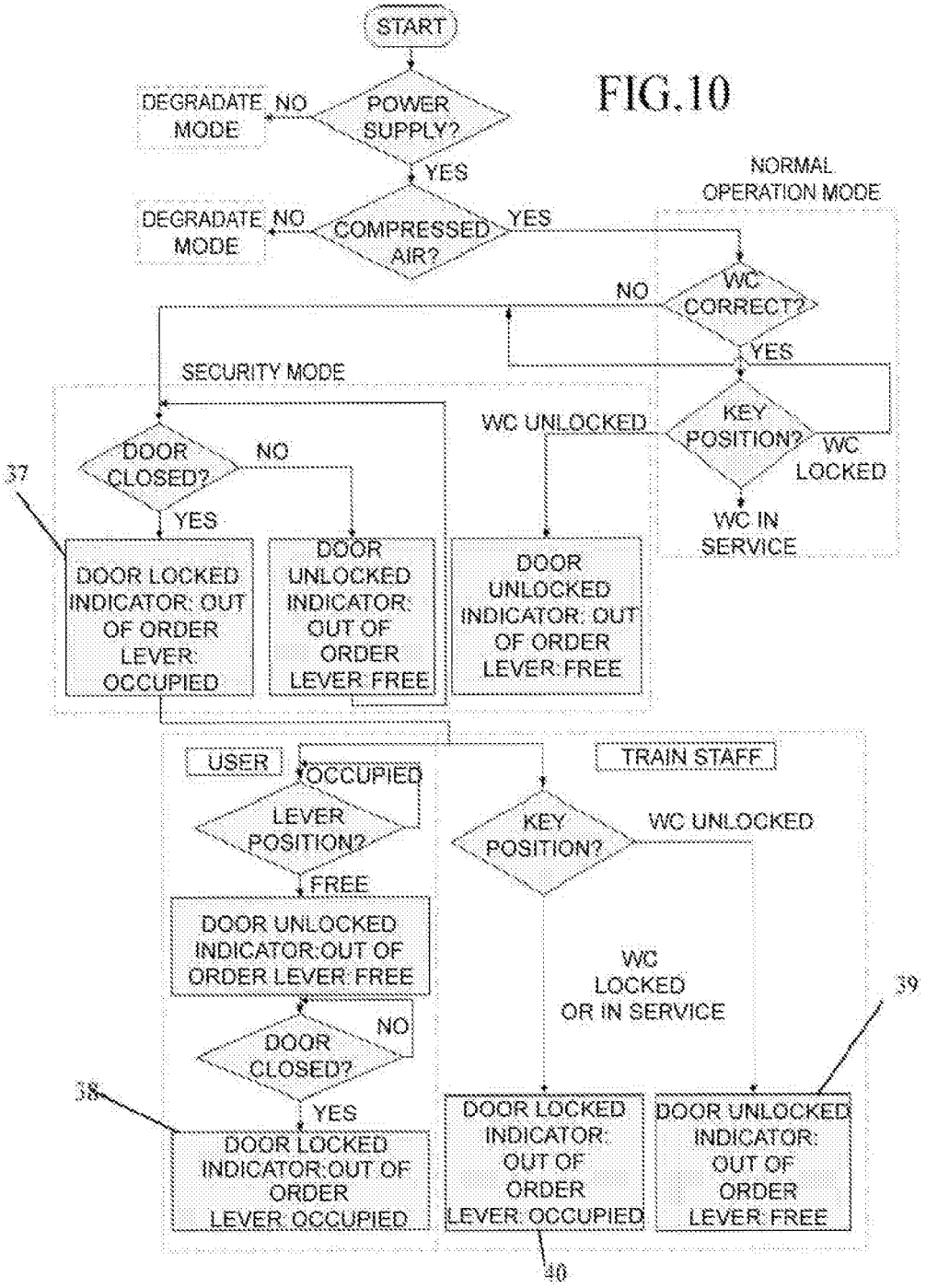
FIG. 9



EP 2 495 381 A1

(Cont. next page)

FIG.10


START
POWER SUPPLY?
NO
DEGRADATE MODE
YES
COMPRESSED AIR?
NO
DEGRADATE MODE
YES
NORMAL OPERATION MODE
WC CORRECT?
NO
YES
SECURITY MODE
KEY POSITION?
WC LOCKED
WC UNLOCKED
WC IN SERVICE
DOOR CLOSED?
NO
YES
37
DOOR LOCKED INDICATOR: OUT OF ORDER LEVER: OCCUPIED
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
USER
TRAIN STAFF
OCCUPIED
LEVER POSITION?
FREE
KEY POSITION?
WC UNLOCKED
DOOR UNLOCKED INDICATOR:OUT OF ORDER LEVER: FREE
WC LOCKED OR IN SERVICE
39
NO
DOOR CLOSED?
YES
38
DOOR LOCKED INDICATOR:OUT OF ORDER LEVER: OCCUPIED
DOOR LOCKED INDICATOR: OUT OF ORDER LEVER: OCCUPIED
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
40

Description

[0001] The present invention relates to a system for locking and unlocking the door of a toilet module in a transportation vehicle, a process for locking and unlocking said door using said system and a computer program product to carry out said process.

BACKGROUND OF THE INVENTION

[0002] Toilet modules for public transportation vehicles are known, such as those in trains, which include a clean water tank, a wastewater tank and flushing systems to discharge the wastewater from the toilet bowl to the wastewater tank.

[0003] The cited modules have a locking and unlocking system for the door which includes a locking and unlocking mechanism which is activated by a pneumatic actuator linked to an electronic control unit which detects the locked or unlocked position of a lever located inside the module.

[0004] The same electronic control unit is configured to detect any malfunctioning of the module, be it because the water level in the waste water tank has reached its limit, due to lack of air or power supply or, for example, due to the lack of clean water in the tank.

[0005] As such, when a failure or malfunction is produced in said modules, for example due to lack of air or power supply, the aforementioned electronic control unit of the module sends an unlocking signal to the pneumatic actuator which activates the unlocking mechanism of the door. Therefore, in the event of a breakdown due to malfunctioning, the user can always leave the module.

[0006] However, the problem with this locking and unlocking system is that as the door remains unlocked due to a malfunction, the module remains accessible to any user, in spite of the fact that it is out of order, which leads to problems of incorrect use of the module on the part of other users.

[0007] To solve these problems, the existing locking and unlocking systems include a second locking and unlocking mechanism for the door which is activated from outside the module. This mechanism is associated with a square head key which only the train staff can operate.

[0008] As such, when the train staff detects that the module is out of order, the same staff activates the second locking mechanism using the square head key so that the door remains permanently locked.

[0009] However, the problem with this system is that the locking of the door is not immediate, with the possibility that a great deal of time could pass before the train staff detect the toilet module is out of order and lock the door. As a result the module remains equally exposed to incorrect use on the part of the users.

[0010] Another problem that this system has stems from the fact that if a user is left inside with the door locked by the train staff this user cannot get out.

DESCRIPTION OF THE INVENTION

[0011] The objective of the present invention is to solve the aforementioned problems, developing a system for locking and unlocking the door of a toilet module in a public transportation vehicle which has the advantages that will be described below

[0012] In accordance with this objective, according to a first aspect the present invention provides a locking and unlocking system for the door of a toilet module in a public transportation vehicle, which comprises means of locking and unlocking said door when said door is closed, first means of detection of an order to lock or unlock the door coming from the interior of said module, and means of processing and control to supply a signal to said means of locking and unlocking depending on a signal emitted by said first means of detection.

[0013] The system is characterised by the fact that it includes second means of detection of an order to lock or unlock the door from the exterior of said module, said second means of detection being associated with said means of processing and control to supply a door locking signal to said means of locking, said means of processing and control being configured to allow the unlocking of said door at any time from the interior of said module when said means of processing and control receive an unlocking signal coming from said first means of detection, it being possible to lock said door again to leave the module out of order when the locking signal coming from the exterior of the module persists.

[0014] The system of the present invention has the advantage that it is possible to lock the door from the exterior by the train staff, and at the same time, unlock said door by a user that may have been left inside. In this way, it is guaranteed that the module remains out of order and locked without the danger of a user being left inside, it being possible to lock the door again when the user leaves when the signal to lock from the exterior persists.

[0015] This is as such thanks to the fact the means of locking and unlocking the door are associated with said means of processing and control in that they can receive a signal to lock or unlock the door be it from the exterior (second means of detection) or from the interior (first means of detection).

[0016] Another advantage of the system stems from the fact that it is possible to carry out an automatic out of order of all of the modules in the vehicle once a journey has been completed, for example, to carry out maintenance operations, given that the means of locking and unlocking the door can be controlled automatically from the exterior without the risk of anybody being left locked inside.

[0017] According to a preferred embodiment, said system comprises means of detection of a failure of the module, and wherein said means of processing and control are configured to allow said door to be locked at any time when said means of processing and control receive a failure signal coming from said means of detection, it be-

ing possible said door to be unlocked by said means of unlocking upon receiving from said means of processing and control an unlocking signal coming from said first means of detection from the interior of the module, allowing said means of processing and control to lock said door again in order to leave the module out of order when the failure signal persists.

[0018] In this way, the system has the advantage of when an out of order signal is produced due to a failure of the module, for example, owing to a lack of water in the clean water tank, the door locks to leave the module out of order, it being possible to unlock it at any moment from the interior (first means of detection) to allow a user to exit.

[0019] As such, unlike with what occurs in the state of the art, when a malfunction is detected, the module remains locked and out of order, and as a result preventing incorrect use. Furthermore, if there is a user inside, said user can exit and the door will lock again, providing the failure signal continues.

[0020] This is as such thanks to the fact that the means of locking and unlocking the door are associated with said means of processing and control in that they can receive a signal to lock or unlock the door coming from the interior (first means of detection) and/or from said means that detect the malfunction.

[0021] According to the same preferred embodiment, said means of locking and unlocking includes a door locking mechanism actuated by a fluid dynamic actuator, and a closed-door electronic sensor associated with said actuator.

[0022] Preferably, said locking and unlocking mechanism includes a locking piston actuated by said actuator and a stop element positioned over the door to prevent said door from opening when said stop element comes into contact with said piston.

[0023] Advantageously, said system is applied on a door that is a sliding door. However, any other type of door could be used.

[0024] Again preferably, said first means of detection of the order to lock or unlock the door coming from the interior of the module include a lever for locking and unlocking situated in the interior of the module, a fluid dynamic actuator to actuate said lever, and at least one electronic sensor associated with said actuator to detect the position of said lever and supply a signal to said means of processing and control.

[0025] Again preferably, said second means of detection of an order to lock or unlock the door coming from the exterior of said module include a lock provided with a locking and unlocking key, and at least one electronic sensor associated with said key to detect the position of said key and supply a signal to said means of processing and control.

[0026] Advantageously, said system comprises an indicator of the status of the module, said indicator being associated with said means of processing and control to supply an informative signal on the status of the module according to a signal emitted by said first or second means of detection of the order to lock or unlock the door, or according to a signal emitted by said means of detection of a failure of the module.

[0027] Thanks to these characteristics, the system can provide information at any moment on the status of the module coming from the exterior, from the interior or from the operating control system of the module itself.

[0028] Again advantageously, said indicator of the status of the module includes at least one fluid dynamic actuator associated with said informative signal in order to show said informative signal according to the signal emitted by said means of detection of the order to lock or unlock the door or according to said means of detection of a failure of the module.

[0029] Advantageously, said indicator of the status of the module includes at least three pictograms to provide tactile information of at least three states of the module (for example, out of order, occupied and free).

[0030] According to an embodiment, said door is an automatic door and said system comprises a push button to open and close said door automatically from the interior or exterior of the module, said button being associated with said means of processing and control to supply a signal to unlock said door automatically to said means of locking and unlocking said door, such that said door can be at the same time unlocked and open.

[0031] This embodiment is useful for people with disabilities and has an anti-panic function.

[0032] Preferably, said means of detection of a failure include means of detection of a lack of electric energy for the proper operation of the module and, again preferably, said means of processing and control include, in addition, an automaton of pneumatic logical functions.

[0033] The automaton of pneumatic logical functions has the advantage of guaranteeing efficient and reliable operation of the system for locking and unlocking in absence of power supply.

[0034] According to the embodiment, which includes the automaton of pneumatic logical functions;

- said means of locking and unlocking the door include, in addition, a pneumatic sensor to detect if the door is closed.
- said first means of detection of the order to lock or unlock the door from the interior of said module include, in addition, a pneumatic sensor to detect the position of the locking and unlocking lever and supply a signal to said automaton of pneumatic logical functions,
- said second means of detection of the order to lock or unlock the door from the exterior of said module include, in addition, a pneumatic sensor to detect the position of the locking and unlocking key and supply a signal to said automaton of pneumatic logical functions.

[0035] Advantageously, said automaton is configured

to allow the door to be unlocked at any time upon receiving an unlocking signal coming from the pneumatic sensor associated with the key of said second means. In this way, the door can be unlocked at any moment from the exterior in the absence of power supply.

[0036] According to a second aspect, the present invention provides a process for locking and unlocking the door of a toilet module in a public transportation vehicle, by using the claimed system which comprises the stages of;

a) receive a door locking signal coming proceeding from the exterior,
b) if the door is closed, send a door locking signal to leave the door locked and the module out of order,
c) while the door is locked, if a door unlocking signal is received coming from the interior of the module, unlock the door to allow the user to exit.
d) if the door is closed again by said user, send a door locking signal in order to lock the door and leave the module out of order.

[0037] This process has the advantage that it envisages the locking of the door from the exterior by the train staff, and at the same time, the unlocking of said door by a user that may have been left inside. In this way it is guaranteed that the module remains out of order and locked without the danger of a user being left inside, it being possible the door to be locked again when the user leaves if the locking signal coming from the exterior continues.

[0038] Preferably, said process comprises the stages of;

a) receive a failure signal from the module,
b) if the door is closed, send a door locking signal to leave the door locked and leave the module out of order,
c) while the door is locked, if a door unlocking signal is received coming from the interior of the module, unlock the door to allow the user to exit.
d) if the door is closed again by said user, send a door locking signal in order to lock the door and leave the module out of order.

[0039] In this way, the process envisages the locking of the door in the event of a malfunction or failure and, at the same time, the unlocking of said door by a user who may have been left inside, with the door locking again when the user exits. In this way, it is guaranteed that the module remains out of order and locked in the event of a malfunction without the danger of a user being left inside.

[0040] According to a third aspect, the present invention provides a computer program product to carry out said process which is characterised by the fact that it executes by means of pneumatic logical and/or electric functions the claimed process.

DESCRIPTION OF THE DIAGRAMS

[0041] For a better understanding of all that has been set forth, there are attached some drawings in which, schematically and only by way of example, without any restrictive character, a practical example of embodiment is represented.

[0042] In said drawings,

figure 1 shows a perspective view of a module with a sliding door which includes the locking and unlocking system of the present invention.
figure 2 shows a detail of a door from figure 1 in which includes the locking and unlocking mechanism of the sliding door.
figure 3 shows a front view of a mechanical plate to be situated in the interior of the module which includes locking and unlocking lever of the door and the indicator of the status of the module.
figure 4 shows a rear view of the plate from figure 3.
figure 5 shows a front view of a mechanical plate from the exterior of the module which includes the locking and unlocking mechanism and an indicator of the status of the module.
figure 6 shows a rear view of the plate from figure 5.
figure 7 shows a front view of a mechanical plate to be situated in the interior of the module for users with disabilities.
figure 8 shows a front view of a mechanical plate to be situated outside the module for users with disabilities.
figure 9 and 10 are block diagrams which represent the operating algorithm of the system.

DESCRIPTION OF EMBODIMENTS

[0043] The following discloses a preferred embodiment of the locking and unlocking system of a door 1 of a module 2 of the toilet in a public transportation vehicle, such as for example, a train.

[0044] This embodiment includes means of processing and control that are configured by an electric processing and control unit and a pneumatic processing and control unit, also called herein automaton of pneumatic logical functions.

[0045] The operation of either one or other unit is determined by the operating conditions of the module 2. Such that, whenever the module 2 has power supply, the system will be governed by the electronic processing and control unit, while the system will be governed by the pneumatic automaton, only in the event that there is no power supply.

[0046] As will be disclosed further on, so that the system can operate either with the electronic control unit or the pneumatic control unit correctly, both electric sensors and pneumatic sensors have been envisaged to detect the actions which operate in the system.

[0047] As can be seen in figure 1, the toilet module 2

includes a sliding door 1 with an upper guide 3 that has means of locking and unlocking the door 1.

[0048] The means of locking and unlocking include a locking mechanism 4 which consists in a locking piston 5 associated with a stop element 6 positioned above the sliding door 1. The mechanism 4 is actuated by a pneumatic actuator 7 which is associated with a closed door pneumatic sensor 8 and a closed door electric sensor 9, operating either one or other sensor according to whether the control of the system is governed by the electric automaton or the pneumatic automaton.

[0049] The locking of the door 1 is produced, when the door is closed, in the event that the pneumatic actuator 7 receives a locking signal coming from the means of processing and control of the system which makes the piston 5 to descend. In turn, the unlocking is produced when the same actuator 7 receives an unlocking signal from the same means of processing and control.

[0050] The signals for locking and unlocking the door 1 are emitted by electric sensors 10, 11 or by pneumatic sensors 12, according to whether the system is governed by the electric automaton or the pneumatic automaton. In either case, these sensors 10, 11, 12 are associated with a locking and unlocking lever 13 which is actuated by the user or the system itself (in the event of a failure being detected), by way of a pneumatic actuator 14.

[0051] The locking of the door 1 from the interior is produced, with the door closed, when the user or the system itself moves the lever 13 by way of the actuator 14 until the position in which there is one of the said electric sensors 10 which sends the locking signal to the means of processing and control.

[0052] When the lever 13 is in the locked position no pneumatic sensor is envisaged given that, in the event of a failure in the supply of power supply, the door will already have been locked by the system itself upon the system detecting a malfunction or failure (lack of power supply, electric energy, in this case).

[0053] To unlock the door 1 from the interior, the user or the system itself must move the lever 13 to a position in which there is another electric sensor 11 which sends an unlocking signal to the means of processing and control.

[0054] When the lever 13 is in the unlocked position, a pneumatic sensor 12 is envisaged in order to be able to also unlock the door in the event of a failure in the power supply by way of the automaton of pneumatic logical functions.

[0055] The locking and unlocking lever 13, the electric sensors 10, 11, the pneumatic sensors 12 and the pneumatic actuator 14 form the first means which detect the order to lock or unlock the door 1 from the interior of the module. These means are positioned in a plate 15 situated in the interior of the module 2.

[0056] Figure 3 shows a front view of said plate 15 in which can be appreciated, in addition to the lever 13, the indicator 16 of the status of the module in which tactile pictograms are displayed which provide the user with information on the status of the module (out of order, occupied and free) according to the signal they receive from the means of processing and control.

[0057] Figure 4 shows the front view of the same plate 15 in which represented schematically are, the pneumatic actuator 14 of the lever 13, electric sensors 10, 11 and the pneumatic sensor 12 associated with said lever 13 and a couple of pneumatic actuators 17, 18 associated with the pictograms. Said pictograms provide information on the status of the module 2 according to the signal proceeding from the means of processing and control.

[0058] As disclosed in previous sections, one of the novel features of the system of the present invention stems from the fact that the door 1 can be locked from the exterior by the train staff, it being possible at the same time to unlock it from the interior in order to allow a user locked inside to exit.

[0059] To achieve the aforementioned, envisaged on the exterior of the module 2 is a lock 19 with an unlocked position (WC unlocked) and another locked position (WC locked) which are associated with a pneumatic sensor 20 and to two electric sensors 21, 22, according to whether the system is governed by the electric automaton or the pneumatic automaton.

[0060] The locking of the door 1 from the exterior is produced, with the door 1 being closed, when a shaft 23 of the lock 19 moves a key 24 to the position in which there is the first electric sensor 21 which sends the locking signal to the means of processing and control, which in turn, send the signal to the pneumatic actuator 7 of the locking mechanism 4 of the door 1.

[0061] When the key 24 is in the locked position no pneumatic sensor is envisaged given that, in the event of a failure in the power supply, the door will already have been locked by the system itself upon the system detecting the power failure.

[0062] To unlock the door 1 from the exterior, shaft 23 of the lock 19 must move the key 24 to the position in which there is the second electric sensor 22 which supplies the unlocking signal to the means of processing and control.

[0063] When the key 24 is in the unlocked position, a pneumatic sensor 20 is envisaged in order to be able to also unlock the door 1 in the event of a failure in the power supply by way of the automaton of pneumatic logical functions.

[0064] The lock 19, the shaft 23, the key 24, the electric sensors 21, 22 and the pneumatic sensor 20 form the second means which detect the order to open or close the door 1 from the exterior. These means are positioned in a plate 25 situated in the exterior of the module 2.

[0065] Figure 5 shows a front view of said plate 25, in which can be appreciated, in addition to the lock 19, the indicator 26 of the status of the module in which tactile pictograms are displayed which provide the user with information on the status of the module (out of order, occupied and free).

[0066] As can be observed in this figure 5, the lock 19

includes, in addition to the positions of toilet locked (WC locked) and toilet unlocked (WC unlocked), the position of toilet in service (WC in service). In this position of service, the key 24 of the lock 19 is found in an intermediate position in which no signal is sent to the means of processing and control, the system being able to operate in a normal way.

[0067] Figure 6 shows the rear view of the same plate 25 in which represented schematically are, the shaft 23, the key 24, the electric sensors 21, 22 and the pneumatic sensor 20 associated with said key 24 and a couple of pneumatic actuators 27, 28 associated with the pictograms. Said pictograms provide information on the status of the module 2 according to the signal which they receive from the means of processing and control of the system.

[0068] As disclosed in the description of the invention, the door can be an automatic door envisaged with a push button 29 to open or close said door automatically from the interior or exterior of the module 2. This door is useful for users with disabilities.

[0069] Figures 7 and 8 represent the front views of an interior plate 30 and an exterior plate 31 of the module 2 envisaged with an automatic door. As can be seen in these figures 7 and 8, the plates 30, 31 are identical to the plates in figures 3 and 4 with the only particularity that they additionally include a button 29.

[0070] In addition to opening and closing the automatic door, it has been envisaged that the button 29 is associated with the means of processing and control of the system in order to be able to send an unlocking signal to the mechanism 4 of the door. In this way, it is possible to open and unlock the door with a single push of a button facilitating the exit of the user in the case of panic.

[0071] As mentioned in the description of the invention, the system has the advantage of when detecting an out of order signal that has been produced due to a failure of the module 2, for example, owing to a lack of water in the clean water tank or due to a lack of power supply, the door 1 locks to leave the module 2 out of order, it being possible to unlock the module at any moment from the interior or exterior to allow a user to exit.

[0072] To be able to operate in this way, it has been envisaged that the system has means of detection of a failure (for example, a sensor for the water level in the tanks, power supply sensor, etc...) which are associated with the processing and electronic control unit to be able to supply a locking signal at any moment to the pneumatic actuator 7 of the locking means. When this occurs, the processing and electronic control unit sends, simultaneously, a signal to the actuator 14 of the lever 13 in order to put it in a locked position, and the actuators 17, 18 of the tactile indicator to show the out of order signal. Once the door is locked and, in the event of a failure due to a lack of power supply, to be able to unlock the door 1 both from the interior and from the exterior, an automaton of pneumatic logical functions will enter into operation which will respond to the signals sent by the pneumatic sensors of the system.

[0073] Disclosed below is the way of operating the system making reference to the algorithm represented in diagrams 9 and 10.

[0074] The diagram in figure 9 represents the operating algorithm of the system when limited without air and/or power supply (degrade mode). In this way the system is governed by the electronic processing and control unit (if there is power supply) or the pneumatic processing and control unit (if there is no power supply), it being necessary to have a tank of reserve air to make the system operate if there is a shortage of it.

[0075] As can be seen in blocks 32 and 33 in figure 9, upon the (electronic or pneumatic) processing and control unit receiving a signal due to a lack of power supply or air, if the door is closed, the same (electronic or pneumatic) processing and control unit of the system proceeds to lock the door 1 sending a locking signal to the actuator 7 of the locking mechanism 4 of the door 1. When this happens, the (electronic or pneumatic) processing and control unit sends, simultaneously, a signal to the actuator 14 of the lever 13 in order to put it in a locked position (occupied), and to the actuators 17, 18 of the tactile indicator to display the out of order signal.

[0076] Once the door 1 is locked due to lack of power and/or air supply, two situations can exist.

[0077] The first situation is that in which a user inside wants to exit, the user proceeds to move the lever 13 into the unlocked position (free) in which there are the electric sensor 11 and pneumatic sensor 12 which supply an unlocking signal to the (electronic or pneumatic) processing and control unit so that pneumatic actuator 7 of the locking and unlocking mechanism 4 is actuated. In this way, the user can exit the module 2 by opening the door 1 manually or, in the event that the door is automatic, by pressing the button 29.

[0078] As can be seen in block 34 in diagram 9, once the user has exited the module 2, if the door 1 is closed, this becomes locked again by the (electronic or pneumatic) processing and control unit which sends the locking signal coming from the means that have detected the lack of power and/or air supply. When this happens, (electronic or pneumatic) processing and control unit sends, simultaneously, a signal to the actuator 14 of the lever 13 in order to put it in a locked position (occupied), while the out of order signal is maintained on the indicator (16, 26).

[0079] A second situation is that in which the train staff detect the out of order and wish to open the door 1 to carry out, for example, a maintenance operation, the train staff proceed to move the key 24 of the lock 19 to the position (WC unlocked) in which there are the electric sensor 22 and pneumatic sensor 20 which supply an unlocking signal to the (electronic or pneumatic) processing and control unit so that the pneumatic actuator 5 of the locking and unlocking mechanism 4 is actuated. In this way, the train staff can open the door 1 and access the module 2. When this happens, the (electronic or pneumatic) processing and control unit sends, simultaneous-

ly, a signal to the actuator 14 of the lever 13 in order to put it in an unlocked position (free), while the out of order signal is maintained on the indicator (16, 26).

[0080] As can be seen in block 35 of the diagram, when the key 24 is in the toilet unlocked position (WC unlocked), the module 2 remains permanently unlocked, it being necessary to move the key 24 to the toilet locked position (WC locked) to lock the module again which is represented by block 36.

[0081] The diagram in figure 10 represents the operating algorithm of the system in security mode and in normal operation mode. In these operation modes the system is always governed by the electronic processing and control unit.

[0082] As can be seen in block 37 in figure 10, upon the electronic processing and control unit receiving a failure signal different to that due to a lack of power supply or air, for example, a failure due to a lack of water in the clean water tank, if the door is closed, the same electronic processing and control unit of the system proceeds to lock the door 1 sending a locking signal to the actuator 7 of the locking mechanism 4 of the door 1. When this happens, the electronic processing and control unit sends, simultaneously, a signal to the actuator 14 of the lever 13 in order to put it in a locked position (occupied), and to the actuators 17, 18 of the tactile indicator to display the out of order signal.

[0083] Once the door 1 is locked due to a failure, two situations can exist.

[0084] The first situation is that in which a user inside wants to exit, the user proceeds to move the lever 13 into the unlocked position (free) in which there is the electric sensor 11 which sends an unlocking signal to the electronic processing and control unit so that the pneumatic actuator 7 of the locking and unlocking mechanism 4 is actuated. In this way, the user can exit the module 2 by opening the door 1 manually or, in the event that the door is automatic, by pressing the button 29.

[0085] As can be seen in block 38 in diagram 10, once the user has exited the module 2, if the door 1 is closed, this becomes locked again by the electronic processing and control unit which sends the locking signal coming from the means that have detected the failure signal due to the lack of power and/or air supply. When this happens, the electronic processing and control unit sends, simultaneously, a signal to the actuator 14 of the lever 13 in order to put it in a locked position (occupied), while the out of order signal is maintained on the indicator (16, 26).

[0086] A second situation is that in which the train staff detect the out of order and wish to open the door 1 to carry out, for example, a maintenance operation, the train staff proceed to move the key 24 of the lock 19 to the position (WC unlocked) in which there is the electric sensor 22 which sends an unlocking signal to the electronic processing and control unit so that the pneumatic actuator 7 of the locking and unlocking mechanism 4 is actuated. In this way, the train staff can open the door 1 and access the module 2. When this happens, the electronic processing and control unit sends, simultaneously, a signal to the actuator 14 of the lever 13 in order to put it in an unlocked position (free).

[0087] As can be seen in block 39 of the diagram, when the key 24 is in the toilet unlocked position (WC unlocked), the module 2 remains permanently unlocked, it being necessary to move the key 24 to the toilet locked position (WC locked) to lock the module again, which is represented by block 40.

[0088] Diagram 10 also shows the normal operation mode of the system when the electronic processing and control unit does not detect any failure. In this event, two situations can exist.

[0089] In the first situation, the train staff position the key 24 of the lock 19 to the toilet unlocked position (WC unlocked) because, for example, they detect that the toilet has been occupied for a long time and wish to know if there is an unconscious person inside. In this position of the key 24 there is the electric sensor 22 which sends an unlocking signal to the electronic processing and control unit so that the pneumatic actuator 7 of the locking and unlocking mechanism 4 is actuated. In this way, the train staff can open the door 1 and access the module 2 to see what has happened. When this happens, the electronic processing and control unit sends, simultaneously, a signal to the actuator 14 of the lever 13 in order to put it in an unlocked position (free). The toilet remains permanently unlocked.

[0090] In a second situation, the train staff position the key 24 of the lock 19 to the toilet locked position (WC locked) because they wish, for example, to leave the toilet out of order. In this position of the key 24, there is the electric sensor 21 which supply a locking signal to the electronic processing and control unit so that it proceeds to lock the module 2 as if there were a failure.

[0091] In a third situation, the train staff positions the key 24 of the lock 19 to the toilet in service position (WC in service). In this position the system operates normally awaiting the locking or unlocking signal of the lever 13 which would have to be actuated now by the user when accessing the module 2.

[0092] As has been disclosed previously, the system of the present invention locks the door faced with any out of order produced by the train staff themselves, due to a lack of power and/or air supply, or any other failure detection, allowing at any moment a user or the train staff themselves the possibility to unlock the door in order to exit the module or access the module 2.

[0093] Thanks to these characteristics, safe and efficient management and use is achieved in the toilet modules for public transportation vehicles.

[0094] Despite the fact that a specific embodiment of this invention has been described and shown, it is obvious that an expert in the subject would be able to introduce variations and modifications, or replace the details by others that are technically equivalent, without departing from the sphere of protection defined by the attached claims.

Claims

1. Locking and unlocking system for the door (1) of a toilet module (2) in a public transportation vehicle, which comprises means of locking and unlocking (3,4,5,6,7,8,9) said door (1) when said door (1) is closed, first means of detection (11,12,13,14) of an order to lock or unlock the door coming from the interior of said module (2), and means of processing and control to supply a signal to said means of locking and unlocking (3,4,5,6,7,8,9) depending on a signal emitted by said first means of detection (11,12,13,14), **characterised in that** it includes second means of detection (19,20,21,22,23,24) of an order to lock or unlock the door (1) coming from the exterior of said module (2), said second means of detection (19,20,21,22,23,24) being associated with said means of processing and control to supply a door (1) locking signal (1) to said means of locking (3,4,5,6,7,8,9), said means of processing and control being configured to allow the unlocking of said door (1) at any time from the interior of said module (2) when said means of processing and control receive an unlocking signal coming from said first means of detection (11,12,13,14), it being possible to lock said door (1) again to leave the module (2) out of order when the locking signal coming from the exterior of the module (2) persists.

2. System according to claim 1, which comprises means of detection of a failure of the module, and wherein said means of processing and control are configured to allow said door (1) to be locked at any time when said means of processing and control receive a failure signal coming from said means of detection, it being possible said door (1) to be unlocked by said means of unlocking (3,4,5,6,7,8,9) upon receiving from said means of processing and control a unlocking signal coming from said first means of detection (11,12,13,14) from the interior of the module (2), allowing said means of processing and control to lock said door (1) again in order to leave the module (2) out of order when the failure signal persists.

3. System according to any of the preceding claims in which said means of locking and unlocking include a door locking mechanism (4) actuated by a fluid dynamic actuator (7), and a closed door electronic sensor (9) associated with said actuator (7).

4. System according to claim 3, in which said locking and unlocking mechanism (4) includes a locking piston (5) actuated by said actuator (7) and a stop element (6) positioned over the door (1) to prevent said door (1) from opening when said stop element (6) comes into contact with said piston (5).

5. System according to any of the preceding claims, in which said first means of detection of the order to lock or unlock the door from the interior of the module include a lever for locking and unlocking (13) situated in the interior of the module, a fluid dynamic actuator (14) to actuate said lever (13), and at least one electronic sensor (11, 10) associated with said actuator (14) to detect the position of said lever (13) and supply a signal to said means of processing and control.

6. System according to any of the preceding claims, in which said second means of detection of an order to lock or unlock the door from the exterior of said module include a lock (19) provided with a locking and unlocking key (24), and at least one electronic sensor (21, 22) associated with said key (24) to detect the position of said key (24) and supply a signal to said means of processing and control.

7. System according to any of the preceding claims, which comprises an indicator (16, 26) of the status of the module, said indicator being associated with said means of processing and control to supply an informative signal on the status of the module according to a signal emitted by said first (11,12,13,14) or second (19,20,21,22,23,24) means of detection of the order to lock or unlock the door (1), or according to a signal emitted by said means of detection of a failure of the module.

8. System according to claim 7, in which said indicator (16,26) of the status of the module includes at least one fluid dynamic actuator (17,18,27,28) associated with said informative signal in order to display said informative signal according to the signal emitted by said first (11,12,13,14) and second (19,20,21,22,23,24) means of detection of the order to lock or unlock the door, or according to said means of detection of a failure of the module.

9. System according to any of the preceding claims, in which said door is an automatic door (1) and said system comprises a push button (29) to open and close said door automatically from the interior or exterior of the module (2), said push button (29) being associated with said means of processing and control to supply a signal to unlock said automatic door (1) to said means of locking and unlocking (3,4,5,6,7,8,9) said door, such that said door (1) can be at the same time unlocked and open by said push button (29).

10. System according to any of the claims 2 to 9, in which said means of detection of a failure include means of detection of a lack of electric energy for the proper operation of the module (2).

11. System according to claim 10, in which said means

of processing and control include, in addition, an automaton of pneumatic logical functions.

12. System according to claim 11, in which;

- said means of locking and unlocking the door include, in addition, a pneumatic sensor (8) to detect if the door (1) is closed.
- said first means of detection of the order to lock or unlock the door (1) from the interior of said module (2) include, in addition, a pneumatic sensor (12) to detect the position of the locking and unlocking lever (13) and supply a signal to said automaton of pneumatic logical functions,
- said second means of detection of the order to lock or unlock the door (1) from the exterior of said module (2) include a pneumatic sensor (20) to detect the position of the locking and unlocking key (24) and supply a signal to said automaton of pneumatic logical functions.

13. Process for locking and unlocking the door (1) of a toilet module (2) in a public transportation vehicle, by using the system according to any of the claims 1 to 12, which comprises the stages of;

a) receive a door (1) locking signal coming from the exterior,
b) if the door (1) is closed, send a door (1) locking signal to leave the door (1) locked and the module (2) out of order,
c) while the door (1) is locked, if a door (1) unlocking signal is received coming from the interior of the module (2), unlock the door (1) to allow the user to exit,
d) if the door (1) is closed again by said user, send a door (1) locking signal in order to lock the door (1) and leave the module (2) out of order.

14. Process according to claims 13, which comprises the stages of;

a) receive a failure signal from the module (2),
b) if the door (1) is closed, send a door (1) locking signal to leave the door (1) locked and leave the module (2) out of order,
c) while the door (1) is locked, if a door (1) unlocking signal is received coming from the interior of the module (2), unlock the door (1) to allow the user to exit.
d) if the door (1) is closed again by said user, send a door (19 locking signal in order to lock the door (1) and leave the module (2) out of order.

15. A computer program product to carry out the process according to any of the previous claims **characterised in that** it executes by means of pneumatic logical and/or electric functions the process according to any of the claims 13 to 14.

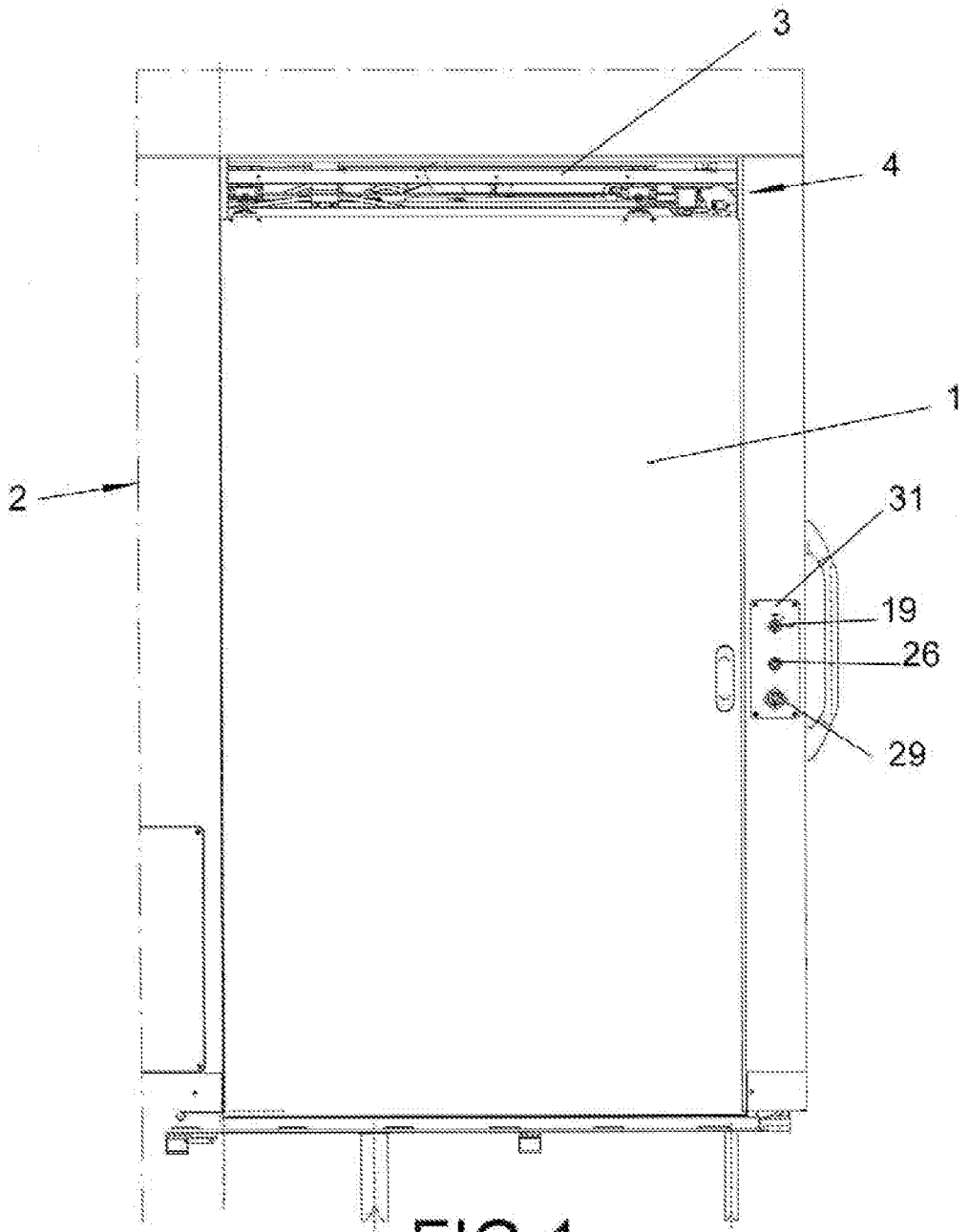


FIG.1

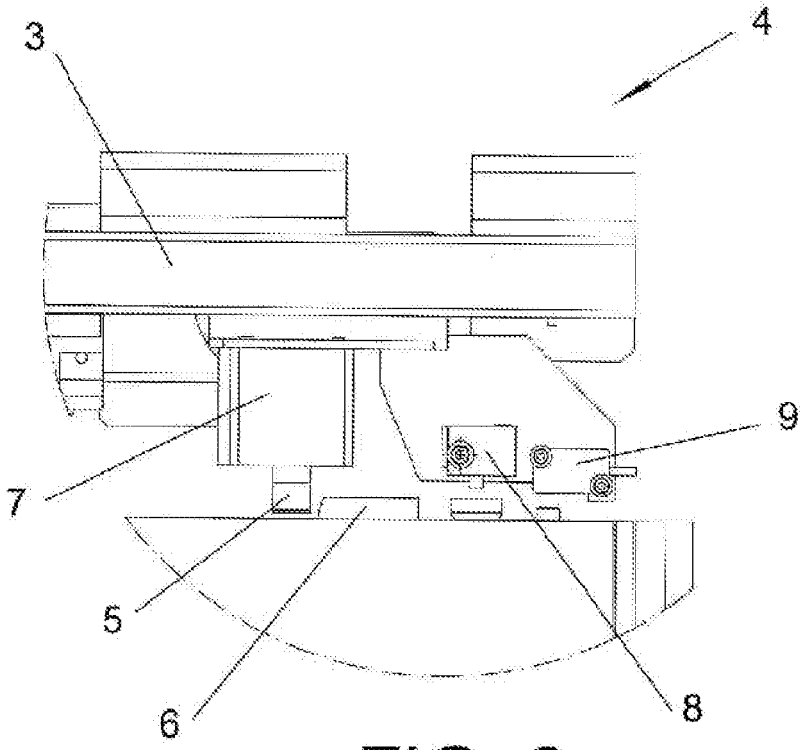


FIG. 2

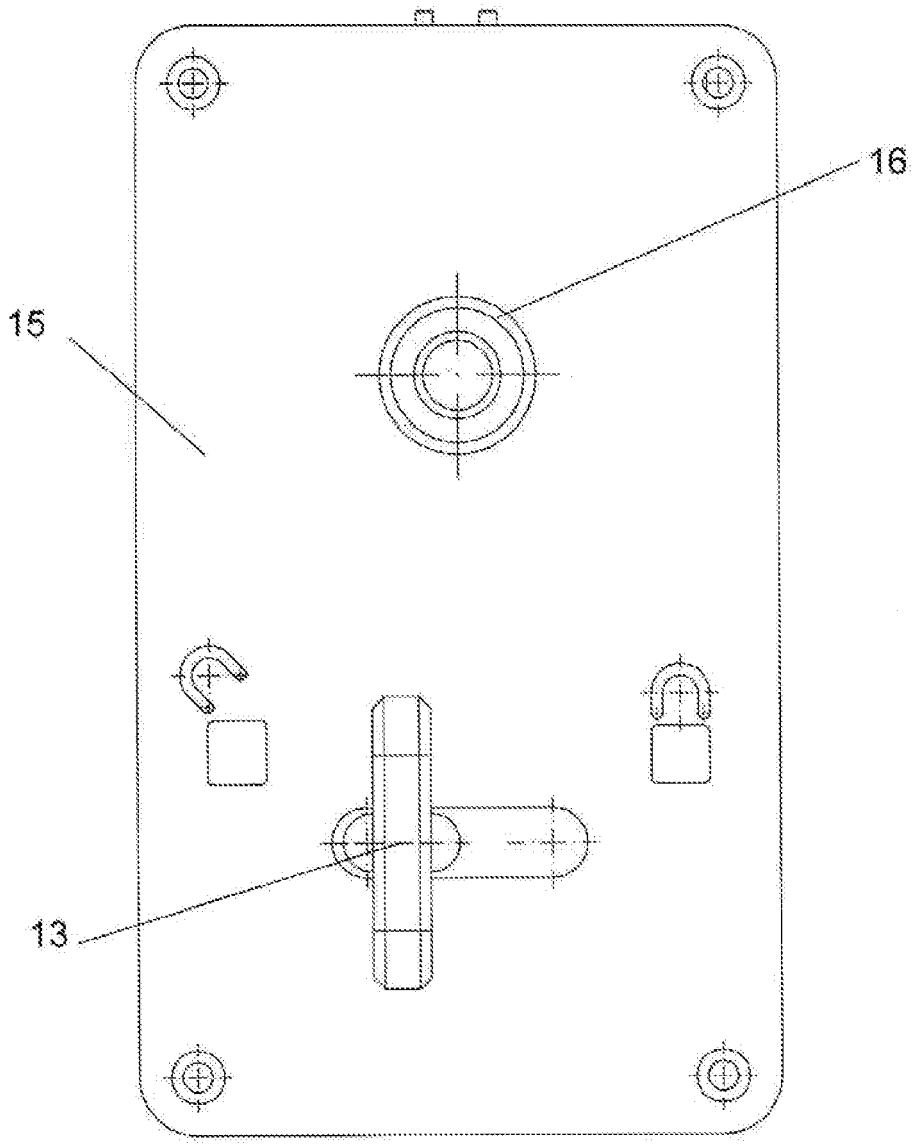


FIG. 3

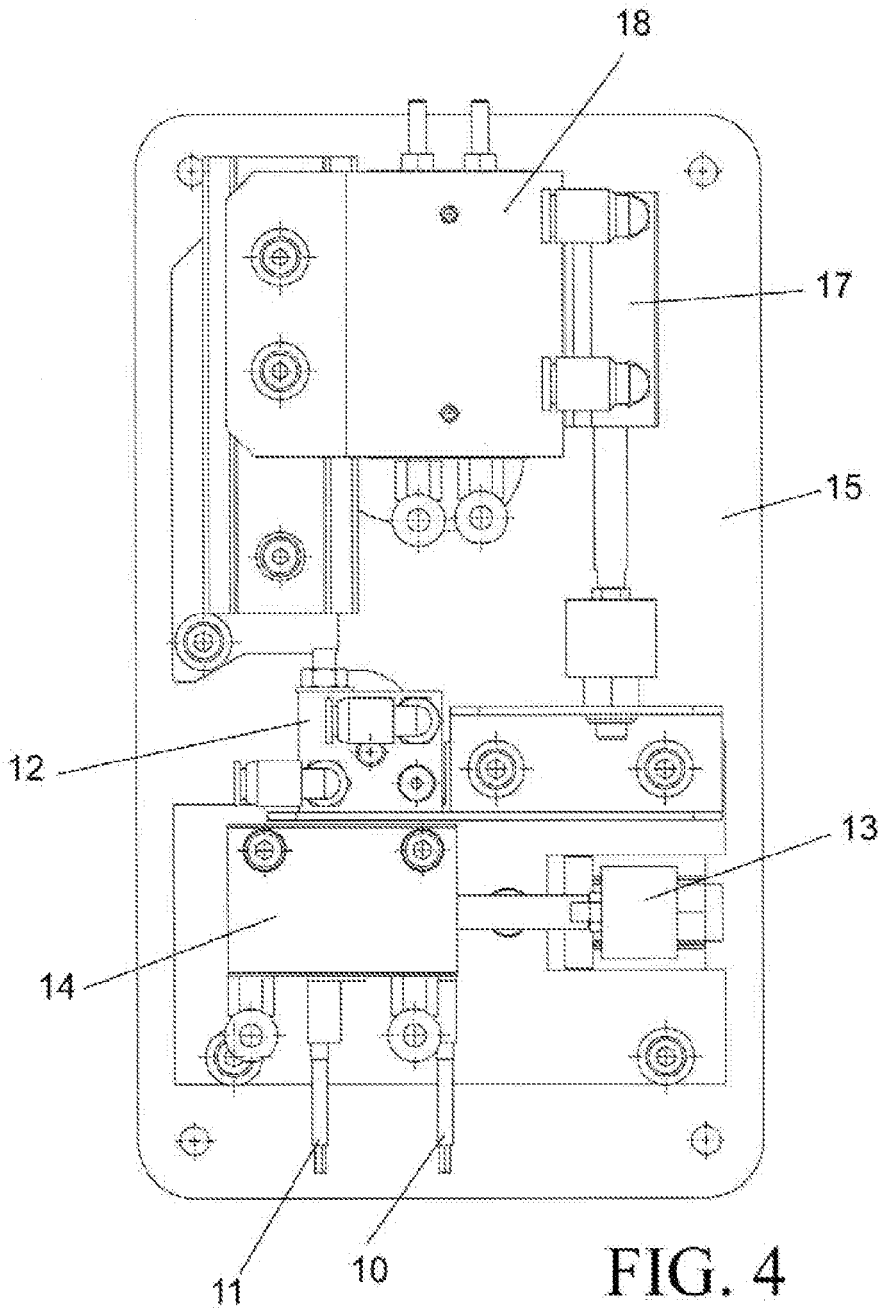


FIG. 4

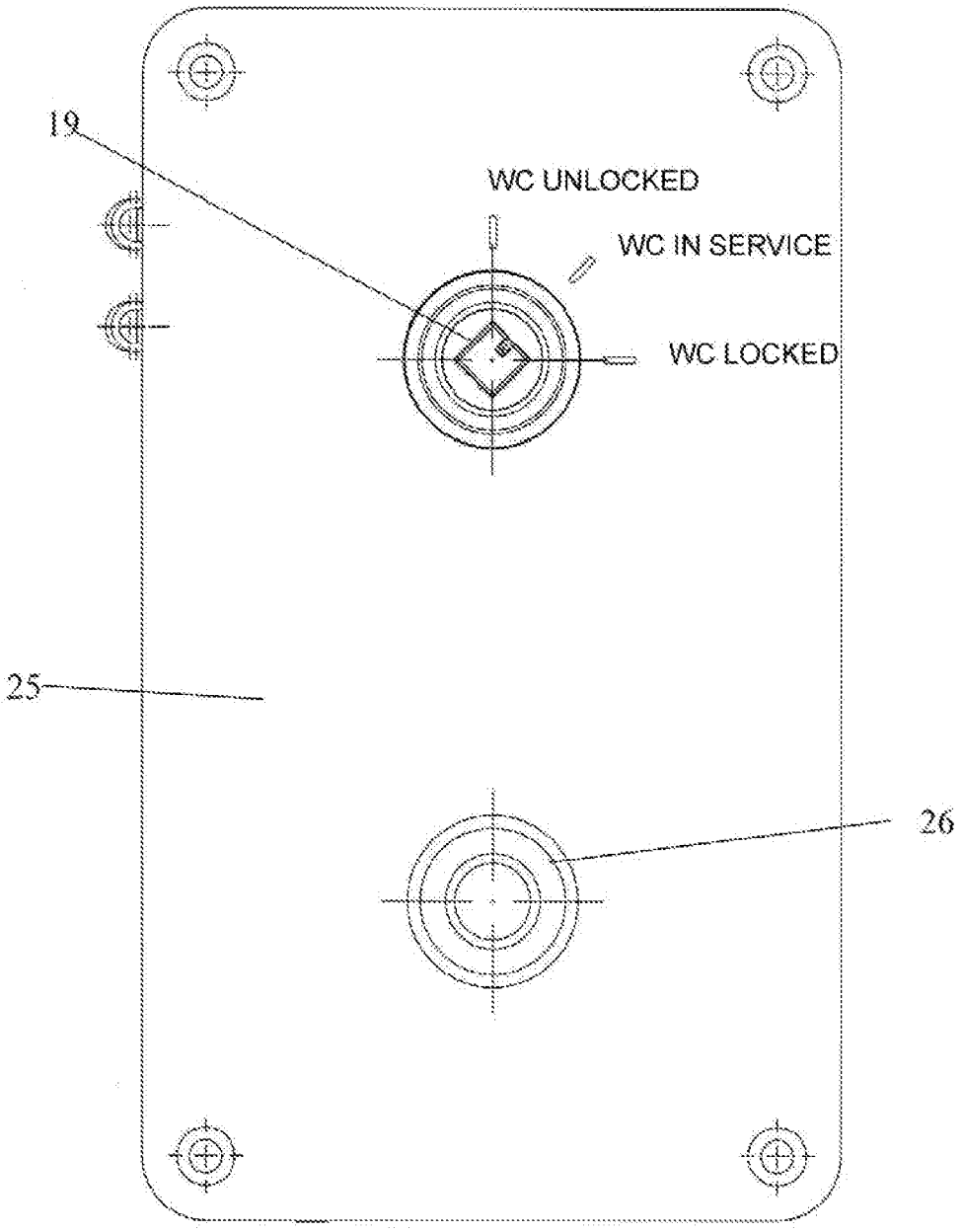


FIG. 5

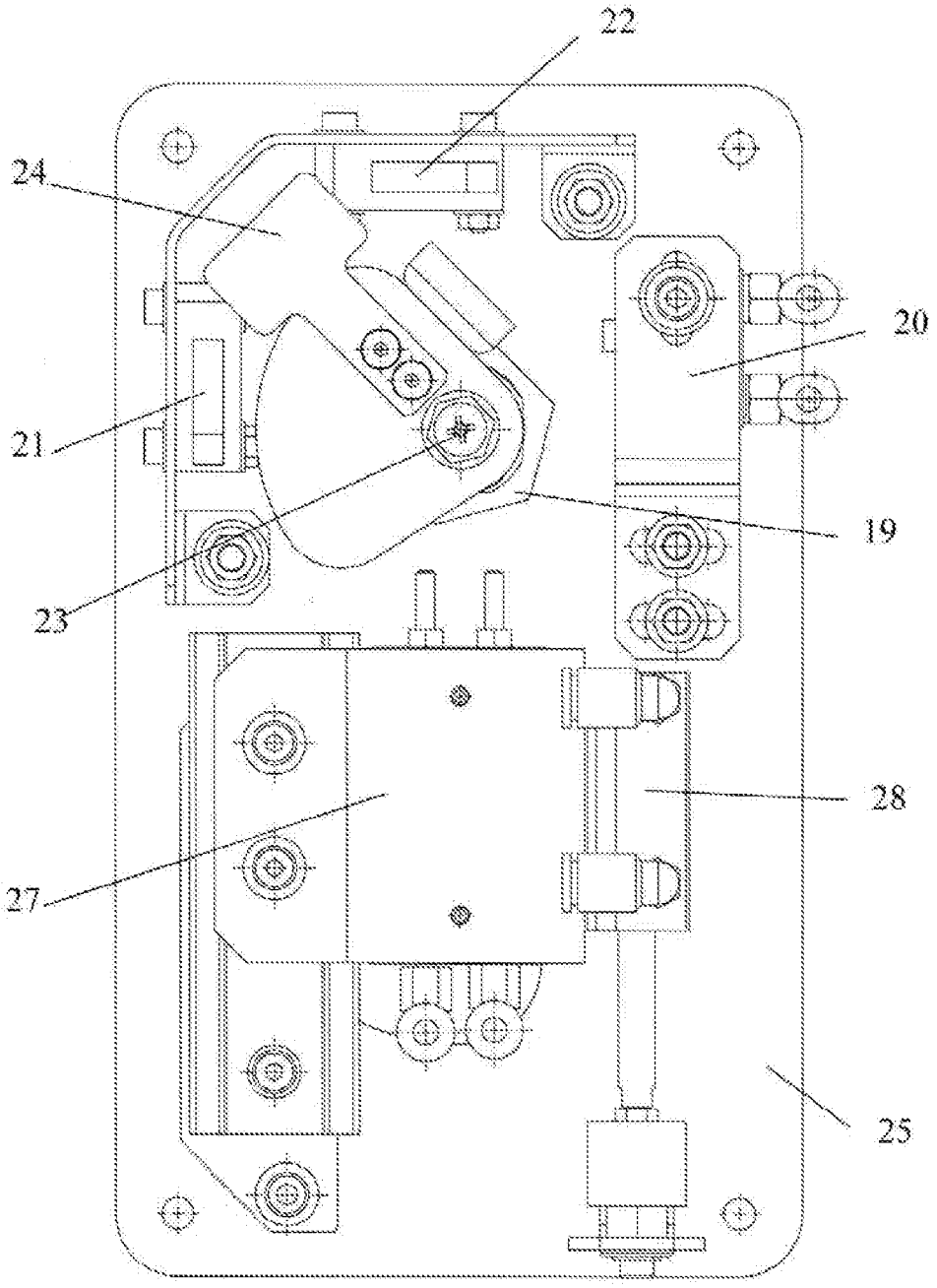


FIG. 6

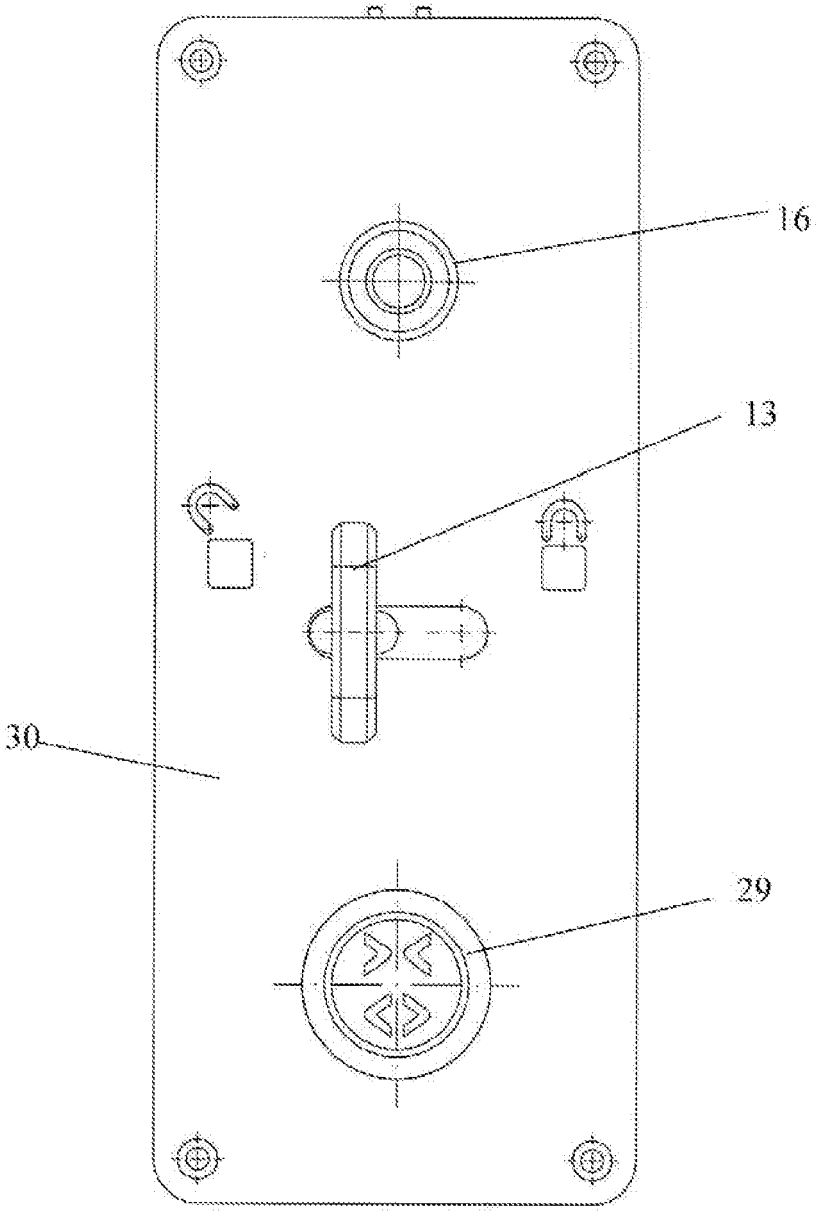


FIG. 7

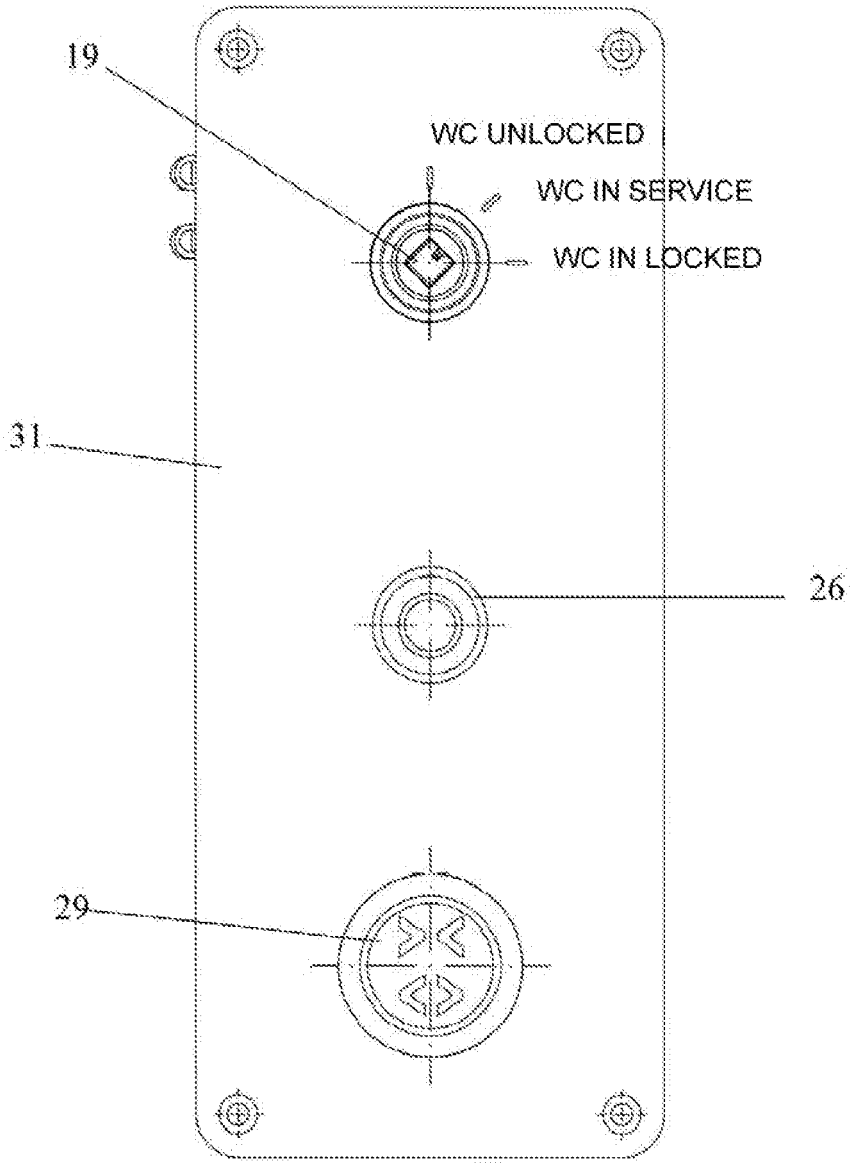


FIG. 8

FIG. 9

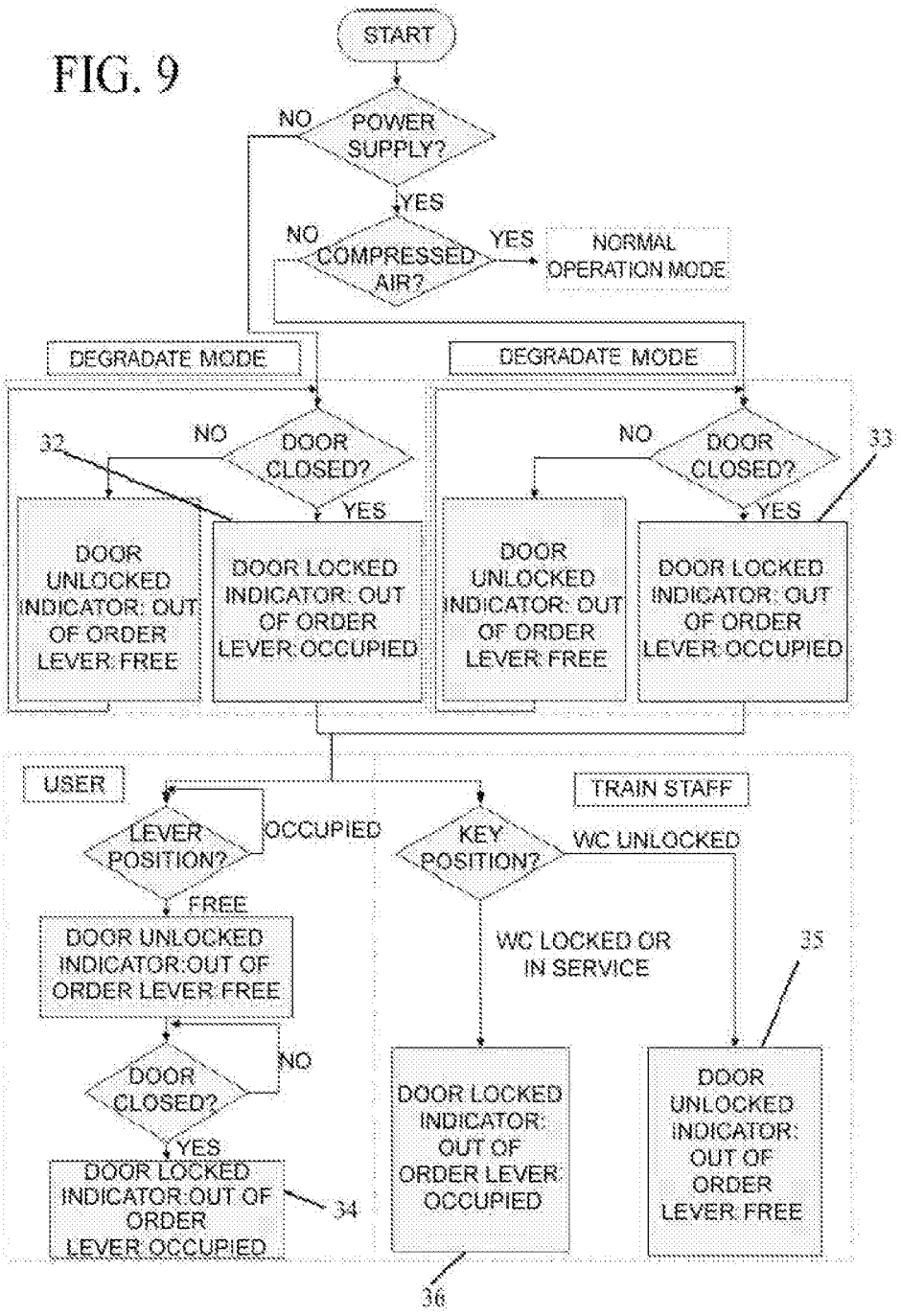
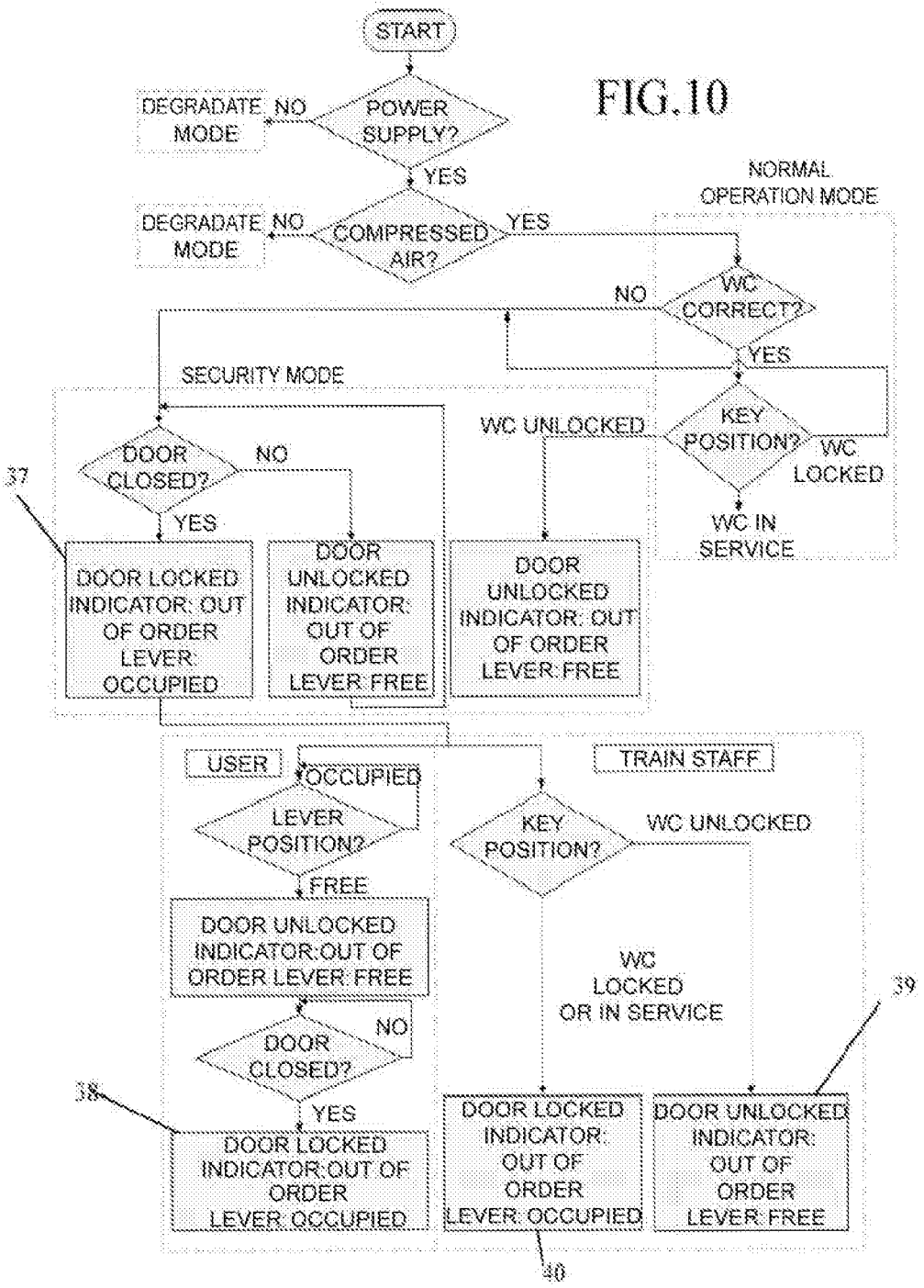

START
POWER SUPPLY?
NO
YES
COMPRESSED AIR?
NO
YES
NORMAL OPERATION MODE
DEGRADATE MODE
DEGRADATE MODE
DOOR CLOSED?
NO
YES
32
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
DOOR LOCKED INDICATOR: OUT OF ORDER LEVER: OCCUPIED
DOOR CLOSED?
NO
YES
33
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
DOOR LOCKED INDICATOR: OUT OF ORDER LEVER: OCCUPIED
USER
LEVER POSITION?
OCCUPIED
FREE
DOOR UNLOCKED INDICATOR:OUT OF ORDER LEVER: FREE
DOOR CLOSED?
NO
YES
DOOR LOCKED INDICATOR:OUT OF ORDER LEVER: OCCUPIED
34
TRAIN STAFF
KEY POSITION?
WC UNLOCKED
WC LOCKED OR IN SERVICE
35
DOOR LOCKED INDICATOR: OUT OF ORDER LEVER: OCCUPIED
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
36

FIG.10


START
POWER SUPPLY?
NO
DEGRADATE MODE
YES
COMPRESSED AIR?
NO
DEGRADATE MODE
YES
NORMAL OPERATION MODE
WC CORRECT?
NO
YES
SECURITY MODE
KEY POSITION?
WC LOCKED
WC UNLOCKED
WC IN SERVICE
DOOR CLOSED?
NO
YES
37
DOOR LOCKED INDICATOR: OUT OF ORDER LEVER: OCCUPIED
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
USER
OCCUPIED
LEVER POSITION?
FREE
DOOR UNLOCKED INDICATOR:OUT OF ORDER LEVER: FREE
DOOR CLOSED?
NO
YES
38
DOOR LOCKED INDICATOR:OUT OF ORDER LEVER: OCCUPIED
TRAIN STAFF
KEY POSITION?
WC UNLOCKED
WC LOCKED OR IN SERVICE
39
DOOR LOCKED INDICATOR: OUT OF ORDER LEVER: OCCUPIED
DOOR UNLOCKED INDICATOR: OUT OF ORDER LEVER: FREE
40

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 38 2056

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2009/007328 A1 (FELTRI PAOLO [IT]) 8 January 2009 (2009-01-08) * page 3, paragraph 65 - paragraph 75 * * figure 1 * -----	1,13,15	INV. E05B65/00 E05B63/00 E05B51/02 B61D35/00
A	US 2009/300988 A1 (BEM BRANKO [US]) 10 December 2009 (2009-12-10) * paragraph [0018] - paragraph [0022] * * figures 3-5 * -----	1,13,15	
A	CN 2 041 707 U (WANG CAIXIA [CN]) 26 July 1989 (1989-07-26) * abstract * * figures 1-4 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

B61D
E05B
G07F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 September 2011	Bitton, Alexandre

CATEGORY OF CITED DOCUMENTS

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

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

& : member of the same patent family, corresponding document

3

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 38 2056

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2009/007328 A1 (FELTRI PAOLO [IT]) 8 January 2009 (2009-01-08) * page 3, paragraph 65 - paragraph 75 * * figure 1 * -----	1,13,15	INV. E05B65/00 E05B63/00 E05B51/02 B61D35/00
A	US 2009/300988 A1 (BEM BRANKO [US]) 10 December 2009 (2009-12-10) * paragraph [0018] - paragraph [0022] * * figures 3-5 * -----	1,13,15	
A	CN 2 041 707 U (WANG CAIXIA [CN]) 26 July 1989 (1989-07-26) * abstract * * figures 1-4 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

B61D
E05B
G07F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 September 2011	Bitton, Alexandre

CATEGORY OF CITED DOCUMENTS

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

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

& : member of the same patent family, corresponding document

3

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 38 2056

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

22-09-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009007328 A1	08-01-2009	NONE	
US 2009300988 A1	10-12-2009	NONE	
CN 2041707 U	26-07-1989	NONE	

EPO FORM P0459

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