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(54) **A system and method for locking and unlocking a door of a toilet module of a public transport vehicle**

System und Verfahren zum Verriegeln und Entriegeln einer Tür eines Toilettenmoduls eines öffentlichen Verkehrsmittels

Système et procédé pour verrouiller et déverrouiller une porte d'un module de WC d'un véhicule de transport public

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EP 2 495 381 B2

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] US 2009/0007328 discloses a self-cleaning public toilet comprising a safety and alarm system. The safety and alarm system includes a plurality of load cells that weigh the user who has entered a space; a photoelectric-sensor device for detecting the presence or otherwise of a person in the space during washing and drying of the inside of the toilet; and at least one pressure switch located in a pneumatic cylinder that actuates a rotating arm for cleaning a toilet bowl.

[0004] 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.

[0005] 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.

[0006] 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.

[0007] 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.

[0008] 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.

[0009] 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.

[0010] 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.

[0011] 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

[0012] 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

[0013] In accordance with this objective, according to a first aspect the present invention provides a locking and unlocking system as claimed in claim 1.

[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] The system comprises means of detection of a failure of the module, and 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 being 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] 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, 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 or receive a failure signal from the module due to lack of electric energy,

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 when the failure signal persists.

[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] The process comprises the stages of;

a) receive a failure signal from the module due to the lack of electric energy,

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 when the failure signal persists.

[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.

DESCRIPTION OF THE DIAGRAMS

[0040] 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.

[0041] 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

[0042] 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.

[0043] 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.

[0044] 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.

[0045] 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.

[0046] 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.

[0047] 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.

[0048] 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.

[0049] 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.

[0050] 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.

[0051] 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).

[0052] 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.

[0053] 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.

[0054] 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.

[0055] 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.

[0056] 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.

[0057] 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.

[0058] 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.

[0059] 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.

[0060] 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.

[0061] 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.

[0062] 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.

[0063] 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.

[0064] 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).

[0065] 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.

[0066] 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.

[0067] 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.

[0068] 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.

[0069] 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.

[0070] 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.

[0071] 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.

[0072] Disclosed below is the way of operating the system making reference to the algorithm represented in diagrams 9 and 10.

[0073] 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.

[0074] As can be seen in blocks 32 and 33 in figure 9, upon the (electronic or pneumatic) processing and con-

trol 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.

[0075] Once the door 1 is locked due to lack of power and/or air supply, two situations can exist.

[0076] 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.

[0077] 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).

[0078] 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, simultaneously, 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).

[0079] 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.

[0080] 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.

[0081] 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.

[0082] Once the door 1 is locked due to a failure, two situations can exist.

[0083] 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.

[0084] 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).

[0085] 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).

[0086] 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.

[0087] 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.

[0088] 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.

[0089] 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.

[0090] 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.

[0091] 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.

[0092] Thanks to these characteristics, safe and efficient management and use is achieved in the toilet modules for public transportation vehicles.

[0093] 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 sig-

nal emitted by said first means of detection (11,12,13,14), wherein the locking and unlocking system 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) in order to leave the module (2) out of order, said means of processing and control being configured;

- to allow the unlocking of said door (1) in order for the user to exit 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), and

- to allow the locking of said door (1) in order to leave again the module (2) out of order once said door (1) is closed again by said user and said locking signal persists, said system further comprising means of detection of a failure of the module which include means of detection of a lack of electric energy for the proper operation of the module (2), 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 an unlocking signal coming from said first means of detection (11,12,13,14) from the interior of the module (2), and

- to allow said door (1) to be locked again in order to leave the module (2) out of order when the failure signal persists.

2. Locking and unlocking 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).
3. Locking and unlocking system according to claim 2, 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).
4. Locking and unlocking 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.

5. Locking and unlocking 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.
6. Locking and unlocking 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.
7. Locking and unlocking system according to claim 6, 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.
8. Locking and unlocking 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).
9. Locking and unlocking system according to claim 1, in which said means of processing and control include, in addition, an automaton of pneumatic logical functions.
10. Locking and unlocking system according to claim 9,

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.

11. 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 10, which comprises the stages of;

- a) receive a door (1) locking signal coming from the exterior or receive a failure signal from the module (2) due to lack of electric energy,
- 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 when the failure signal persists.

12. Locking and unlocking system according to any of claims 1 to 10 **characterised in that** it comprises a computer program product to carry out the process according to claim 11 and **in that** it executes by means of pneumatic logical and/or electric functions the process.

Patentansprüche

1. Verriegelungs- und Entriegelungssystem für die Tür (1) eines Toilettenmoduls (2) in einem öffentlichen Verkehrsmittel, das eine Einrichtung zum Verriegeln und Entriegeln (3, 4, 5, 6, 7, 8, 9) der Tür (1), wenn die Tür (1) geschlossen ist, eine erste Einrichtung zum Detektieren (11, 12, 13, 14) eines Befehls, der aus dem Inneren des Moduls (2) kommt, um die Tür zu verriegeln oder zu entriegeln, und eine Einrichtung zum Verarbeiten und Steuern aufweist, um der Einrichtung zum Verriegeln und Entriegeln (3, 4, 5,

6, 7, 8, 9) in Abhängigkeit eines Signals, das von der ersten Einrichtung zum Detektieren (11, 12, 13, 14) ausgesendet wird, ein Signal bereitzustellen, wobei das Verriegelungs- und Entriegelungssystem eine zweite Einrichtung zum Detektieren (19, 20, 21, 22, 23, 24) eines Befehls umfasst, der von außerhalb des Moduls (2) kommt, um die Tür (1) zu verriegeln oder zu entriegeln, wobei die zweite Einrichtung zum Detektieren (19, 20, 21, 22, 23, 24) der Einrichtung zum Verarbeiten und Steuern zugeordnet ist, um der Einrichtung zum Verriegeln (3, 4, 5, 6, 7, 8, 9) ein Verriegelungssignal für die Tür (1) bereitzustellen, um das Modul (2) außer Betrieb zu halten, wobei die Einrichtung zum Verarbeiten und Steuern dazu ausgebildet ist, das Entriegeln der Tür (1) zu ermöglichen, damit der Nutzer zu jedem Zeitpunkt den Innenraum des Moduls (2) verlassen kann, wenn die Einrichtung zum Verarbeiten und Steuern ein Entriegelungssignal empfängt, das von der ersten Einrichtung zum Detektieren (11, 12, 13, 14) kommt, und das Verriegeln der Tür (1) zu ermöglichen, um das Modul (2) erneut außer Betrieb zu halten, sobald die Tür (1) erneut durch den Benutzer geschlossen wird und das Verriegelungssignal weiterhin vorhanden ist, wobei das System ferner eine Einrichtung zum Detektieren eines Ausfalls des Moduls aufweist, welche eine Einrichtung zum Detektieren eines Fehlens elektrischer Energie für einen ordnungsgemäßen Betrieb des Moduls (2) umfasst, wobei die Einrichtung zum Verarbeiten und Steuern dazu ausgebildet ist, zu ermöglichen, dass die Tür (1) zu jedem Zeitpunkt verriegelt wird, wenn die Einrichtung zum Verarbeiten und Steuern ein Ausfallsignal empfängt, das von der Einrichtung zum Detektieren kommt, wobei es möglich ist, die Tür (1) durch die Einrichtung zum Entriegeln (3, 4, 5, 6, 7, 8, 9) zu entriegeln, wenn ein Entriegelungssignal, das aus dem Innenraum des Moduls (2) von der ersten Einrichtung zum Detektieren (11, 12, 13, 14) kommt, von der Einrichtung zum Verarbeiten und Steuern empfangen wird, und zu ermöglichen, dass die Tür (1) erneut verriegelt wird, um das Modul (2) außer Betrieb zu halten, wenn das Ausfallsignal weiterhin vorliegt.

2. Verriegelungs- und Entriegelungssystem gemäß einem der vorhergehenden Ansprüche, bei dem die Einrichtung zum Verriegeln und Entriegeln einen Türverriegelungsmechanismus (4), der durch ein fluidynamisches Betätigungsbauglied (7) betätigt wird, und einen Geschlossene-Tür-Elektroniksensor (9) umfasst, der dem Betätigungsbauglied (7) zugeordnet ist.
3. Verriegelungs- und Entriegelungssystem gemäß Anspruch 2, bei dem der Verriegelungs- und Entriegelungsmechanismus (4) einen Verriegelungskol-

- ben (5), der von dem Betätigungsbauglied (7) betätigt wird, und ein Anschlagelement (6) umfasst, das über der Tür (1) positioniert ist, um zu verhindern, dass die Tür (1) sich öffnet, wenn das Anschlagelement (6) in Kontakt mit dem Kolben (5) tritt.
4. Verriegelungs- und Entriegelungssystem gemäß einem der vorhergehenden Ansprüche, bei dem die erste Einrichtung zum Detektieren des Befehls aus dem Inneren des Moduls, um die Tür zu verriegeln oder entriegeln, einen Hebel zum Verriegeln oder Entriegeln (13), der im Inneren des Moduls platziert ist, ein fluiddynamisches Bauglied (14), um den Hebel (13) zu betätigen, und zumindest einen elektronischen Sensor (11, 10) umfasst, der dem Betätigungsbauglied (14) zugeordnet ist, um die Position des Hebels (13) zu detektieren und der Einrichtung zum Verarbeiten und Steuern ein Signal bereitzustellen.
5. Verriegelungs- und Entriegelungssystem gemäß einem der vorhergehenden Ansprüche, bei dem die zweite Einrichtung zum Detektieren eines Befehls von außerhalb des Moduls, um die Tür zu verriegeln oder zu entriegeln, ein Schloss (19), das mit einem Verriegelungs- und Entriegelungsschlüssel (24) versehen ist, und zumindest einen elektronischen Sensor (21, 22) umfasst, der dem Schlüssel (24) zugeordnet ist, um die Position des Schlüssels (24) zu detektieren und der Einrichtung zum Verarbeiten und Steuern ein Signal bereitzustellen.
6. Verriegelungs- und Entriegelungssystem gemäß einem der vorhergehenden Ansprüche, das einen Indikator (16, 26) des Status des Moduls aufweist, wobei der Indikator der Einrichtung zum Verarbeiten und Steuern zugeordnet ist, um ein informatives Signal zu dem Status des Moduls gemäß einem Signal, das von der ersten (11, 12, 13, 14) oder zweiten (19, 20, 21, 22, 23, 24) Einrichtung zum Detektieren des Befehls ausgesendet wird, um die Tür (1) zu verriegeln oder entriegeln, oder gemäß einem Signal, das von der Einrichtung zum Detektieren eines Ausfalls des Moduls ausgesendet wird, bereitzustellen.
7. Verriegelungs- und Entriegelungssystem gemäß Anspruch 6, bei dem der Indikator (16, 26) des Status des Moduls zumindest ein fluiddynamisches Betätigungsbauglied (17, 18, 27, 28) umfasst, das dem informativen Signal zugeordnet ist, um das informative Signal gemäß dem Signal, das von der ersten (11, 12, 13, 14) und der zweiten (19, 20, 21, 22, 23, 24) Einrichtung zum Detektieren des Befehls, die Tür zu verriegeln oder zu entriegeln, ausgesendet wird, oder gemäß der Einrichtung zum Detektieren eines Ausfalls des Moduls anzuzeigen.
8. Verriegelungs- und Entriegelungssystem gemäß einem der vorhergehenden Ansprüche, bei dem die Tür eine automatische Tür (1) ist und das System eine Drucktaste (29) aufweist, um die Tür automatisch vom Inneren oder von außerhalb des Moduls (2) zu öffnen und zu schließen, wobei die Drucktaste (29) der Einrichtung zum Verarbeiten und Steuern zugeordnet ist, um der Einrichtung zum Verriegeln und Entriegeln (3, 4, 5, 6, 7, 8, 9) der Tür ein Signal bereitzustellen, um die automatische Tür (1) zu entriegeln, so dass die Tür (1) durch die Drucktaste (29) gleichzeitig entriegelt und geöffnet werden kann.
9. Verriegelungs- und Entriegelungssystem gemäß Anspruch 1, bei dem die Einrichtung zum Verarbeiten und Steuern zusätzlich einen Automaten pneumatischer logischer Funktionen umfasst.
10. Verriegelungs- und Entriegelungssystem gemäß Anspruch 9, bei dem:
- die Einrichtung zum Verriegeln und Entriegeln der Tür zusätzlich einen pneumatischen Sensor (8) umfasst, um zu detektieren, ob die Tür (1) geschlossen ist,
- die erste Einrichtung zum Detektieren des Befehls aus dem Inneren des Moduls (2), um die Tür zu verriegeln oder zu entriegeln, zusätzlich einen pneumatischen Sensor (12) umfasst, um die Position des Verriegelungs- und Entriegelungshebels (13) zu detektieren und dem Automat pneumatischer logischer Funktionen ein Signal bereitzustellen,
- die zweite Einrichtung zum Detektieren des Befehls von außerhalb des Moduls (2), um die Tür zu verriegeln oder zu entriegeln, einen pneumatischen Sensor (20) umfasst, um die Position des Verriegelungs- und Entriegelungsschlüssels (24) zu detektieren und dem Automat pneumatischer logischer Funktionen ein Signal bereitzustellen.
11. Prozess zum Verriegeln und Entriegeln der Tür (1) eines Toilettenmoduls (2) in einem öffentlichen Verkehrsmittel unter Verwendung des Systems gemäß einem der Ansprüche 1 bis 10, welcher folgende Schritte aufweist;
- a) Empfangen eines Verriegelungssignals für die Tür (1), das von außen kommt, oder Empfangen eines Ausfallsignals von dem Modul (2) aufgrund eines Fehlens elektrischer Energie,
- b) falls die Tür (1) geschlossen ist, Senden eines Verriegelungssignals für die Tür (1), um die Tür (1) verriegelt und das Modul (2) außer Betrieb zu halten,
- c) während die Tür (1) verriegelt ist, falls ein Entriegelungssignal für die Tür (1), das aus dem

Inneren des Moduls (2) kommt, empfangen wird, Entriegeln der Tür (1), um dem Benutzer das Verlassen zu ermöglichen,
 d) falls die Tür (1) erneut durch den Benutzer geschlossen wird, Senden eines Verriegelungs-
 signals für die Tür (1), um die Tür (1) zu verrie-
 geln und das Modul (2) außer Betrieb zu halten,
 wenn das Ausfallsignal weiterhin vorliegt.

12. Verriegelungs- und Entriegelungssystem gemäß einem der Ansprüche 1 bis 10, das **dadurch gekennzeichnet ist, dass** dasselbe ein Computerprogrammprodukt aufweist, um den Prozess gemäß Anspruch 11 durchzuführen, und dass dasselbe den Prozess mittels pneumatischer logischer und/oder elektrischer Funktionen ausführt.

Revendications

1. Système de verrouillage et de déverrouillage pour la porte (1) d'un module de WC (2) dans un véhicule de transport public, qui comprend des moyens de verrouillage et de déverrouillage (3, 4, 5, 6, 7, 8, 9) de ladite porte (1) lorsque ladite porte (1) est fermée, des premiers moyens de détection (11, 12, 13, 14) de l'instruction de verrouiller ou déverrouiller la porte provenant de l'intérieur dudit module (2), et des moyens de traitement et de contrôle pour fournir un signal auxdits moyens de verrouillage et de déverrouillage (3, 4, 5, 6, 7, 8, 9) en fonction d'un signal émis par lesdits premiers moyens de détection (11, 12, 13, 14), dans lequel le système de verrouillage et de déverrouillage comprend des seconds moyens de détection (19, 20, 21, 22, 23, 24) d'une instruction de verrouiller ou déverrouiller la porte (1) provenant de l'extérieur dudit module (2), lesdits seconds moyens de détection (19, 20, 21, 22, 23, 24) étant associés auxdits moyens de traitement et de contrôle pour fournir un signal (1) de verrouillage de porte (1) auxdits moyens de verrouillage (3, 4, 5, 6, 7, 8, 9) afin de laisser le module (2) hors service, lesdits moyens de traitement et de contrôle étant configurés :

pour permettre le déverrouillage de ladite porte (1) afin que l'utilisateur sorte à n'importe quel moment de l'intérieur dudit module (2) lorsque lesdits moyens de traitement et de contrôle reçoivent un signal de déverrouillage provenant desdits premiers moyens de détection (11, 12, 13, 14), et
 pour permettre le verrouillage de ladite porte (1) afin de laisser à nouveau le module (2) hors service une fois que ladite porte (1) a été refermée par ledit utilisateur et ledit signal de verrouillage persiste, ledit système comprenant en outre des moyens de détection de défaillance du module

qui comprennent des moyens de détection d'un manque d'alimentation électrique pour le bon fonctionnement du module (2), dans lequel lesdits moyens de traitement et de contrôle sont configurés :

pour permettre à ladite porte (1) d'être verrouillée à tout moment lorsque lesdits moyens de traitement et de contrôle reçoivent un signal de défaillance provenant desdits moyens de détection, il est possible que ladite porte (1) soit déverrouillée par lesdits moyens de déverrouillage (3, 4, 5, 6, 7, 8, 9) après avoir reçu desdits moyens de traitement et de contrôle, un signal de déverrouillage provenant desdits premiers moyens de détection (11, 12, 13, 14) de l'intérieur du module (2), et
 pour permettre à ladite porte (1) d'être verrouillée à nouveau afin de laisser le module (2) hors service lorsque le signal de défaillance persiste.

2. Système de verrouillage et de déverrouillage selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens de verrouillage et de déverrouillage comprennent un mécanisme de verrouillage de porte (4) actionné par un actionneur fluïdo-dynamique (7), et un capteur électronique de porte fermée (9) associé audit actionneur (7).
3. Système de verrouillage et de déverrouillage selon la revendication 2, dans lequel ledit mécanisme de verrouillage et de déverrouillage (4) comprend un piston de verrouillage (5) actionné par ledit actionneur (7) et un élément de butée (6) positionné sur la porte (1) pour empêcher ladite porte (1) de s'ouvrir lorsque ledit élément de butée (6) vient en contact avec ledit piston (5).
4. Système de verrouillage et de déverrouillage selon l'une quelconque des revendications précédentes, dans lequel lesdits premiers moyens de détection de l'instruction de verrouiller ou déverrouiller la porte de l'intérieur du module comprennent un levier pour verrouiller et déverrouiller (13) situé à l'intérieur du module, un actionneur fluïdo-dynamique (14) pour actionner ledit levier (13), et au moins un capteur électronique (10, 11) associé audit actionneur (14) pour détecter la position dudit levier (13) et fournir un signal auxdits moyens de traitement et de contrôle.
5. Système de verrouillage et de déverrouillage selon l'une quelconque des revendications précédentes, dans lequel lesdits seconds moyens de détection d'une instruction de verrouiller ou déverrouiller la porte de l'extérieur dudit module comprennent un

- verrou (19) prévu avec une clé de verrouillage et de déverrouillage (24), et au moins un capteur électronique (21, 22) associé à ladite clé (24) pour détecter la position de ladite clé (24) et fournir un signal auxdits moyens de traitement et de contrôle. 5
6. Système de verrouillage et de déverrouillage selon l'une quelconque des revendications précédentes, qui comprend un indicateur (16, 26) de l'état du module, ledit indicateur étant associé auxdits moyens de traitement et de contrôle pour fournir un signal d'information concernant l'état du module selon un signal émis par lesdits premiers (11, 12, 13, 14) ou seconds (19, 20, 21, 22, 23, 24) moyens de détection de l'instruction de verrouiller ou déverrouiller la porte (1), ou selon un signal émis par lesdits moyens de détection d'une défaillance du module. 10
7. Système de verrouillage et de déverrouillage selon la revendication 6, dans lequel ledit indicateur (16, 26) de l'état du module comprend au moins un actionneur dynamique hydraulique (17, 18, 27, 28) associé audit signal d'information afin d'afficher ledit signal d'information selon le signal émis par lesdits premiers (11, 12, 13, 14) et seconds (19, 20, 21, 22, 23, 24) moyens de détection de l'instruction de verrouiller ou déverrouiller la porte, ou selon lesdits moyens de détection d'une défaillance du module. 20
8. Système de verrouillage et de déverrouillage selon l'une quelconque des revendications précédentes, dans lequel ladite porte est une porte automatique (1) et ledit système comprend un bouton-poussoir (29) pour ouvrir et fermer ladite porte automatiquement de l'intérieur ou de l'extérieur du module (2), ledit bouton-poussoir (29) étant associé auxdits moyens de traitement et de contrôle pour fournir un signal pour déverrouiller ladite porte automatique (1) auxdits moyens de verrouillage et de déverrouillage (3, 4, 5, 6, 7, 8, 9) de ladite porte, de sorte que ladite porte (1) peut être déverrouillée et ouverte en même temps par ledit bouton-poussoir (29). 25
9. Système de verrouillage et de déverrouillage selon la revendication 1, dans lequel lesdits moyens de traitement et de contrôle comprennent, de plus, un automate de fonctions logiques pneumatiques. 30
10. Système de verrouillage et de déverrouillage selon la revendication 9, dans lequel : 35
- les moyens de verrouillage et de déverrouillage de la porte comprennent, en plus, un capteur pneumatique (8) pour détecter si la porte (1) est fermée, 40
- lesdits premiers moyens de détection de l'instruction de verrouiller ou déverrouiller la porte (1) de l'intérieur dudit module (2) comprennent, 45
- de plus, un capteur pneumatique (12) pour détecter la position du levier de verrouillage et de déverrouillage (13) et fournir un signal audit automate de fonctions logiques pneumatiques, lesdits seconds moyens de détection de l'instruction de verrouiller ou déverrouiller la porte (1) de l'extérieur dudit module (2) comprennent un capteur pneumatique (20) pour détecter la position de la clé de verrouillage et de déverrouillage (24) et fournir un signal audit automate de fonctions logiques pneumatiques. 50
11. Processus pour verrouiller et déverrouiller la porte (1) d'un module de WC (2) dans un véhicule de transport public, en utilisant le système selon l'une quelconque des revendications 1 à 10, qui comprend les étapes consistant à :
- a) recevoir un signal de verrouillage de porte (1) provenant de l'extérieur ou recevoir un signal de défaillance du module (2) dû au manque d'énergie électrique, 55
- b) si la porte (1) est fermée, envoyer un signal de verrouillage de porte (1) pour laisser la porte (1) verrouillée et le module (2) hors service,
- c) alors que la porte (1) est verrouillée, si un signal de déverrouillage de porte (1) est reçu de l'intérieur du module (2), déverrouiller la porte (1) pour permettre à l'utilisateur de sortir,
- d) si la porte (1) est refermée par ledit utilisateur, envoyer un signal de verrouillage de porte (1) afin de verrouiller la porte (1) et laisser le module (2) hors service lorsque le signal de défaillance persiste.
12. Système de verrouillage et de déverrouillage selon l'une quelconque des revendications 1 à 10, **caractérisé en ce qu'il** comprend un produit de programme informatique pour réaliser le processus selon la revendication 11 et **en ce qu'il** exécute, au moyen des fonctions logiques pneumatiques et/ou électriques le processus. 60

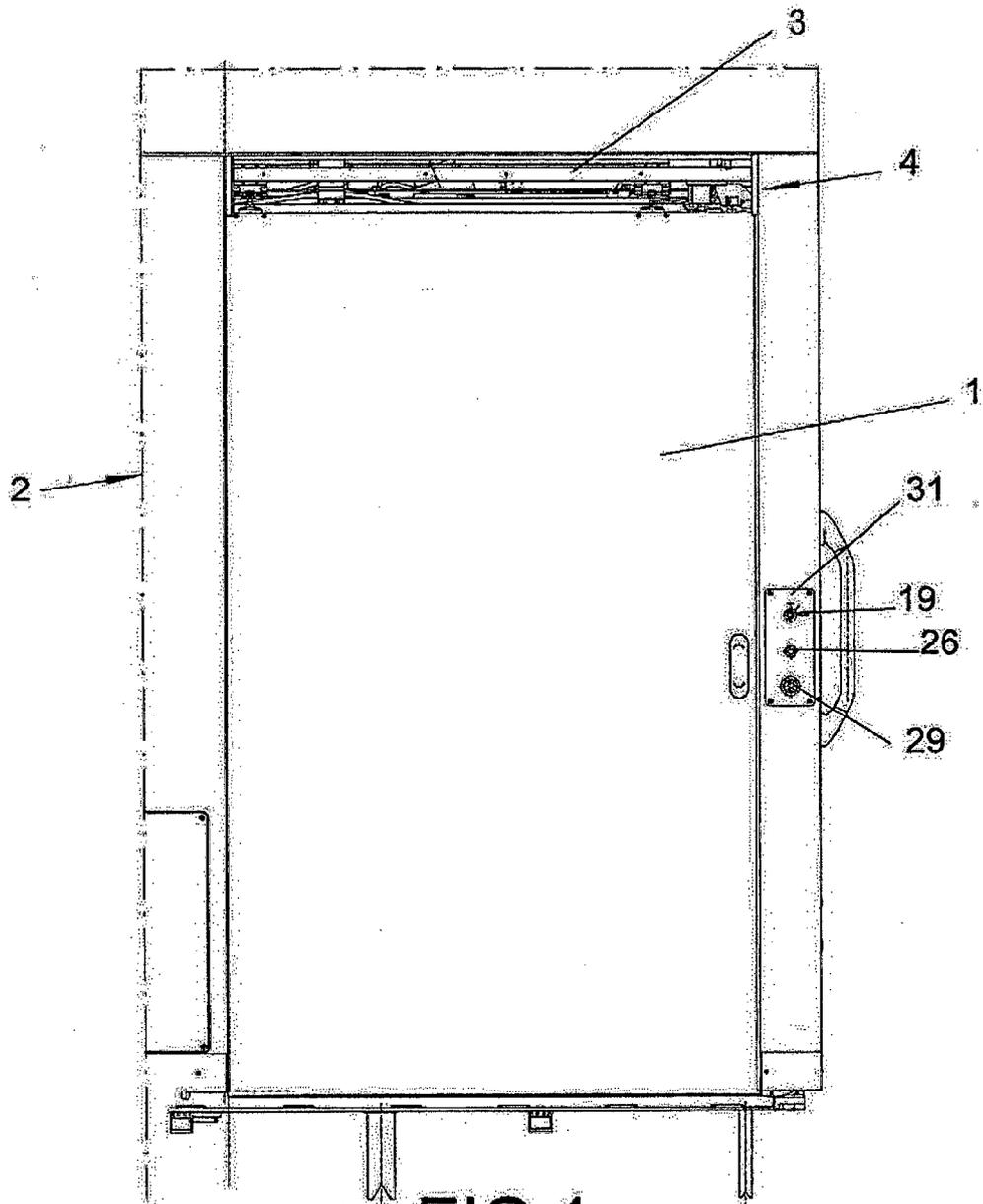


FIG.1

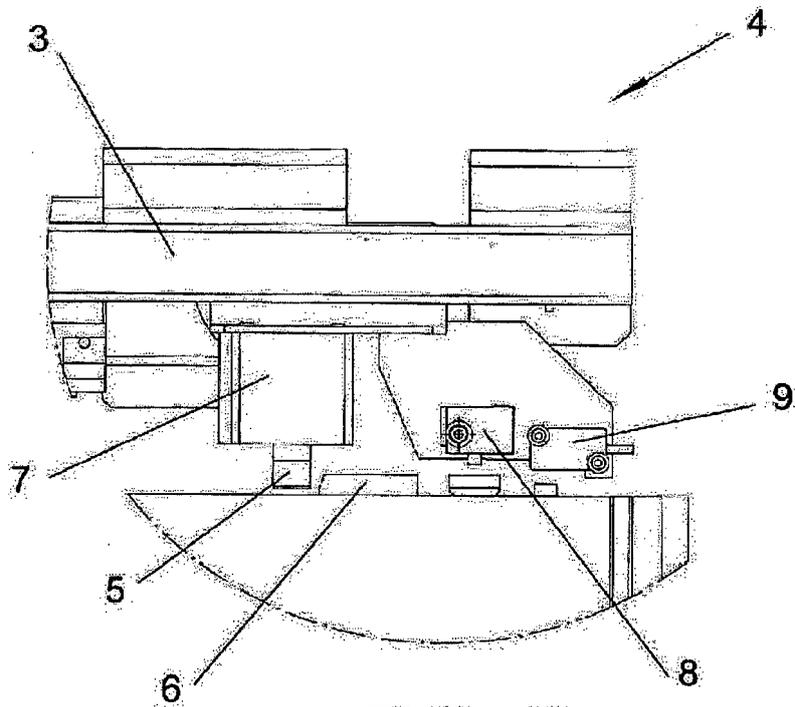


FIG. 2

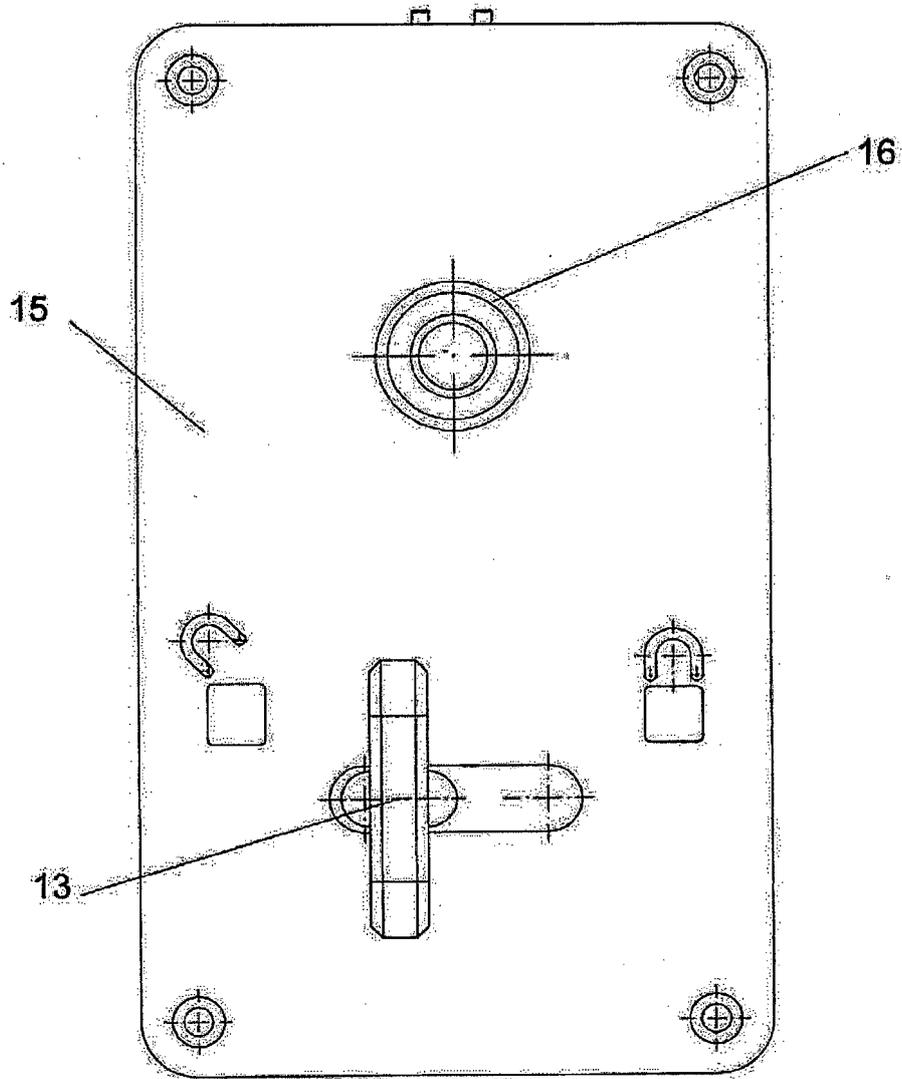


FIG. 3

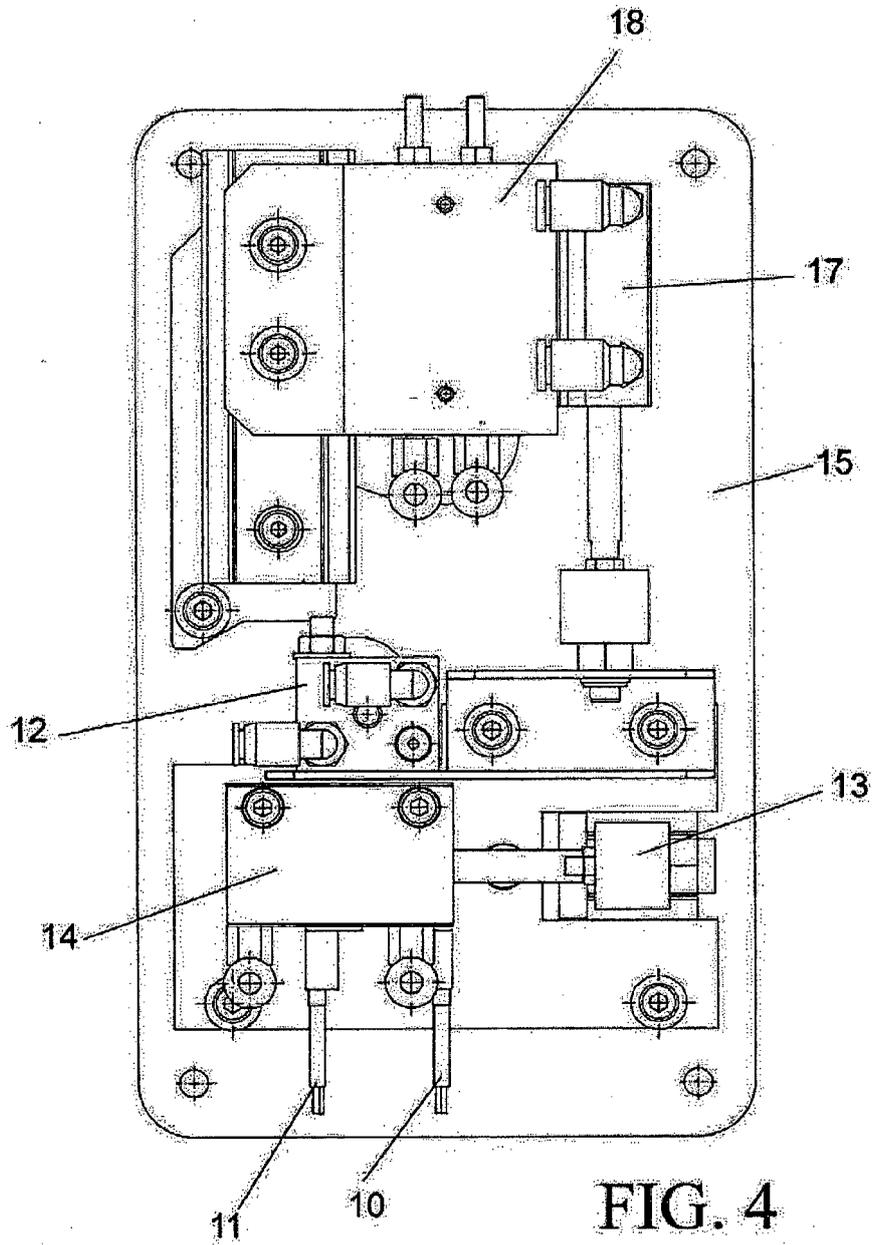


FIG. 4

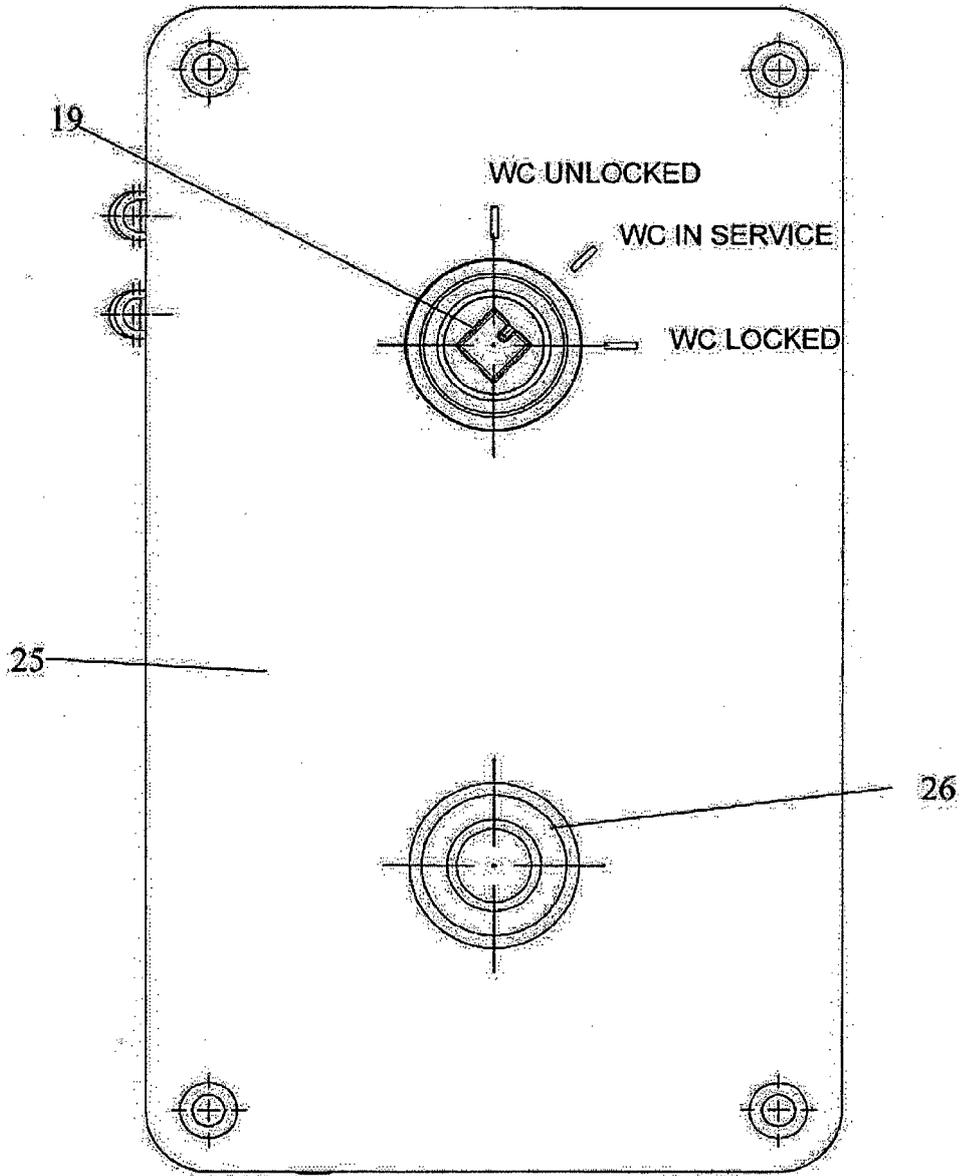


FIG. 5

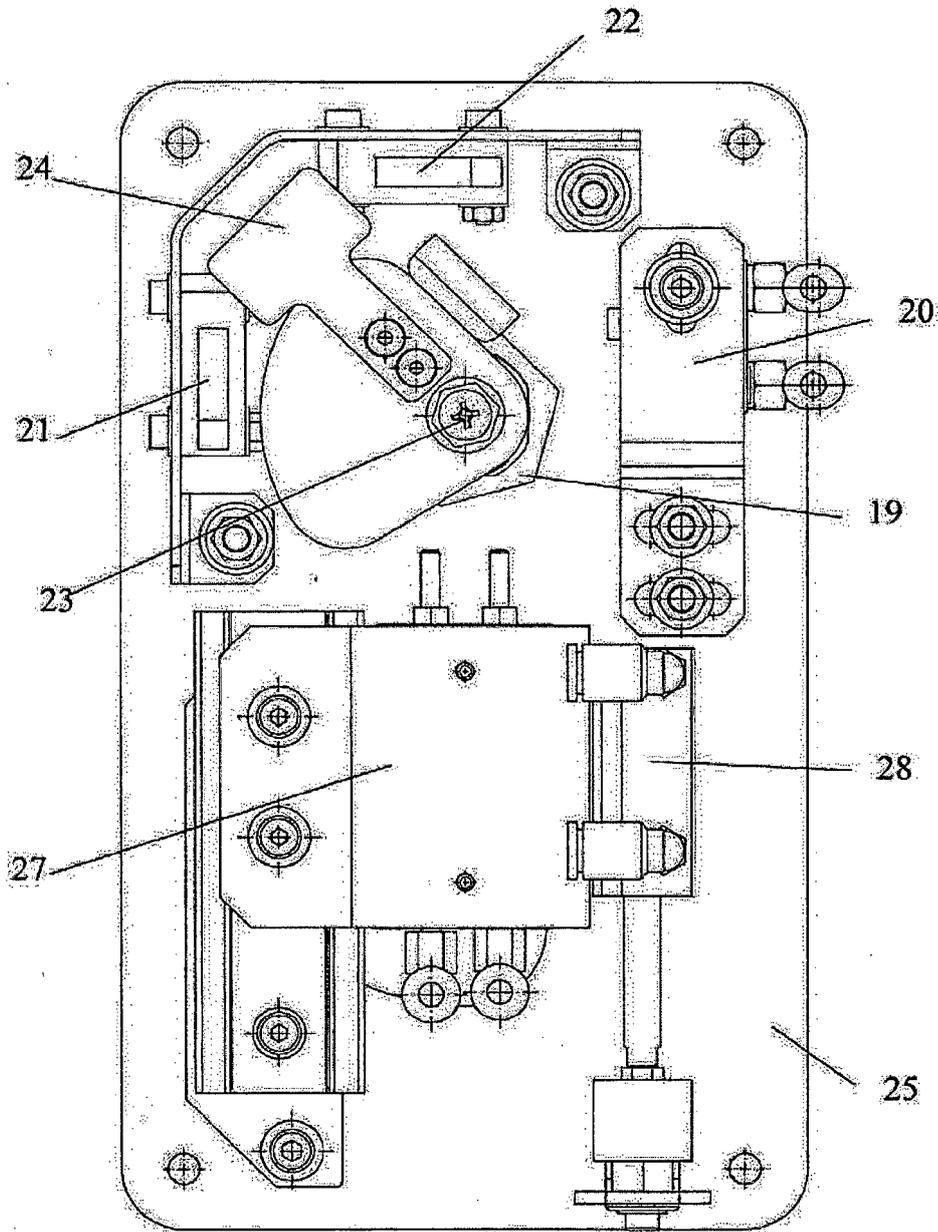


FIG. 6

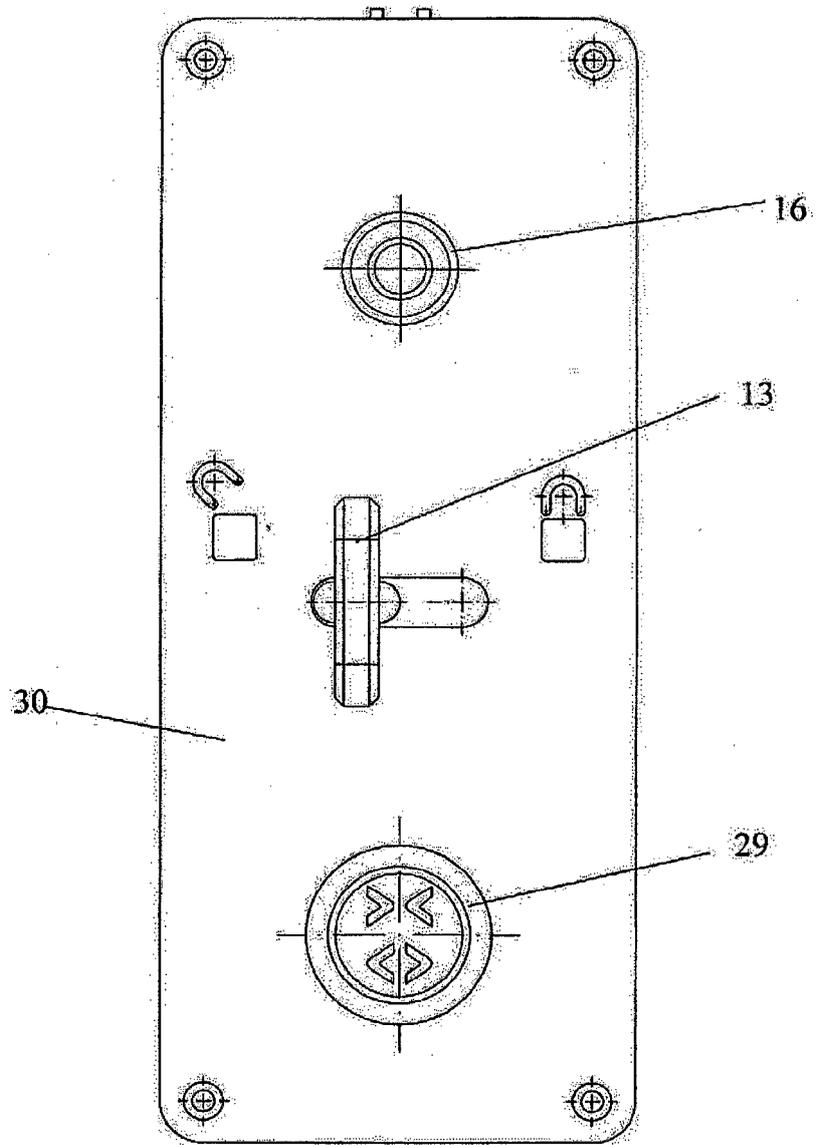


FIG. 7

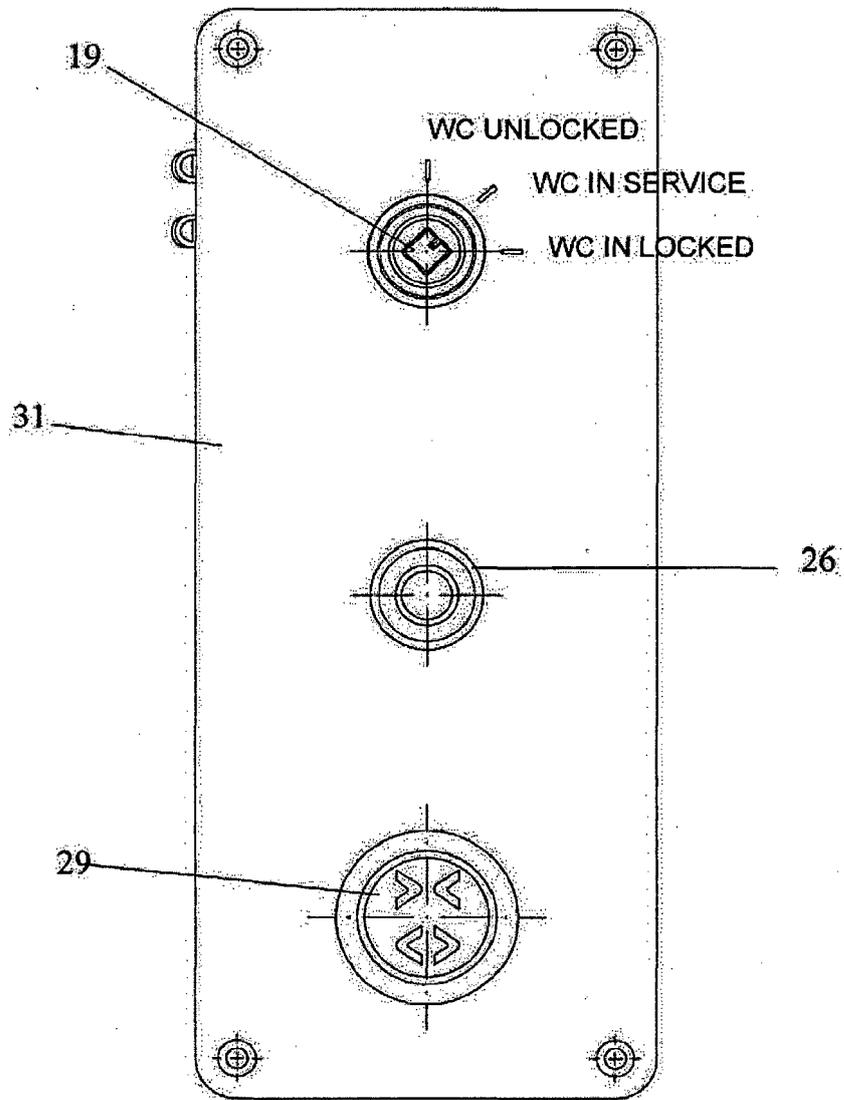


FIG. 8

FIG. 9

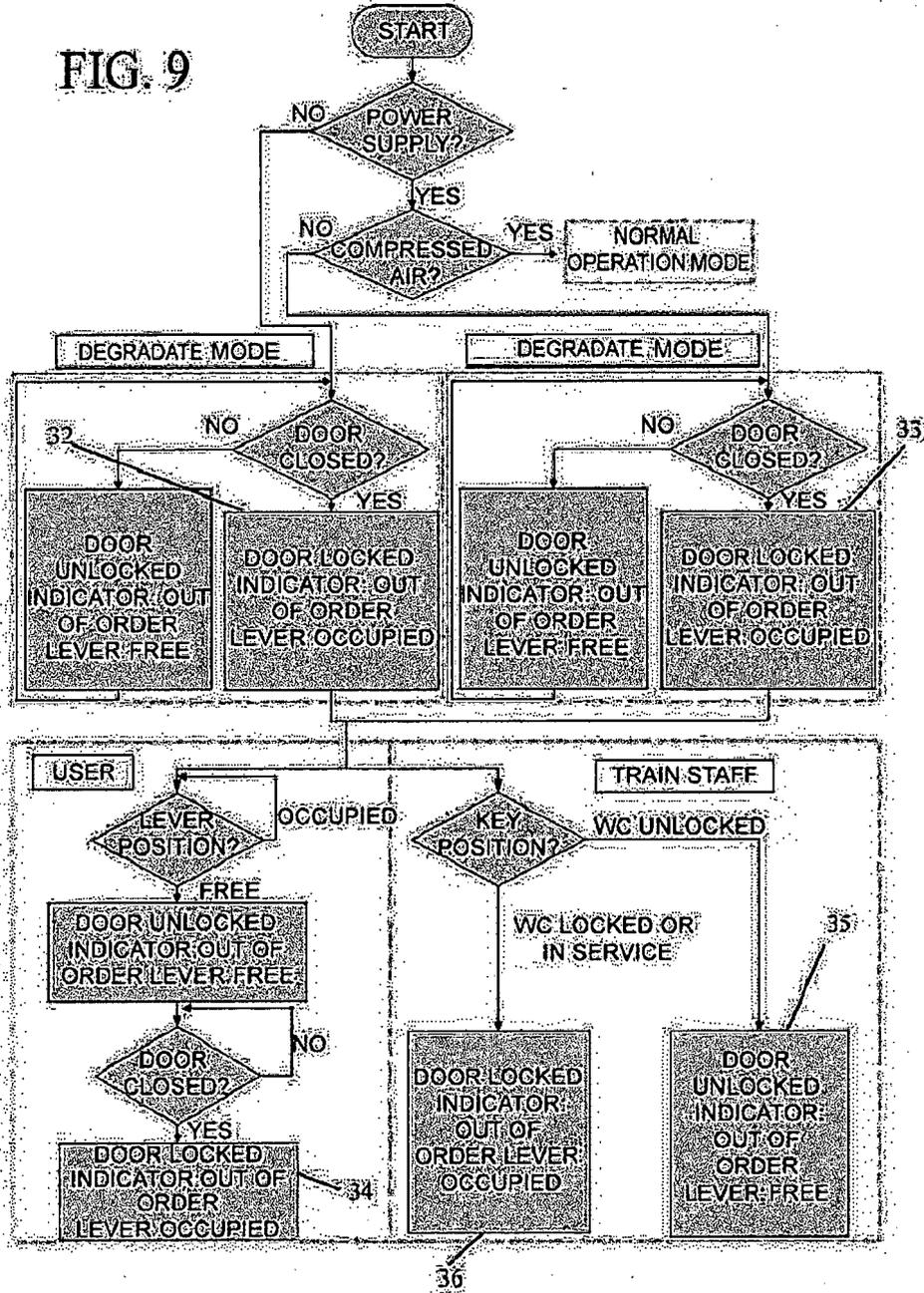
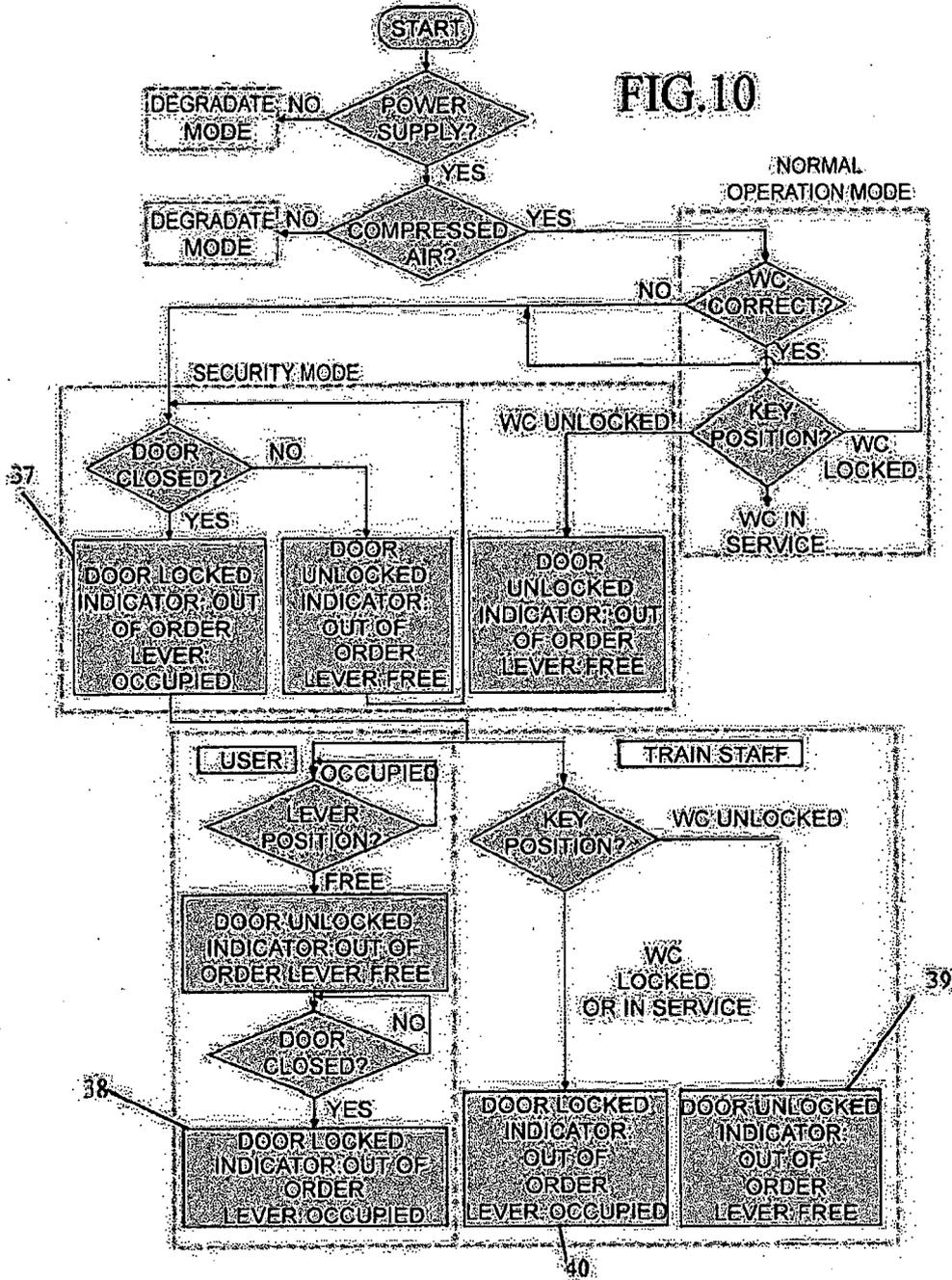


FIG. 10



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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