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DESCRIPTION

TECHNICAL FIELD

[0001] The present invention relates to HVAC. In particular, the present invention relates to HVAC control of a room.

BACKGROUND

[0002] HVAC, heating, ventilating, and air conditioning, is the technology of indoor environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a subdiscipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics, and heat transfer. Refrigeration is sometimes added to the field's abbreviation as HVAC&R or HVACR, or ventilating is dropped as in HACR (such as the designation of HACR-rated circuit breakers). HVAC is important in the design of indoors, where safe and healthy building conditions are regulated with respect to temperature and humidity, using fresh air from outdoors.

[0003] Ventilating (the V in HVAC) is the process of changing or replacing air in any space to provide high indoor air quality, for example to control temperature, replenish oxygen, or remove moisture, odors, smoke, heat, dust, airborne bacteria, and carbon dioxide. Ventilation is used to remove unpleasant smells and excessive moisture, introduce outside air, to keep interior building air circulating, and to prevent stagnation of the interior air. Ventilation includes both the exchange of air to the outside as well as circulation of air within the building. It is one of the most important factors for maintaining acceptable indoor air quality in buildings. Methods for ventilating a building may be divided into mechanical or forced and natural types.

[0004] A publication FR 2 854 595 A1 discloses information that can be regarded as useful for understanding the background.

SUMMARY

[0005] An objective of the present invention is to provide a control of at least one HVAC device of a room.

[0006] According to examples a system, a method and a computer program for controlling at least one indoor environmental condition of a room, comprising: at least one processor, and at least one memory storing program instructions that, when executed by the at least one processor, cause the apparatus to: Receive first data of a number of persons within the room. Receive second data of a clothing of the persons. Based on the first and the second data, send

a signal to at least one hvac device of the room configured to control a level of a cleanness of the indoor environmental condition.

[0007] For example, based on the data on the number of person within the room, the apparatus is configured to send a signal to at least one hvac device of the room configured to control a level of a cleanness of the indoor environmental condition. The level of cleanness of the room can be controlled quite instantly right after the data has been obtained. Consequently, the feedback loop of detecting merely the outputted air can be avoided, and the control of the level of cleanness of the air within the room may be more instant. For example, the level of cleanness can be controlled before it can actually be measure, due to controlling it based on the level of sources of impurities.

[0008] At least one of the afore-mentioned implementation examples offers one or more solutions to the problems and disadvantages of known prior art. Other technological benefits of the present invention become evident to a person skilled in the art from the following description and the claims. The numerous examples of implementing the present invention achieve only a part of the presented advantages. None of the advantages is critical to the examples of implementation. Any required embodiment can technically be combined with any other required embodiment. The examples represent only a few advantageous embodiments and they do not limit the idea of the invention that can be implemented even in other manners within the framework of the claims presented further below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The attached figures illustrate examples of embodiments of the present invention, and together with the above general description and the detailed current embodiments help explain, by way of examples, the principles of the invention.

FIG. 1 is an example of a schematic diagram of a room in accordance with an embodiment;

FIG. 2 is an example of a user interface in accordance with an embodiment;

FIG. 3 is an example of a user interface in accordance with an embodiment;

FIG. 4 is an example of a worklist of patient information management system;

FIG. 5 is an example of a user interface in accordance with an embodiment;

FIG. 6 is an example of a user interface in accordance with an embodiment;

FIG. 7 is an example of a user interface in accordance with an embodiment;

FIG. 8 is an example of a user interface in accordance with an embodiment;

FIG. 9 is an example of a user interface in accordance with an embodiment;

FIG. 10 is an example of a user interface in accordance with an embodiment;

FIG. 11 is an example of a user interface in accordance with an embodiment;

FIG. 12 is an example of a user interface in accordance with an embodiment;

FIG. 13 is a schematic diagram of an apparatus according to an embodiment;

FIG. 14 is a schematic diagram of a system in accordance with an embodiment; and

FIG. 15 is a schematic flow chart of process in accordance with an embodiment.

DETAILED DESCRIPTION

[0010] In the example of FIG. 1, an indoor environmental condition of a room 10 is shown. For example, the room 10 may be a clean room, which has an operation subject to a contamination. Examples of the clean room may be an operation room, OR, for a medical operation. Other examples of the room 10 may be indoors, which are subject to control the level of cleanness of the indoor environmental conditions of the room 10. For example, a room within a hospital. Pharmacy indoors, manufacturing or processing spaces may be other examples. Electronics or fine mechanics manufacturing or processing rooms may be another kind of examples. Biological or microbiological manufacturing or processing spaces may be other examples. The room comprises HVAC devices 11, 12, 13, 14 configured to control the indoor environmental condition of the room 10. Input ventilation device 11 and output ventilation device 12 are configured to control the ventilation of the room. An apparatus 300 is configured to control the ventilation devices 11,12 for the level of the cleanness of the room 10. Furthermore, the ventilation devices 11, 12 may be configured to detect the level of the cleanness of the room 10. For example, amount of impurities, particles, gasses, etc. may be controller or detected from the air of the room 10. Thus, the ventilation devices 11, 12 are configured to control a level of cleanness of the indoor environmental condition of the room 10. The level of the cleanness may partly be based on an amount of a ventilation of the room 10. The level of the cleanness may partly be based on an amount of a ventilation of the room 10, an amount of air entering the room, an amount of air leaving the room. The air entering the room 10 may be made hygienic. The room further comprises a heating device 14 and a cooling device 13, which both are also configured to the control of the indoor environmental conditions. The HVAC devices 11, 12, 13, 14 are coupled with an apparatus 300 configured to control the indoor environmental conditions of the room 10. The apparatus 300 may control each HVAC device 11,12,13,14 individually. For example, an excess pressure may be created into the room 10 by inputting more air with the input ventilation device 11 than air exiting the room by output ventilation device 12. For another example, an under pressure may be created into the room 10 by outputting more air by the output ventilation device 12 than input of the input ventilation device 11.

[0011] In an example, the room 10 comprises also a detector 15 configured to detect persons within the room. For example, the detector 15 is configured to detect a number of persons within the room 10. The detector 15 may be a part of the system of the real estate facility of the room 10 so that the number of person within the room 10 can be obtained from the system. Data of the detector 15 is send to the control apparatus 300 for controlling the level of the cleanness of the indoor environmental condition. The number of person may also be manually entered. Consequently, the apparatus 300 may be linked with a system having data of the number of the persons within the room 10. For example, an access control system of the real estate may provide the data. The number of persons within the room 10 can be detected by the detector 15. For example, by a direct detection, or based on detecting persons entering and leaving the room 10. The number of persons may be furthermore manually entered or corrected, added, etc. The number of persons may be based on a database of a computing system.

[0012] According to an example, the apparatus 300 receives data of a clothing of the persons within the room 10. Type or quality of the clothing the persons within the room 10 is entered to the apparatus 300. This may relate to protective or special clothing the persons are wearing when they are inside the room 10. The type or the quality of the special clothing and characteristics are known and can be given to the apparatus 300. For example, the data may relate to released particles from the clothing, insulation of the clothing, etc.

[0013] Based on the data on the number of person within the room 10, and for example based on the data of to the clothing of the persons, the apparatus 300 is configured to send a signal to at least one hvac device of the 10 room configured to control a level of a cleanness of the indoor environmental condition. The level of cleanness of the room 10 can be controlled quite instantly right after the data has been obtained. Consequently, the feedback loop of detecting merely the outputted air can be avoided, and the control of the level of cleanness of the air within the room 10 may be more instant. For example, the level of cleanness can be controlled before it can actually be measure, due to controlling it based on the level of sources of impurities.

[0014] A mode of operation carried within the room 10 may affect the controlled level of cleanness. For example, the level of cleanness of the indoor environmental condition is based on a certain operation, which is carried out within the room 10. The operation launches the apparatus 300 to set a certain level of cleanness, for example directly. Furthermore, the control maybe dynamic. For example, an action takes place, when carried out the operation, and the apparatus 300 receives data of the action so that the level of cleanness of the indoor environmental condition is based on the action. This may be temporary or more stable change of the level of the cleanness. Furthermore, the control maybe based on a time. For example, the room 10 may be flushed before the start of the operation for a certain period of time. After the operation, an economy mode is engaged, etc.

[0015] Furthermore, the apparatus 300 is configured to receive data indicating that a door of the room 10 is opened. The door of the room 10 contains a detector detecting whether the

door is open or closed. Based on the detecting that the door is open, the apparatus 300 is configured to send a signal to the at least one hvac device for temporarily increase a performance of the at least one hvac device configured to control the level of the cleanness. Consequently, a temporary boost for HVAC of the room 10 can be given. For example, air pressure within the room 10 may be increased so that basically no air enters the room 10 from the door opening. For another example, heating, cooling or under pressure may be temporarily increased within the room 10. Even furthermore, an activity of the medical operation may cause the dynamic control. For example, activating a laser surgical tool, such as laser surgical knife, may increase negative emissions within the room 10. Consequently, based on a detection that the toll is activated, the apparatus 300 is configured to send the signal to the at least one hvac device for temporarily increase the performance of the at least one hvac device.

[0016] In an example, a security of a patient of the operation may be improved. Improved indoor environmental condition may help to improve the security of the patient. Under defined working conditions the concentration of airborne contaminations can be observed and may be reduced. The amount of contamination factors within the operating room may be reduced. Energy consumption for the HVAC of the operating room may be reduced. Work of the personnel of the operating room, for example nurses, staff, etc., may be relived. For example they do not need to focus to operating the HVAC of the operating room, but they may better focus into the actual operation. Furthermore, the thermal comfort of the operating personnel may be improved.

[0017] In the example of FIG. 2, a user interface, UI, 100 is shown. The UI 100 comprises modules 101...103. There may a variety of different modules for the room 10, and for the sake illustrating purposes only, three is shown. Furthermore, the example of the room 10 relates to an operating room, however other rooms are applicable as well with the examples of the UI. Each module represents a functionality of the room 10. Module 101 comprises HVAC control of the room 10. Modules 102 may relate to an operation carried out within the room, for example an operating table control, and module 103 may be a camera control, etc. Module 101 may be configured to control each room 10 individually. Alternatively module 101 may be configured to control two or more, or all, rooms.

[0018] An example relate to an operating room, OR, also known as an operating theater, an operating theatre, or an operating suite, is a facility within a hospital where a medical operations are carried out in a sterile environment. For example a surgical operation is typically carried out in the operating room. The operating room comprise several equipment. The 100 UI may be configured to control any of these operation room equipment. The operating table in the center of the room can be raised, lowered, and tilted in any direction. The operating room lights are over the table to provide bright light, without shadows, during surgery. The anesthesia machine is at the head of the operating table. This machine has tubes that connect to the patient to assist him or her in breathing during surgery, and built-in monitors that help control the mixture of gases in the breathing circuit. The anesthesia cart is next to the anesthesia machine. It contains the medications, equipment, and other supplies that the anesthesiologist may need. An electronic monitor (which records the heart rate and respiratory

rate by adhesive patches) are placed on patient's chest. The pulse oximeter machine attaches to the patient's finger with an elastic band aid. It measures the amount of oxygen contained in the blood. Automated blood pressure measuring machine that automatically inflates the blood pressure cuff on patient's arm. An electrocautery machine uses high frequency electrical signals to cauterize or seal off blood vessels and may also be used to cut through tissue with a minimal amount of bleeding. If surgery requires, a Heart-lung machine, or other specialized equipment, may be brought into the room. Hybrid Operating Rooms, which integrate diagnostic imaging systems such as MRI and Cardiac Catheterization into the operating room to assist surgeons in specialized Neurological and Cardiac procedures. Sterile instruments to be used during surgery are arranged on a stainless steel table.

[0019] Module 101 comprises an indicator such as a number "1" as shown in the FIG 2. This indicator represents a level of criticality of the operation conducted within the room 10. For example, ISO standardization may contain and determine the levels of criticality for operations. The levels may be 1, 2, 3, and 4 so that, for example, some surgical operation may require higher level than the others. Each level comprises predetermined HVAC settings, for example temperature, ventilation, pressure difference, humidity, and level of particles. The indicator may be highlighted (not shown in FIG. 2). In another example, a highlighting symbol appears approximate to the indicators (not shown in FIG. 2). This may indicate HVAC values of the room 10 are not corresponding to the values of the level of the indicator. However, the HVAC control is processing for reaching the appropriate values. In another example, this may indicate that the operating being conducted at the room 10 has imbalanced or shocked the indoor environmental conditions of the operating room. The indoor environmental conditions are not within the required level of criticality. HVAC is running in order to meet the level of criticality. Once the indoor environmental conditions are within the required level of the criticality, the highlight goes off and HVAC is set accordingly for maintaining the indoor environmental conditions corresponding to the level of criticality.

[0020] The module 101 is activated with respect to the room 10. FIG. 2 comprises a view 104. In the example of FIG. 1 the view is connected to the camera module 103 and shows a patient 112 lying on an operating surface 111 such as an operating table. The patient is subject to the operation, which contains at least one area subject to a contamination (not shown in FIG. 2). For example a wound area. This may be a wound area caused by a medical operation, such as a surgery, dental activity, injection, etc.

[0021] In the example of FIG. 3, the HVAC module 101 is activated. The activation may, for example, take place by a user touching the module 101 on a touchscreen of the UI 100. The HVAC module 101 becomes highlighted on the UI 101. A HVAC window 105 is illustrated on the UI 100. The HVAC window 105 may be an independent user interface, with or without a connection to the management system of the operating room. The HVAC window 105 is opened by activation of the HVAC module 101. The HVAC window 105 comprises the level of criticality of the operation 106. Each level, as shown by the squared 1, 2, 3, and 4 may be activated on the touchscreen. In FIG. 2 "1" is activated. HVAC window 105 comprises a temperature of the operating room 107. Temperature may be set by up and down arrows. A

current temperature "21" is highlighted and desired temperature "21" is not highlighted. HVAC window 105 comprises a humidity of the room 108. Humidity may be set by up and down arrows. A current humidity level "50" is highlighted and desired humidity "50" is not highlighted. HVAC window 105 comprises a number of persons 109 within the room 10 during the operation. For example, 5 persons are shown. The number of persons 109 may be increased or decreased by "+" or "-" as shown in the squares. For example, user may touch the respective buttons on the touchscreen. Number of persons 109 affects the HVAC of the room 10. For example, more persons in the operating room require higher performance of HVAC, especially with respect to the air flow. Statuses of HVAC 110 is shown at the bottom of window 105. This may, for example, show statuses of pressure difference, filter, air flow, particles level, etc. Status may be OK or not OK, NOK.

[0022] The HVAC contents of HVAC window 105 may alter. For example, a pressure difference may be illustrated and adjustable, both by target level and manually by touchscreen buttons. HVAC window 105 may comprises the pressure difference.

[0023] The apparatus 300 is configured to control at least one HVAC device 11, 12, 13, 14 of the room 10. The apparatus 300 may control all HVAC devices 11,12, 13, 14 of the room 10. The HVAC device 11, 12, 13, 14 may be controlled individually and/or with the combined effect of several HVAC devices 11, 12, 13, 14. The HVAC devices 11, 12, 13, 14 are configured to heating, ventilating, and air conditioning of the room 10. There may be a single HVAC device 11, 12, 13, 14, or several HVAC devices 11, 12, 13, 14, for each of them (heating, ventilation and air condition).

[0024] FIG. 4 is an example of a related external data affecting the control of the level of cleanness of the indoor environmental condition of the room 10. A worklist 200 of patient information management system is shown. For example, this may be a worklist of hospital, and hospital patient information management system. The work list may be illustrated within the user interface 100, or in a separate patient management system. The apparatus 300 is configured to communicate with the worklist 200. The apparatus 300 receives data information of the worklist 200. Consequently, the worklist 200 of the patience, to be operated, can be directly and automatically uploaded time of the operation 205. Time of the operation 205 may indicate time when the operation will begin. Time of the operation 205 may further contain information about any breaks of the operation. Worklist 200 comprises also name of the patient 206 and the operating room 207. Worklist 200 may also contain the level of criticality of the operation for each operation or patient. Data of the worklist 200 can be used to control HVAC of the room 10. This may also consider time so that the room 10 is cleaned by HVAC before the start of the operation. During non-use of the operating room HVAC of the operating room may be set to economy mode. For example, during night hours and weekends. Significant energy savings can be obtained. Furthermore, because the level of criticality of the operation can be received, by the control apparatus, from the worklist, easy and automatic use of HVAC can be achieved. For example in the operating room nurses do not need to focus to adjust HVAC for each operation, but the apparatus takes care of HVAC automatically based on the worklist 200. In an example, the apparatus 300 for controlling the HVAC of the room 10 can be

linked to the system or computer having the worklist 200.

[0025] FIG. 5 illustrates an example, wherein the level of criticality 106 of the operation can be manually set. The level of criticality 106 indicating "3" may be touched on the touchscreen. Consequently, the apparatus 300 gives a command to HVAC of the room 10 to change the indoor environmental conditions to correspond with the level "3". For example, something may have happened during the operation causing a need for increasing the level of criticality 106. In the example of the operating room, now the nurse may simply touch level "3" on the touchscreen and the apparatus 300 automatically takes care of the HVAC reaching the required indoor environmental conditions of level "3".

[0026] FIG. 6 illustrates an example, wherein the module 101 has been changed to correspond with the level of criticality 106. Level "3" appears on the module 101 also showing the level of criticality of the operation. Module 101 may further contain a symbol indicating that the indoor environmental conditions are not within the required level (not shown in FIG. 6). Module 101 may further contain a symbol indicating how much is missing to meet the required level (not shown in FIG. 6).

[0027] FIG. 7 illustrates an example of a maintenance need appearing on the module 101. FIG. 7 shows an exclamation mark 113 appearing on the module 101. This appears due to the need for a maintenance action of the HVAC of the room 10. For example, this may indicate a need to do maintenance work for the HVAC. However, the operation may not be at risk and do not necessarily require interruption of the operation. The need for maintenance may be also automatically conveyed to estate manager of the room 10, for example to an estate manager of the hospital.

[0028] In the example of FIG. 8, being based on FIG. 7 announcement at the module 101, user may open the window 105 by touching the module 101. Filter needs maintenance. Now, the status 110 of the filter is NOK showing the need for maintenance of the filter of the HVAC of the room 10. In an example, the exclamation mark 113 and the status of the filter NOK cannot be acknowledgement within the user interface 100. These may, for example, be only acknowledged by performing the maintenance action and doing acknowledgement in this context.

[0029] Indoor environmental conditions may be manually adjusted. In the example of FIG. 9, user touched temperature increase triangle 114 on the touchscreen. The temperature will be increased from 21C to 22C. The actual temperature is shown as bolded "**21**". After the user interface 100 has received the touch, the apparatus 300 starts to control HVAC for changing the temperature. In FIG. 10 the temperature "21" 116 is not bolded, which indicates that the apparatus 300 is working for reaching the target value "**21**". After the target value has been reached the actual temperature is shown as "**22**". In the example of FIG. 10 the user touches triangle 115 to reduce humidity of the room 10. The control apparatus 300 starts to activate HVAC for reducing the humidity within the room 10. FIG. 11 illustrates as example, wherein the actions of FIG. 10 and FIG. 9 are being carried out by HVAC of the room 10. In the example of

FIG. 11 the actual temperature 116 and the actual humidity 117 are not highlighted so that the HVAC of the room 10 is operating to reach the target values 22C and 40, respectively. When the target values have been reached, the actual temperature value 116 and the actual humidity value are highlighted.

[0030] Consequently, each indoor environmental condition can be adjusted one-by-one. For another example, two or more indoor environmental conditions can be adjusted simultaneously. In an example, the apparatus 300 may control the indoor environmental conditions of the room 10 and the user can fine tune these conditions.

[0031] FIG. 12 illustrates an example for adjusting the number of person 109 within the room 10. The user may touch the square having a symbol "+" for increasing the number of person within the room 10. In the example, the number is increased from 5 to 6. For example, a further personnel enters the room 10, and a personnel manually increases the number of persons 109. The apparatus 300 commands HVAC to adjust the indoor environmental conditions so that the number of person within the room 10 is 6, instead pf previous 5. For example, ventilation may be adjusted higher and heating slightly lower, etc. In an example, the number of person may be adjusted manually via the UI 100.

[0032] According to an example, number of person 109 can be adjusted automatically. For example, the number of persons entering and leaving the room 10 can be detected, and accordingly the apparatus 300 may configure HVAC of the room 10 automatically based on the detected number of persons within the room 10. The room 10 may also contain one or more detectors 15 for detecting the number of persons within the room 10. For example, the detection may be based on an id card of personnel. The id card may contain an identifier, such as rfid, that can be detected by a detector 15 of the room 10. Detection and automatic adjustment of HVAC of the room 10 can be real-time and react quickly for the change of the number of persons within the room 10. Furthermore, the number of persons in the room 10 can be obtained from the worklist 200, or from an external computer system.

[0033] A schematic diagram of the apparatus 300 of controlling at least one indoor environmental condition of an operating room is shown in FIG. 13. The apparatus 300 can be a computing device in a real estate facility of the room 10,for example in a hospital. The apparatus 300 may include a processing means 301 such as a microprocessor or Application Specific Integrated Circuit, ASIC, a storage unit 303 and a communication interfacing unit 304. The storage unit 303 may be any data storage device that can store a program code 302, accessed and executed by the processing means 301. Examples of the storage unit 303 include but are not limited to read-only memory, ROM, flash memory, random-access memory, RAM, CD-ROM/DVD-ROM, magnetic tape, hard disk and optical data storage device. The communication interfacing unit 304 may be a transceiver and is used to transmit and receive signals, for example, messages or packets, according to processing results of the processing means 301. The functionality described herein can be performed, at least in part, by one or more hardware logic component. The apparatus 300 may be configured to perform the operations described in the examples. The apparatus 300 comprises the user interface such

as a touch sensitive area. Instead of touch gestures may be applied. The touch sensitive area may also output information of the apparatus 300. For example a touchscreen can be used.

[0034] FIG. 14 illustrates an example of system of controlling at least one indoor environmental condition of an operating room. The system comprises several apparatuses 300, 300', 300" which can communicate with cloud servers 400, 401. For example, a big hospital or a communal or enterprise hospital community may control the indoor environmental conditions of each operating room the community has.

[0035] Referring to FIG. 15, the process is utilized in the apparatus 300 shown in figure 13, for controlling indoor environmental conditions of the operating room. The process of FIG. 15 maybe compiled into the program code 302. The process includes the following steps:

Step 400: Receive data of a number of persons.

Step 401: transmit a signal to at least one HVAC device.

[0036] According to the process, the indoor environmental conditions of the room 10 are being controlled. Data of a number of persons within the room 10 is received in the step 400. For example the number of persons in the room 10 within an ongoing operation. Based on the received data, a signal is transmitted to at least one HVAC device 11, 12,13,14 of the room 10. The at least one HVAC deice controls the level of cleanness of the indoor environmental condition of the room 10. For example, a worklist 200 shows that three trainees attend a surgical operations in addition to normal staff. HVAC receives this information and automatically increases ventilation and decreases heating.

[0037] In addition to the number of person affecting the indoor environmental conditions of the operating room, clothing of the staff may affect the indoor environmental conditions. For example, staff of the operating room may have certain type of protective clothing. For example, amount of separated particles, insulation.

[0038] For a person skilled in the art, it is obvious that numerous modifications and variations can be made to the equipment and method. Other embodiments and exemplary implementations become evident to a person skilled in the art on the basis of the specification and practice related to the equipment and method described.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all

liability in this regard.

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July 2017

Krav

1. Et apparat (300) til kontrol af mindst en indendørs omgivelsestilstand (107, 108, 110) af et rum (10), omfattende:

   mindst en processor (301), og

   mindst en hukommelse (303) -lagringsprogram-instruktion (302) som, når denne afvikles af den mindst ene processor, får apparatet til:

   at modtage første datamængde for et antal af personer i rummet;

   at modtage anden datamængde for en beklædningsgenstand af personerne;

   kendetegnet ved, baseret på denne første og anden datamængde, at sende et signal til mindst en hvac enhed (11, 12, 13, 14) af rummet konfigureret til at kontrollere niveauet af renhed af den indendørs omgivelsestilstand.

2. Apparatet ifølge krav 1, hvor niveauet af renhed er delvist baseret på en mængde af ventilation (11, 12) af rummet; eller
   hvor ventilationen (11) er delvist baseret på en mængde af luft, der kommer ind i rummet; eller hvor niveauet af renhed er delvist baseret på en mængde af luft, der forlader rummet; eller hvor luften der kommer ind i rummet er gjort hygiejnisk.

3. Apparatet ifølge et hvilket som helst af de foregående krav, hvor rummet omfatter et rent rum (10), og hvor det rene rum omfatter en operation udsat for kontaminering.

4. Apparatet ifølge et hvilket som helst af de foregående krav, hvor programinstruktionerne yderligere får apparatet til: at modtage tredje datamængde (101, 106) af en operation; og baseret på den første, anden og tredje datamængde, at sende et signal til mindst en hvac enhed af rummet konfigureret til at kontrollere indendørs omgivelsestilstanden.

5. Apparatet ifølge et hvilket som helst af de foregående krav, hvor den første datamængde modtages fra et computersystem (15), der detekterer antallet af personer i rummet.

6. Apparatet ifølge et hvilket som helst af de foregående krav, hvor datamængden modtages automatisk, uden menneskelig indgriben; eller

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hvor den første eller anden datamængde er manuelt indført i apparatet.

7. Apparatet ifølge et hvilket som helst af de foregående krav, hvor en modtagelse af information om en aktivitet (106), som øger emissioner i rummet, får apparatet til yderligere at sende signalet; eller
hvor den mindst ene hukommelses-lagringsprogram-instruktion som, når denne afvikles af den mindst ene processor, får apparatet yderligere til:
at modtage tredje datamængde som indikerer at en dør i rummet er åbnet; og
baseret på denne tredje datamængde, at sende et signal til den mindst ene hvac enhed om midlertidigt at øge en ydeevne af den mindst ene hvac enhed konfigureret til at kontrollere niveauet af renhed.

8. Apparatet ifølge et hvilket som helst af de foregående krav, hvor rummet omfatter et operationsrum, hvor operationsrummet omfatter en operationsoverflade (111) på hvilket der er tilvejebragt et område (112) udsat for kontaminering, og hvor programinstruktioner yderligere får apparatet til:
At modtage datamængde fra en operation (101, 106) som forårsager området udsat for kontamineringen;
baseret på denne datamængde, at sende et signal til mindst en hvac enhed af operationsrummet konfigureret til at kontrollere den indendørs omgivelsestilstand.

9. Apparatet ifølge et hvilket som helst af de foregående krav, hvor området udsat for kontaminering omfatter et såområde, og operationen forårsager såområdet.

10. Apparatet ifølge et hvilket som helst af de foregående krav, hvor apparatet er forbundet til et styringssystem (100) for rummet, og datamængden modtages fra styringssystemet; eller
hvor apparatet er forbundet til et ejendomssystem for rummet, og datamængden modtages fra ejendomssystemet; eller
hvor apparatet er forbundet til et patientstyringssystem for rummet (100), og datamængden modtages fra patientstyringssystemet.

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11. Apparatet ifølge et hvilket som helst af de foregående krav, hvor datamængden af operationen modtages fra en arbejdsliste (200) for patientstyringssystemet; eller
hvor datamængden for operationen omfatter en type (101) af en operation udført i rummet; eller hvor datamængden yderligere omfatter operationsdata omfattende en tidsplan (205) for operationen; eller hvor datamængden for operationen omfatter et niveau (101) for, hvor kritisk operationen er.

12. Apparatet ifølge et hvilket som helst af de foregående krav, hvor den mindst ene hvac enhed omfatter en varmeenhed (14), en ventilationsenhed (11, 12), eller en klimaanlæg-enhed (13).

13. Apparatet ifølge et hvilket som helst af de foregående krav, hvor datamængden yderligere omfatter data om den indendørs omgivelsestilstand af rummet.

14. En metode til at kontrollere mindst en indendørs omgivelsestilstand (107, 108, 110) af et rum (10), omfattende:

    modtagelse (400) af første datamængde for et antal af personer (109) i rummet;
    modtagelse af anden datamængde for en beklædningsgenstand af personerne;
    kendetegnet ved baseret på denne første og anden datamængde, afsendelse (401) af et signal til mindst en hvac enhed (11, 12, 13, 14) for rummet konfigureret til at kontrollere niveauet af renhed af den indendørs omgivelsestilstand.

15. Et computerprogramprodukt (302), omfattende programmerbare midler konfigureret til at forårsage en computer (300) til at udføre trinene af metoden ifølge krav 14.

DRAWINGS

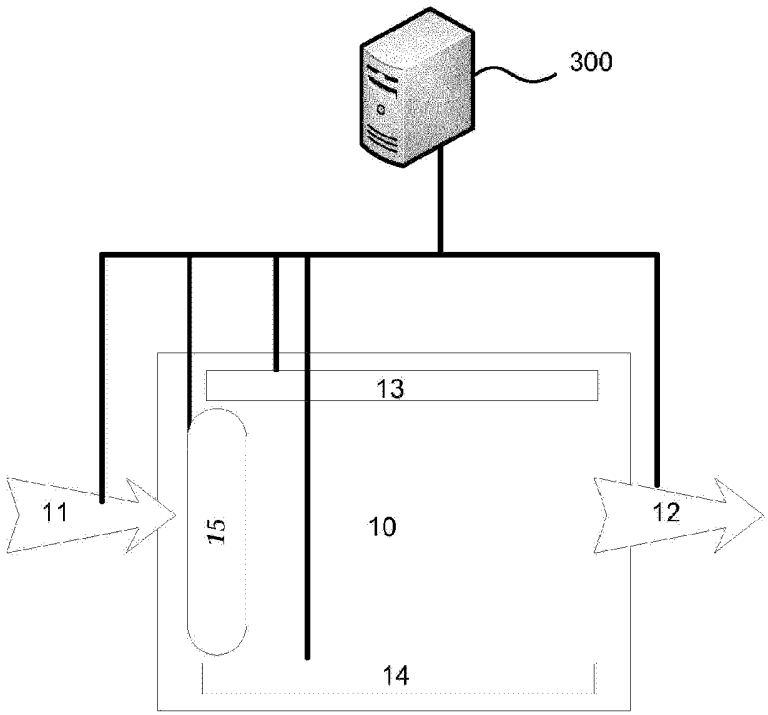


FIG. 1

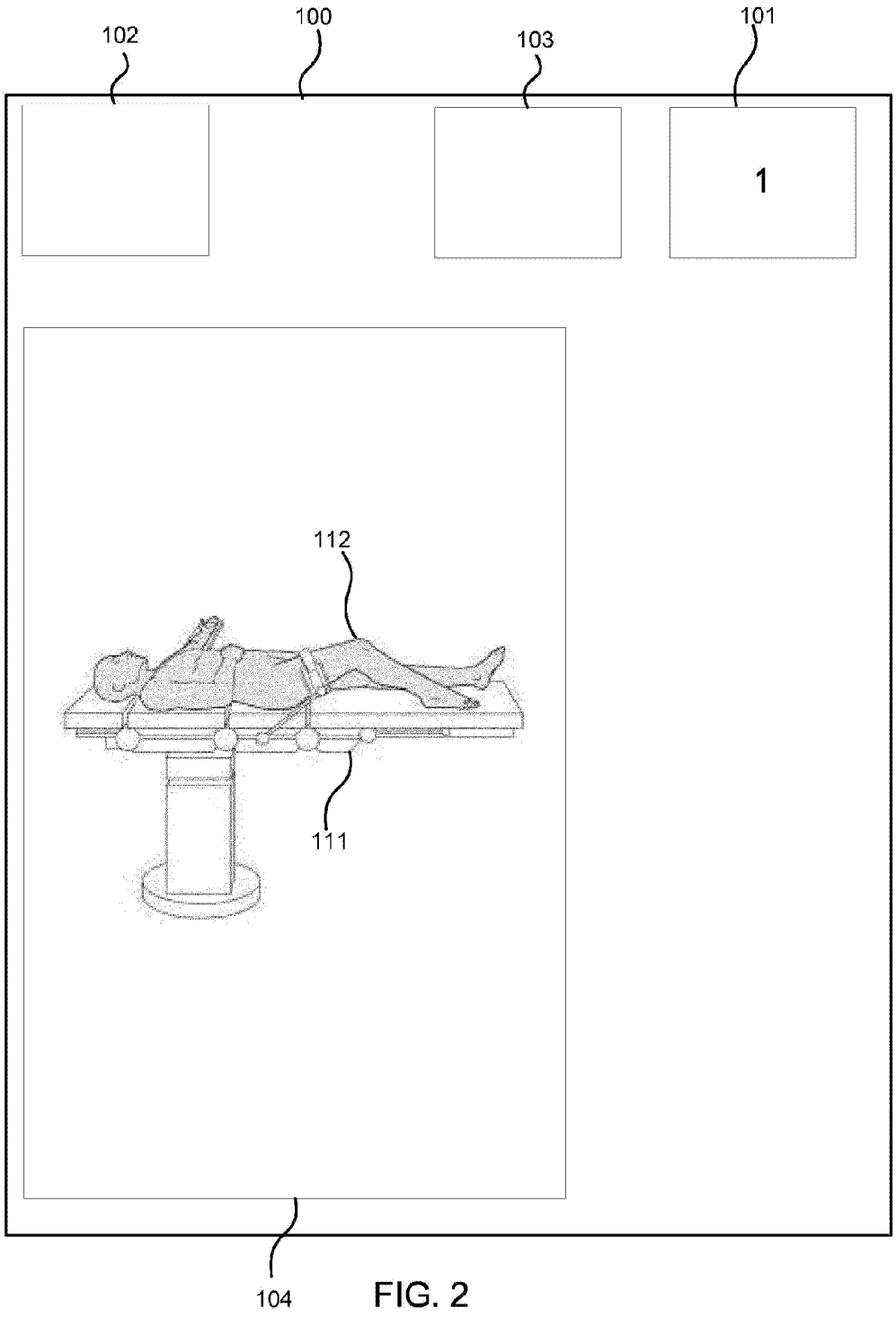


FIG. 2

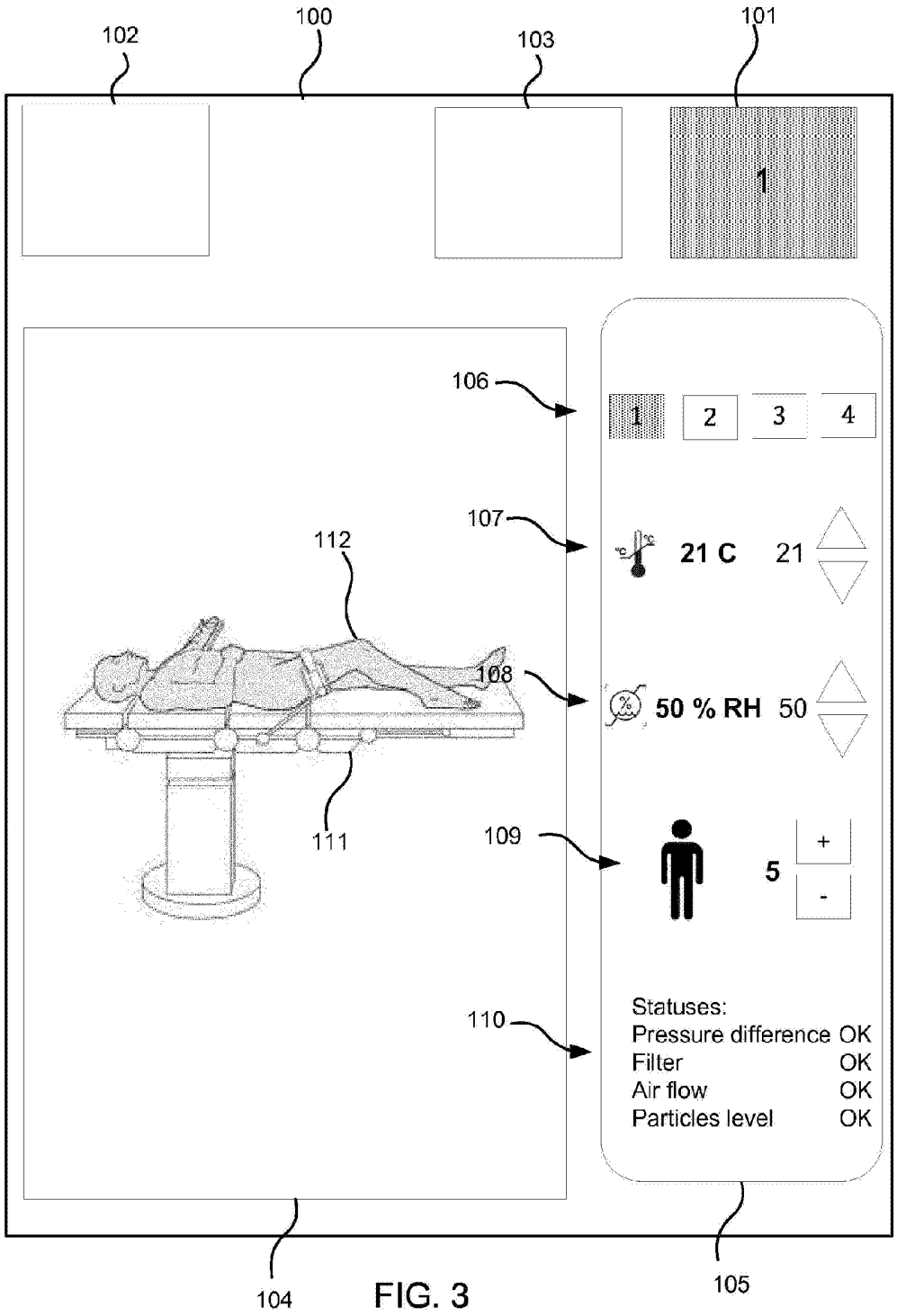

102
100
103
101
1
106
1
2
3
4
107
21 C
21
112
108
50 % RH
50
111
109
5
+
-
110
Statuses:
Pressure difference OK
Filter OK
Air flow OK
Particles level OK
104
105

FIG. 3

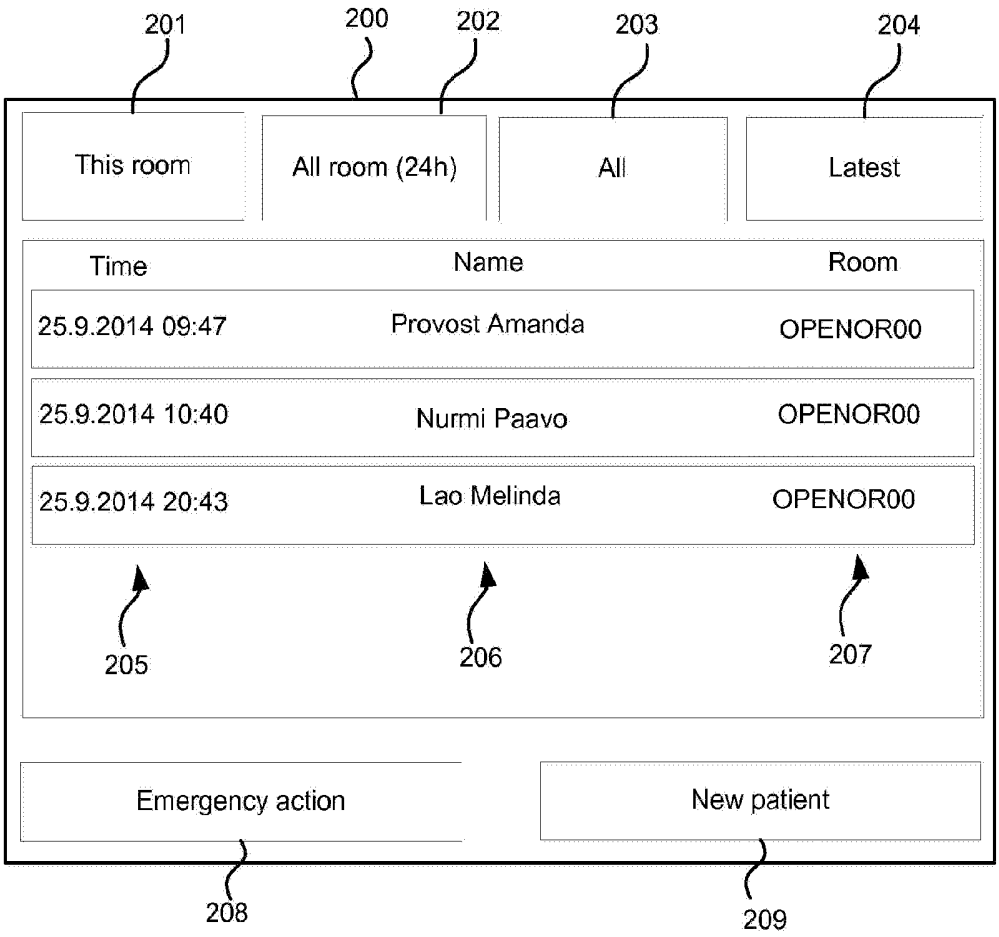
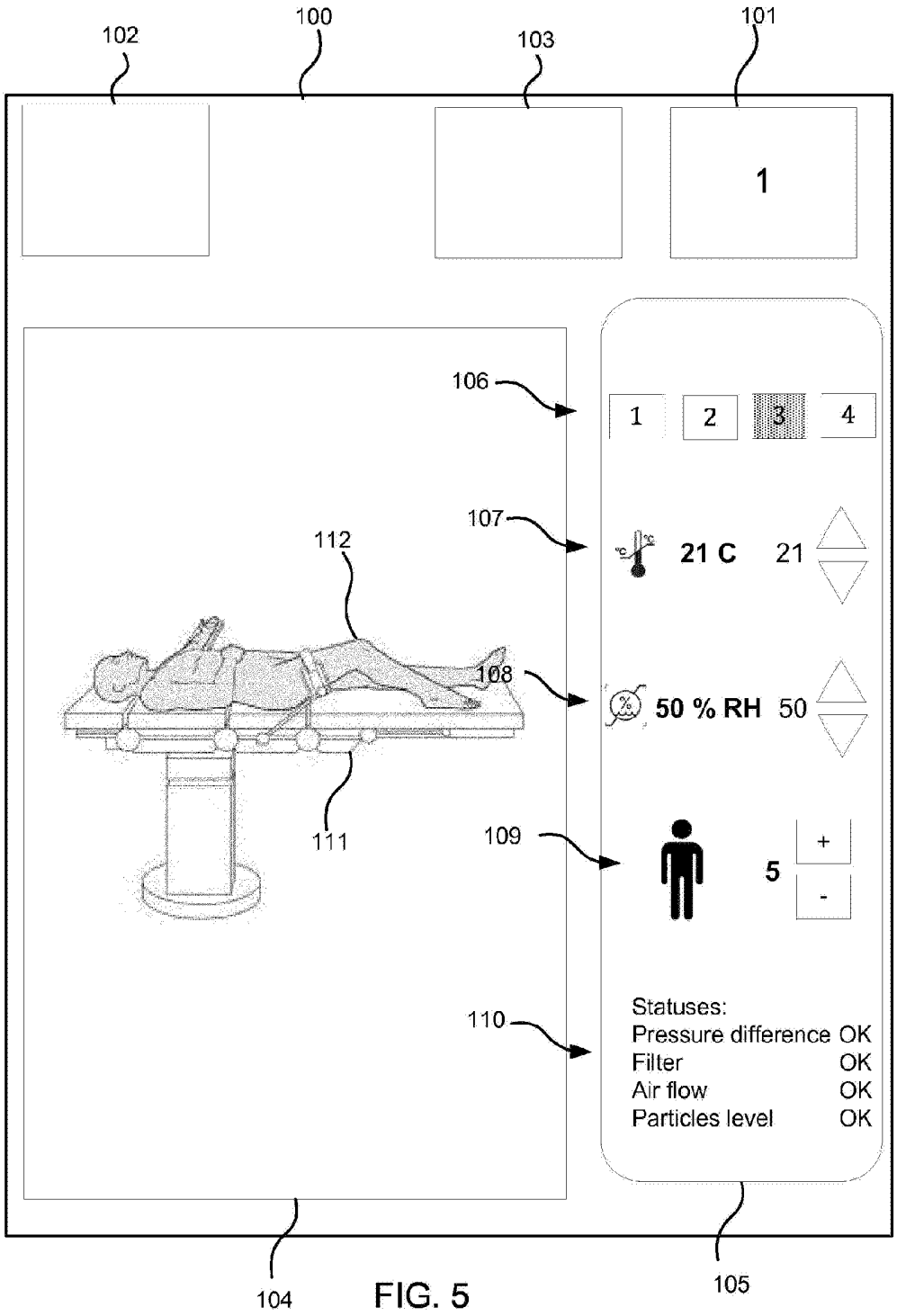

201
200
202
203
204
This room
All room (24h)
All
Latest
Time
Name
Room
25.9.2014 09:47
Provost Amanda
OPENOR00
25.9.2014 10:40
Nurmi Paavo
OPENOR00
25.9.2014 20:43
Lao Melinda
OPENOR00
205
206
207
Emergency action
New patient
208
209

FIG. 4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107
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112
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50 % RH
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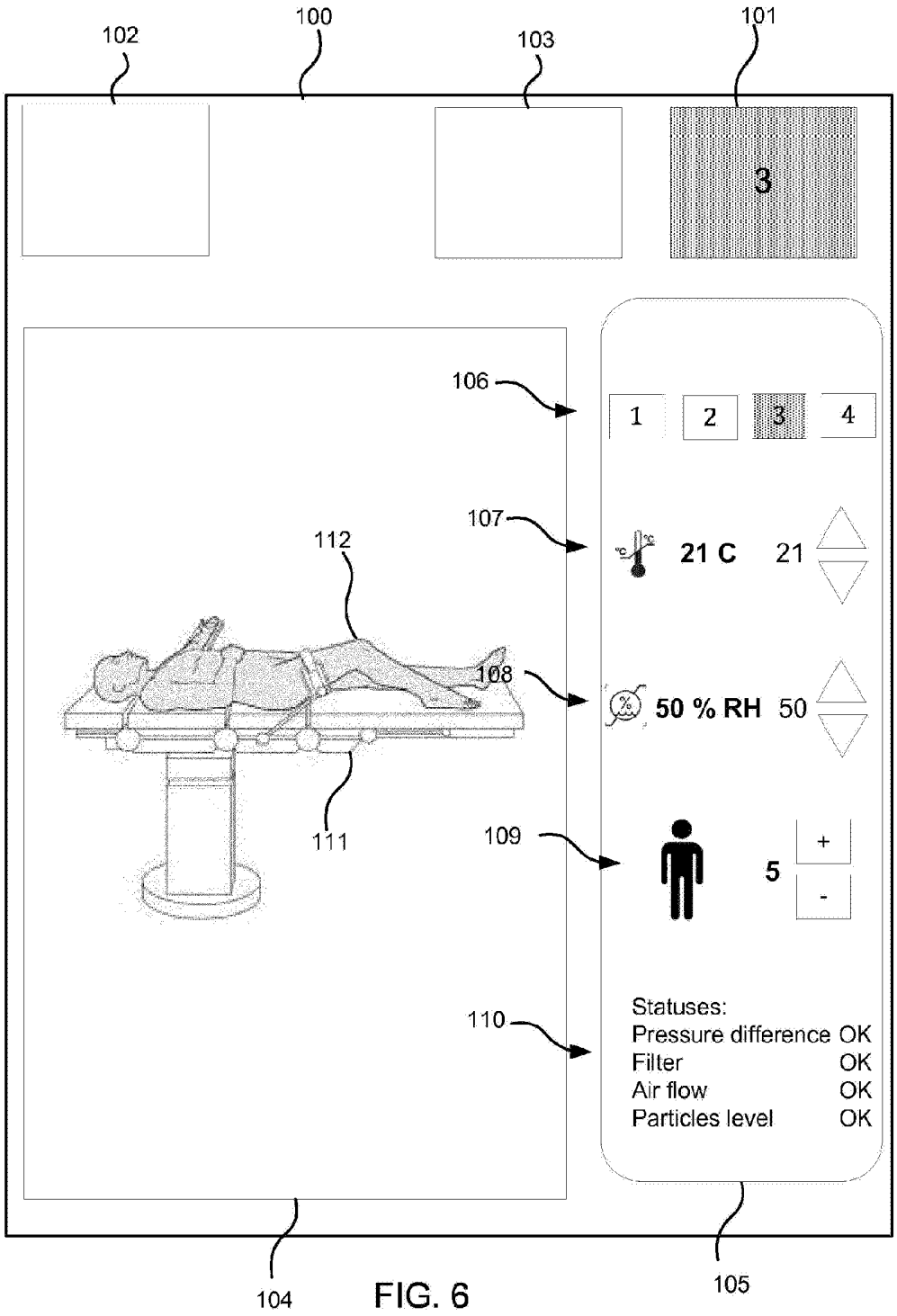
Statuses:
Pressure difference OK
Filter OK
Air flow OK
Particles level OK
104
105

FIG. 5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107
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110
Statuses:
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Filter OK
Air flow OK
Particles level OK
104
105

FIG. 6

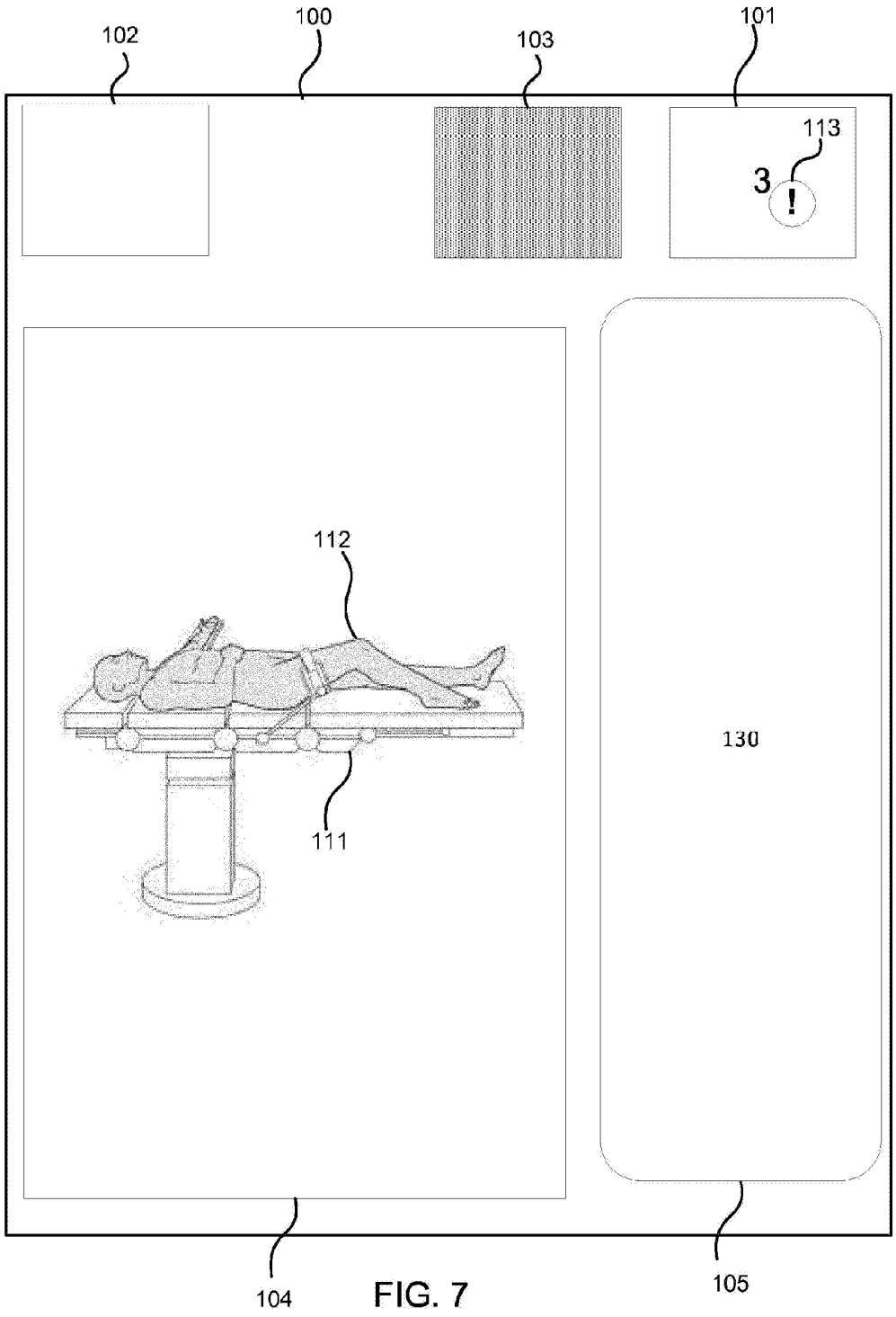
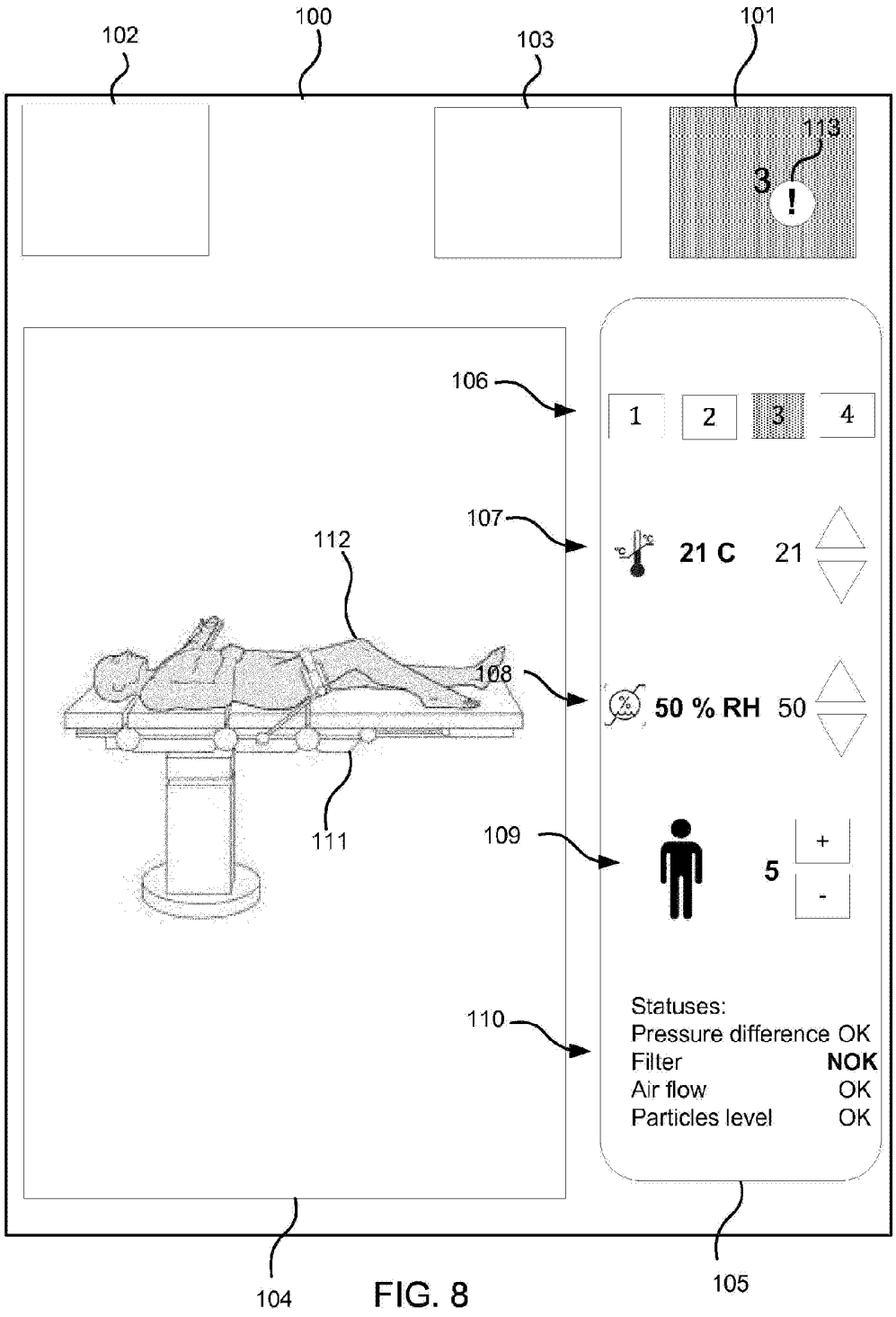


FIG. 7


102
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113
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106
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2
3
4
107
21 C
21
112
108
50 % RH
50
111
109
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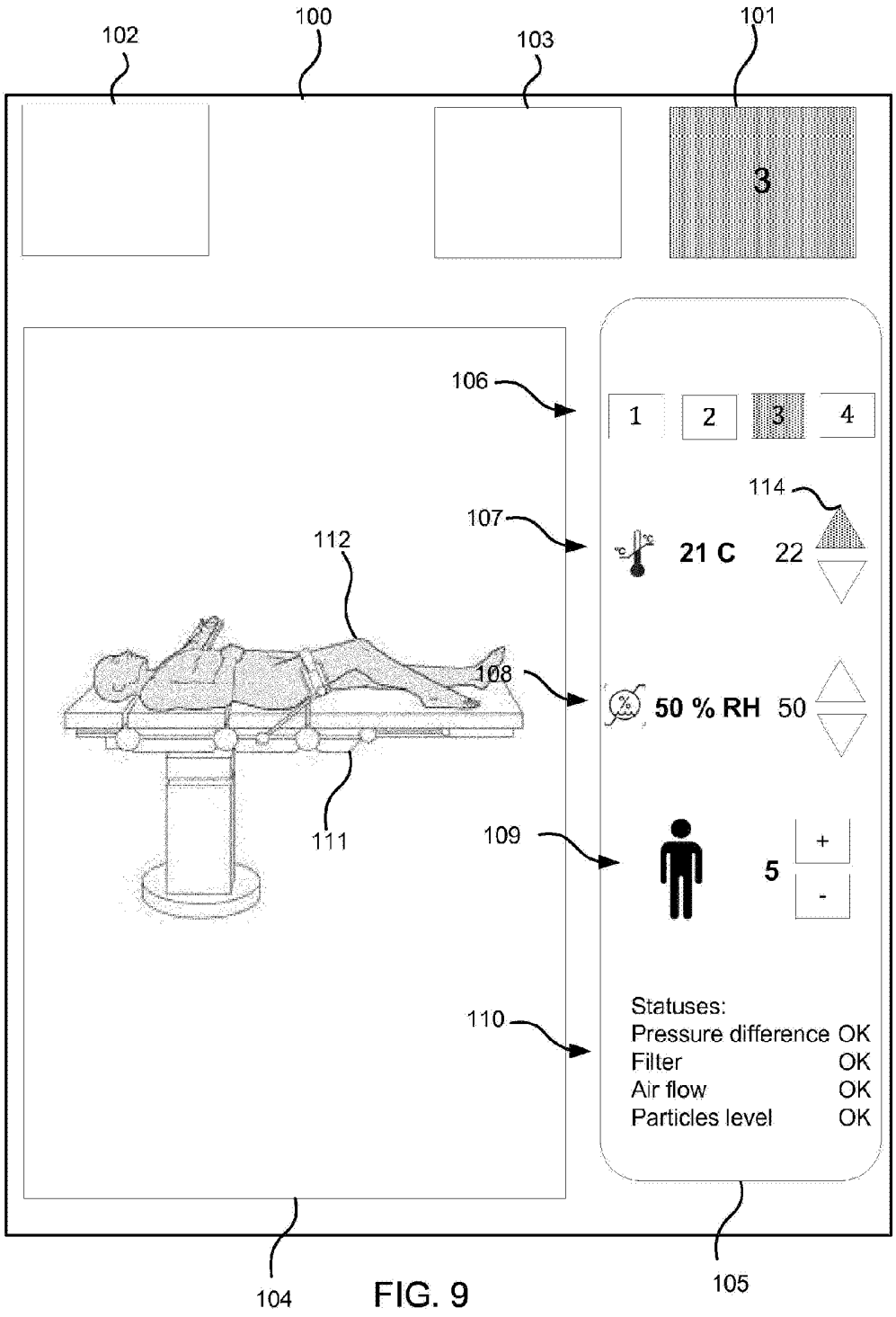
+
-
110
Statuses:
Pressure difference OK
Filter NOK
Air flow OK
Particles level OK
104
105

FIG. 8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101
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106
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4
114
107
21 C
22
112
108
50 % RH
50
111
109
5
+
-
110
Statuses:
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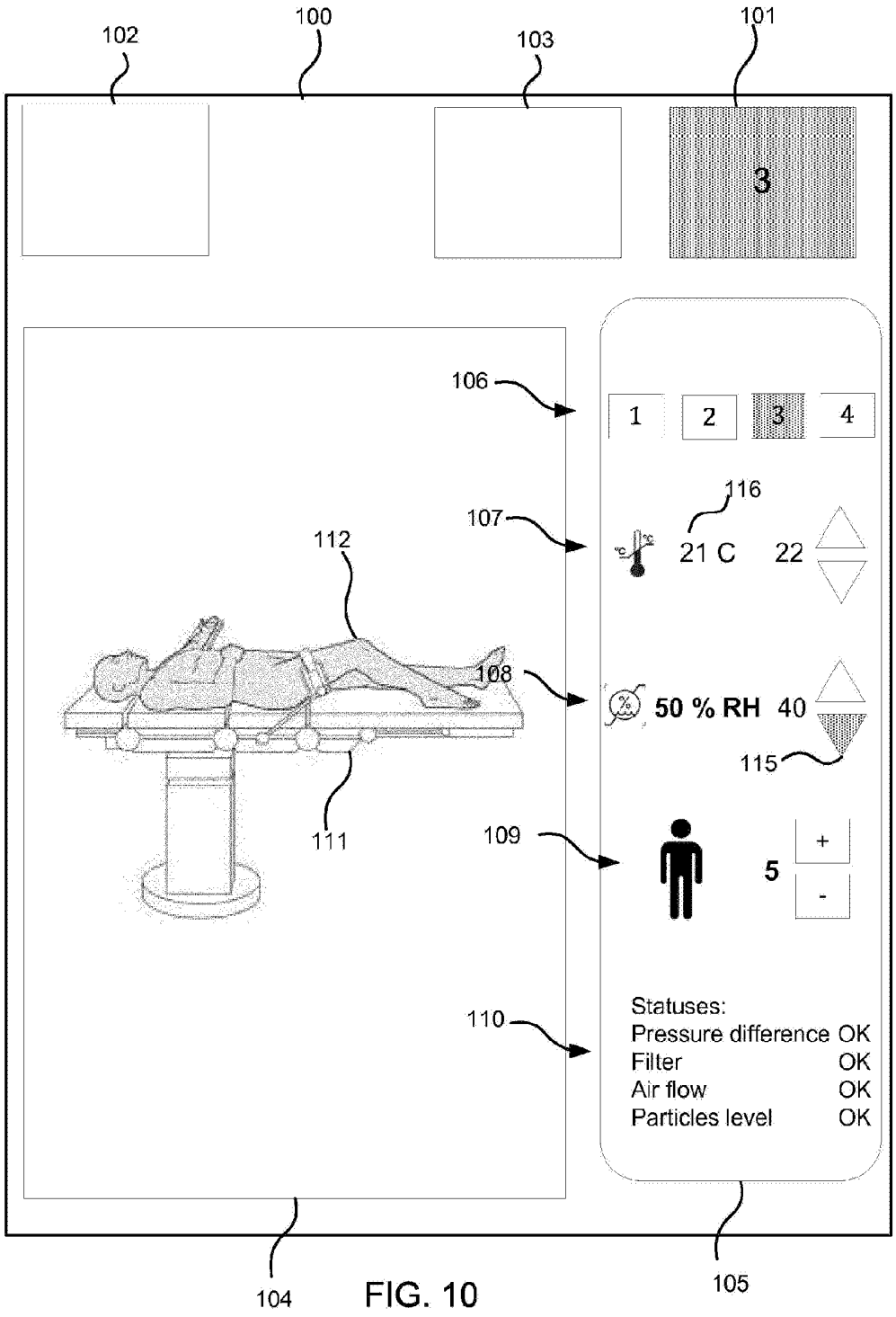
Filter OK
Air flow OK
Particles level OK
104
105

FIG. 9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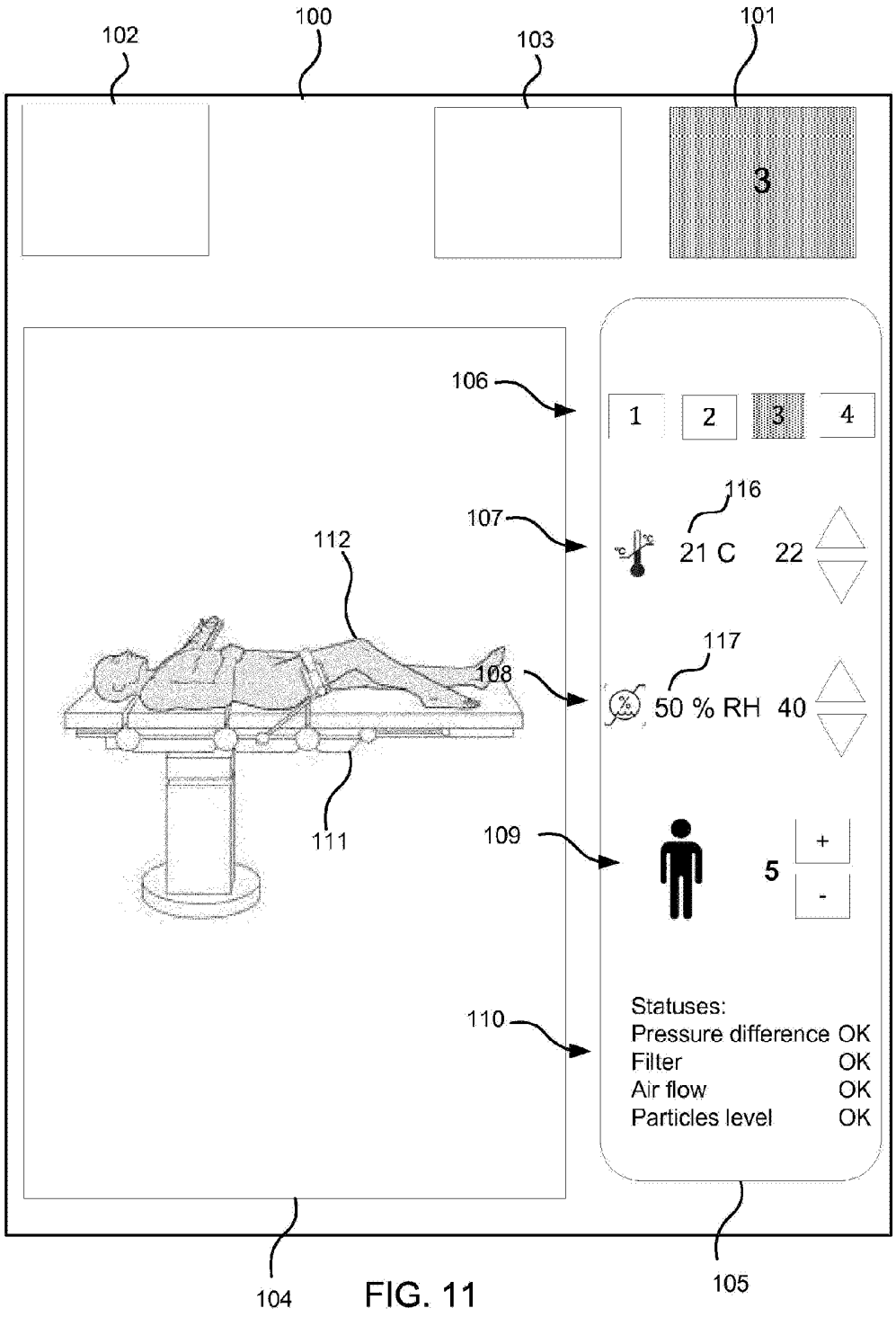
100
103
101
3
106
1
2
3
4
107
116
21 C
22
112
108
50 % RH
40
115
111
109
5
+
-
110
Statuses:
Pressure difference OK
Filter OK
Air flow OK
Particles level OK
104
105

FIG. 10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100
103
101
3
106
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2
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4
107
116
21 C
22
112
117
108
50 % RH
40
111
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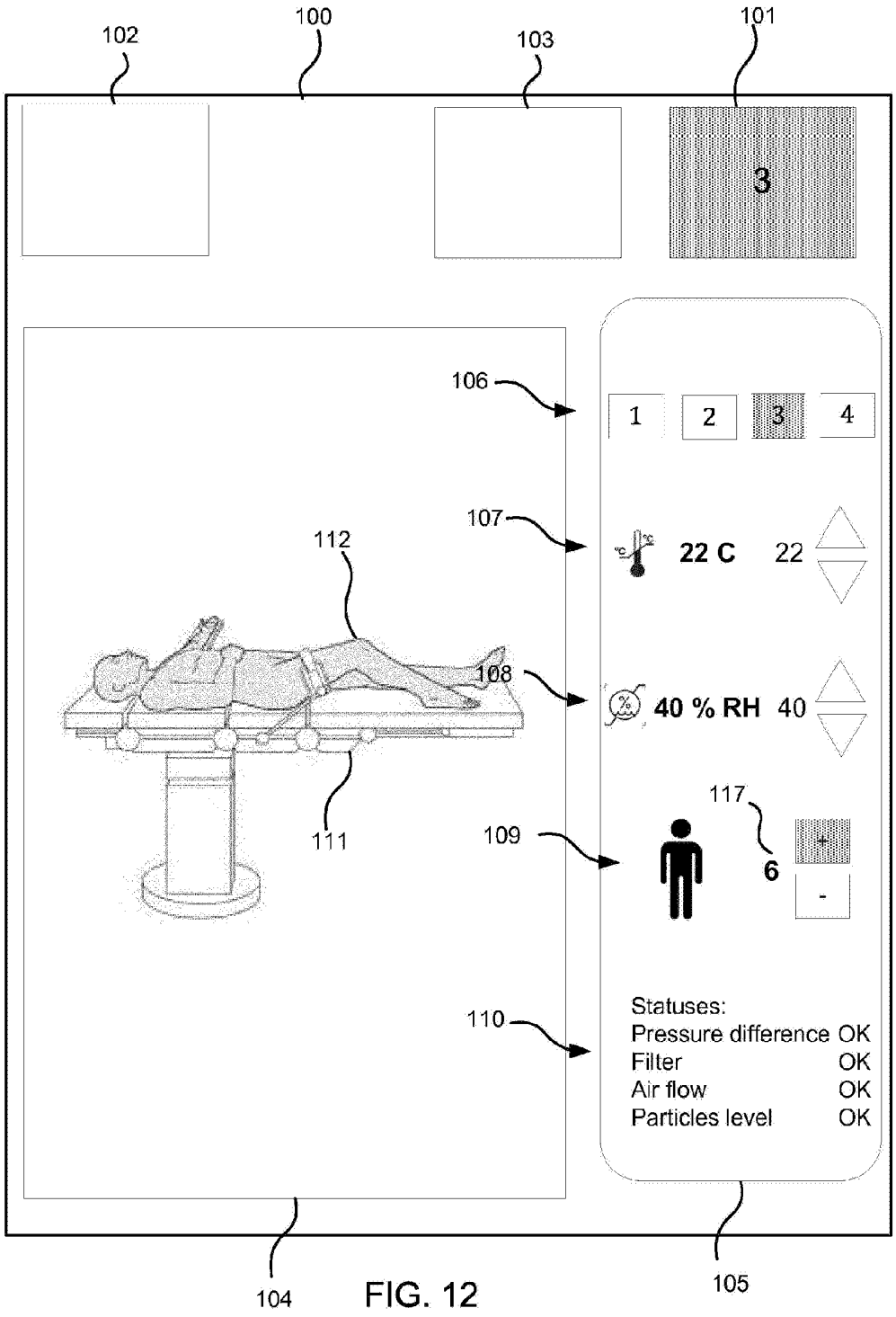
5
+
-
110
Statuses:
Pressure difference OK
Filter OK
Air flow OK
Particles level OK
104
105

FIG. 11


102
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107
22 C
22
112
108
40 % RH
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110
Statuses:
Pressure difference OK
Filter OK
Air flow OK
Particles level OK
104
105

FIG. 12

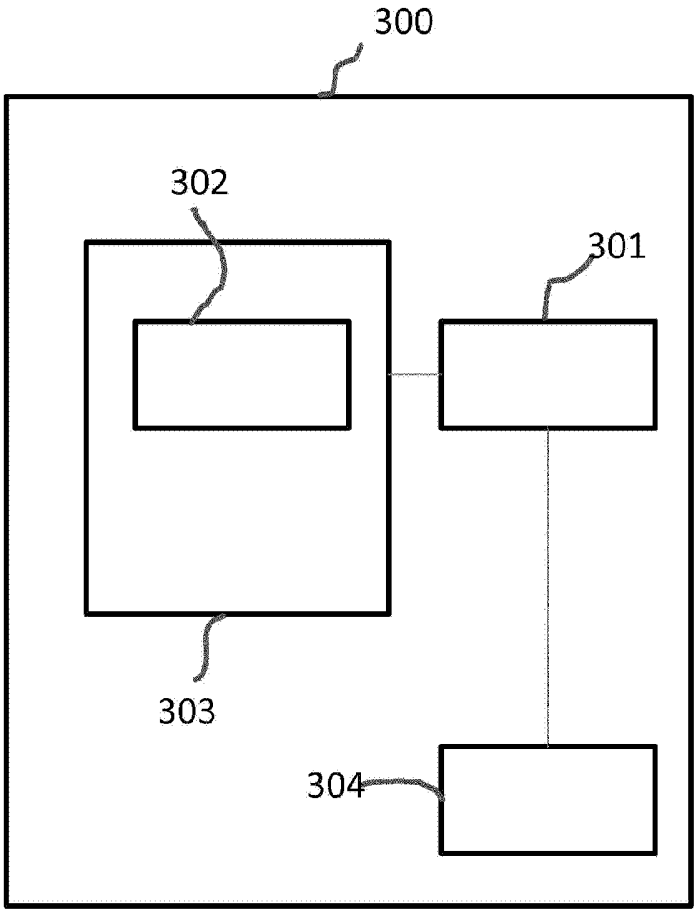

FIG. 13

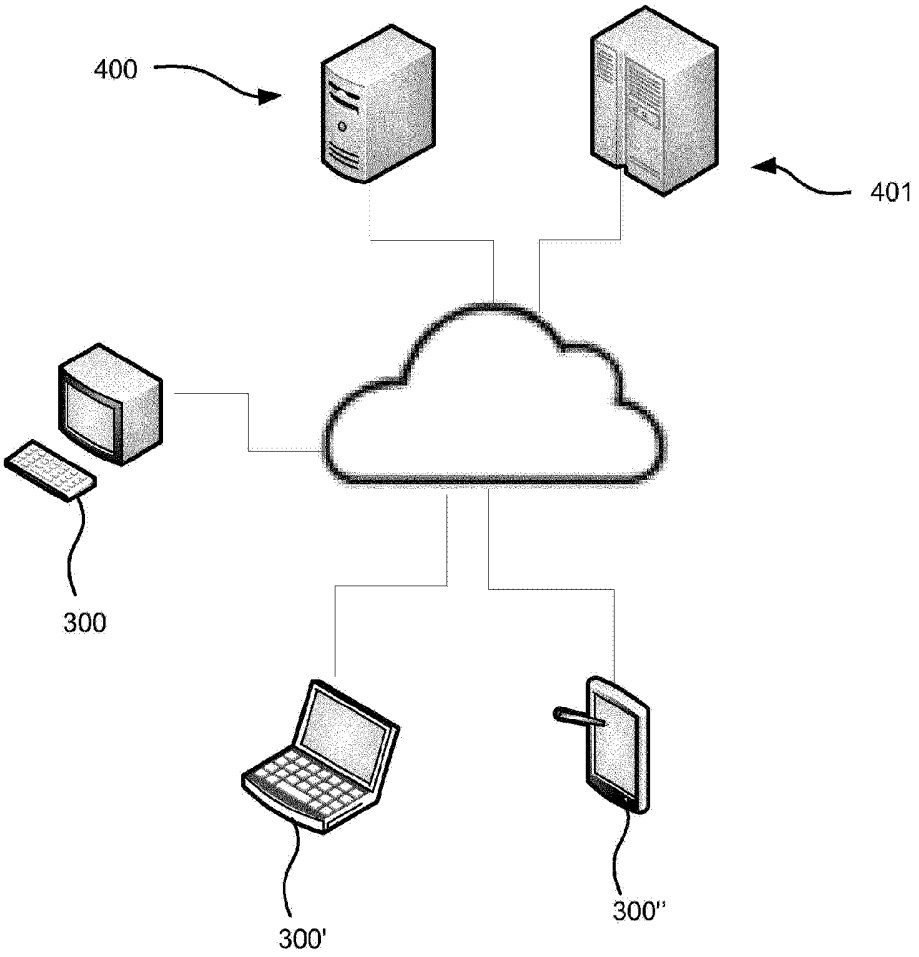

FIG. 14

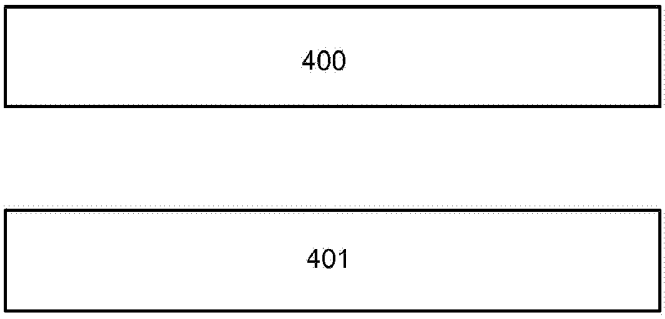

FIG. 15