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(54) METHOD FOR OPERATING A MODULAR PERSON SUPPORT APPARATUS

(57) A method for operating a modular person support apparatus is provided. The method comprises a step of determining a unique identity of a component attached to the modular person support apparatus, using a unique identifier of the component; and a step of modifying at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component. A system and a modular person support apparatus component are also provided.

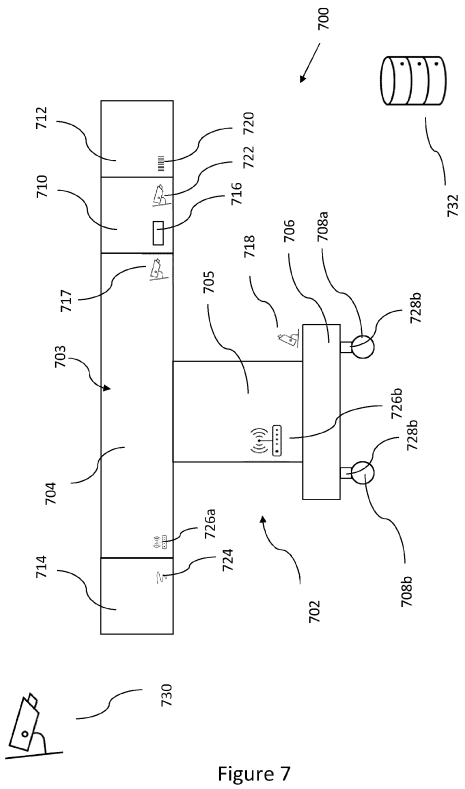

Figure 7

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a method for operating a modular person support apparatus. In particular, the disclosure relates to a method in which at least one operating parameter of the modular person support apparatus is modified in dependence on a determined unique identity of a component attached to the modular person support apparatus.

BACKGROUND

[0002] Person support apparatuses, such as operating tables and hospital beds, may be adapted to a wide range of purposes, for example for a variety of different surgical interventions. One way to adapt the person support apparatus for a specific purpose may be to attach one or more of a variety of components to modify the person support apparatus. The components may include leg sections; leg extensions; pelvis extensions; back sections; and head sections.

[0003] Modular person support apparatuses, which comprise a primary module and components that can be attached to (i.e., coupled to) the primary module (or base module) of the modular person support apparatus, are known.

[0004] Some prior art methods for operating modular person support apparatuses comprise using a collision avoidance model. A collision avoidance model seeks to prevent a collision between the person support apparatus and its surroundings (e.g., the floor), or between different parts of the person support apparatus. For example, when the person support apparatus is in a low configuration in combination with a Trendelenburg configuration, a collision of a head end, or head section, of the person support apparatus with the floor may be prevented by the collision avoidance model. Similarly, when the person support apparatus is in a reverse Trendelenburg position and the leg section is moved downwardly, a collision of a leg section with a central, or main, column of the person support apparatus may be prevented by the collision avoidance model.

[0005] However, prior art person support apparatus operating methods and prior art person support apparatuses are not capable of recognizing which component, or combination of components, is attached to a primary module. As such, control of the person support apparatus, and the information available about the present configuration of the person support apparatus, is limited.

[0006] The inventors have appreciated the need for an improved method for operating a modular person support apparatus, which allows for improved control of the person support apparatus and/or more information to be available about the present configuration/arrangement of the person support apparatus.

SUMMARY OF THE DISCLOSURE

[0007] The present disclosure provides a method for operating a modular person support apparatus, a system comprising a modular person support apparatus, and a modular person support apparatus component. Optional features are defined in the appended dependent claims.

[0008] According to a first aspect of the present disclosure, there is provided a method for operating a modular person support apparatus. The method comprises a step of determining a unique identity of a component attached to the modular person support apparatus, using a unique identifier of the component. The method further comprises a step of modifying at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component.

[0009] Unlike methods of the prior art, determining a unique identity of a component, rather than merely determining e.g. a type of a component or dimensions of the component, allows for the method of the present disclosure to control an operating parameter of the person support apparatus more precisely, i.e. based on the exact, unique identity of a component, rather just its type or geometry.

[0010] In other words, as a "unique identifier" is determined in the method of the present disclosure, each component can be distinguished on an individual basis, from all other component. Thus, the identity is unique to the component, i.e. it does not relate to a type, or class, of component but to the individual component. It will be apparent to the skilled person that the unique identifier may be used to determine information such as a type, dimensions, etc. of the component, but also further information e.g. about previous uses of the component. Previous uses and other information about the component may affect modification of the at least one operating parameter.

[0011] The method may comprise a step of determining that the component is attached to the modular person support apparatus. Alternatively, the method may comprise a step of receiving data indicating that the component is attached to the modular person support apparatus. Further alternatively, confirming that the component is attached to the modular person support apparatus may be inherent to the step of determining a unique identity of a component.

[0012] The component may be attached directly to a primary module of the modular person support apparatus, or the component may be attached to the primary module of the modular person support apparatus via at least one other component.

[0013] The component being attached to the primary module may refer to the component, or more specifically a component support surface, forming an extension of a primary person support surface of the primary module.

[0014] The component may preferably be attached to the primary module, or another component, by hook

couplers. Alternatively, the component may be attached to side rails of the person support apparatus. Even when attached to the side rails, the component may form an extension of the primary support surface.

[0015] In some embodiments, the method further comprises: notifying a user of the at least one, modified, operating parameter.

[0016] Advantageously, notifying the user of the at least one, modified, operating parameter may allow for a user, such as a caregiver, to more efficiently care for a patient. This may be because the caregiver may have better, more precise information available about the person support device, and about the component(s) attached to the person support device, than would otherwise be possible. In fact, as the unique identity of the component may be determined, and the operating parameter modified, based on said unique identity, information which would otherwise not be available to the user may be notified to the user.

[0017] Optionally, the user may be a caregiver, such as a nurse, or a healthcare assistant, or a personal carer.

[0018] Notifying a user of the at least one, modified, operating parameter may comprise displaying the at least one, modified, operating parameter to the user. By displaying the, potentially more precisely modified, operating parameter to the user, the user may be easily made aware of the operating parameter, and thus provided with information not otherwise available to the user.

[0019] Optionally, displaying the at least one, modified, operating parameter to the user comprises displaying the at least one, modified, operating parameter on at least one of: a remote control for controlling the modular person support apparatus; a mobile device of the user; a screen of a surgical suite; and a terminal, the terminal being remote from the modular person support apparatus.

[0020] Displaying the operating parameter on a remote control may allow for the information to be available to a user instantaneously, and in particular to a user who is controlling, or may control, the person support apparatus. Displaying the operating parameter on a mobile device, or a terminal, may allow for the modified operating parameter to be made available to the user even if they are remote from the person support apparatus. Displaying the operating parameter on a screen of a surgical suite in which the person support apparatus is positioned may allow for the modified operating parameter to be made available to multiple users in a surgical suite simultaneously.

[0021] The at least one, modified, operating parameter may comprise a limit. In particular, the limit may comprise at least one of: a load limit; and a range of motion limit.

[0022] Advantageously, by determining a unique identity of a component, rather than merely determining e.g. a type of a component or dimensions of the component, a limit may be modified to be more specific to the, uniquely identified, component. Particularly, it may allow for, e.g., a load limit of a person support apparatus to be modified taking into account for example a service history of a component, or a model number of a component, or a previous use of the component, which may affect the load limit.

[0023] The range of motion limit may relate to the person support apparatus as a whole, e.g. to a minimum or maximum height, or to a maximum inclination, of the person support apparatus, or it may relate only to a portion of the person support apparatus, e.g. a maximum inclination of a foot section, a back section, or a head section of the person support apparatus.

[0024] The load limit may refer to a maximum patient weight for the person support apparatus, or it may refer to a maximum patient weight on a specific portion of the person support apparatus.

[0025] The limit, in particular a load limit, may be automatically determined by an algorithm, e.g. upon the component being attached to the person support apparatus.

[0026] In some embodiments, the method further comprises determining that the limit is being exceeded, or close to being exceeded. Advantageously, not only modifying the operating parameter, but also monitoring whether the limit is being exceeded or close to being exceeded, may allow for more precise control of the person support apparatus or may reduce the risk of user error.

[0027] As used herein, the term "close to being exceeded" may refer to a value being within 20% of the limit, or within 10% of the limit, or within 5% of the limit, or within 1% of the limit. For example, if the modified load limit is 300 kg, and a measured load is 271 kg and thus within 10% of the load limit, the limit may be determined to be "close to being exceeded".

[0028] The method may further comprise measuring a load. For example, the method may comprise using sensors, such as load cells, to measure a load. The load cells may be attached to legs, or casters, of the person support apparatus to measure a load.

[0029] Measuring a load may relate to measuring a load on the entire person support apparatus, or it may relate to measing a load on a portion of the person support apparatus. Measuring a load may also relate to measuring a load for each of a plurality of portions of the person support apparatus.

[0030] The measured load may be compared to the load limit to determine if a load limit is being exceeded or is close to being exceeded. Thus, the method may further comprise comparing a measured load to a load limit.

[0031] Optionally, the method further comprises notifying the user when the limit is being exceeded, or close to being exceeded. Notifying the user may further reduce the risk of user error, or incorrect operation of a person support apparatus.

[0032] In some embodiments, the user may be notified only when the limit is being exceeded, or close to being exceeded. This may allow for the user to only be notified of a modified operating parameter when necessary, and

thus prevents burdening a user with unnecessary information.

[0033] In some embodiments, the at least one, modified, operating parameter comprises enabled configuration options and disabled configuration options.

[0034] "Configuration options" may refer to pre-set, or pre-programmed, configurations of the person support apparatus. Such "configuration options" may include standard positions such as Trendelenburg, reverse Trendelenburg, knee gatch, Fowler, lithotomy, Kraske, lateral, and neutral.

[0035] Advantageously, by determining enabled and disabled configuration options, undesirable pre-programmed configurations may be avoided based on the unique identification of a component.

[0036] In some embodiments in which the method comprises notifying a user of the at least one, modified, operating parameter, notifying a user of the at least one, modified, operating parameter comprises at least one of: displaying only the enabled configuration options; ceasing to display the disabled configuration options; highlighting the enabled configuration options; de-emphasising the disabled configuration options; and providing a warning if a disabled configuration option is selected.

[0037] Advantageously, by displaying only the enabled configuration options, or by ceasing to display disabled configuration options, inadvertent selection of disabled configuration options is prevented. On the other hand, by highlighting the enabled configuration options, or de-emphasising the disabled configuration options, the disabled configuration options are still visible to the user, while the user is clearly being guiding to select an enabled configuration option. Providing a warning if a disabled configuration option is selected allows for a user to be notified in case of an undesirable selection.

[0038] Modifying the at least one operating parameter of the modular person support apparatus in dependence on said unique identity of the component may comprise: modifying a collision avoidance model in dependence on said unique identity of the component. Advantageously, by modifying a collision avoidance model in dependence on said unique identity of the component, collisions between different portions of the person support apparatus, and between portions of the person support apparatus and its surroundings, may be prevented. Indeed, as the unique identity of the component is identified and used in modifying the collision avoidance model, the collision avoidance model may be more accurate than if only a type or standard geometry of an attached component is determined.

[0039] Optionally, the method further comprises sending data relating to the component to a computing device, such as a server, said data comprising the unique identity and/or the unique identifier. Advantageously, sending data relating to the component, including the unique identity or unique identifier to a computing device may allow for data relating to usage of the component to be stored, or processed. In fact, it may also allow for data relating to the attached component to be sent back to the user or a processor of the person support apparatus.

[0040] The data may further comprise at least one of: a location of the modular person support apparatus, an attachment location of the component on the modular person support apparatus, and a duration of use.

[0041] Sending such data to the computing device may allow for the data to be stored, and used to determine a maintenance need of the component, or other information relevant to present or future use of said component. For example, by sending a location of the modular person support apparatus with the identity of the component, a usage profile of the identified component may be developed. Similarly, sending an attachment location, and a duration of use, may be used to determine whether any maintenance may be required.

[0042] In some embodiments, the method further comprises receiving data relating to the component from a, or the, computing device, said data comprising at least one of: physical characteristics of the component, which may comprise at least one of: a type of the component, at least one dimension of the component, such as a length of the component, a width of the component, and a depth of the component, a weight of the component, a load limit, and a material of the component; a maintenance status, which may comprise at least one of: a time of a last maintenance, a time period since a last maintenance, a number of uses since a last maintenance, a time period until a next maintenance is required, a number of uses until a next maintenance is required, and a maintenance alert; data relating to a preceding use, which may comprise at least one of: a time of the preceding use, a time period since the preceding use, a duration of the preceding use, a location of the preceding use, and an attachment location of the component on the modular person support apparatus during the preceding use; data relating to all previous uses, which may comprise at least one of: a number of all previous uses, and a total duration of all previous uses; modification information comprising data relating to a current, or previous, modification of the component; a modified collision avoidance model, the modified collision avoidance model being modified in dependence on the unique identifier of the component; a limit, which may comprise at least one of: a load limit, and a range of motion limit; a status of configuration options, which may comprise at least one of: enabled configuration options, and disabled configuration options; and a user input, wherein the user input may comprise: notes from a user, and an indication from a user that maintenance is required.

[0043] Advantageously, receiving additional information about the specific component being used (based on the unique identity of said component) may allow a user, or a controller of the person support apparatus, to more accurately control the person support apparatus.

[0044] The at least one operating parameter of the modular person support apparatus may be modified in response to said data received from a computing device

(e.g. if a modified collision avoidance model is received in response to unique component identity information sent to the computing device), or directly on the person support apparatus, e.g. by a controller or a processor of the person support apparatus.

[0045] The computing device may be within a healthcare facility in which the person support apparatus is located, or external to the healthcare facility, or the computing device may be realised in the cloud. The computing device may be a gateway device, e.g. a gateway device configured to connect the person support apparatus with the cloud or an external server.

[0046] The computing device may be, or comprise, an electronic medical records (EMR) system.

[0047] Determining the unique identity of the component may comprise receiving a radio signal comprising the unique identifier from the component. Advantageously, a radio signal emitted by the component may easily comprise/encode a unique identifier. Indeed, such a radio signal may comprise further data relating to the component.

[0048] Optionally, the radio signal is a short distance radio signal or a long distance radio signal.

[0049] A short distance radio signal may require less power for the component to send the signal. On the other hand, a long distance radio signal may require more power, but is also capable of being received by a receiver or a transceiver on the person support apparatus more easily. It is noted that another advantage of using short distance radio signals may be that such signals would only be received when the component is actually in close proximity to a specific location, i.e. attached to a specific location of the person support apparatus. This may provide a passive failsafe mechanism for determining that a component is indeed attached to the person support apparatus and/or a mechanism for determining where on a person support apparatus a component is attached.

[0050] If the radio signal is a long distance radio signal, a larger antenna/radio transceiver may be provided on a base of the person support apparatus. The radio transceiver may be capable of differentiating between different components and between different positions in which a component is attached to the person support apparatus.

[0051] Indeed, using radio signals may allow for the method to be applied to existing person support apparatuses and components, as existing person support apparatuses and component may be easily retrofittable with radio transmitters/transceivers by incorporating radio transmitters/transceivers into their existing structures.

[0052] Further optionally, the method further comprises providing power to a radio transmitter of the component. Advantageously, by providing power to a radio transmitter, and in particular by providing power wirelessly to a passive radio transmitter of the component, there is no need for cabling to the component, or for a power source to be included in the component. Thus, retrofitting of components is facilitated, and maintenance requirements (e.g. to change batteries of the radio transmitter) are reduced.

[0053] Any appropriate radio communications standard may be used. For example, the radio signal may be UWB, Zigbee, ZWAVE, RFID, Bluetooth, NFC, and/or WiFi.

[0054] Alternatively or additionally, determining the unique identity of the component may comprise viewing indicia comprising the unique identifier, arranged on the component, with a camera.

[0055] The camera may be a visible light camera. Alternatively, the camera may be a non-visible light camera, so that the indicia can be provided so as not to be visible to the human eye.

[0056] Preferably, the unique identifier comprises a QR code or a bar code. Providing a QR code or a bar code may allow for the unique identity of a component to be determined reliably and quickly. Retrofitting of components may also be facilitated.

[0057] Alternatively or additionally, determining the unique identity of the component may comprise using an image recognition algorithm to identify the unique identifier of the component. This may comprise using an image recognition algorithm to determine a unique identity number of the component.

[0058] Alternatively or additionally, determining the unique identity of the component may comprise using hall sensors to sense changes to a magnetic field encoding the unique identifier.

[0059] Optionally the hall sensors are configured to sense a presence or absence of a projection. Alternatively, the hall sensors are configured to sense a characteristic of a projection. The or each projection may comprise a ferromagnetic material.

[0060] If the hall sensors are configured to sense a presence or absence of a projection, the unique identifier may be encoded by an arrangement of projections and/or slots on the component, in the field of view of the hall sensors when the component is attached to the person support apparatus, providing a binary identification system. For example, if a respective projection is either provided or not provided in a plurality (x) of possible positions, 2^x unique identities may be encoded.

[0061] If the hall sensors are configured to sense a property of the projection instead, by providing projections or slots of different sizes (y) more unique identities may be encoded for a set number (x) of possible positions. In particular, y^x unique identities may be encoded. For example, if a respective projection is: not provided, provided having a mass 0.5z, or a mass z, and the hall sensor is capable of distinguishing between a projection having a mass 0.5z and one having a mass z, 3^x unique identities may be encoded.

[0062] In some embodiments, the method further comprises: determining a unique identity of a further component, attached to the component attached to the modular person support apparatus, using a unique identifier of the further component, wherein the step of modifying at least one operating parameter of the modular person support

apparatus comprises modifying at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component and the determined unique identity of the further component.

[0063] Advantageously, this may allow for components which are "daisy-chained", i.e. a component which is attached to another component which is attached to a primary module of the person support apparatus, to be uniquely identified, and said unique identity of the daisy-chained component to be used to modify at least one operating parameter of the modular person support apparatus, thus improving control of a person support apparatus to which multiple components are connected in series.

[0064] The method may further comprise determining a unique identity of a further component attached (directly) to the modular person support apparatus, using a unique identifier of the further component; and modifying at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the further component. Thus, the method may allow for at least one operating parameter of the modular person support apparatus to be modified in dependence on the unique identities of more than one component attached (directly) to the person support apparatus.

[0065] Advantageously, this may allow for improved control of a person support apparatus to which multiple components are connected, in different positions.

[0066] The method may further comprise: retrofitting the component with the unique identifier.

[0067] The method may further comprise: confirming that the person support apparatus is set up according to a user profile. The user profile may be specific to a surgeon, or another type of user.

[0068] Confirming that the person support apparatus is set up according to a user profile may comprise at least one of: receiving the user profile from a, or the, computing device; providing guidance to a user which component, or components, to attach to the person support apparatus; and confirming that the correct component, or components, are attached to the person support apparatus.

[0069] According to a second aspect of the present disclosure, there is provided a system comprising a modular person support apparatus, the modular person support apparatus comprising: a primary module; and a component attachable to the primary module. The system is configured to determine a unique identity of the component when the component is attached to the modular person support apparatus, using a unique identifier of the component. The system is further configured to modify at least one operating parameter of the modular person support apparatus in dependence on the unique identity of the component.

[0070] As set out above in relation to the method of the first aspect, unlike systems of the prior art, the system of the second aspect is configured to determining a unique identity of the component attachable to the primary module, rather than merely determining e.g. a type of a component or dimensions of the component, which allows for the system of the present disclosure to control an operating parameter of the person support apparatus more precisely, i.e. based on the exact identity of a component, rather just the type or geometry of a component.

[0071] The system may further be configured to determine that the component is attached to the primary module.

[0072] The component may be attached directly to the primary module of the modular person support apparatus, or the component may be attached to the primary module of the modular person support apparatus via at least one other component.

[0073] The component may comprise at least one hook coupler for attaching to the primary module, or another component. The component may be attached, via the at least one hook coupler or another coupling mechanism, to one or more side rails of the person support apparatus.

[0074] When attached to the person support apparatus, the component may be configured to form an extension of the primary person support surface of the primary module.

[0075] The system may further comprise at least one component attachable to the primary module (and attachable to another component).

[0076] The component may comprise a radio transmitter, such as an antenna. The radio transmitter may be configured to emit a radio signal comprising, or encoding, the unique identifier. The radio transmitter may be a short distance radio transmitter, or a long distance radio transmitter.

[0077] The radio transmitter may be a passive radio transmitter configured to be powered (wirelessly) by a corresponding radio transceiver when the radio transceiver is brought into proximity of the radio transmitter. Alternatively, the radio transmitter may be an active device, comprising, or connected to, a power source.

[0078] Optionally, the radio transmitter is configured to use a radio communications standard such as UWB, Zigbee, ZWAVE, RFID, Bluetooth, NFC, and/or WiFi.

[0079] Alternatively or additionally, the component may comprise indicia comprising the unique identifier. The indicia may be configured to be viewed by a camera. The indicia may comprise a QR code or a bar code.

[0080] Alternatively or additionally, the component may comprise a unique identifying number, which may be configured to be determined using an image recognition algorithm.

[0081] Alternatively or additionally, the component may comprise at least one of a plurality of projections and a plurality of slots encoding a unique identity of the component, configured to affect a magnetic field sensed by hall sensors.

[0082] The system may further comprise a computing device, such as a server, the modular person support

apparatus being configured to communicate with the computing device to: send data relating to the component to the computing device, and/or receive data relating to the component from the computing device.

[0083] The computing device may be positioned within a healthcare facility in which the person support apparatus is located, or external to the healthcare facility, or the computing device may be realised in the cloud. The computing device may be a gateway device, e.g. a gateway device configured to connect the person support apparatus to the cloud or a server.

[0084] As set out above in relation to the method of the first aspect, sending data relating to the component to the computing device, and/or receiving data relating to the component from the computing device, may allow for improved control of the person support apparatus of the system.

[0085] According to a third aspect of the present disclosure, there is provided a modular person support apparatus component for use in the system according to the second aspect of the present disclosure. The component comprises: a coupler for attaching the component to a primary module of a modular person support apparatus, or to another component of a modular person support apparatus; and a unique identifier, configured to be used by the modular person support apparatus to determine a unique identity of the component when the component is attached to the modular person support apparatus.

[0086] Further features of the second and third aspects of the present disclosure are described above in relation to the first aspect of the present disclosure.

[0087] It will be appreciated that features described in relation to one aspect of the present disclosure may also be applied equally to all of the other aspects of the present disclosure. In particular, features described in relation to the method of the first aspect of the present disclosure may be applied equally to the system of the second, and to the component of the third aspect, of the present disclosure and *vice versa.* For example, the system of the second aspect may be configured to implement, *mutatis mutandis,* the method steps described in relation to the first aspect.

BRIEF DESCRIPTION OF DRAWINGS

[0088] The disclosure will be further described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a flow diagram of an exemplary method according to the present disclosure;

Figure 2 shows a flow diagram of a further exemplary method according to the present disclosure;

Figure 3 shows a flow diagram of a further exemplary method according to the present disclosure;

Figure 4 shows a flow diagram of a further exemplary method according to the present disclosure;

Figure 5 shows a flow diagram of a further exemplary method according to the present disclosure;

Figure 6 shows a flow diagram of a further exemplary method according to the present disclosure;

Figure 7 shows a schematic side view of a system according to the present disclosure; and

Figure 8 shows a schematic top view of a further exemplary system according to the present disclosure.

DETAILED DESCRIPTION OF DRAWINGS

[0089] Figure 1 shows a method 100 for operating a modular person support apparatus. The method 100 comprises a step of determining 102 a unique identity of a component attached to the modular person support apparatus, using a unique identifier of the component.

[0090] Determining 102 a unique identity of a component attached to the modular person support apparatus may be implemented in various ways. For example, it may comprise receiving a radio signal comprising the unique identifier from the component. It may also, or instead, comprise viewing indicia comprising the unique identifier, arranged on the component, with a camera. It may also, or instead, comprise using an image recognition algorithm to identify the unique identifier of the component. Further alternatively or additionally, it may comprise using hall sensors to sense a set of projections or slots encoding the unique identifier.

[0091] The method 100 further comprises a step of modifying 104 at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component.

[0092] The at least one operating parameter may comprise a limit, such as a load limit, or a range of motion limit. If the operating parameter comprises a limit, the method may further comprise determining that the limit is being exceeded, or close to being exceeded. In one particular embodiment, the limit is a load limit, and the limit is considered to be close to being exceeded when the load is within 10% of the load limit.

[0093] In some embodiments, the at least one, modified, operating parameter comprises enabled configuration options and disabled configuration options.

[0094] Figure 2 shows a further method 200 for operating a modular person support apparatus. The further method 200 comprises the steps 102 and 104 of method 100, and a further step 202 of notifying 202 a user, such as a caregiver, of the at least one, modified, operating parameter.

[0095] Notifying 202 may comprise displaying the at least one, modified, operating parameter to the user. The

at least one, modified, operating parameter may be displayed on at least one of a remote control, a mobile device, such as a mobile phone or tablet computer, a screen of the surgical suite, and a terminal which is remote from the person support apparatus.

[0096] Figure 3 shows a further method 300 for operating a modular person support apparatus. The further method 200 comprises the step 102 of methods 100 and 200. The method 300 further comprises a step of modifying 302 at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component (similar to step 104 of methods 100 and 200), wherein modifying at least one operating parameter comprises modifying a collision avoidance model in dependence on said unique identity of the component. By modifying a collision avoidance model, which is configured to prevent (e.g. by limiting a range of motion of the person support apparatus), and/or give advance warning of, a possible collision amongst components of the person support apparatus and with the external environment, based on the unique identity of the component, improved collision avoidance may be achieved.

[0097] Figure 4 shows a further method 400 for operating a modular person support apparatus. The further method 400 comprises the steps 102 and 104 of methods 100 and 200. The further method 400 further comprises a step of sending 402 data relating to the component to a computing device, such as a server, said data comprising the unique identity and/or the unique identifier.

[0098] The data being sent may comprise at least one of: a location of the modular person support apparatus to which the component is attached, an attachment location of the component on the modular person support apparatus, and a duration of use of the component.

[0099] Figure 5 shows a further method 500 for operating a modular person support apparatus. The further method 500 comprises the steps 102 and 104 of methods 100 and 200. The further method 500 further comprises a step of receiving 502 data relating to the component from a computing device.

[0100] The data being received may relate to physical characteristics of the component; a maintenance status of the component; data relating to a preceding use of the component; data relating to all previous uses of the component; modification information comprising data relating to a current, or previous, modification of the component; a modified collision avoidance model; a limit; a status of configuration options; and a user input.

[0101] Figure 6 shows a further method 600 for operating a modular person support apparatus. The further method 600 comprises the step 102 of methods 100 and 200. The further method 600 further comprises a step of determining 602 a unique identity of a further component, attached to the component attached to the modular person support apparatus, using a unique identifier of the component. Thus, the method 600 comprises steps of determining 102, 602 the unique identities of a first component attached directly to the modular person support apparatus and of a second component, attached to the modular person support apparatus via the first component.

[0102] The method 600 further comprises a step of modifying 604 at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component and the determined unique identity of the further component.

[0103] Although methods 100 to 600 have been described as separate embodiments, the various steps of these methods may be combined. For example, a method may comprise some or each of steps 102, 202, 302, 402, 502, 602, and 604.

[0104] Figure 7 shows a schematic side view of an exemplary system 700 according to the present disclosure. The system 700 comprises a modular person support apparatus 702. The modular person support apparatus 702 is made up of various modules, including a primary module 703 (or base module), and components 710, 712, 714 attached to the primary module 703.

[0105] The system 700 is configured to determine a unique identity of the component 710 attached to the primary module 703, using a unique identifier 716 of the component 710. In this particular example, the unique identifier 716 is a QR code, which has been retrofitted to the component 710, and is arranged such that it is in the field of view of a camera 717, 718 of the primary module 703.

[0106] The camera 717 may be arranged adjacent a patient supporting surface 704 of the primary module 703, so that the unique identifier 716 is in the field of view of the camera 717 when the component 710 is attached to the primary module 703. The camera 718 may be arranged on a base 706 of the primary module 703, connected to the primary patient supporting surface 704 of the primary module 703 by a central column 705.

[0107] A further component 712 is attached to the component 710 attached directly to the primary module 703. The system 700 is configured to determine a unique identity of the further component 712 using a unique identifier 720 of the further component 712. In this particular example, the unique identifier 720 is a barcode arranged such that it is in the field of view of the camera 718 of the primary module 703 and/or a camera 722 of the further component 712.

[0108] The component 710 and the further component 712 are attached, in this example, to a foot end of the primary module 703. A yet further component 714 may be attached to the head end of the primary module 703, opposite the component 710 and the further component 712. The yet further component 714 comprises a passive near field communication (NFC) antenna 724.

[0109] The NFC antenna 724 is configured to emit a radio signal encoding the unique identifier of the yet further component 714. The primary module 703 comprises a NFC transceiver 726a (at a head end of the primary module 703), proximate a position to which the

yet further component 714 is attached, configured to power the NFC antenna 724 and receive the radio signal from the NFC antenna 724.

[0110] Instead of a NFC transceiver 726a, the primary module 703 may comprise a long distance radio transceiver 726b, e.g. attached to the central column 705 or the base 706, configured to receive a radio signal from a long distance antenna 724 of the yet further component 714.

[0111] The components 710, 712, 714 are described above, and shown in Figure 7, as having different types of unique identifiers 716, 720, 724, and the primary module 703 (and component 710) is described above, and shown in Figure 7, as having different types of detectors for the unique identifier. However, the components 710, 712, 714 may also have the same type of unique identifier, facilitating provision of "detectors" on the primary module 703, as then only a single type of "detector" may be required.

[0112] The primary module 703 is arranged on caster wheels 708a, 708b, allowing for the modular person support apparatus 702 to be moved. Attached to the caster wheels 708a, 708b are load cells 728a, 728b, configured to sense a load exerted on each caster wheel. Sensing the load allows determination of whether a load limit is being exceeded, or close to being exceed.

[0113] Alternatively, or in addition, to determining the unique identity of any of the components 710, 712, 714 without using cameras 717, 718, 722 or radio transceivers 726a or 726b, the system 700 may comprise a further camera 730, and is configured to operate an image recognition algorithm to identify the unique identifier of the, or each, component 710, 712, 714.

[0114] The system 700 may comprise a server 732, which may be within a healthcare facility in which the person support apparatus 702 is located, or it may be external to the healthcare facility.

[0115] Figure 8 shows a schematic top view of a part of a further exemplary system 800 according to the present disclosure, showing an alternative way of implementing determination of a unique identity of a component. The system 800 comprises a primary module 801 having a primary patient supporting surface 802, and, attachable to (and in use, attached to) the primary module 801, a component 810 having a component patient supporting surface 811 configured to extend the primary patient supporting surface 802.

[0116] The component 810 comprises hook couplers 812a, 812b, configured to engage with hook coupler receiving portions 814a, 814b on the primary module 801. It will be apparent to those skilled in the art that the hook couplers and receiving portions may be reversed, that is the hook couplers may be provided on the primary module 801 and the receiving portions may be provided on the component 810.

[0117] The primary module 801 comprises a plurality of slots 815a...815l, adjacent to which are arranged a plurality of hall sensors 816a...816l. The component 810 comprises a plurality of projections 818a... 818k, each projection configured to affect a magnetic field so as to be detectable by a corresponding one of the plurality of hall sensors 816a... 816l when the projection protrudes into a corresponding one of the plurality of slots 815a...815l. In positions configured to be opposite to some of the slots 815a...815l, the component 810 does not comprise a corresponding projection - instead, the position 820 in which such a corresponding projection would be arranged is vacant.

[0118] Thus, if the component 810 is attached to the primary module 801 using the hook couplers 812a, 812b, the projections 818a...818k project into the corresponding slots 815a...8151 and thus into the proximity of the hall sensors 816a... 816l. Therefore, it is possible to uniquely identify the component 810 by detecting the arrangement of projections (and vacancies). In this case, as there are twelve hall sensors 816a...816l (and possible projections), over 4.000 components may be uniquely identified. It is noted that more hall sensors may be provide to increase the number of uniquely identifiable components, or the hall sensors may be configured to detect not merely presence/absence of a projection, but e.g. a thickness of the projection to encode a larger number of unique identities using a set number of hall sensors.

[0119] It will be appreciated that the above described embodiments are exemplary embodiments of the disclosure only. Features described above in relation to one embodiment of the disclosure may also be applied to other embodiments of the disclosure.

Claims

1. A method for operating a modular person support apparatus, the method comprising:

   determining a unique identity of a component attached to the modular person support apparatus, using a unique identifier of the component; and
   modifying at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component.

2. A method according to claim 1, further comprising: notifying a user of the at least one, modified, operating parameter; optionally wherein the user is a caregiver.

3. A method according to claim 2, wherein notifying a user of the at least one, modified, operating parameter comprises displaying the at least one, modified, operating parameter to the user,
   optionally wherein displaying the at least one, modified, operating parameter to the user comprises

displaying the at least one, modified, operating parameter on at least one of:

a remote control for controlling the modular person support apparatus;
a mobile device of the user;
a screen of a surgical suite; and
a terminal, the terminal being remote from the modular person support apparatus.

4. A method according to claim 1, 2, or 3, wherein the at least one, modified, operating parameter comprises a limit,
preferably the limit comprising at least one of:

a load limit; and
a range of motion limit.

5. A method according to claim 4, further comprising determining that the limit is being exceeded, or close to being exceeded; and optionally, notifying the user when the limit is being exceeded, or close to being exceeded.

6. A method according to any preceding claim, wherein the at least one, modified, operating parameter comprises enabled configuration options and disabled configuration options.

7. A method according to claim 6 when dependent on claim 2, wherein notifying a user of the at least one, modified, operating parameter comprises at least one of:

displaying only the enabled configuration options;
ceasing to display the disabled configuration options;
highlighting the enabled configuration options;
de-emphasising the disabled configuration options; and
displaying a warning if a disabled configuration option is selected.

8. A method according to any preceding claim, wherein modifying the at least one operating parameter of the modular person support apparatus in dependence on said unique identity of the component comprises:
modifying a collision avoidance model in dependence on said unique identity of the component.

9. A method according to any preceding claim, further comprising sending data relating to the component to a computing device, such as a server, said data comprising the unique identity and/or the unique identifier, and,
optionally, the data further comprising at least one of:

a location of the modular person support apparatus;
an attachment location of the component on the modular person support apparatus; and
a duration of use.

10. A method according to any preceding claim, further comprising receiving data relating to the component from a, or the, computing device, said data comprising at least one of:

physical characteristics of the component, which may comprise at least one of:

a type of the component;
at least one dimension of the component, such as a length of the component, a width of the component, and a depth of the component;
a weight of the component;
a load limit; and
a material of the component;

a maintenance status, which may comprise at least one of:

a time of a last maintenance;
a time period since a last maintenance;
a number of uses since a last maintenance;
a time period until a next maintenance is required;
a number of uses until a next maintenance is required; and
a maintenance alert;

data relating to a preceding use, which may comprise at least one of:

a time of the preceding use;
a time period since the preceding use;
a duration of the preceding use;
a location of the preceding use; and
an attachment location of the component on the modular person
support apparatus during the preceding use;

data relating to all previous uses, which may comprise at least one of:

a number of all previous uses; and
a total duration of all previous uses;

modification information comprising data relating to a current, or previous,
modification of the component;
a modified collision avoidance model, the modified collision avoidance model being modified in

dependence on the unique identifier of the component;
a limit, which may comprise at least one of:

a load limit; and
a range of motion limit;

a status of configuration options, which may comprise at least one of:

enabled configuration options; and
disabled configuration options; and

a user input, wherein the user input may comprise:

notes from a user; and
an indication from a user that maintenance is required.

11. A method according to any preceding claim, wherein determining the unique identity of the component comprises at least one of:

receiving a radio signal comprising the unique identifier from the component;
optionally wherein the radio signal is a short distance radio signal or a long distance radio signal;
optionally wherein the method further comprises providing power to a radio transmitter of the component;
viewing indicia comprising the unique identifier, arranged on the component,
with a camera,
optionally wherein the unique identifier comprises a QR code or a bar code;
using an image recognition algorithm to identify the unique identifier of the component; and
using hall sensors to sense a magnetic field encoding the unique identifier, optionally wherein each hall sensor is configured to sense a presence or an absence of a respective projection or a respective slot of the component, or wherein each hall sensor is configured to sense a property of a respective projection or a respective slot of the component.

12. A method according to any preceding claim, wherein the method further comprises:
determining a unique identity of a further component, attached to the component attached to the modular person support apparatus, using a unique identifier of the further component,
wherein the step of modifying at least one operating parameter of the modular person support apparatus comprises modifying at least one operating parameter of the modular person support apparatus in dependence on the determined unique identify of the component and the determined unique identify of the further component.

13. A system comprising a modular person support apparatus, the modular person support apparatus comprising:

a primary module; and
a component attachable to the primary module, wherein the system is configured to determine a unique identity of the component when the component is attached to the modular person support apparatus, using a unique identifier of the component, and wherein the system is further configured to modify at least one operating parameter of the modular person support apparatus in dependence on the unique identity of the component.

14. A system according to claim 13, further comprising a computing device, such as a server, the modular person support apparatus being configured to communicate with the computing device to:

send data relating to the component to the computing device; and/or
receive data relating to the component from the computing device.

15. A modular person support apparatus component for use in the system of claim 13 or 14, comprising:

a coupler for attaching the component to a primary module of a modular person support apparatus, or to another component of a modular person support apparatus; and
a unique identifier, configured to be used by the modular person support apparatus to determine a unique identity of the component when the component is attached to the modular person support apparatus.

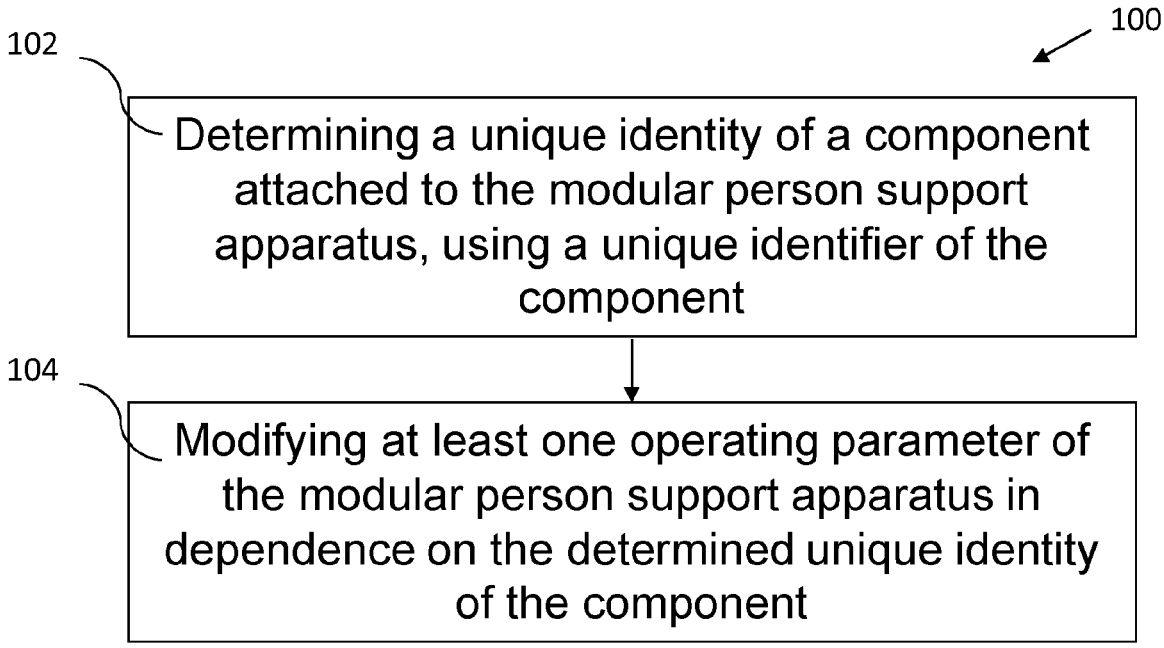


Figure 1

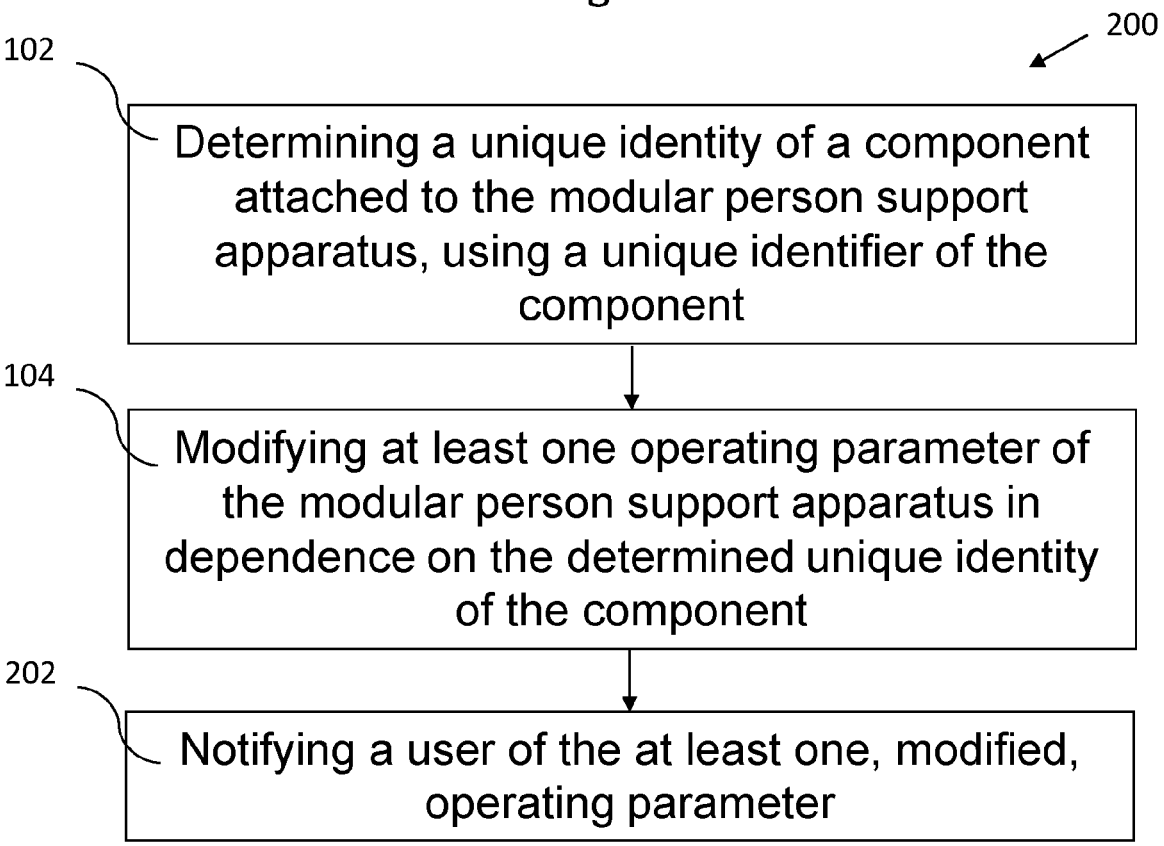


Figure 2

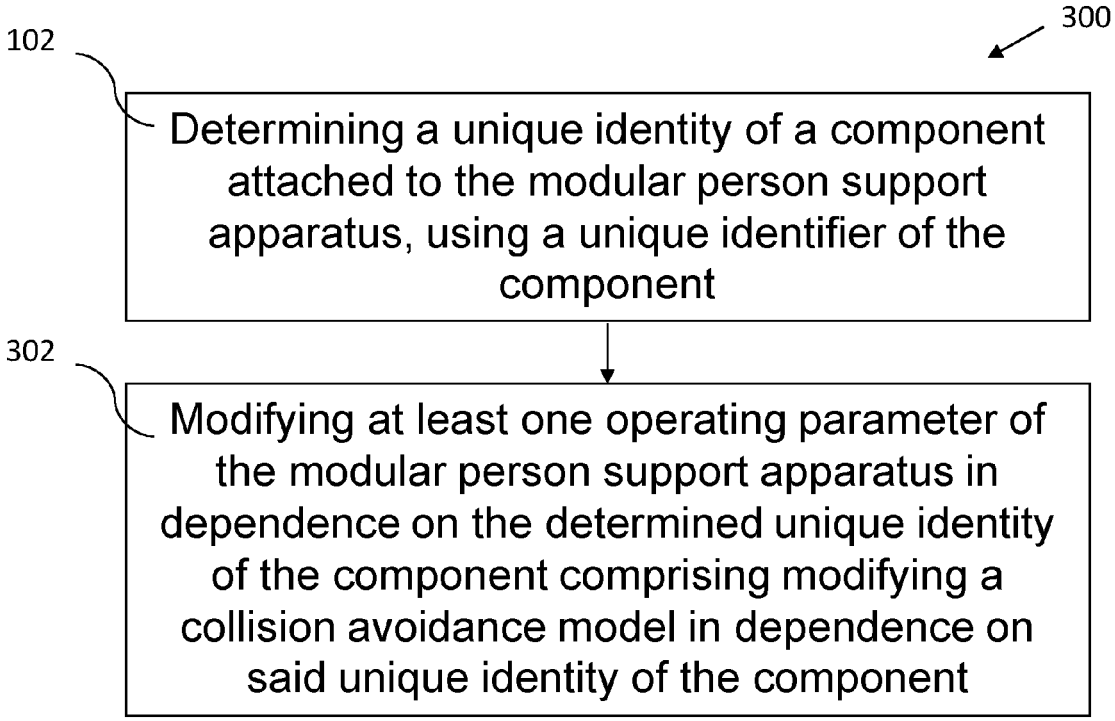


Figure 3

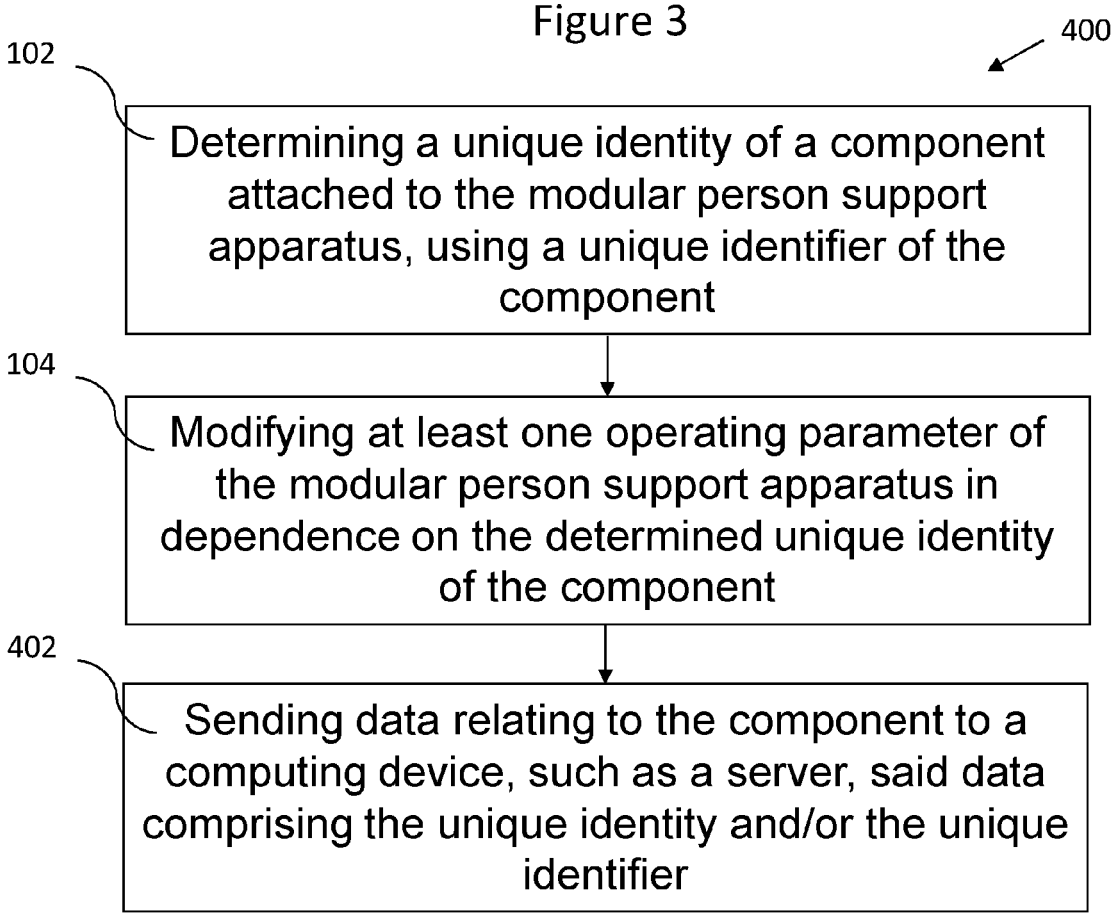


Figure 4

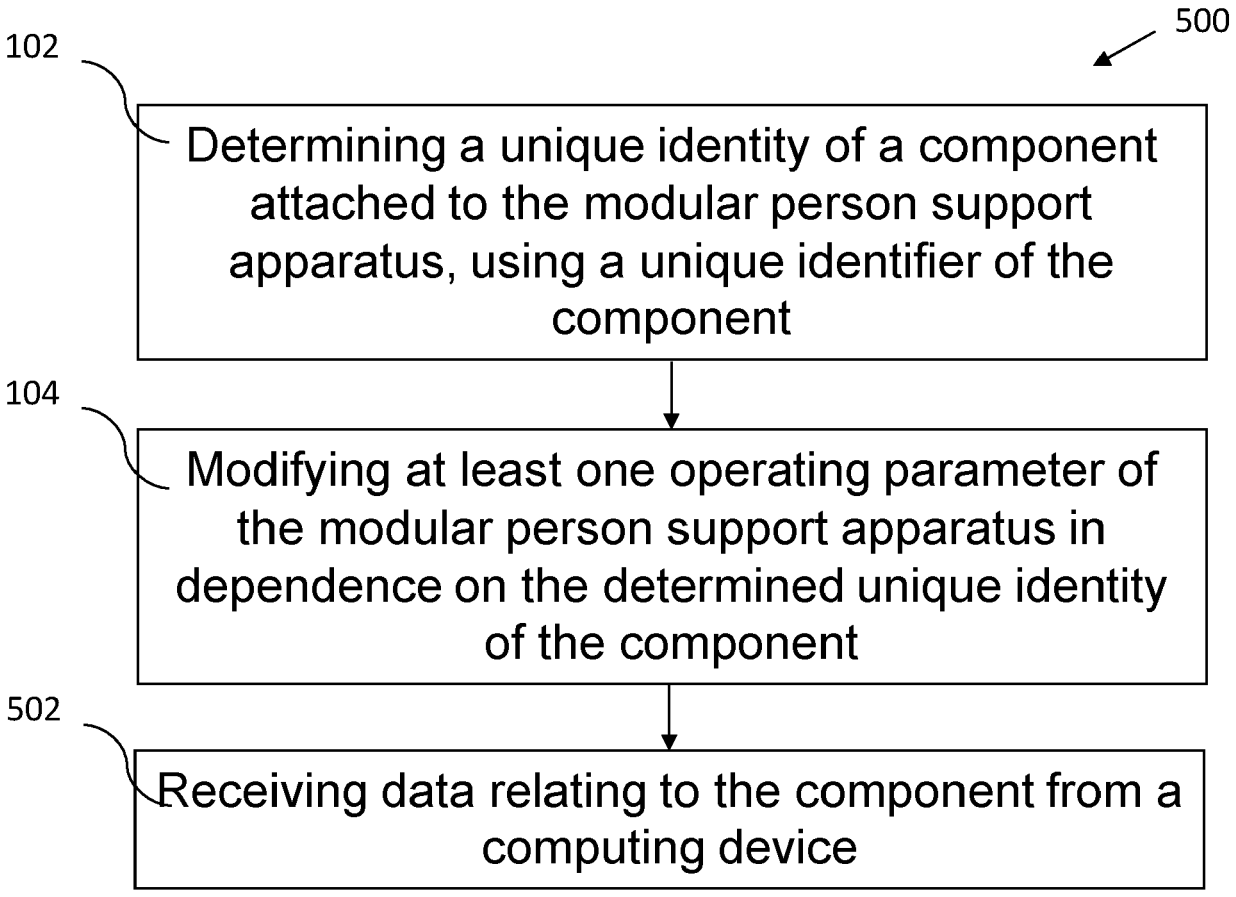

500
102
Determining a unique identity of a component attached to the modular person support apparatus, using a unique identifier of the component
104
Modifying at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component
502
Receiving data relating to the component from a computing device

Figure 5

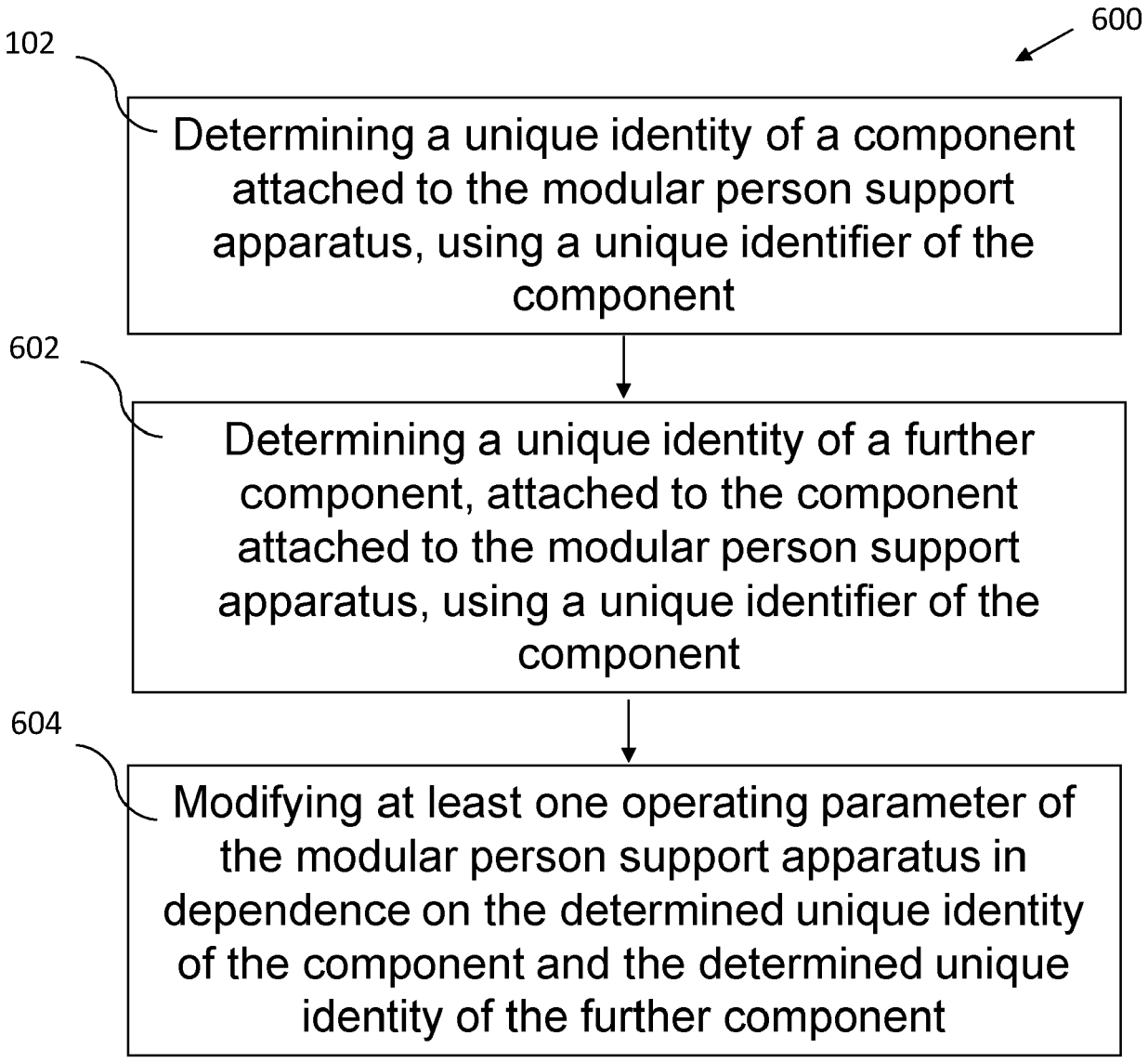
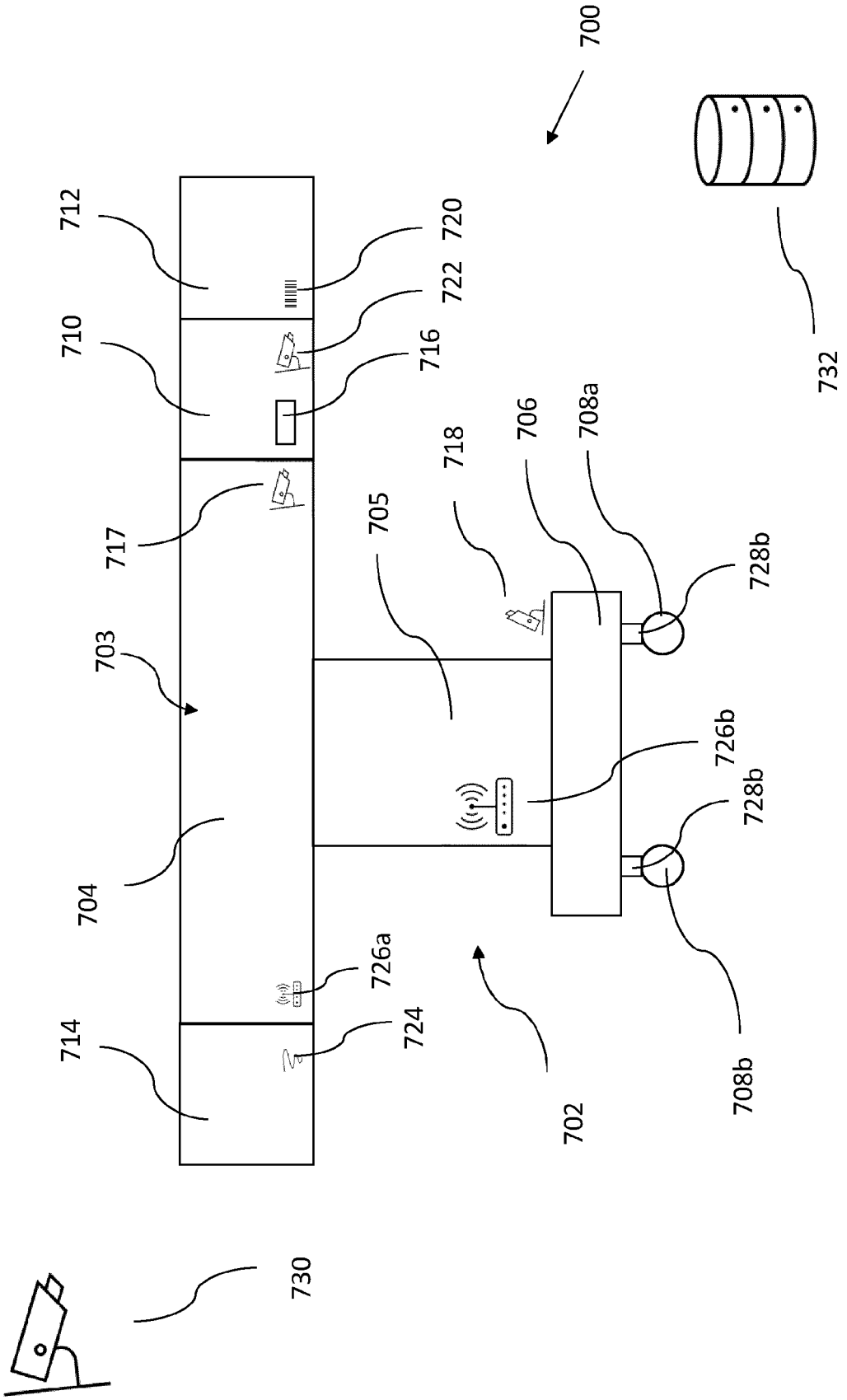

600
102
Determining a unique identity of a component attached to the modular person support apparatus, using a unique identifier of the component
602
Determining a unique identity of a further component, attached to the component attached to the modular person support apparatus, using a unique identifier of the component
604
Modifying at least one operating parameter of the modular person support apparatus in dependence on the determined unique identity of the component and the determined unique identity of the further component

Figure 6


700
712
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722
710
716
732
706
708a
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717
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728b
703
726b
728b
704
726a
724
714
702
708b
730

Figure 7

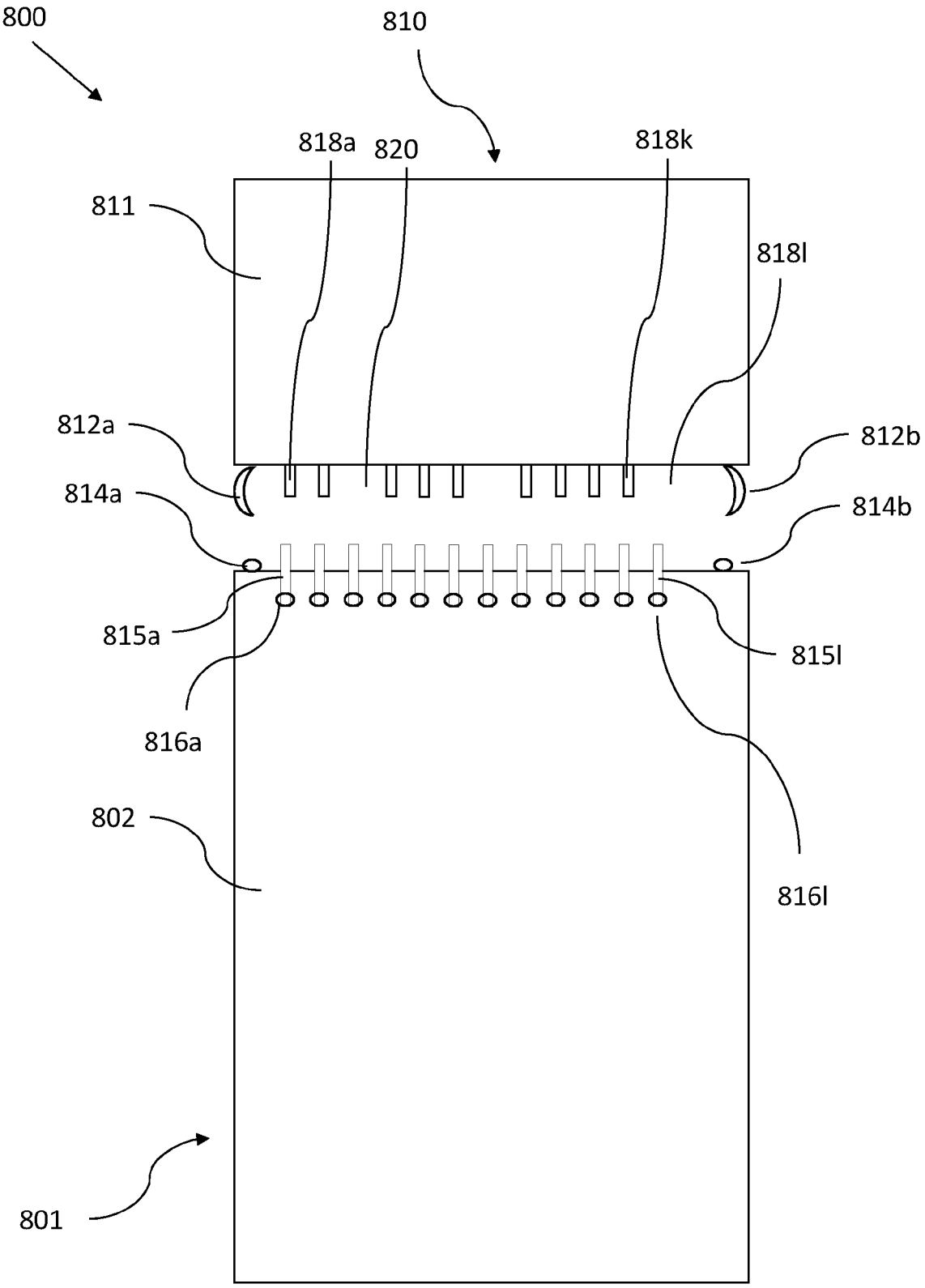
800
810
818a
820
818k
811
818l
812a
812b
814a
814b
815a
815l
816a
816l
802
801

Figure 8

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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 9900

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2023/278478 A1 (STRYKER CORP [US]) 5 January 2023 (2023-01-05) * paragraphs [0094] - [0175]; figures 1-12 *	1-15	INV. A61G7/05
X	EP 3 124 000 A1 (ALLEN MEDICAL SYSTEMS INC [US]) 1 February 2017 (2017-02-01) * paragraphs [0054] - [0071]; figures 1A-13 *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

A61G
A61B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 December 2023	Gkama, Alexandra

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 17 9900

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07-12-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2023278478 A1	05-01-2023	NONE	
EP 3124000 A1	01-02-2017	EP 3124000 A1	01-02-2017
		US 2017027797 A1	02-02-2017

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