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(54)

AN INSTALLATION ARRANGEMENT FOR A TOILET SYSTEM

- (57) Described herein is an installation arrangement [202] for a toilet system [200], wherein the toilet system [200] comprises a toilet bowl [204] defining a mounting region [210] on a rear side thereof. The installation arrangement [202] comprises a first and second toilet installation units [202a, 202b]. Each of the first and second toilet installation units [202a, 202b] comprises a first and second mounting pin [206a, 206b]; a first and second flange nut [218a, 218b]; and a first and second mounting brackets [220, 222]. Each of the first and second mounting brackets [220, 222] are adapted to mount and support the toilet bowl [204] thereon. Notably, the first and second mounting brackets [220, 222] are mounted on the first and second mounting pins [206a, 206b], to be fixed thereon, by means of the first and second flange nut [218a, 218b], respectively.

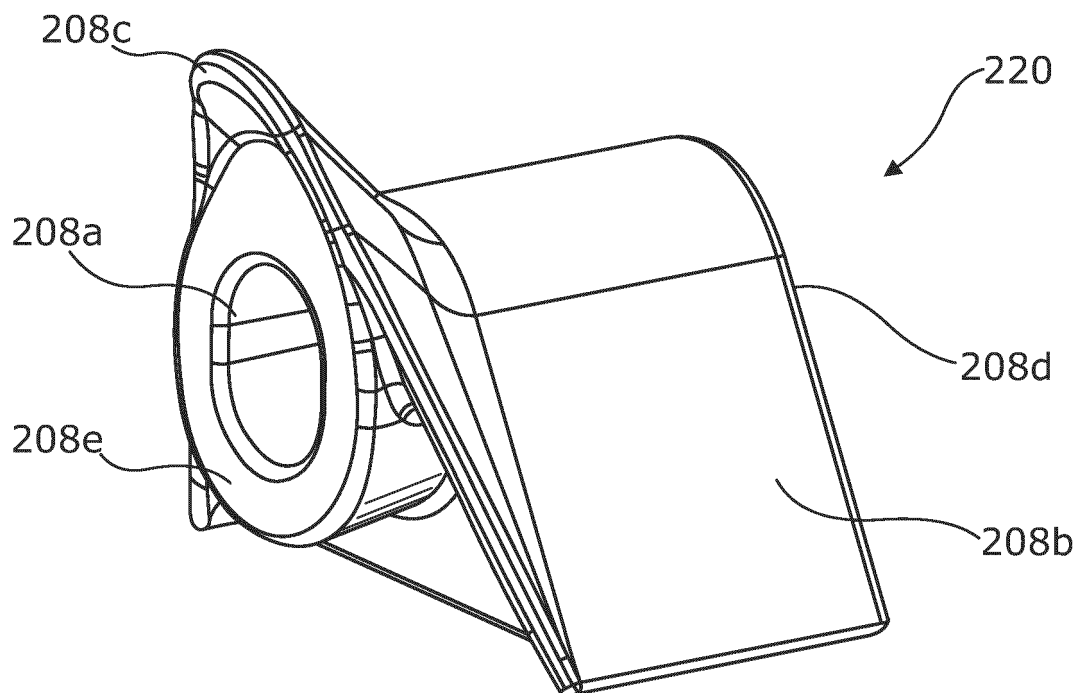


Figure 3a

Description

TECHNICAL FIELD

[0001] The present disclosure relates to wall-hung toilet systems. More particularly, the present disclosure relates to an installation arrangement for a wall-hung toilet system, for enabling quick and easy installation of a toilet bowl of the wall-hung toilet system on a wall.

BACKGROUND

[0002] This section is intended to provide information relating to the field of the invention and thus any approach or functionality described below should not be assumed to be qualified as prior art merely by its inclusion in this section.

[0003] Toilet systems are known in sanitation industry, to enable persons to defecate in good sanitary conditions. Toilet systems may be one of a wall-hung toilet system, a floor-mounted toilet system, and the like. A typical wall-hung toilet system [100] (hereinafter interchangeably referred to as 'toilet system [100]') includes a toilet bowl [104] and an installation arrangement [102], wherein the installation arrangement [102] is required to hang/install the toilet bowl [104] on a wall of a toilet cabinet.

[0004] Figure 1a is a sectional side view of a conventional toilet system [100]. Figure 1b is a perspective view of a conventional mounting bracket [108] of the installation arrangement [102], employed for installation (hanging) of the toilet bowl [104] on the wall of the toilet cabinet. Figures 1a and 1b are to be viewed in conjunction with each other in order to completely understand a structure and arrangement of the conventional toilet system [100]. The toilet bowl [104] is a conventionally known bowl-shaped structure, and is provided to receive faecal matter, when a user performs defecation thereon. The toilet bowl [104] is adapted to be mounted on the wall. The toilet bowl [104] defines a first and a second mounting cavities [112, 114] on a rear side thereof, for enabling mounting of the toilet bowl [104] on the wall. The first and second mounting cavities [112, not shown] defined by the toilet bowl [104] are substantially rectangular in shape.

[0005] Conventionally, the installation arrangement [102] includes a first toilet installation unit and a second toilet installation unit, in combination, are adapted to install/hang the toilet bowl [104] on a wall of a toilet cabinet. Particularly, the first toilet installation unit and the second toilet installation unit engage with the first mounting cavity [112] and the second mounting cavity [114] of the toilet bowl [104], respectively, for installation/hanging of the toilet bowl [104] on the wall of the toilet cabinet. Each of the first and second toilet installation units have a similar structure and arrangement thereof. In view of the above, a structure and arrangement the toilet installation unit engaging with the mounting cavity will be explained here-

inafter in detail.

[0006] The first toilet installation unit comprises a first mounting bracket [108] and a first mounting pin [106]. The second toilet installation unit comprises a second mounting bracket [108] and a second mounting pin [not shown]. During installation, the first mounting pin [106] and the second mounting pin are screwed on the wall. The first mounting bracket [108] is received within the first mounting cavity [112] defined by the toilet bowl [104], to be locked therein. Similarly, the second mounting bracket [108] is received within the second mounting cavity [112] defined by the toilet bowl [104]. Thereafter, the toilet bowl along with the first and the second mounting brackets [108] is positioned and installed over the first mounting pin [106] and the second mounting pin on the wall, such that the first and the second mounting bracket [108] interlocks with its respective first mounting pin [106] and the second mounting pin.

[0007] Additionally, each of the mounting brackets [108] comprise an allen bolt feature [110], for fixedly locking the first and the second mounting brackets [108] to their respective first mounting pin [106] and second mounting pin, during assembly of the toilet system [100]. The allen bolt [110] of the mounting bracket [108] is tightened by means of an allen key, for locking the first mounting pin [106] therein. Additionally, for such installation, the toilet bowl [104] has one or more pockets therein proximal to the first and second mounting cavities [112, not shown] to allow the allen key to be passed there-through, and access the allen bolt of the mounting bracket [108]. However, such pockets in the toilet bowl reduces overall structural strength of the toilet bowl, and reduces manufacturing productivity and yield thereof. Moreover, while installation of the existing toilet system [100], locating the allen bolt [110] of the existing mounting bracket [108] from pockets (provided in form of a top hole or bottom hole) defined on the toilet bowl [104], with the allen key, requires a person skilled in such installation. This may result in inaccurate installation of the toilet bowl [104] on the wall of the toilet cabinet. It may further be noted that such installation is carried out by means of trial and error. Thus, the installation of the existing toilet system [100] is a time consuming and cumbersome process, and strictly requires a person skilled in such installation.

[0008] Accordingly, in light of the aforementioned drawbacks and several other inherent in the existing arts, there is a well felt need to provide an installation arrangement for a toilet system that provides for a quick and easy installation of the toilet system on the wall of the toilet cabinet.

OBJECTS OF THE INVENTION

[0009] This section is intended to introduce certain objects of the disclosed method and system in a simplified form, and is not intended to identify the key advantages or features of the present disclosure.

[0010] It is an object of the present invention to provide

for an installation arrangement for a toilet system to be mounted on the wall and which is adapted to be received into corresponding mounting cavities in a rear end of a toilet bowl.

[0011] It is another object of the present invention to provide for an installation arrangement comprising a first and second installation unit, each comprising a mounting pin, a mounting bracket, and a flange nut.

[0012] It is yet another object of the present invention to provide for a mounting bracket to enable installation of the toilet on the wall of the toilet cabinet. The mounting bracket, is configured to be a single part structure defining a through-hole within it for receiving the mounting pin therethrough.

[0013] It is yet another object of the present invention to provide for a method of assembling the installation arrangement on the wall.

[0014] It is yet another object of the present invention to provide for a method of installation of a toilet bowl on the wall through the installation arrangement pre-mounted on the wall.

SUMMARY:

[0015] The present invention discloses an installation arrangement for a toilet system, wherein the toilet system comprises a toilet bowl defining a first and second mounting cavities on its rear side. The installation arrangement comprises a first and second toilet installation units, wherein each of the first and second toilet installation units are adapted to enable mounting of the toilet bowl on a wall of a toilet cabinet.

[0016] Each of the first and second toilet installation units includes a mounting pin adapted to be mounted on the wall, a mounting bracket adapted to carry weight of the toilet bowl thereon, and a mounting flange nut adapted to lock the mounting bracket mounted on the mounting pin. A mounting bracket, configured to be a single part structure defines a through-hole within it for receiving the mounting pin therethrough. It further comprises a slanting protruded surface adapted to lock and support the toilet bowl thereon. The mounting bracket is mounted on the mounting pin, to be fixed thereon, by means of the mounting flange nut. Particularly, the mounting bracket is adapted to be received within the first and second mounting cavities defined by the toilet bowl. More particularly, the slanted protruded surface of the mounting bracket enables locking of the toilet bowl to the wall.

[0017] In an embodiment, the present invention discloses a toilet bowl with a mounting region located at the rear side of the bowl having a first mounting cavity and a second mounting cavity. Each of the first and second mounting cavity has an external slotted region and an interior hollow region.

[0018] In an embodiment, the present invention discloses an assembly of the installation arrangement on the wall wherein in a first step a first mounting pin and a second mounting pin are mounted on a wall; secondly,

the first and second mounting brackets are mounted on the first mounting pin and a second mounting pin; and finally, the first and second mounting brackets are fastened on the first mounting pin and a second mounting pin through a first and second flange nuts.

[0019] In an embodiment, the present invention discloses a method installing a toilet bowl on the wall using the installation arrangement. It involves placement of a toilet bowl proximal to an installation arrangement pre-mounted on a wall; secondly, inclining the toilet bowl with reference to a floor adjacent to the wall; thirdly, positioning the toilet bowl, at the inclination, to enable the first and second mounting cavities defined on the toilet bowl at least partially receive the first and second toilet installation unit, respectively within itself; and finally, lowering the toilet bowl to completely affix the first and second toilet installation unit within the first and second mounting cavities. Specifically, the interlocking effect between the first and second mounting cavities and the first and second toilet installation unit is achieved through the first and second mounting brackets.

[0020] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF DRAWINGS

[0021] The present invention, both as to its organization and manner of operation, together with further objects and advantages, may best be understood by reference to the following description, taken in connection with the accompanying drawings. These and other details of the present invention will be described in connection with the accompanying drawings, which are furnished only by way of illustration and not in limitation of the invention, and in which drawings:

Figure 1a is a sectioned side view of a conventional toilet system.

Figure 1b is a perspective view of a mounting bracket employed for installation of the toilet bowl of figure 1a, on a wall.

Figure 2a is a sectioned perspective view of a toilet bowl of a toilet system, in accordance with the concepts of the present disclosure.

Figure 2b is an enlarged view of a mounting cavity on the rear side of a toilet.

Figure 3a is a perspective view of a mounting bracket employed for installation of the toilet bowl of figure 2, on a wall of a toilet cabinet, in accordance with

the concepts of the present disclosure.

Figure 3b is an enlarged view of the mounting bracket mounted on a mounting pin and locked in position by a flange nut.

Figure 3c is view depicting the positioning of the mounting bracket, mounting pin and the flange nut, wherein the mounting pin is pre-positioned on a wall.

Figure 4a is a perspective view of the wall with mounting holes for installation of the toilet system thereon, in accordance with the concepts of the present disclosure.

Figure 4b is a perspective view of the wall of figure 4a, with a first and second mounting pins of the toilet arrangement, inserted therein, in accordance with the concepts of the present disclosure.

Figure 4c is a perspective view of the wall of figure 4b, with a first and second mounting brackets mounted on the first and second mounting pins, in accordance with the concepts of the present disclosure.

Figure 4d is a perspective view of the wall of figure 4c, with the first and second mounting bracket mounted on the first and second mounting pins, by means of the first and second mounting flange nuts, in accordance with the concepts of the present disclosure.

Figure 4e is a perspective view of the wall of figure 4d, with a water inlet and outlet pipes inserted therein, in accordance with the concepts of the present disclosure.

Figure 4f is a top view of the toilet bowl positioned proximal to the wall of figure 4e, in accordance with the concepts of the present disclosure.

Figure 4g is a perspective view of the toilet bowl of figure 4f, positioned proximal to the wall, at an inclination with respect to the wall, in accordance with the concepts of the present disclosure.

Figure 4h is a side view of the toilet bowl of figure 4g, at an inclination with respect to the wall, in accordance with the concepts of the present disclosure.

Figure 4i is a side view of the toilet bowl of figure 4h, partially positioned on the wall, in accordance with the concepts of the present disclosure.

Figure 4j is a side view of the toilet bowl of figure 4i, mounted on the installation arrangement, to form the toilet system thereof, in accordance with the con-

cepts of the present disclosure.

Figure 4k is an enlarged view of the interlocked position created due to the mounting of the installation arrangement on the toilet bowl.

DETAILED DESCRIPTION

[0022] In the following description, for the purposes of explanation, various specific details are set forth in order to provide a thorough understanding of embodiments of the present invention. It will be apparent, however, that embodiments of the present invention may be practiced without these specific details. Several features described hereafter can each be used independently of one another or with any combination of other features. An individual feature may not address any of the problems discussed above or might address only one of the problems discussed above. Some of the problems discussed above might not be fully addressed by any of the features described herein. Example embodiments of the present invention are described below, as illustrated in various drawings in which like reference numerals refer to the same parts throughout the different drawings.

[0023] In the description of examples disclosed herein, any reference to terms such as "attached," "affixed," "connected," "coupled," "interconnected," and similar refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise.

[0024] The embodiments of the present invention relate to an installation arrangement [202] for a toilet system [200], for a quick and easy installation of a toilet bowl [204], on a wall [300] of a toilet cabinet.

[0025] The toilet system [200] comprises the toilet bowl [204], and an installation arrangement [202]. Figures 2a and 2b pertain to a toilet bowl [204] of the toilet system [200]. Figures 3a, 3b and 3c pertain to a mounting bracket [208] employed for installation of the toilet bowl [204] of figure 2, on the wall [300], in accordance with the concepts of the present disclosure. Figures 2a, 2b, 3a, 3b and 3c are to be conjointly viewed, in order to completely understand the scope of the invention according to the present disclosure.

TOILET BOWL

[0026] Referring to Figures 2a and 2b, a structure and arrangement of the toilet bowl [204] is described hereinbelow.

[0027] The toilet bowl [204] is a bowl-shaped structure, and is provided to receive fecal matter, when a user performs defecation thereon, and is adapted to be mounted on the wall [300] of the toilet cabinet. The toilet bowl [204] has a mounting region [210] on its rear side. The toilet bowl [204], at its mounting region [210] defines a first and

a second mounting cavity [212a, 212b], wherein each of the first and second mounting cavity [212a, 212b] has an external slotted region [214] and an interior hollow region [216]. In the preferred embodiment, the external slotted region [214] has a geometrical shape of a triangle, as disclosed in Figure 2b.

[0028] Preferably, the first and second mounting cavities [212a, 212b] are adapted to receive the installation arrangement [202] therein, such that the toilet bowl [204] is mounted and supported thereon. Additionally, the toilet bowl [204] further defines a water inlet cavity [210a] and a water outlet cavity [210b] on the mounting region [210] thereof. Particularly, the water inlet cavity [210a] is adapted to receive a water inlet pipe [224a] therein, while the water outlet cavity [210b] is adapted to receive the water outlet pipe [224b] therein. The toilet bowl [204] of the toilet arrangement [200] is a single part pocketless structure. More particularly, the toilet bowl [204] is a wall-hung toilet bowl [204]. The toilet bowl [204] may be made of ceramic, porcelain, plastic, and any combinations thereof.

MOUNTING BRACKET

[0029] Referring to Figures 3a, 3b and 3c, a structure and arrangement of the mounting brackets [220, 222] is described hereinbelow. The first mounting bracket [220] of the installation arrangement [202] is a single part structure, adapted to be fixed on a wall [300], for enabling mounting and supporting of the toilet bowl [204] thereon. Preferably, it corresponds to a shape similar to that of the mounting cavity, provided on the rear side of the toilet bowl [204].

[0030] As visualized in figure 3a, the first mounting bracket [220] defines a through-hole [208a] for allowing a first mounting pin [206a] to pass therethrough. As visualized in Figure 3b, the mounting bracket is a symmetrical structure, comprising a bent end which extends downwards as a continuous flat surface [208b]. At the bent end, there is provided an upward slant surface [208c] with a curved protrusion at its edge, wherein the slant protruded surface [208c] engages and locks with the toilet bowl [204] mounted thereon. In its engaged state with the toilet bowl [204], the continuous flat surface [208b] of the first mounting bracket [220] holds the weight of the toilet bowl [204] thereon, by means of its continuous structure. Further, the first mounting bracket [220] defines a wall mounting surface [208d] on its rear side, adapted to come into contact with the wall [300], when mounted thereon. The first mounting bracket [220] additionally defines a flange nut interfacing surface [208e] on a front side thereof, adapted to come into contact with the first flange nut [218a], while locking the first mounting bracket [220] on the first mounting pin [206a].

[0031] In a similar arrangement, a second mounting bracket [222] is provided with a through hole [208a] to allow the second mounting pin [206b] to pass through. The remaining configuration of the second mounting

bracket [222] is identical to that of the first mounting bracket [220] in terms of its structure, configurations etc.

[0032] Notably, each of the first and the second mounting brackets [220, 222] is made of polyoxymethylene (POM), 30% glass fibre reinforced polyamide 66 (PA66-GF30), acrylonitrile butadiene styrene (ABS), polycarbonates (PC), and any combinations thereof.

INSTALLATION ARRANGEMENT

[0033] Referring to Figure 4d, a structure and arrangement of the installation arrangement [202] is described hereinbelow.

[0034] The installation arrangement [202] is provided in the toilet system [200] for mounting of the toilet bowl [204] on the wall [300] of the toilet cabinet. The installation arrangement [202] comprises a first toilet installation unit [202a] and a second toilet installation unit [202b]. For ease of reference and understanding, a structure and arrangement of merely the first toilet installation unit [202a] will be explained hereinafter in detail. A structure and arrangement of the second toilet installation unit [202b] may be contemplated by a person skilled in the art, based on the description of the first toilet installation unit [202a] in the present disclosure.

[0035] The first toilet installation unit [202a] of the installation arrangement [202], comprises a first mounting pin [206a], a first mounting flange nut [218a], and a first mounting bracket [220]. The first mounting pin [206a] is configured to be mounted on the wall [300] through a hole/aperture provided on the wall [300] for installation purposes, and defines a plurality of external threads on its external surface. The first mounting pin [206a] receives and supports the first mounting bracket [220] thereon and the first flange nut [218a] is utilized to lock the first mounting bracket [220] on the first mounting pin [206a], such that the internal threads defined by the first flange nut [218a] mates with the external threads defined by the first mounting pin [206a]. In the embodiment described herein, the locking mechanism is preferably described as a mating arrangement through threads. However, the same is not to be construed as a limitation for the locking mechanism, as alternative methods may be implemented as is known in the relevant state of art. The first installation unit [202a] is configured to be received within the first mounting cavity [212a] defined by the toilet bowl [204].

[0036] In a similar arrangement, the second installation unit [202b] comprises a second mounting pin [206b], a second mounting flange nut [218b], and a second mounting bracket [222]. The configuration of the second toilet installation unit [202b] is identical to the first installation unit [202a] and may be contemplated by a person skilled in the art, based on the description of the first toilet installation unit [202a] in the present disclosure.

ASSEMBLY

[0037] Referring to figures 4a to 4e, an assembly of the installation arrangement is described hereinbelow.

[0038] Firstly, a desired wall [300] is selected and four mounting holes are drilled thereon. As visualized in Figure 4a, the two horizontal smaller holes are configured to receive the first mounting pin [206a] and the second mounting pin [206b]. The two vertical holes are configured to be connected to a water inlet pipe [224a] and a water outlet pipe [224b]. Secondly, as visualized in Figure 4b, the first and second mounting pins [206a, 206b] are mounted in their respective mounting holes. Thirdly, as visualized in Figure 4c, the first and second mounting brackets [220, 222] are mounted on the first and second mounting pins [206a, 206b] respectively through the holes [208a, 208b] provided on the first and second mounting brackets [220, 222], such that the wall mounting surface [208d] of each of the first and second mounting brackets [220, 222] comes into contact with the wall [300]. Fourthly, as visualized in Figure 4d, the first and second mounting brackets [220, 222] are locked on the first and second mounting pins [206a, 206b], by means of the first and second flange nuts [218a, 218b]. Fifthly, as visualized in Figure 4e, the water inlet pipe [224a] and the water outlet pipe [224b], are inserted in their respective mounting holes. Thus, this completes the mounting of the installation arrangement [202] on the wall [300], in accordance with the concepts of the present disclosure.

[0039] Referring to figures 4f to 4j, a method of assembly of a toilet bowl [200] with the installation arrangement [202] on the wall [300] is described hereinbelow.

[0040] As visualized in Figure 4f, the toilet bowl [204] is positioned proximal to the installation arrangement [202] pre-mounted on the wall [300], such that the mounting region [210] of the toilet bowl [204] faces towards the wall [300]. Thereafter, as visualized in Figure 4g, the toilet bowl [204] is inclined upwards with reference to a floor adjacent to the wall [300]. The toilet bowl [204] is then positioned on the wall [300], as visualized in Figure 4h, at the said inclination, such that the first and second mounting cavities [212a, 212b] defined on the toilet bowl [204] at least partially receive the first and second toilet installation unit [220, 222], respectively within itself. Finally, the toilet bowl [204] is lowered to completely come into contact with the wall [300], such that the continuous flat surface [208b] of the first and second mounting brackets [220, 222] is completely received within the external slotted region [214] of the first and second mounting cavities [212a, 212b], while the slant protruded surface [208c] thereof, is received completely within the internal hollow region [216] of the first and second mounting cavities [212a, 212b]. Notably, the slant protruded surface [208c] of the first and second mounting brackets [220, 222] provides a locking effect to the toilet bowl [204], while the continuous flat surface [208b] of the first and second mounting brackets [220, 222] bears a load of the toilet bowl [204] thereon. The partial assembled view of

the toilet system is depicted in Figure 4i and the complete assembled view is depicted in Figure 4j. Thus, this completes the assembly of the toilet system [200] of the present invention.

[0041] Referring to Figure 4k, it discloses an enlarged view of the interlocked position created due to the mounting of the toilet bowl [204] on the installation arrangement [202], in accordance with the disclosure of the present invention. The interlocked position is a snug fit between the installation arrangement [202] and the toilet bowl [204] and does not require any additional pockets for mounting the first and second mounting bracket [220, 222] therein. Thereby, it reduces the need of additional fixing tools such as allen bolts, keys etc., and improves overall productivity and performance of the toilet system [200].

[0042] Although, particular embodiments have been disclosed herein in detail, this is for illustrative purposes only and is not intended in any way to limit the intended scope of the invention. Variations and adaptations of the system as described herein do not depart from the spirit and scope of the invention and is within the expertise of a person skilled in the art.

Claims

1. An installation arrangement for a toilet system, wherein the toilet system comprises a toilet bowl defining first and second mounting cavities on a rear side thereof, the installation arrangement comprises a first and a second toilet installation unit, wherein each of the first and second toilet installation units are adapted to enable mounting of the toilet bowl on a wall of a toilet cabinet, each of the first and second toilet installation units including:

a mounting pin adapted to be mounted on the wall;
a mounting bracket adapted to carry weight of the toilet bowl thereon; and
a mounting flange nut adapted to lock the mounting bracket mounted on the mounting pin.

2. An installation arrangement according to claim 1, wherein:

the mounting brackets each define a through-hole for receiving the mounting pin therethrough and a slant protruded surface adapted to lock and support the toilet bowl thereon; and
the mounting brackets are each mounted on the respective mounting pin, to be fixed thereon, by means of the mounting flange nut.

3. An installation arrangement according to claim 2, wherein the slanted protruded surface of the mounting bracket enables locking of the toilet bowl to the

wall.

4. An installation arrangement according to any preceding claim, wherein the mounting brackets are each a single part structure adapted to be received within the first and second mounting cavities defined by the toilet bowl. 5
5. An installation arrangement according to any preceding claim, wherein the mounting brackets each define a continuous flat surface adapted to hold the weight of the toilet bowl thereon by means of its continuous structure. 10
6. An installation arrangement according to any preceding claim, wherein the mounting brackets each define a wall mounting surface on a rear side thereof, the wall mounting surface adapted to come into contact with the wall when mounted thereon. 15
20
7. An installation arrangement according to any preceding claim, wherein the mounting brackets each define a flange nut interfacing surface on a front side therefore, the flange nut interfacing surface adapted to come into contact with the respective flange nut. 25
8. An installation arrangement according to any preceding claim, wherein each of the mounting brackets are made of polyoxymethylene (POM), 30% glass fibre reinforced polyamide 66 (PA66-GF30), acrylonitrile butadiene styrene (ABS), polycarbonates (PC), and any combinations thereof. 30
9. A method of installing the installation arrangement defined in any preceding claim, the method comprising: 35
 - forming mounting holes adapted to receive the first and second mounting pins respectively;
 - mounting the first and second mounting pins in their respective mounting holes; 40
 - mounting the first and second mounting brackets on the first and second mounting pins; and
 - locking the first and second mounting brackets on the first and second mounting pins by means of the first and second flange nuts. 45
10. A method of installing a toilet system, the toilet system comprising a toilet bowl defining first and second mounting cavities on a rear side thereof, the method comprising: 50
 - performing the steps of claim 9 to install an installation arrangement;
 - positioning the toilet bowl proximal to the installation arrangement mounted on the wall such that a mounting region of the toilet bowl faces towards the wall; 55

inclining the toilet bowl upwards with reference to a floor adjacent to the wall;
positioning the toilet bowl on the wall, at the said inclination, such the first and second mounting cavities at least partially receive the first and second toilet installation units respectively, therein; and
lowering the toilet bowl to completely come into contact with the wall.

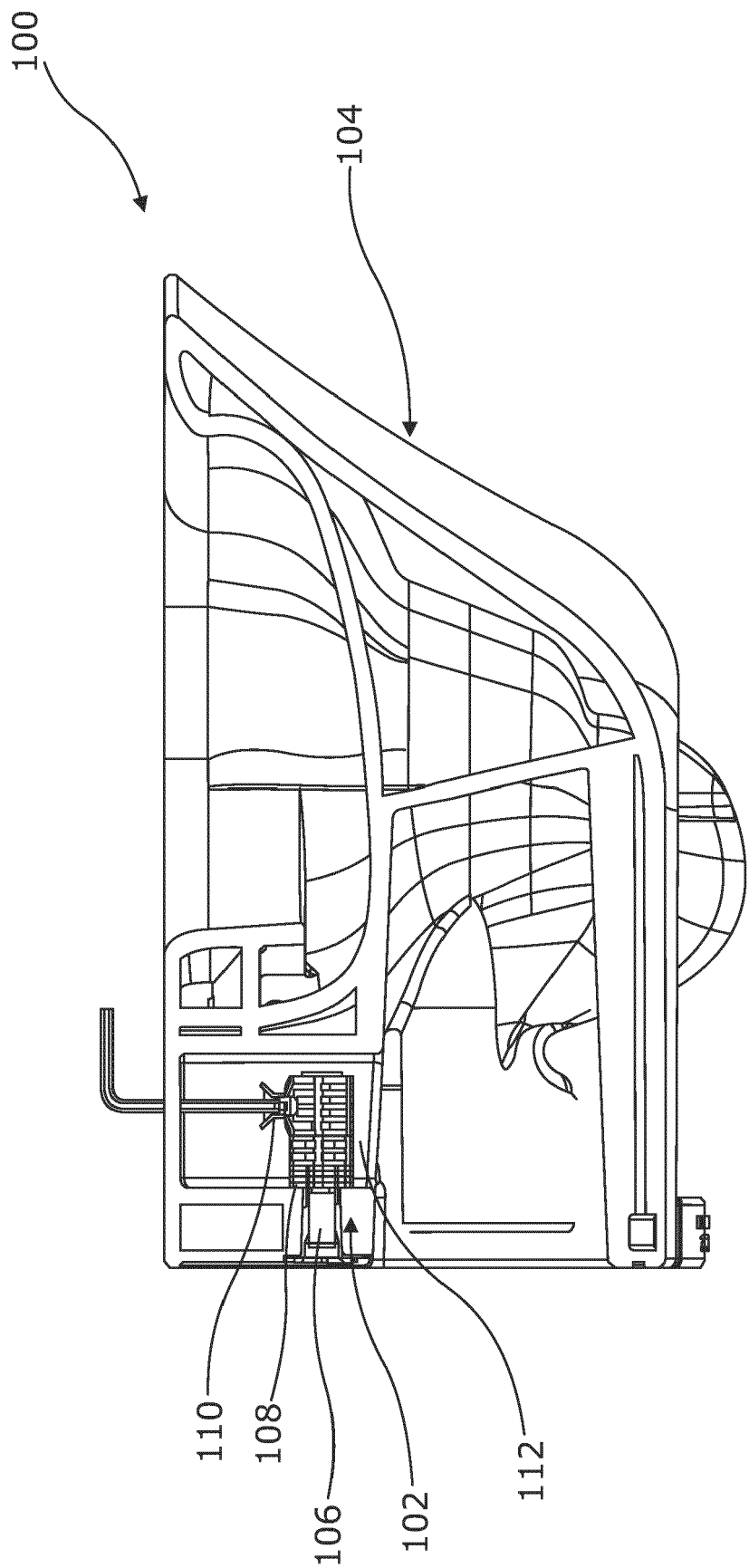


Figure 1a

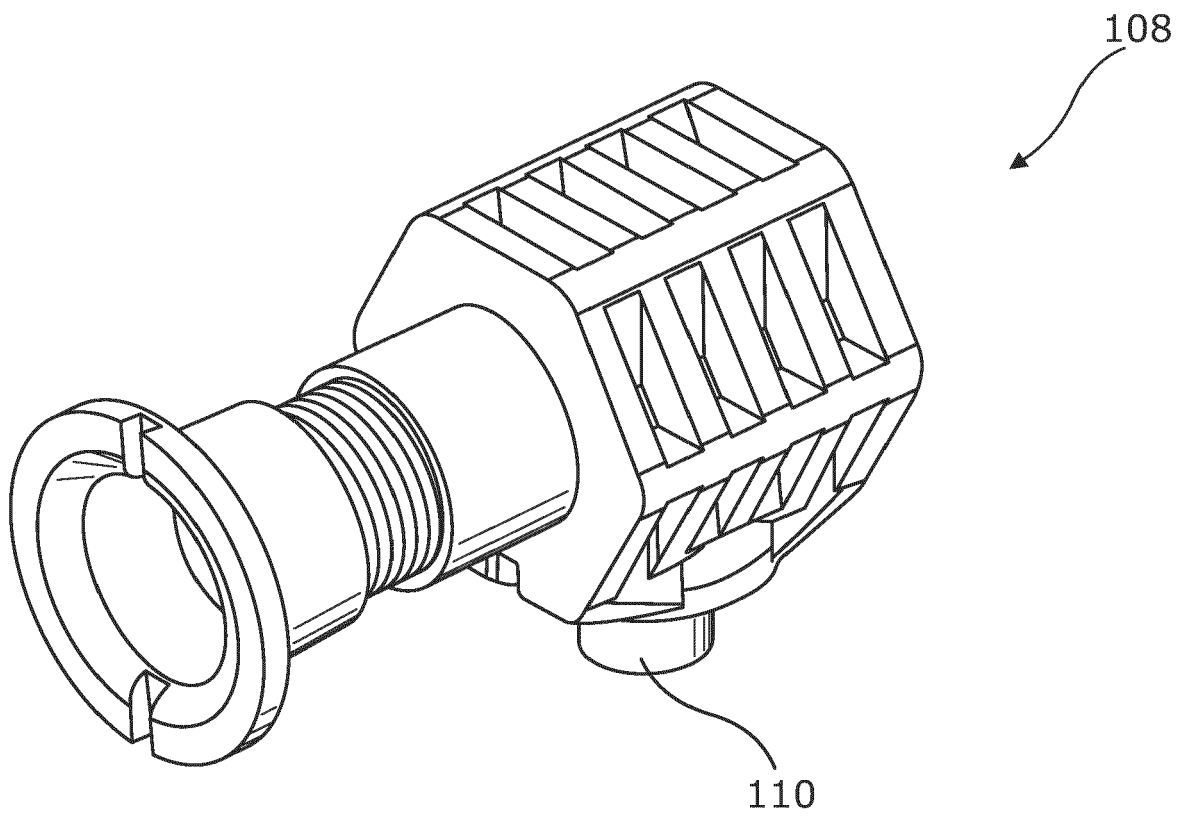


Figure 1b

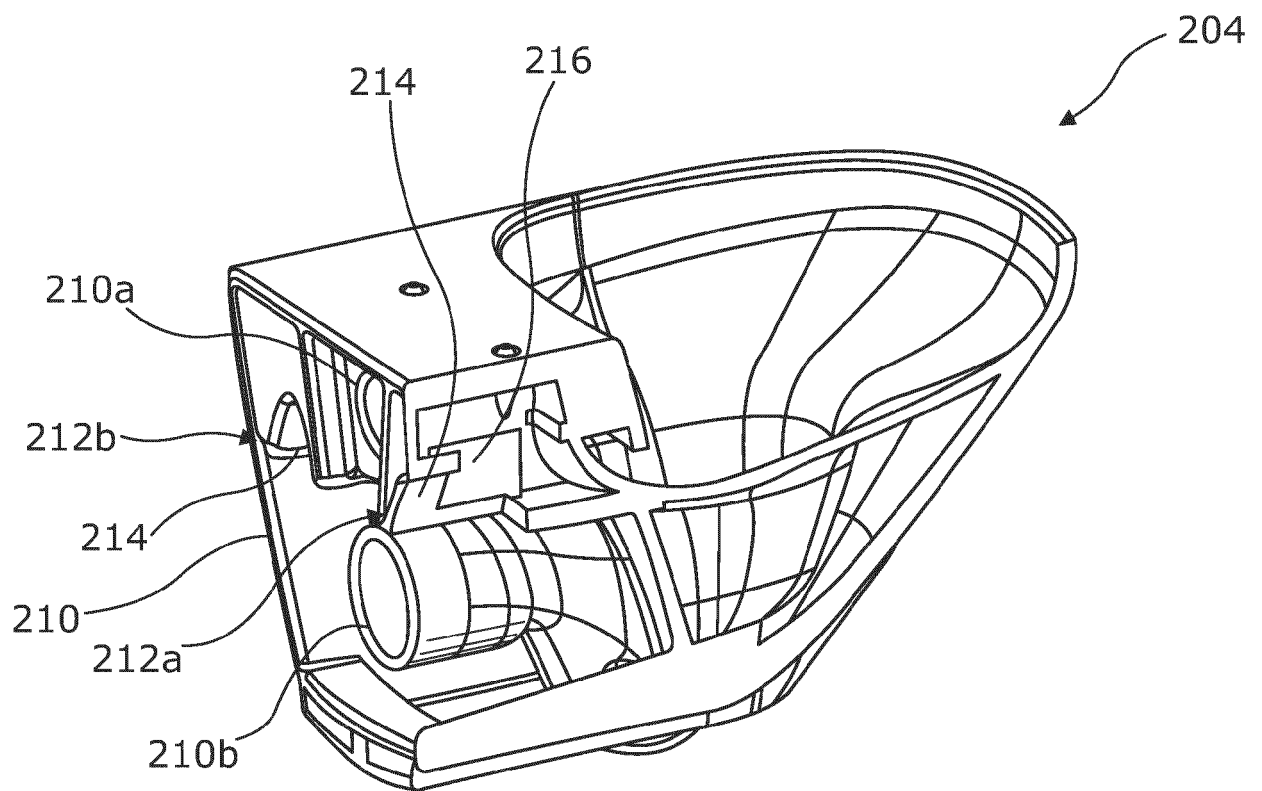


Figure 2a

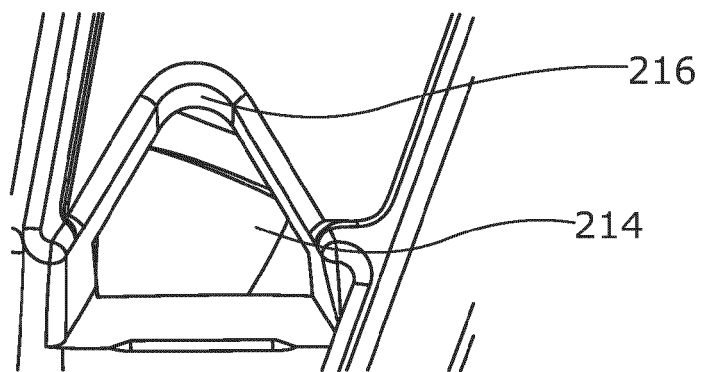


Figure 2b

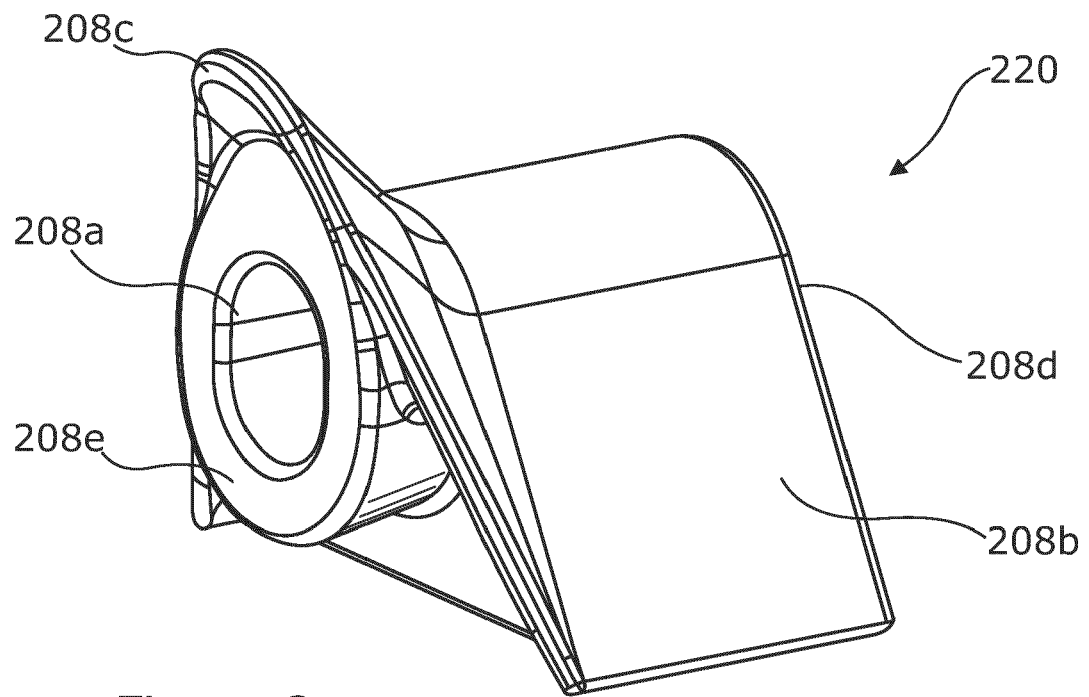


Figure 3a

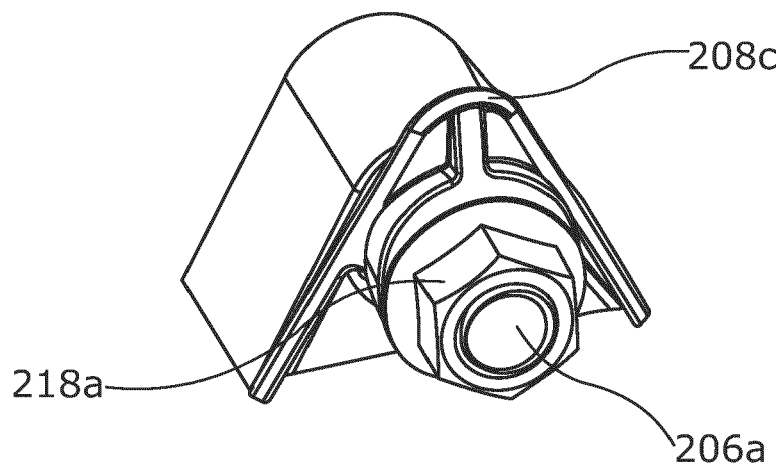


Figure 3b

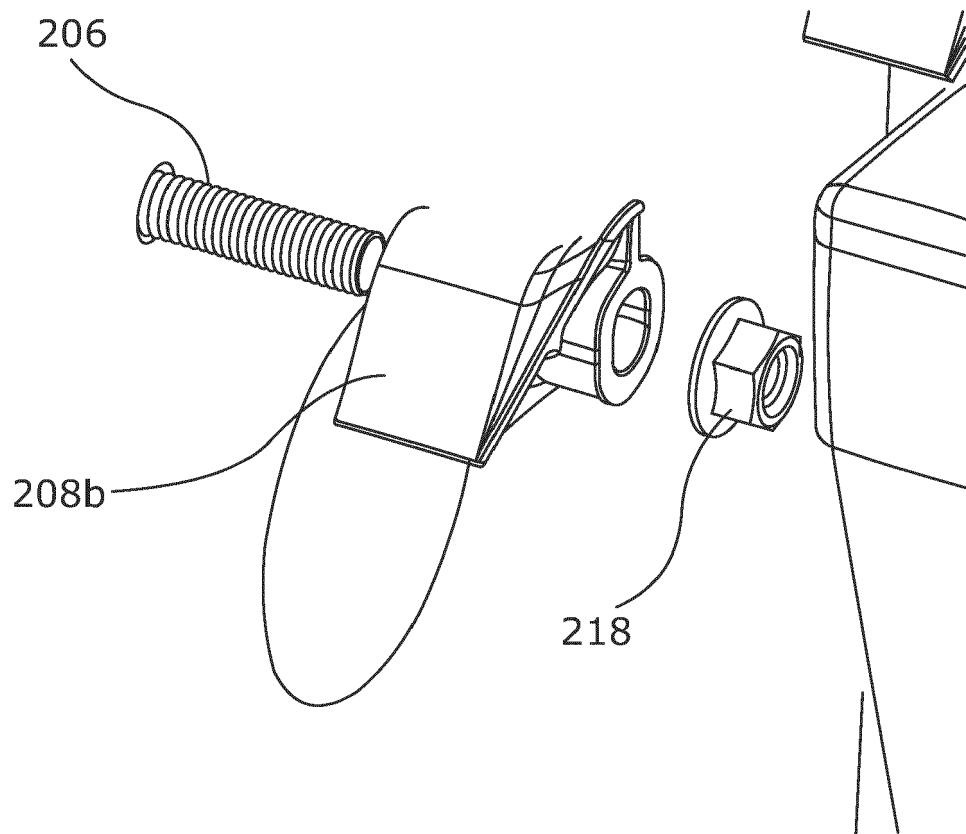


Figure 3c

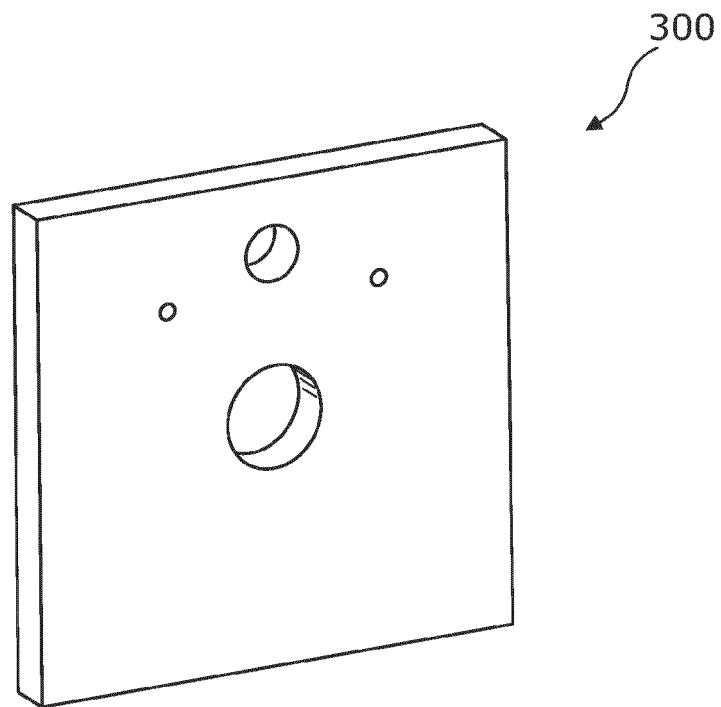


Figure 4a

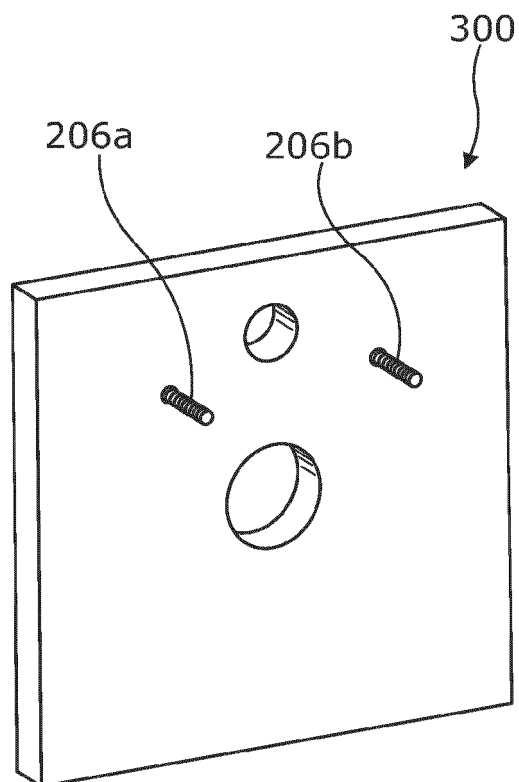


Figure 4b

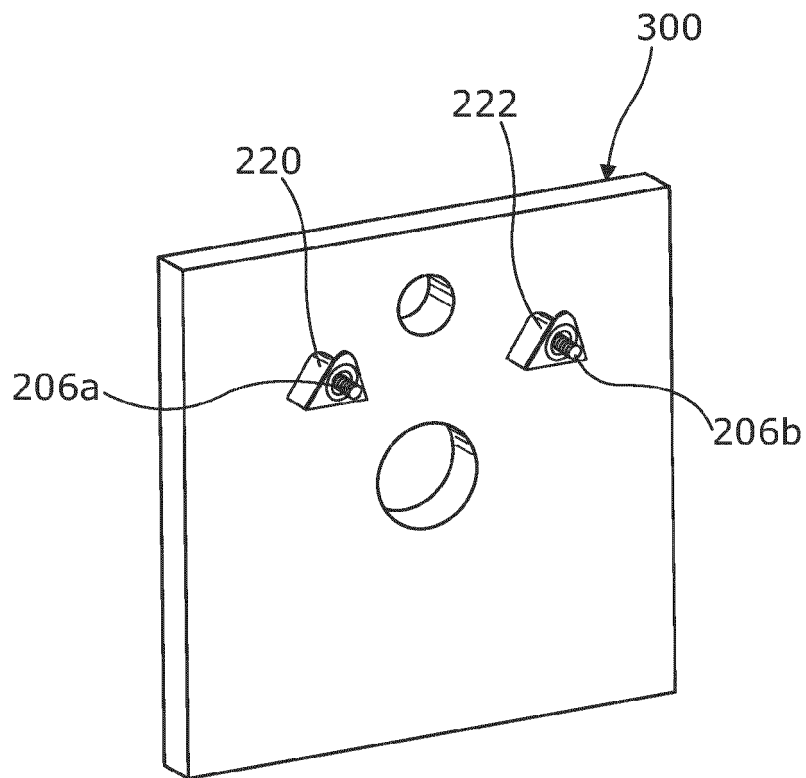


Figure 4c

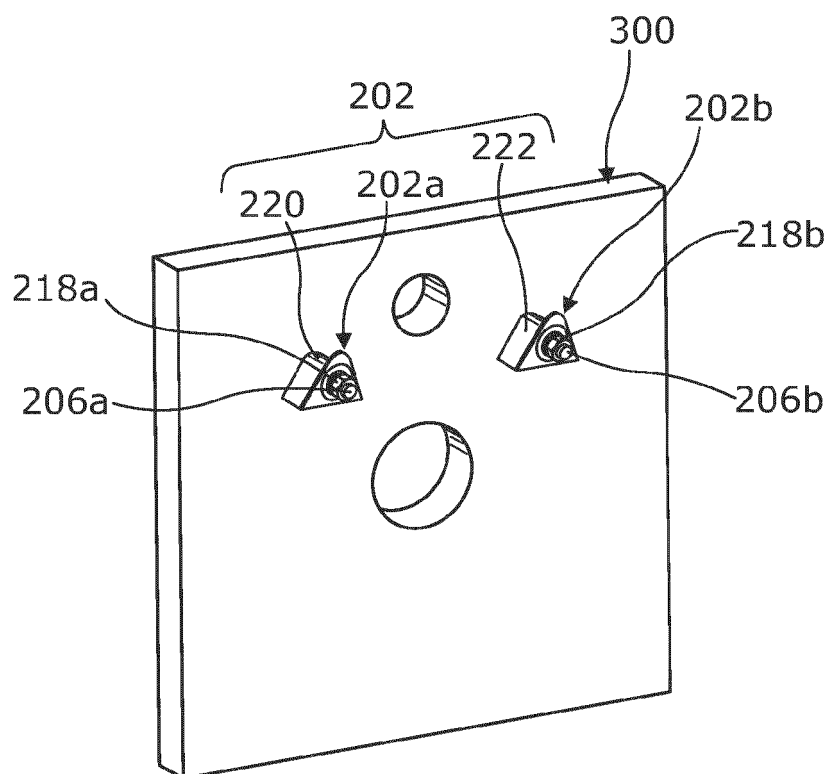


Figure 4d

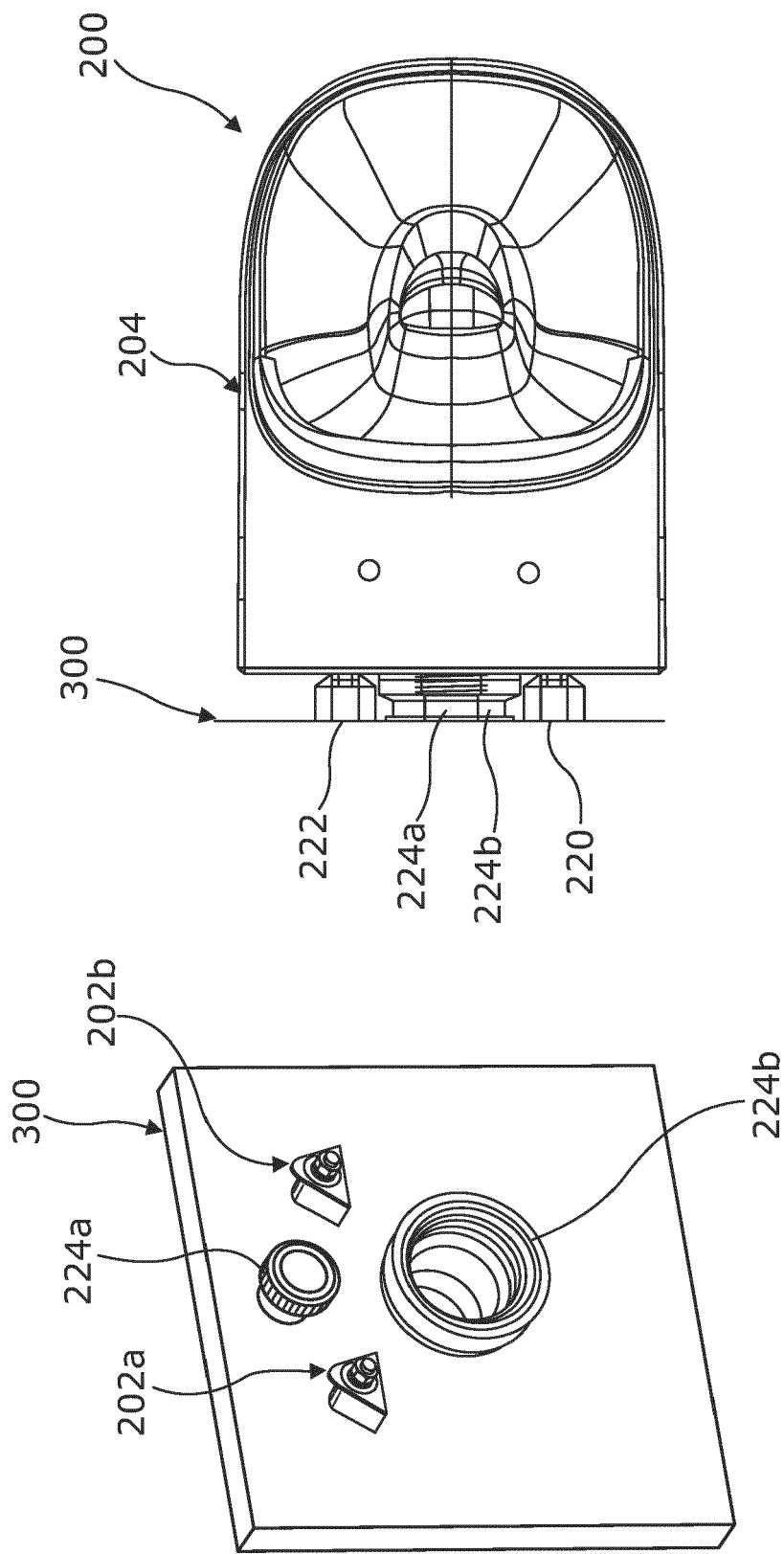


Figure 4f

Figure 4e

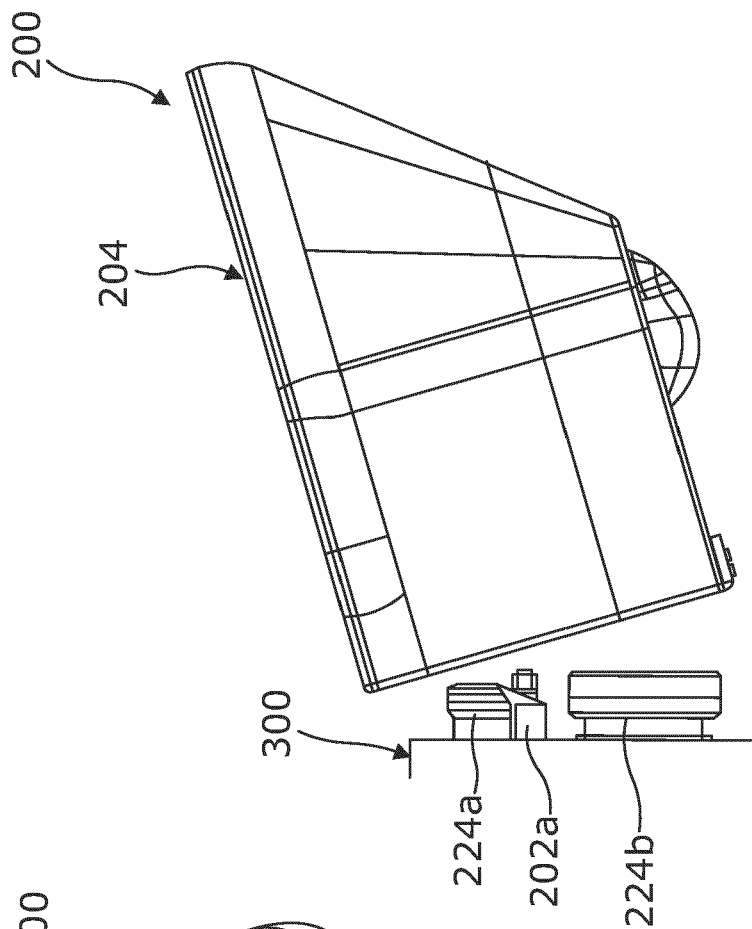


Figure 4h

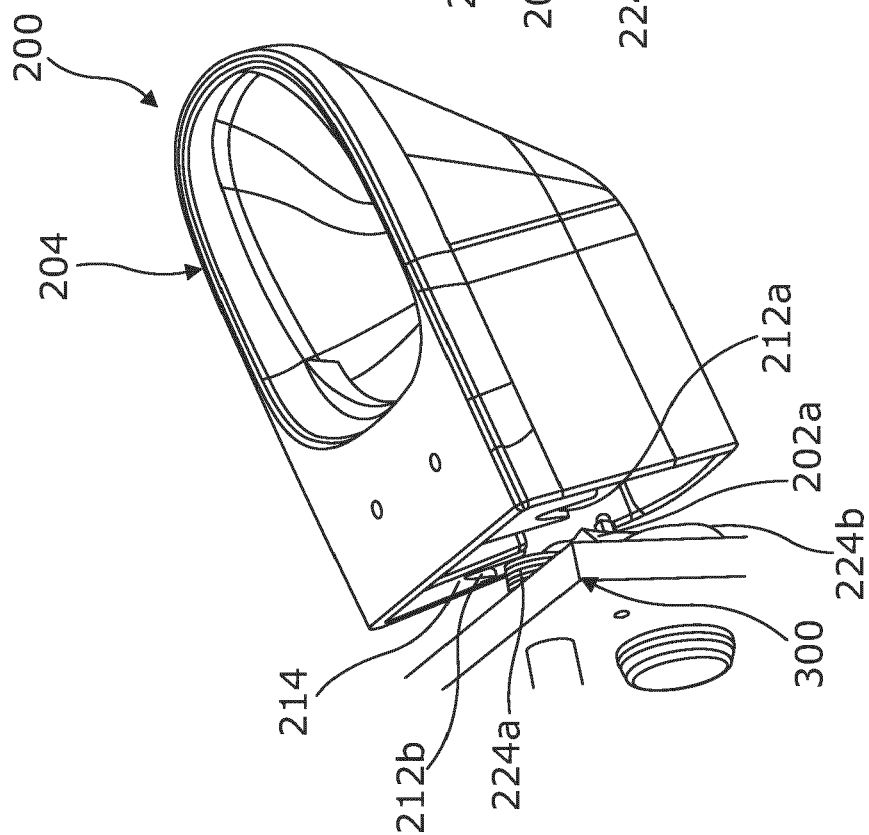


Figure 4g

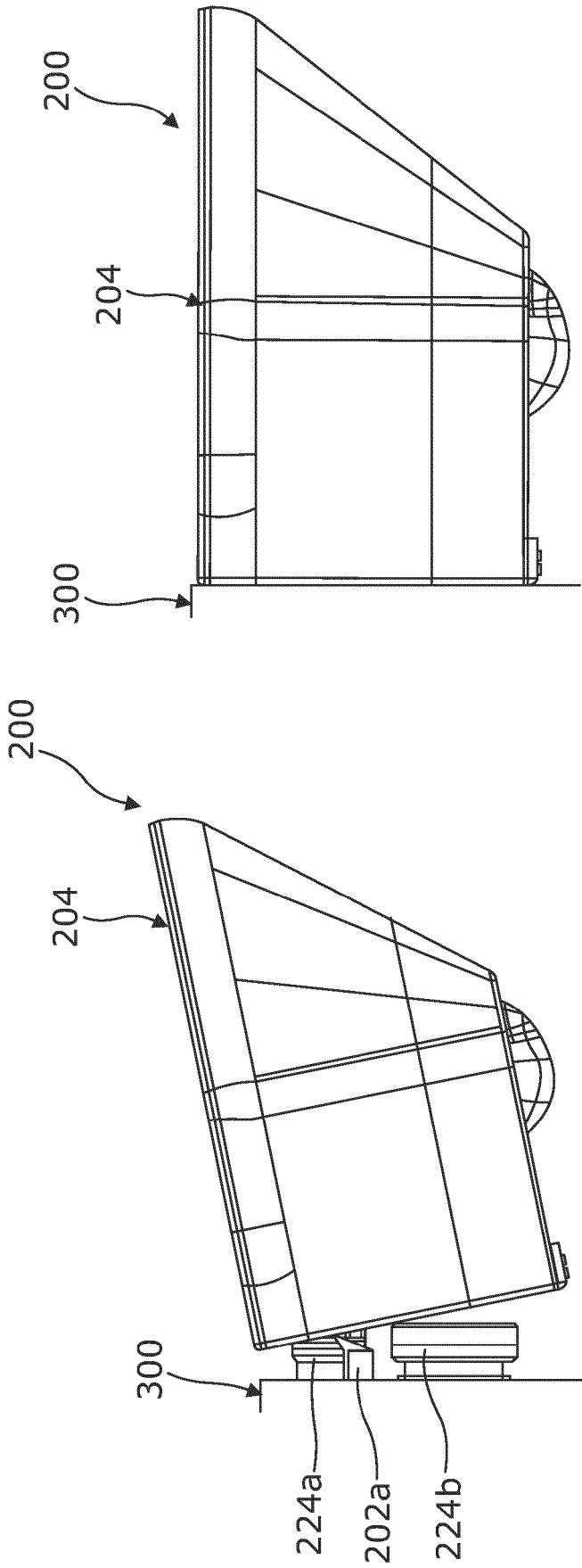


Figure 4j

Figure 4i



EUROPEAN SEARCH REPORT

Application Number

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

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