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(54) **SMART TOILET WITH MULTI SENSING ELECTRIC FIELDS**

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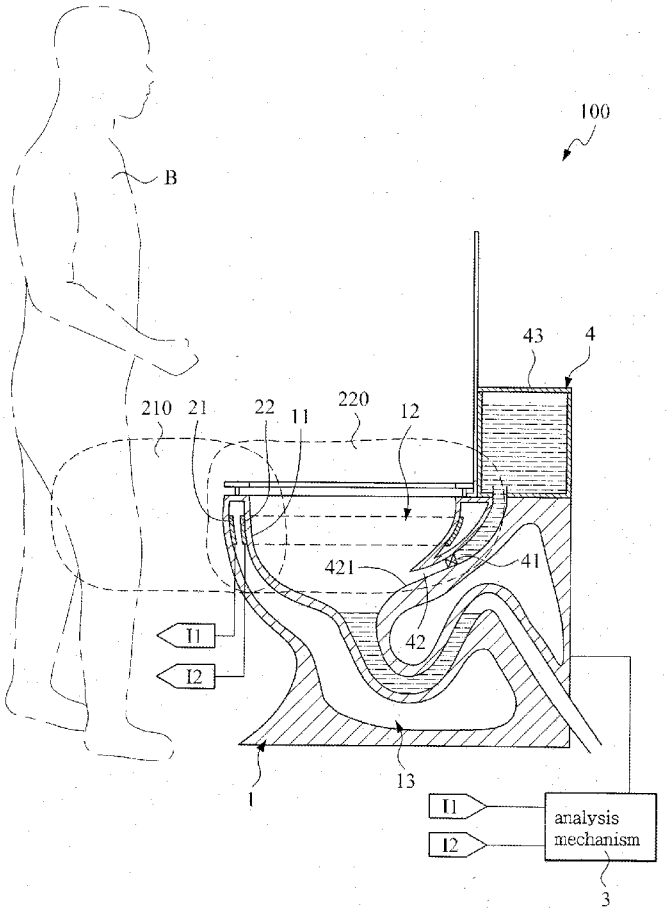
(57) **ABSTRACT**

A smart toilet with multi sensing fields comprises a toilet body, two or more proximity capacitive sensing electric field means and a flushing control unit. A toilet body, comprising a bowl face which forms a bowl area, and a and a cavity arranged inside the toilet body. The two or more proximity capacitive sensing electric field means, which are arranged in the cavity; an proximity capacitive sensing electric field is formed around the proximity capacitive sensing electric field means; said proximity capacitive sensing electric field means individually generate proximity capacitive sensing information according to a change of the electric field energy caused by the proximity capacitive sensing electric field corresponding to a sensed object. The flushing control unit, which receives the proximity capacitive sensing information, and controls the bowl area flushing according to one or more logic operation results in the received proximity capacitive sensing information.



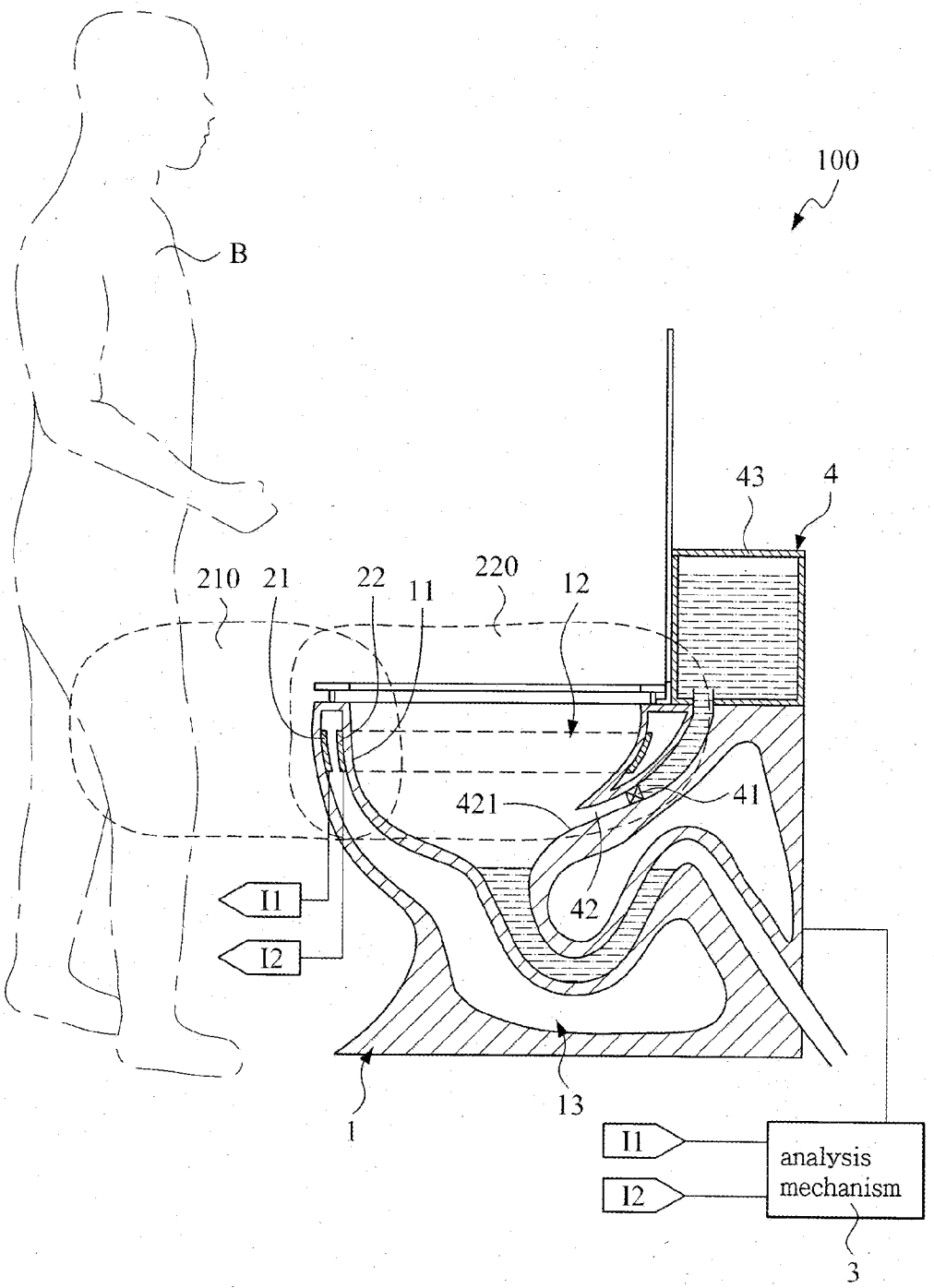

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Fig. 1

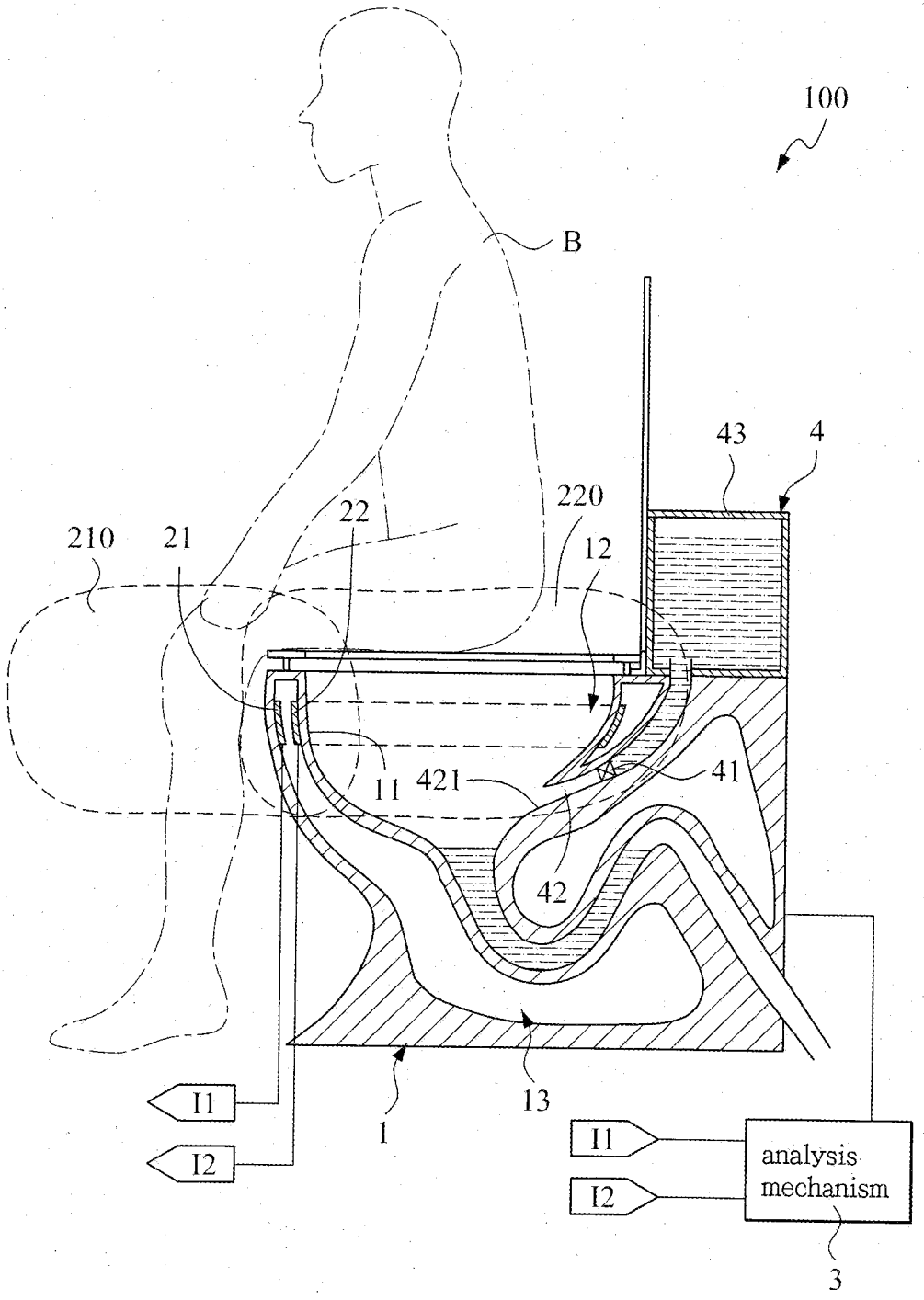
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Fig. 2

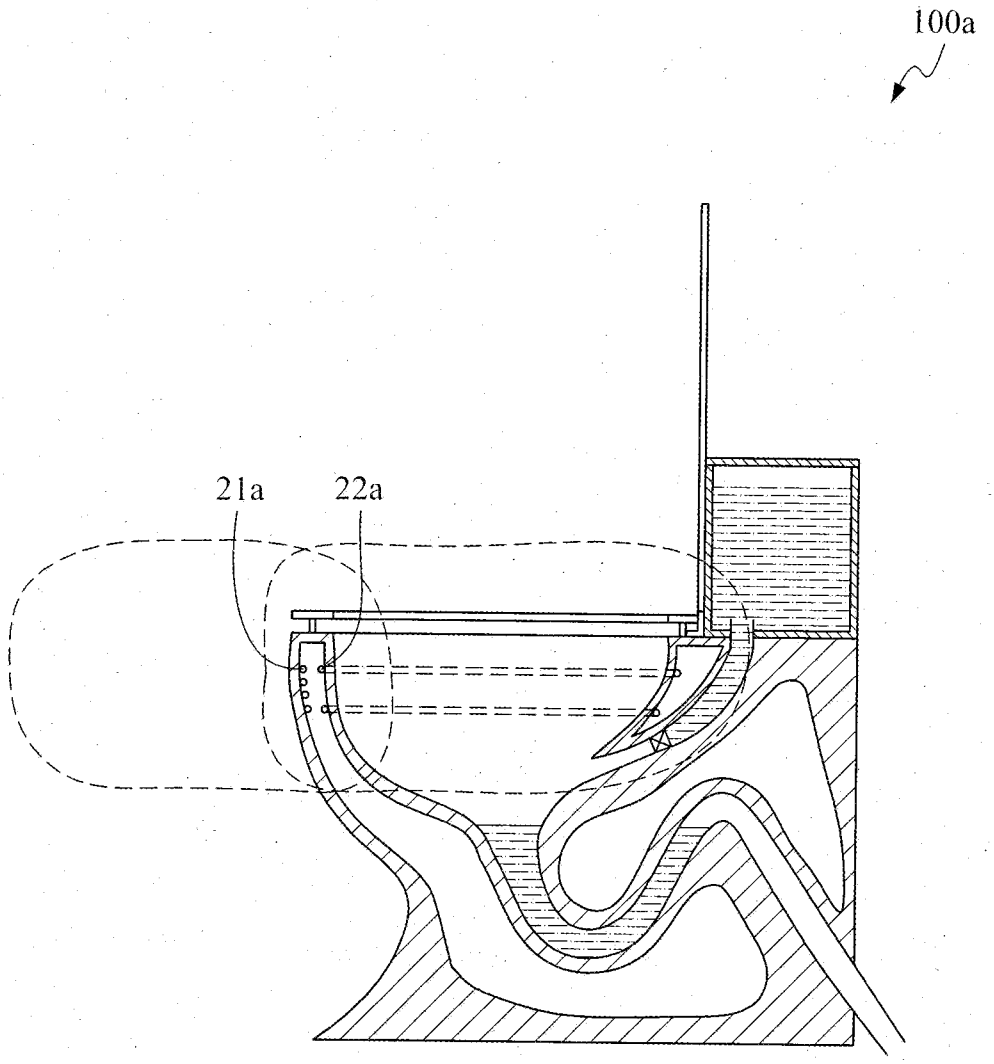

Fig. 3

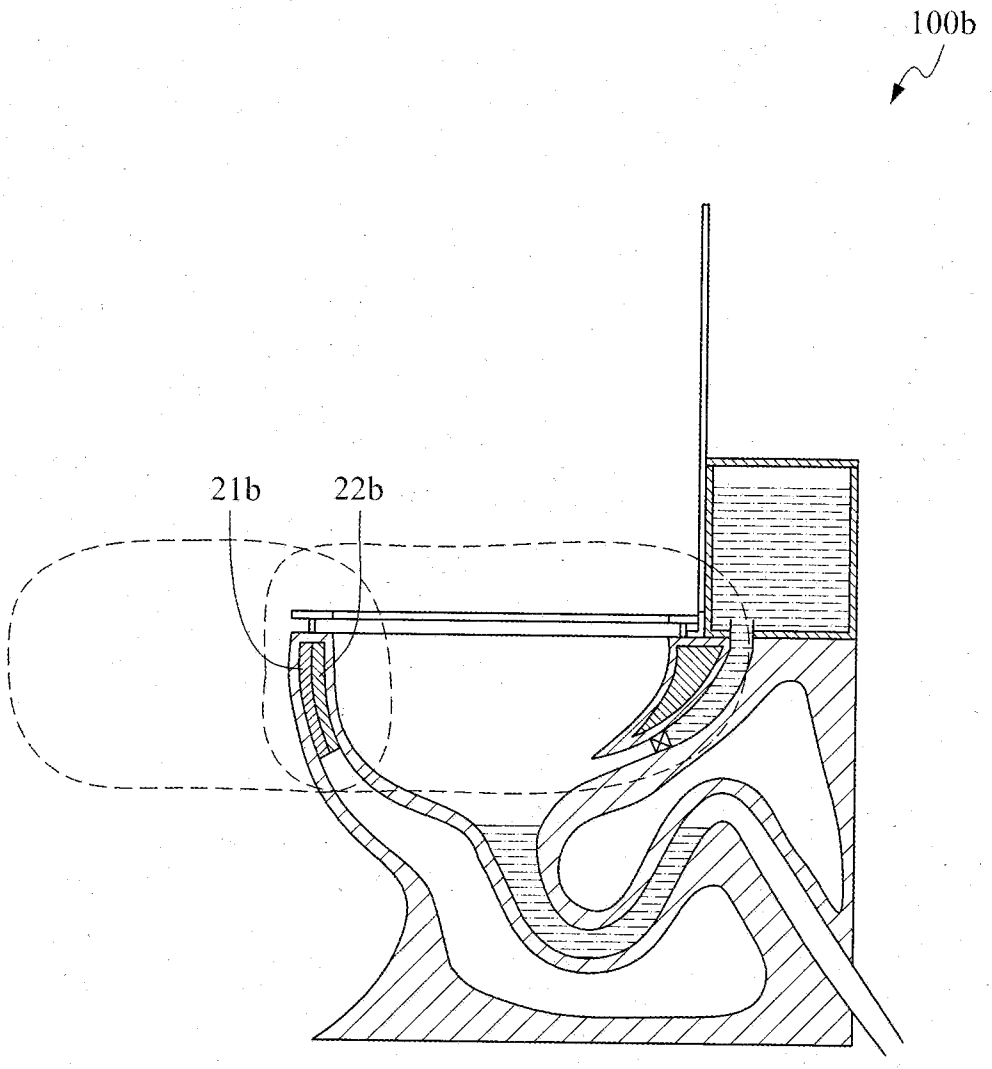

Fig. 4

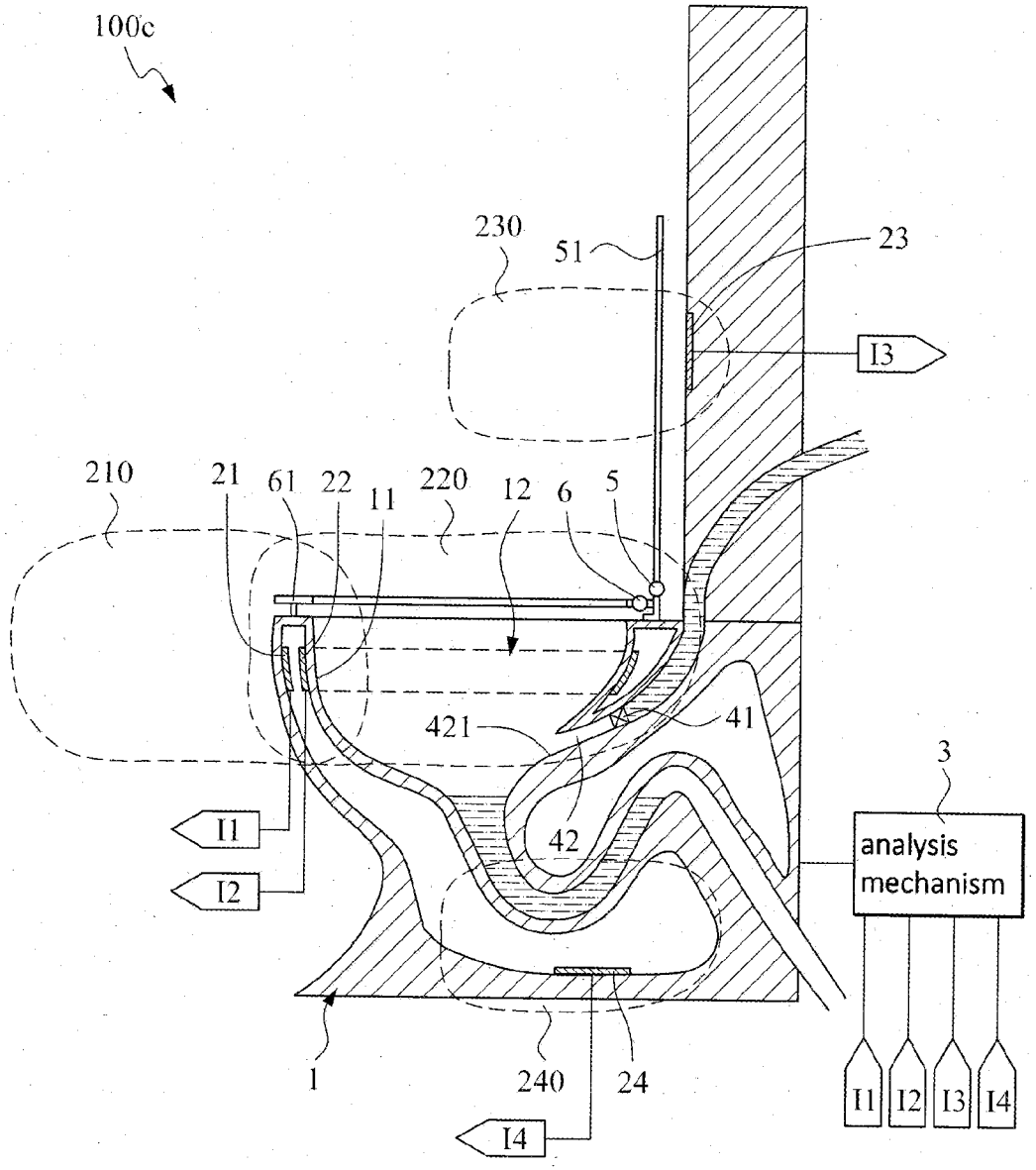
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Fig. 5

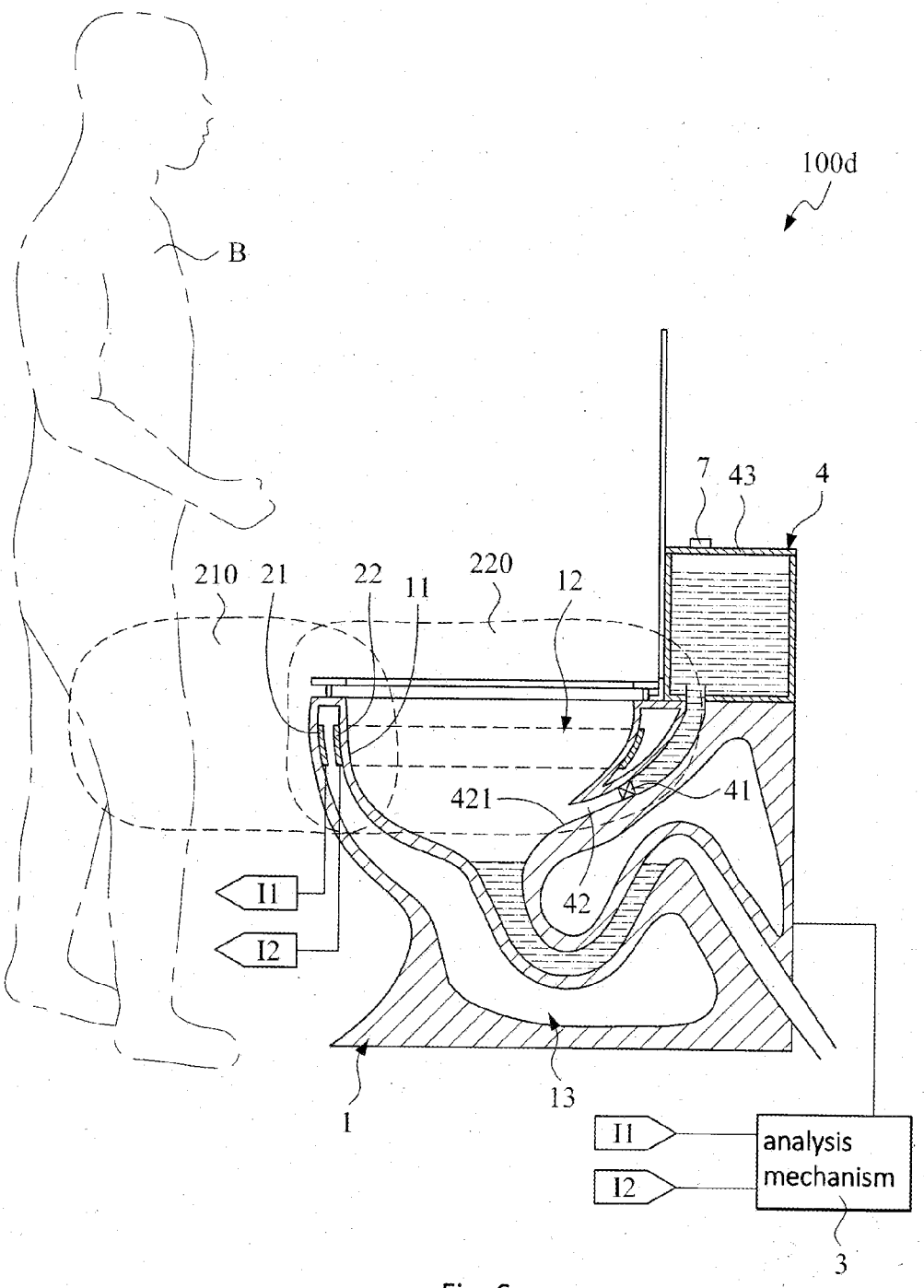
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Fig. 6

SMART TOILET WITH MULTI SENSING ELECTRIC FIELDS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates generally to a toilet, more particularly to a smart toilet which has multi sensing electric fields.

[0003] 2. Description of Related Art

[0004] In order to improve environmental sanitation and life quality, people continuously improve toilets, ranging from squatting pots, pedestal pans to modern smart toilets. The smart toilets provide not only filth flushing function but also various convenient and comfortable functions for users. For example, automatic cover lifting, automatic cushion lifting and automatic water amount adjustment. Theses functions enable users to use toilets without any touch, so as to prevent bacteria infection.

[0005] To achieve the above functions, the smart toilets should be equipped with infrared ray sensors for sensing to make actions. In sensing by the infrared ray sensors, any obstacle is not allowed between the transmitting terminal and the sensing terminal, and thus the transmitting terminal must be installed on the exposed toilet body instead of the inside. For example, a hole is drilled on the toilet to install transmitting terminal or an additional sensor is installed adjacent to the toilets for sensing.

SUMMARY OF THE INVENTION

[0006] However, in the invention the infrared ray sensor will be installed on the toilet body. The sensor will be exposed to wet environment of the washroom and affected by damp, and even electric leakage may occur. Next, any obstacle between the transmitting end of the infrared ray sensors and the induced object shall be eliminated in setting of the sensor, or the misjudgment may occur. The temperate sensing infrared ray may have misjudgment or missing judgment if the temperature of object (shell temperature) changes.

[0007] Thus, this invention intends to provide a smart toilets with multi sensing electric fields to solve the problems.

[0008] The technical problem to be solved by the utility model is to overcome defects of the prior art, which provide a smart toilet with multi sensing fields comprises a toilet body, comprising a bowl face which forms a bowl area, and a cavity arranged inside the toilet body; two or more proximity capacitive sensing electric field means, which are arranged in the cavity; an proximity capacitive sensing electric field is formed around the proximity capacitive sensing electric field means; said proximity capacitive sensing electric field means individually generate proximity capacitive sensing information according to a change of the electric field energy caused by the proximity capacitive sensing electric field corresponding to a sensed object; and a flushing control unit, which receives the proximity capacitive sensing information, and controls the bowl area flushing according to one or more logic operation results in the received proximity capacitive sensing information, wherein the flushing control unit controls flushing timing, flushing duration, and/or flush water amount.

[0009] A preferred embodiment in the present invention, wherein the proximity capacitive sensing electric field means is a line, a plane or a body sensing unit.

[0010] A preferred embodiment in the present invention, wherein the proximity capacitive sensing electric field means are disposed corresponding to the bowl face, front side, back side and/or bottom of the toilet body.

[0011] A preferred embodiment in the present invention, wherein the proximity capacitive sensing information includes size, position, motion direction/speed of the sensed object.

[0012] A preferred embodiment in the present invention, wherein the proximity capacitive sensing electric fields have different sensitivity.

[0013] A preferred embodiment in the present invention, wherein the flushing control unit comprises a solenoid valve and a flushing pipe; the solenoid valve is arranged on the flushing pipe, and an outlet of the flushing pipe is disposed on the bowl face.

[0014] A preferred embodiment in the present invention, wherein the proximity capacitive sensing electric field covers space at the upper side of the bowl area of the toilet body.

[0015] A preferred embodiment in the present invention, wherein the proximity capacitive sensing electric field covers space at the front side of the toilet body.

[0016] A preferred embodiment in the present invention, a manual valve is further provided therewith to control flushing via hand.

[0017] By adopting the above improvement of the technical scheme, the proximity capacitive sensing electric field means don't need to be exposed in the wet environment, so as to increase longer lifespan and avoid the risk of electric leakage, and also maintain the appearance of the toilet instead of change of the toilet structure for installing the proximity capacitive sensing electric field means. The sensing accuracy also doesn't be affected by the object blocked. Moreover, by adopting installation of a plurality of proximity capacitive sensing electric field means, the toilet will facilitate complicated action judgment and directly finish the flush timing, flush duration, the flush water amount or the operation of toilet instead of the control by user's hands, the invention not only has advantage of good sanitation, but also improve the convenience of the toilet.

[0018] The invention will now be described in connection with certain preferred embodiments with reference to the following illustrative figures so that it may be more fully understood.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. **1** is one of sectional schematic view showing the first preferred embodiment of the present invention.

[0020] FIG. **2** is another of sectional view showing the first preferred embodiment of the present invention.

[0021] FIG. **3** is a sectional schematic view showing the second preferred embodiment of the present invention.

[0022] FIG. **4** is a sectional schematic view showing the third preferred embodiment of the present invention.

[0023] FIG. **5** is a sectional schematic view showing the fourth preferred embodiment of the present invention.

[0024] FIG. **6** is a sectional schematic view showing the fifth preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0025] With reference to FIGS. **1** and **2**, in the embodiment the smart toilet (**100**) with multi-sensing electric fields comprises a toilet body (**1**), three proximity capacitive sensing electric field means (**21**), (**22**) and (**23**), an analysis mechanism (**3**) and a flushing control unit (**4**).

[0026] The toilet body (**1**) is made of insulation material (such as ceramics), comprising a bowl face (**1**) which forms a bowl area (**12**), and a cavity (**13**) arranged inside the toilet body (**1**).

[0027] The proximity capacitive sensing electric field means (**21**) and (**22**) can from the proximity capacitive sensing electric fields around themselves. The proximity capacitive sensing electric field has different effective sensing range according to the energy intensity. It covers a space (15 cm) in a main direction. The proximity capacitive sensing electric field means (**21**) and (**22**) are installed in the cavity (**13**). The proximity capacitive sensing electric fields (**210**) and (**220**) are formed around the proximity capacitive sensing electric field means (**21**) and (**22**). The proximity capacitive sensing electric field means (**21**) and (**22**) can generate proximity capacitive sensing information (**11**) and (**12**) according to field energy change of the sensed object B which the sensing electric fields (**210**) and (**220**) correspond to. The proximity capacitive sensing information includes size, position and motion direction/speed of the sensed object B. In the embodiment, the proximity capacitive sensing electric field means (**21**) and (**22**) are means for sensing plane. However, this invention is not only limited to this but in other embodiments, as shown in FIG. **3** the smart toilet (**100***a*) with multi sensing electric fields, the proximity capacitive sensing electric field means (**21***a*) and (**22***a*) are line sensing means, winding the cavity (**13**), or as shown in FIG. **4** smart toilet (**100***b*) with multi sensing fields, the electric field proximity capacitive sensing means (**21***b*) and (**22***b*) are body sensing means filled in the cavity (**13**).

[0028] For example, in the embodiment herein, the proximity capacitive sensing electric field means (**21**) is located at front side of the toilet body (**1**) in front of which the proximity capacitive sensing electric field (**210**) is formed (within 15 cm) to sense proximity of the sensed object B (such as foot). Another proximity capacitive sensing field means (**22**) is located on the bowl face (**11**) of the toilet body (**1**), and the proximity capacitive sensing electric field (**220**) is formed on the upper side of the bowl area (**12**) (approximately 15 cm) to sense proximity of the sensed object B (hip). When the sensed object B is close to 15 cm of front side of toilet body (**1**), energy of the proximity capacitive sensing electric field (**210**) also changes, and the electric field proximity capacitive sensing means (**21**) generates proximity capacitive sensing information (**11**). Likewise, when the sensed object B is close to upper side of the bowl area (**12**) of the toilet body (**1**), energy of the proximity capacitive sensing electric field (**220**) also changes, and the proximity capacitive sensing electric field component (**22**) generates proximity information (**12**). Next, the proximity capacitive sensing information (**11**) and (**12**) is transmitted to the analysis mechanism (**3**).

[0029] The analysis mechanism (**3**) will analyze size, position and motion direction and/or speed of the sensed object B after receipt of one or more pieces of proximity capacitive sensing information (**11**) and (**12**). Furthermore, it transmits the control signal to the flushing control unit according to the logic operation results.

[0030] The flushing control unit (**4**) electrically connects the analysis mechanism (**3**) to control flushing, time and/or flushing water amount. The flushing control unit comprises a solenoid valve (**41**), a flushing pipe (**42**) and a water tank (**43**). The solenoid valve (**41**) is installed in the flushing pipe (**42**), and an outlet (**421**) of the flushing pipe (**42**) is located on top of the bowl surface, and the other outlet connects the water tank (**43**). The flush control mechanism (**4**) controls startup and shutdown of solenoid valve (**41**) and time length according to the received control signals, so as to control flushing, flushing time and/or flushing water amount.

[0031] As shown in FIG. **1** energy of proximity capacitive sensing field (**210**) of the proximity capacitive sensing electric field means (**21**) is affected and changes when the sensed object B stands at the front side of the toilet body (**1**). The proximity capacitive sensing electric field means (**21**) generates information (**11**) and transmits the information to the analysis mechanism (**3**). In terms of the information, the analysis mechanism (**3**) can analyze the sensed object B pee standing, and decide flushing time according to the time of the sensed object B standing before the toilet body (**1**).

[0032] As shown in FIG. **2**, energy of the electric fields (**210**) and (**220**) may change with proximity of humans (legs and hip) when the sensed object B sits on the toilet body (**1**). The two electric field sensing means (**21**) and (**22**) may generate the proximity capacitive sensing information (**11**) and (**12**), and transmits them to the analysis mechanism (**3**). In terms of the information, the analysis mechanism (**3**) analyzes the sensed object B sit on the toilet body (**1**), and decides the flushing time according to the time of sensed object B sitting on the toilet body (**1**). For example, the flushing time and/or flushing water is more when the time of sitting on the toilet body (**1**) is longer.

[0033] With reference to FIG. **5**, this invented smart toilet (**100***c*) with multi sensing electric fields has no water tank. In this embodiment, the smart toilet (**100***c*) with multi sensing electric fields can decide flushing water amount, i.e. flushing time by control of opening time of the solenoid valve (**41**). Thus, additional water tank is not used to fix flushing water amount each time. Besides saving cost water tank box, the control is more convenient and accurate. As compared to the above embodiment, the smart toilet (**100***c*) with multi electric fields has no water tank, but comprises two proximity capacitive sensing electric field means (**23**), (**24**). The proximity capacitive sensing electric field means (**23**) is disposed on the backrest of the toilet body (**1**), and a sensing electric field (**230**) is formed in front of the back wall of the toilet body (**1**). The analysis mechanism (**3**) may produce sensing information (**13**) of various gestures such as waving to the right, waving to the left, upwards swing or downwards swing when the sensed object B is close to the sensing electric field (**230**), and transmits the signals to the flush control mechanism **4**, or the toilet cover mechanism (**5**) and a saddle mechanism (**6**) to controls toilet cover (**51**) or saddle (**61**). The proximity capacitive sensing electric field means (**24**) is disposed on the downside of the toilet body (**1**), and the electric field (**240**) is formed on the downside of the toilet body (**1**). It can be used to sense energy change of the toilet body (**1**), such as energy change caused by environment humidity or vibration. The environment proximity capacitive sensing information (**14**) of the proximity capacitive sensing electric field means (**24**) can be used for error compensation of other electric fields of proximity capacitive sensing to eliminate misjudgment of environment energy field change. In addition, different sensitivity is set for the electric fields of proximity capacitive sensing when range covered by proximity capacitive sensing electric field means is overlapped to prevent misjudgment caused by mutual interference of the electric fields, so as to increase sensitivity.

[0034] In the embodiment of FIG. **6** the invented smart toilet (**100***b*) with multi sensing fields comprises a manual

valve (**7**). The manual valve (**7**) is connected with the solenoid valve (**41**) to control startup and shutdown of the solenoid valve (**41**). In the embodiment herein the hand switch (**7**) is a button. This invention is not only limited to this but also other embodiments, the hand switch can be a pedal, or mechanical, electronic or inductive or remote controlled. The manual valve (**7**) enables users to operate hand switch (**7**) (in case of failure or misjudgment) if necessary, and flushing can be controlled via startup and shutdown of solenoid valve (**41**). Besides, in the embodiment, the smart toilet (**100***d*) with multi sensing fields is one-way configuration, and two-way configuration can be also used (the flushing is controlled by manual valve with switch valve) (not illustrated).

I claim:

1. A smart toilet with multi sensing fields comprises:

a toilet body, comprising a bowl face which forms a bowl area, and a cavity arranged inside the toilet body;

two or more proximity capacitive sensing electric field means, which are arranged in the cavity; an proximity capacitive sensing electric field is formed around the proximity capacitive sensing electric field means; said proximity capacitive sensing electric field means individually generate proximity capacitive sensing information according to a change of the electric field caused by the proximity capacitive sensing electric field means corresponding to a sensed object; and

a flushing control unit, which receives the proximity capacitive sensing information, and controls the bowl area flushing according to one or more logic operation results in the received proximity capacitive sensing information, wherein the flushing control unit controls flushing timing, flushing duration, and/or flush water amount.

2. The structure defined in claim **1**, wherein the proximity capacitive sensing electric field element is a line, a plane or a body sensing element.

3. The structure defined in claim **1**, wherein the proximity capacitive sensing electric field means are disposed corresponding to the bowl face, front side, back side and/or bottom of the toilet body.

4. The structure defined in claim **1**, wherein the proximity capacitive sensing information includes size, position, motion direction/speed of the sensed object.

5. The structure defined in claim **1**, wherein the proximity capacitive sensing electric fields have different sensitivity.

6. The structure defined in claim **1**, wherein the flushing control unit comprises a solenoid valve and a flushing pipe; the solenoid valve is arranged on the flushing pipe, and an outlet of the flushing pipe is disposed on the bowl face.

7. The structure defined in claim **1**, wherein the proximity capacitive sensing electric field covers space at the upper side of the bowl area of the toilet body.

8. The structure defined in claim **1**, wherein the proximity capacitive sensing electric field covers space at the front side of the toilet body.

9. The structure defined in claim **1**, a manual valve is further provided therewith to control flushing via hand.

* * * * *