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(54) **Apparatus and method for identifying a person using a toilet bowl and for effecting a flush**

(57) The invention relates to an apparatus monitoring the position of a person using a toilet bowl, and to a corresponding method. The location of an occupant in a toilet facility is determined by one or more sensors and the received information is used as a basis for activating a predetermined automated flush after a desired delay time.

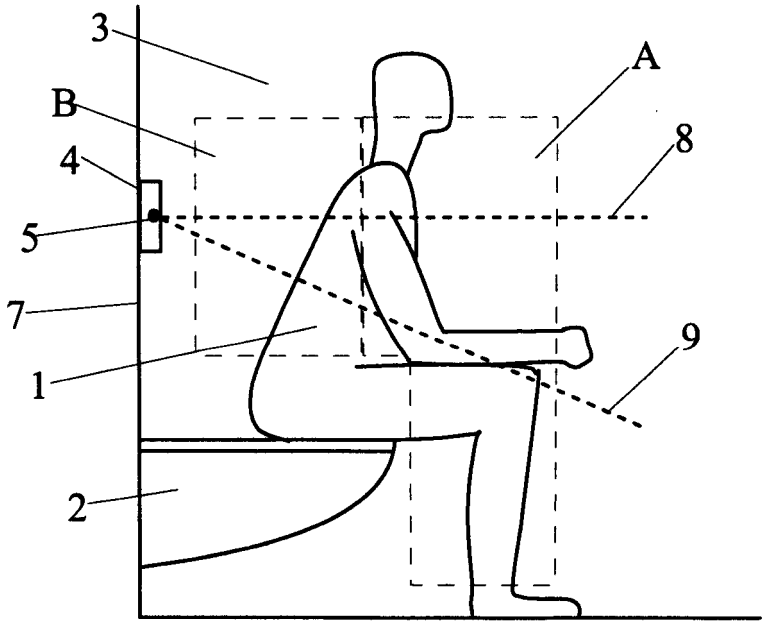

Fig. 2

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Description

[0001] The invention concerns a toilet bowl. More specifically, the invention relates to an apparatus which identifies the position of a person using the toilet bowl and effects a flush, as well as to a corresponding method.

[0002] An important objective in terms of environmental protection is to reduce the amount of produced sewage. This objective has also financial effects on the economy of individual people in the form of reduced fees. Especially in regions with a limited supply of water, the possibility of controlling the amount of flushing will be highly beneficial.

[0003] It is prior known to provide a toilet bowl with two options for manual flushing, the occupant having a choice of using a small or a large amount of water in flushing. This option can be implemented for example by means of a pull knob, which is pulled half-way or all the way up for a so-called minor/major flush. The same option can be implemented by means of a centrally articulated rocker arm, the decision to use either free end of the rocker arm effecting either a minor or a major flush.

[0004] On the other hand, prior known are also urinal flushing systems, in which the flush occurs automatically as a person approaches the urinal. The identification of an occupant is effected for example by a photocell. The occupant steps in front of the photocell and breaks the light signal. The flush can be set to begin either as the light signal breaks or as the light signal arrives again in a receiver, whereby the automated flushing can be adapted to occur either when the occupant arrives in front of or steps away from the urinal.

[0005] The amount of water consumed by such foregoing prior art systems and equipment can be adjusted to a given level, whereafter the flushing takes place always with the same amount of water.

[0006] An apparatus and method according to the invention enable automatically proceeding identification of a sitting or standing occupant and regulation of the consumed amount of water according to the nature of an occupant's visit.

[0007] Regarding benefits of the invention, there is achieved a hygienic non-contacting flushing action, at the same time enabling a control over the amount of flushing for the conservation of water.

[0008] Another advantage of the invention is an automated flush taking place after every visit, ensuring that the toilet bowl has always become flushed after the previous visitor.

[0009] The invention will now be described more specifically by way of examples with reference to the drawings, in which

fig. 1 shows one preferred embodiment of an identification system in a lateral view,

fig. 2 shows another preferred embodiment of an identification system in a lateral view,

fig. 3 shows one preferred embodiment of an identification system in an overhead view,

fig. 4 shows a contact-based system in a toilet bowl rim for identifying an occupant, and

fig. 5 shows a simplified diagram for a method of providing a non-contacting flush.

[0010] Referring to fig. 1, there is shown one preferred embodiment of an identification system and an identification method relevant thereto. The objective is to identify the activity of an occupant 1 in the proximity of a toilet bowl 2 and to apply the occupant's activity as a basis for distinguishing the occupants as sitting and standing occupants. On the basis of this information, it is possible to conduct a flush of the toilet bowl 2 with a required amount of water without the occupant's personal involvement in flushing, i.e. a non-contacting flush is provided. Thus, water can be conserved in a flushing process, a more hygienic activity is obtained in a toilet facility 3, and it is always ensured that the flushing has been conducted before the next visitor.

[0011] At the same time, this enables observing/counting the number of visits and, if necessary, a larger-scale flush can be effected for example every tenth visit. This facilitates minimizing the blocking of pipe systems. On the other hand, this also enables identifying toilet seats not visited for a long time and effecting a flush automatically without a visit by anyone. This procedure serves to prevent drying of the water trap and a pervasion of sewer gases into the toilet facility.

[0012] At its simplest, the identification can be conducted, as shown in fig. 1, with a single identification device 4, monitoring the toilet facility 3 with a single beam 6 emitted from a sensor 5. Instead of the beam 6 of fig. 1, it is plausible to employ other per se known identification devices/methods, monitoring the toilet facility 3 by various observation ranges which are conical or otherwise typical of transducers 5. Such identification devices/methods, feasible for use in the toilet facility 3, include for example various optical transducers and optical measuring systems and methods. Various feasible options will be described more specifically hereinafter. The identification device 4 can be mounted for example on a wall 7 above the toilet bowl 2 and, depending on the alignment, it can be just barely above the toilet bowl or as high as about 1 to 1,5 m thereabove. The identification device 4 can be embedded in the wall 7, as in fig. 1, or provided as a surface mounting. The alignment of the identification device's 4 sensor 5 depends on the height at which it has been mounted on the wall. In the event that the identification device 4 is installed in the very proximity of the toilet bowl 2, above the same at the height of about 0,5 m from a floor 8, as shown in fig. 1, it is preferred that the sensor 5 be aligned obliquely slightly upwards, whereby it identifies and is capable of distinguishing the sitting occupant 1 from a standing occupant. A horizon-

tally directed narrow beam 6 of the sensor 5 could propagate between the legs of a standing occupant and the occupant may not become identified at all. On the other hand, by providing the toilet facility 3 with a system which produces a more wide-range sensor beam, the result will be a system which functions also with a horizontal alignment of the sensor 5. For example, the employed IR beams have typically a width of about 5°, while some other transducers/sensors may have an identification beam width substantially more than that. The width of a beam can be also influenced by the choice of employed lenses/optical elements. The use of a narrow beam enables a better determination of the reflection's positional data without using the intensity of light (the intensity of light depends also on a material delivering the reflection and brings more uncertainty to the measurement).

[0013] The identification device 4 can also be located elsewhere in the toilet facility 3, not just on the same wall 7 as the toilet bowl 2. Various options can be implemented, depending on the size and shape of the toilet facility 3, for example by mounting the identification device 4 on a side wall, a back wall, or even on the ceiling. Thus, the identification device's 4 sensor 5 must be planned in terms of its alignment for providing as clear a distinction as possible between a standing and a sitting occupant.

[0014] After an identification effected by the identification device 4, a flush can be set to be launched by activating a flushing mechanism associated with a water tank by means of an actuator or flush activator after a desired delay time as the occupant has left/arrived in the monitoring range of the identification device's sensor 5. The water tank can be embedded inside a wall as a so-called concealed installation, whereby all devices can be hidden from the sight and the wall surface becomes smooth. The amount of flushing can be controlled to make a difference depending whether the occupant is sitting or standing.

[0015] In fig. 2, a toilet bowl 2 is depicted from the side. In front of the toilet bowl 2 is an area A, representing the space claimed by an occupant 1 in standing position while using the toilet. Above the toilet bowl 2 is depicted an area B, representing the space claimed by an occupant 1 in sitting position, in addition to the space A. That is, the space A is only used by a standing occupant 1 and the spaces A and B jointly are used by a sitting occupant. The areas A and B provide a better visualisation regarding the identification process of a sitting or standing occupant 1.

[0016] On the wall 7 above the toilet bowl 2 is an identification device for identifying an occupant in the proximity of the toilet bowl. In the embodiment of fig. 2, the identification device 4 is now mounted externally of the wall 7. In this embodiment, the identification device 4 is additionally set at a height of about 1 meter. The sensor 5 can be used for determining whether the occupant 1 is in a sitting position or in a standing position at the toilet bowl 2. Preferably, as shown in fig. 2, the identification device 4 is positioned behind the toilet bowl 2, but it can also be positioned at lateral distances from, in front of, or above (on the ceiling) a toilet bowl. Also, the identification implemented by several identification devices 4 and sensors can be conducted by setting up identification devices and sensors simultaneously in various parts of the toilet facility 3. It is preferred to employ a single identification device 4, in which the identification is conducted by a single sensor 5 in two directions (angles), for example by means of IR beams 8 and 9. Thus, the employed identification angles are for example 0° (horizontal) and obliquely downward about 28-35°. The horizontal beam 8 measures a distance/positional data and receives information about the distance of an occupant 1 in the area A or B relative to the sensor 5. The inclined beam 9 measures a distance/positional data across the area B In practice, the dimensions of occupants 1 of various sizes set the limits for the installation heights or directions of an identification device. When a short person 1 uses the toilet in a sitting position, the identification beam 8, if set at an excessive height, may pass over the person. On the other hand, even a tall person 1, in a forward or sideways bending position, may avoid the horizontal identification beam 8.

[0017] At its minimum, the positional identification can be conducted with a single beam, but in that case the received information may be unreliable and the flush action control of a toilet bowl 2 does not necessarily function in an optimal fashion. The best positional identification is naturally obtained by several sensors 5, disposed in various parts of the toilet facility. However, this increases the system costs considerably. The most favorable (functionally/economically) system reliable in operation is provided by a single sensor 5 fitted in one and the same identification device 4, transmitting two identification beams 8 and 9 which can be e.g. IR beams. The IR beams are capable of providing high precision identification and the method is energy and cost efficient in comparison with many other techniques. Thus, use is made of one sensor 5 which identifies in two different directions, for example horizontally and obliquely downward.

[0018] When the identification device 4 is placed elsewhere, not in connection with the water tank of a toilet bowl 2, the signal for activating a flush must be communicated by way of some known technique to the flushing mechanism. In order to make do with an apparatus as simple as possible, it is most favorable to place the identification device 4 in connection with the flushing mechanism and the water tank.

[0019] Identifying the position of an occupant 1 can be effected by using a wide variety of identification techniques, such as a photocell, a photo-electric trip device, an optical proximity switch, a laser scanner, a microwave transducer, an ultrasonic transducer, a capacitive transducer, an infrared detector or the like non-contacting transducer. When using several transducers/sensors 5, it is possible to intermingle transducers/sensors with different operating principles or to implement all transducers/sensors with one technology. It is further possible that a measuring process be conducted by various trans-

ducers/sensors in a variety of techniques. For example, in the case of optical transducers, it is possible to place an optical transmitter and receiver so as to face each other, to employ a V-reflection principle, or to use a radar principle which comprises measuring the propagation time of light and finding out the distance of an obstacle (person) from the transducer.

[0020] Fig. 3 illustrates an identification conducted by means of two photoelectric trip devices 10 and 11. The first photoelectric trip device 10 identifies an occupant positioned on top of a toilet bowl 2 (in the area B of fig. 2). The first and second photoelectric trip devices 10 and 11 may be set either at equal or unequal heights relative to each other. In addition, such devices need not be horizontally installed, but can also be set at a given arbitrary angle relative to the horizontal plane. For example, the first photoelectric trip device 10 can be set horizontally and the second photoelectric trip device 11 vertically.

[0021] The embodiments shown in figs. 1-3 have presented non-contacting identification methods and equipment for determining the position of an occupant 1. In addition to these methods and equipment, it is possible to employ for example a contact-based identification method according to fig. 4 for identifying a sitting occupant 1.

[0022] Fig. 4 shows in a cross-sectional view a rim 12 for the seat of a toilet bowl, consisting of a bottom element 13 and a top element 14, as well as for example of guide rods 15, which at the same time keep both elements connected to each other. Inside the rim 12 is installed a conduit 16 or the like, the light propagating therethrough from a transmitter to a receiver (not shown in the figure). As the occupant sits down on the toilet seat, the conduit 16 becomes at least partially compressed in a vacant space 17, the volume of light propagating therethrough diminishing and a positive identification of the sitting occupant is obtained. This method/apparatus can be combined for example with a standing occupant identification effected by some non-contacting identification method, thus providing an assembly operating by two different methods for carrying out an automated and non-contacting flush. The same way it is also possible to combine various non-contacting identification methods in one and the same facility for distinguishing a sitting and a standing occupant.

[0023] Fig. 5 shows in a simplified diagram a method for identifying an occupant and setting up a non-contacting flush. The position of an occupant 1 in the toilet facility is identified by an identification device 4. On the basis of received information, the identification device 4 transmits a message to an actuator 18 for activating a flush of the toilet bowl with a flushing mechanism 19 after a preset delay time.

Claims

1. An apparatus for providing a flush for a toilet bowl (2), comprising the toilet bowl (2), a water tank, a flushing mechanism, **characterized in that** the apparatus further comprises at least one identification device (4), including at least one sensor/transducer (5) for determining the location of an occupant (1) in a toilet facility (3) and means for conveying a message received from the sensor/transducer (5) to an actuator (18) which activates a flush of the toilet bowl.

2. An apparatus as set forth in claim 1, **characterized in that** the sensor/transducer (5) has one or more separate identification beams (6,10,11).

3. An apparatus as set forth in claim 1, **characterized in that** the apparatus includes two or more identification devices (4).

4. An apparatus as set forth in claim 1, **characterized in that** the identification device (4) is mounted on a wall (7) common with the toilet bowl (2).

5. An apparatus as set forth in claim 1, **characterized in that** the identification device (4) is mounted on a wall other than the toilet bowl (2).

6. An apparatus as set forth in claim 1, **characterized in that** the identification device (4) is mounted on a ceiling of the toilet facility (3).

7. An apparatus as set forth in claim 1, **characterized in that** the identification device (4) includes a non-contacting sensor/transducer (5).

8. An apparatus as set forth in claim 1, **characterized in that** the transducer/sensor (5) is a photocell, a photo-electric trip device, an optical proximity switch, a laser scanner, a microwave transducer, an ultrasonic transducer, a capacitive transducer, an infrared detector or the like non-contacting sensor/transducer (5).

9. An apparatus as set forth in claim 1, **characterized in that** the transducer (5) is an optical transducer responsive to pressing/touching, which is fitted inside a rim (14) of the toilet bowl.

10. An apparatus as set forth in claim 3, **characterized in that** the apparatus has its various identification devices (4) employing sensors/transducers (5) which are similar to each other.

11. An apparatus as set forth in claim 1, **characterized in that** the apparatus has its various identification devices (4) employing sensors/transducers (5) which are dissimilar to each other.

12. A method for providing a flush for a toilet bowl, **characterized in that** the method comprises the follow-

ing steps of:

a) adapting at least one identification device (4) to monitor a toilet facility (3) by means of one identification beam (6, 10, 11) of at least one sensor/transducer (5),
b) the identification device (4) determining the position of an occupant (1) in the toilet facility (3) by means of the sensor/transducer (5),
c) conveying a signal from the identification device (4) to an actuator (18),
d) using the actuator to activate a flushing mechanism (19), and
e) using the flushing mechanism (19) to effect a flush with a predetermined amount of water on the basis of the signal received from the identification device (4) and after a preset delay time.

13. A method as set forth in claim 12, **characterized in that** there are provided two or more identification devices (4) in the toilet facility (3).

14. A method as set forth in claim 12, **characterized in that** the sensor/transducer (5) monitors the toilet facility (3) with at least two separate identification beams (10, 11).

15. A method as set forth in claim 12, **characterized in that** the identification device makes use of non-contacting technology, such as a photocell, a photoelectric trip device, an optical proximity switch, a laser scanner, a microwave transducer, an ultrasonic transducer, a capacitive transducer, an infrared detector or the like non-contacting sensor/transducer (5).

16. A method as set forth in claim 13, **characterized in that** at least one of the identification devices (4) identifies a sitting occupant (1) with a contact sensor fitted in a rim (14) of a toilet bowl (2).

17. A method as set forth in claim 13, **characterized in that** the various identification devices (4) make use of the same technology.

18. A method as set forth in claim 16, **characterized in that** the various identification devices (4) make use of different technologies.

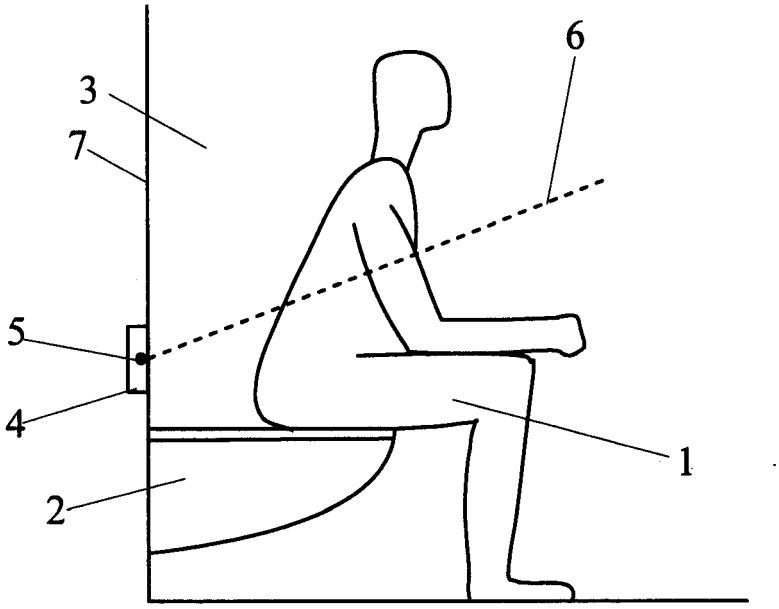

Fig. 1

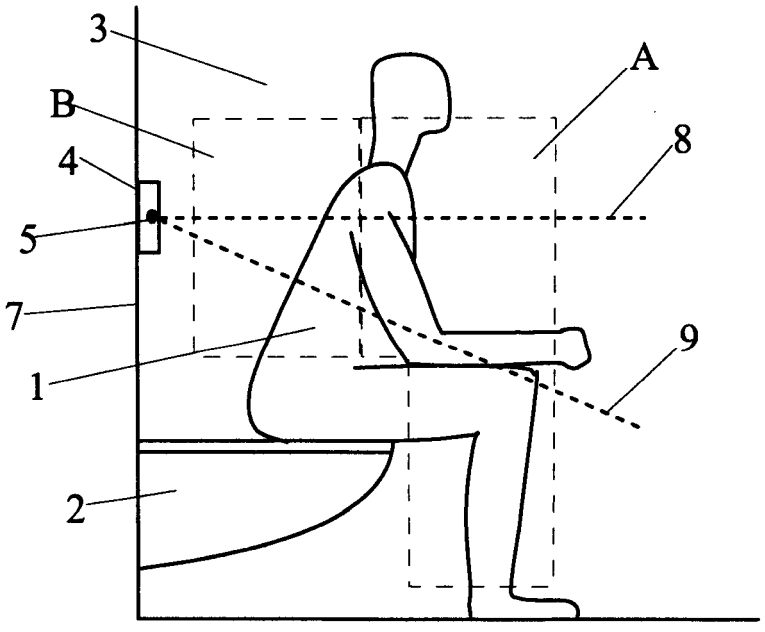

Fig. 2

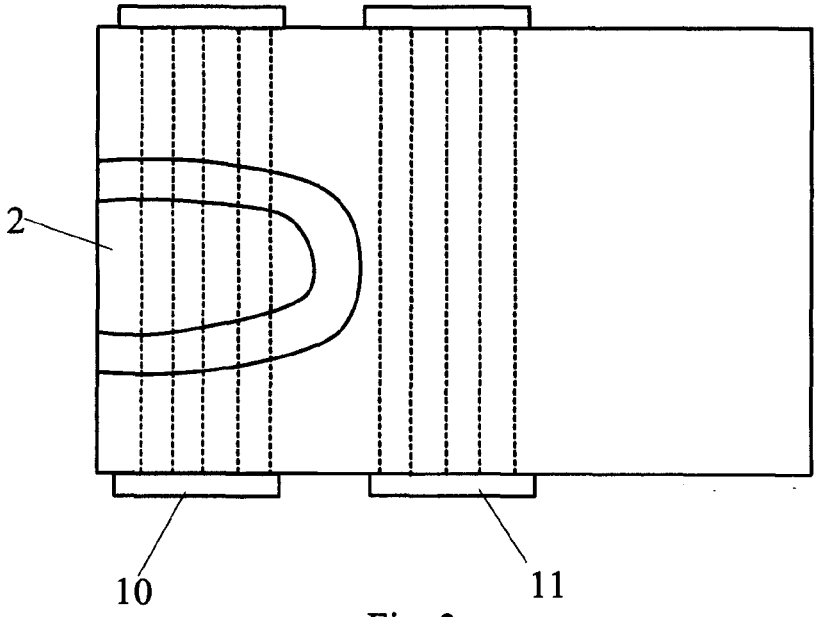

Fig. 3

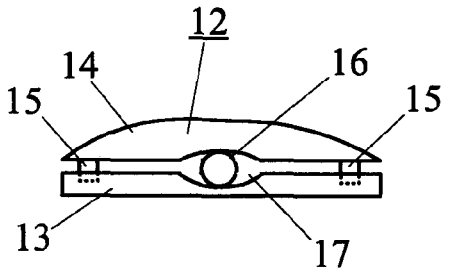

Fig. 4

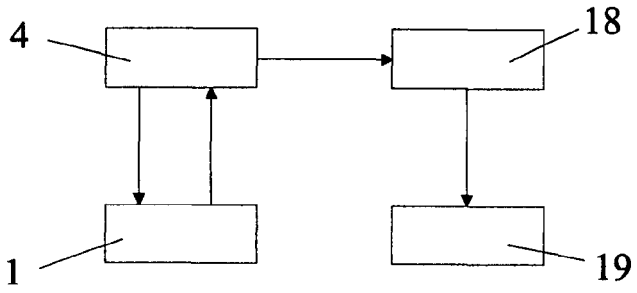

Fig. 5