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(54) Improvement regarding the flushing reliability of a urinal

(57) This invention relates to a method for maintaining the reliable operation of a sensor detecting a need for flushing a urinal (10). According to the invention, urine stone and/or other such dirt adhered over the area of the flushing-need detecting sensor within the liquid basin of the urinal (10) is removed by means of a vibrator

operating over this particular area. In a preferred case, the sensor comprises for example a piezoelectric crystal. In one embodiment of the invention, the sensor is adapted to vibrate by means of a piezoelectric crystal. In a second preferred embodiment, said piezoelectric crystal is set in the immediate vicinity of the sensor, thereby removing the dirt.

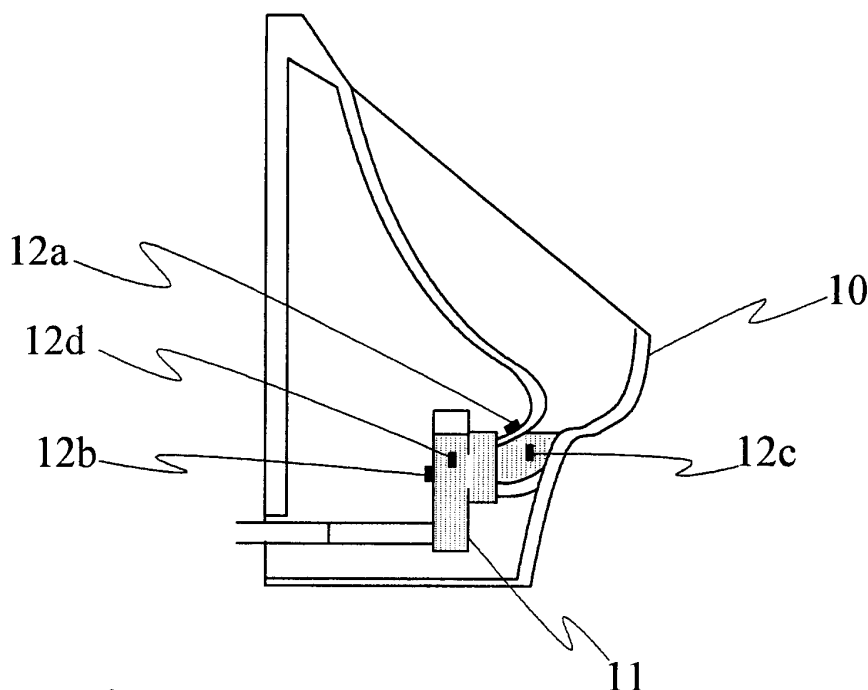


Fig. 1

Description

[0001] This invention relates to a method for improving the flushing reliability of a urinal, as well as to an arrangement applying the method for improving the flushing reliability of a urinal.

[0002] Several solutions have been disclosed for flushing urinals. Traditional solutions are based on mechanical equipment, such as faucets and press buttons, which can be turned or pressed to flush a urinal. A solution more sophisticated than the above involves automatic flushing of a urinal after use. Various sensors have been designed to implement automatic flushing, whereby the use of a urinal is identified and whereby a signal is produced for flushing the urinal. One of the first sensor types comprises photocells and radars capable of detecting the presence of a user to set off the flushing at a given time delay after the user has stepped in the way of a beam of light. Another available type of sensor comprises a sensor activated by urine arriving in a urinal. The sensors respond for example to the heat content of urine or to the change of electrical conductivity brought about by urine in the liquid present in a urinal. One requirement regarding the use of a sensor monitoring the urine-induced changes in electrical conductivity is that, in order to work properly, it must be placed inside the wall of a urinal within a body of liquid contained in the urinal or its water seal. Another possibility, particularly with sensors capable of detecting a temperature change, is that the sensor be positioned outside the wall of a urinal or its water seal. In solutions like this, it is possible that the wall thickness of a urinal or its water seal must be reduced for enhancing the sensitivity of a sensor.

[0003] One possible sensor design has been disclosed in the present Applicant's earlier patent publication FI-99265, describing a sensor which identifies a vibration caused by incoming urine in a urinal or in a liquid contained therein, the flushing being set off as a result thereof. Such a sensor can be positioned outside the wall of a urinal or its water seal. Optionally, the sensor can be placed in a liquid basin on the floor of a urinal or in the water seal.

[0004] Urine contains mostly water, but the actual ureal matter or urea contains various minerals, such as phosphates and recrements. In the cited publication, these matters are referred to as urine stone. Urine stone causes problems regarding the operation of the above-described automatic systems for flushing a urinal. Problems arise from the fact that such urine stone is prone to adhere to the internal surface of a urinal, as well as, respectively, to the internal surface of a water seal, thus affecting the operation of sensors mounted on the external surface of the urinal or water seal. Furthermore, in case the sensors are positioned inside a urinal or a water seal, and said sensors come to contact with urine, the urine stone may stick to sensor surfaces and thus undermine the operation and sensitivity of the sensors.

In the worst case, the identification sensor may cease to operate completely as a result of having a sufficiently thick layer of urine stone adhered thereto.

[0005] In addition to urine stone, it is possible that the urinal flushing water may contain similar substances having an adverse effect on the operation of sensors. Various minerals present in the flushing water may stick the same way to the surface of a urinal and a water seal, as well as to the surface of sensors.

[0006] It is an object of this invention to introduce a solution, whereby the flushing reliability of a urinal can be improved by preventing the adherence of urine stone and other such impurities to the surface of a urinal, a water seal, as well as to the surface of sensors.

[0007] The objects of the invention are achieved by providing a urinal or a water seal with an appropriately placed vibrator or the like, said vibrator being operated regularly for removing impurities from the surface of a urinal, a water seal, or a sensor.

[0008] A method of the invention is characterized in that the urine stone and/or other such contamination accumulated in the liquid basin of a urinal in a sensor area is removed by means of a vibrator operating over said area.

[0009] An arrangement of the invention is characterized in that the urine stone and/or other such contamination accumulated in the liquid basin of a urinal in a sensor area is adapted to be removed by means of a vibrator.

[0010] The solution of the invention can be used for preventing the adherence of urine stone and the like substances present in flushing water to such surfaces in a urinal, upon which it has an adverse effect on the operation of sensors. The solution of the invention is capable of prolonging the service life of sensors, as well as of reducing the maintenance demand for sensors. Furthermore, the solution of the invention is capable of improving the flushing reliability of a urinal, which refers to the fact that the demand for flushing the urine arriving in a urinal is detected and performed at a proper time.

[0011] The invention will now be described with reference to the accompanying drawings, in which

Figure 1 shows alternative locations for sensors present in the water seal of a urinal and

Figure 2 shows an entire flushing cycle in a flow chart.

[0012] It is prior known that a urinal can be fitted with sensors capable of detecting the need for flushing the urinal. Fig. 1 depicts by way of example possible alternative locations for sensors and respective vibrators to be included in a urinal 10 and its water seal 11. According to a first preferred embodiment, the sensors are mounted outside the urinal 10 or the water seal 11, as shown at 12a; 12b. One sensor suitable for such an arrangement comprises for example a temperature sen-

sor, which is sufficiently sensitive to detect a temperature change effected at the surface of the urinal 10 or the water seal 11 by urine coming in the urinal 10. According to one preferred embodiment, the urinal 10 or the water seal 11 can have the thickness of its surface reduced over the area in line with the sensor. A reduction of the wall thickness can be used for enhancing thermal conductivity through the surface of the urinal 10 or the water seal 11, whereby the sensor shall detect a need for flushing even more readily. The accumulation of urine stone within the area of the urinal 10 or the water seal 11 directly in line with the sensor can be ruled out by setting a vibrator in the immediate vicinity of a sensor location. The vibrator can be e.g. a piezoelectric crystal or the like element, which is supplied with a signal at a proper frequency for the creation of vibration. According to one preferred embodiment, the vibrator is set in action as the flushing of the urinal 10 is started. The vibrator vibrates at a given frequency, the waves in flushing water produced by said vibrator flushing the internal surface of the urinal 10 or the water seal 11 over the area in line with the sensor, thus preventing the adherence of urine stone to the wall of the urinal 10 or the water seal 11 in the area in line with the sensor.

[0013] According to a second preferred embodiment, sensors measuring the flushing demand for the urinal 10 are mounted on an internal surface 12c; 12d of the urinal 10 and the water seal 11, preferably in a liquid basin. Such sensors may comprise for example sensors based on electrical conductivity, which are responsive to the change of electrical conductivity brought about by urine in a liquid present in the urinal 10. Such sensors can be mounted for example on the urinal 10 or the water seal 11 at such a location that the sensors inevitably come to contact with the liquid present in the urinal 10. In an arrangement like this, the adherence of urine stone to sensors can be avoided in such a way that a vibrator is provided in the immediate vicinity of the sensors for preventing urine stone and the like impurities from adhering to the surface of the sensor or sensors. It is obvious for a skilled person that there may be several vibrators if there are several measuring sensors or the latter are located far apart, in which case a single vibrator is insufficient for keeping said sensors clean. It is also possible to provide a single sensor with several vibrators. According to one preferred embodiment, the vibrators can be integrated with a sensor in a common element, as a consequence of which the vibrator prevents urine stone from adhering to the sensor element by setting said element in vibration at a sufficiently high frequency.

[0014] Reference will now be made to a preferred embodiment of the invention, wherein a piezoelectric crystal functions as a sensor that detects a need for flushing the urinal 10. The piezoelectric crystal is arranged to detect a need for flushing the urinal 10 as a result of vibration produced by urine arriving in the urinal 10. As a result of the vibration, the piezoelectric crystal generates

a signal transmitted to a flush-control microprocessor or the like, which uses the signal level to determine a need for flushing. The signal level is preferably arranged to be such that the need for unnecessary flushes can be minimized. By using a piezoelectric crystal serving as a sensor, it is possible to implement a flushing of the sensor in a particularly preferred manner, such that the same piezoelectric crystal is used as a vibrator by supplying it for example with a high-frequency signal, thereby removing contamination from the sensor surface. It is obvious for a person skilled in the art that the proposed piezoelectric crystal serving as a sensor can be positioned inside either the urinal 10 or the water seal 11.

[0015] One simple solution for controlling the flushing of a urinal and a vibrator is to employ a microprocessor. A piezoelectric crystal is coupled with the microprocessor. In this exemplary embodiment, the piezoelectric crystal functions both as a sensor and a vibrator. According to one preferred embodiment, said piezoelectric crystal is connected over an A/D-converter of the processor, wherein a possible sensoremitted signal is worked into a digital signal which is compared to a reference level previously fed into the microprocessor, said comparison being used as a basis for a command to perform a flush. At the outset of flushing, the piezoelectric crystal can be supplied with a high-frequency signal for creating vibration. As the piezoelectric crystal vibrates at a sufficiently high frequency, the impurities dislodge off the sensor surface while the adherence of new impurities can be prevented at the same time. Thus, the sensitivity of the sensors is maintained longer and the urinal 10 can be improved in terms of its flushing reliability. It is obvious for a skilled person that, if the vibrator is constituted by an element separate with respect to the sensor and positioned in the immediate vicinity of the sensor, the vibrator can be used for flushing the sensor wall with flushing water to thereby remove dirt accumulated on the sensor surface.

[0016] Fig. 2 shows an entire flushing cycle in the form of a simple flow chart presentation. At first, the system is in a measuring mode 21, wherein signals coming from a sensor are being read by a microprocessor and compared with a previously set threshold value. As the urinal receives urine or the like, the sensor-transmitted signal changes and the microprocessor detects a need for flushing 22. The microprocessor issues a command for urinal flushing 23. As the flushing is started after a proper given delay, the microprocessor preferably issues a command for a vibrator to start vibration 24 for cleaning the sensor surface of dirt possibly accumulated thereon. This is followed by returning to the normal measuring mode 21. It is obvious for a skilled person that the illustrated flow chart is by no means the only solution for an operating cycle of urinal flushing.

[0017] It is evident for a skilled person that the signal delivered to a vibrator for starting vibration is timed in such a way that, according to one preferred embodiment, it does not begin until the flushing has started. The

timing of vibration can be adjusted as desired for example programmatically by means of a microprocessor.

[0018] It is clear for a skilled person that various applications of the invention are not limited to those set forth above as examples, but may vary within the scope of the annexed claims. For example, the useful sensors are not limited to those described above, as the sensors may comprise any sensor configuration whatsoever fit for recognizing a need for flushing a urinal, which can be preferably linked with a vibrator of the invention for keeping the sensor clean. The employed vibrator may also comprise any other corresponding vibrator instead of a piezoelectric crystal. The locations of sensors and vibrators in a urinal and its water seal are not fixed, as such locations depend on various factors, such as the shape of a urinal, the sensitivity and type of sensors, etc.

Claims

1. A method for maintaining the reliable operation of a sensor detecting a need for flushing a urinal (10), **characterized** in that urine stone and/or other such dirt adhered over the sensor area within the liquid basin of the urinal (10) is removed by means of a vibrator operating over said area. 25
2. A method as set forth in claim 1, **characterized** in that the vibrator is operated while simultaneously flushing the sensor surface with water. 30
3. A method as set forth in claim 1, **characterized** in that the sensor is set in vibration by means of a vibrator. 35
4. A method as set forth in claim 1, **characterized** in that the vibration is produced by means of a piezoelectric crystal. 40
5. A method as set forth in claim 1, **characterized** in that the urine stone and/or other such dirt is removed by means of ultrasound produced in the vibrator. 45
6. An arrangement for maintaining the reliable operation of a sensor detecting a need for flushing a urinal (10), **characterized** in that urine stone and/or other such dirt adhered over the sensor area within the liquid basin of the urinal (10) is arranged to be removed by means of a vibrator. 50
7. An arrangement as set forth in claim 6, **characterized** in that the vibration is arranged to be produced by means of a piezoelectric crystal. 55
8. An arrangement as set forth in claim 7, **characterized** in that the piezoelectric crystal serving as the vibrator is arranged to function as a sensor.
9. An arrangement as set forth in claim 6, **characterized** in that the vibrator is arranged to be integrated with the sensor in a common element.
10. An arrangement as set forth in claim 6, **characterized** in that the vibrator is set in the immediate vicinity of the sensor, said vibrator delivering the vibration to the sensor surface.
11. An arrangement as set forth in claim 6, **characterized** in that the vibrator is arranged to be positioned in a water seal (11).
12. An arrangement as set forth in claim 6, **characterized** in that the vibrator is arranged to be mounted on an internal surface of the urinal (10).
13. An arrangement as set forth in claim 6, **characterized** in that the number of vibrators is at least one per each sensor.

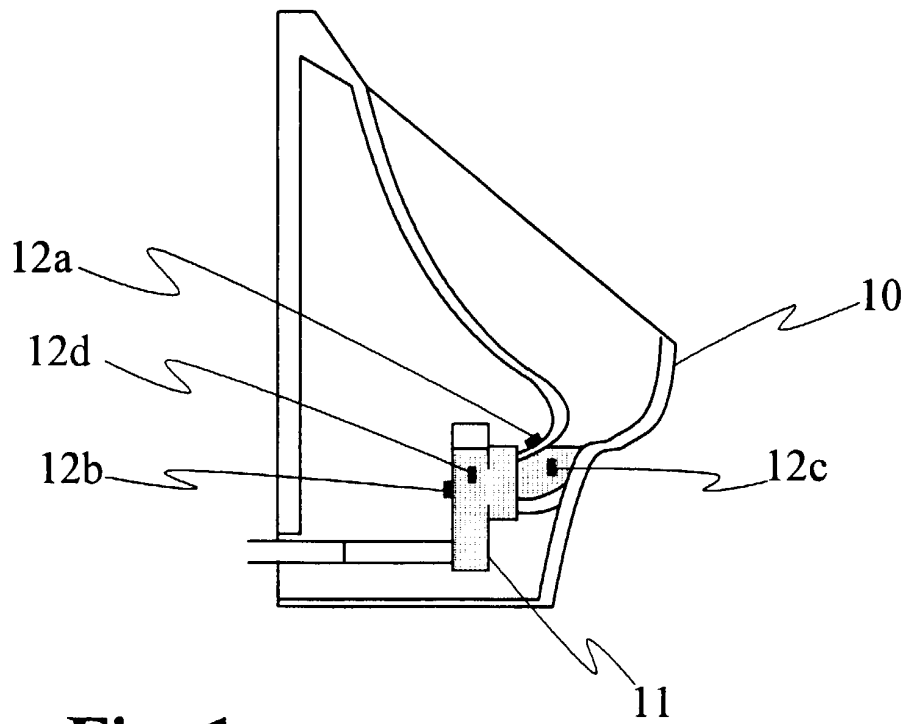


Fig. 1

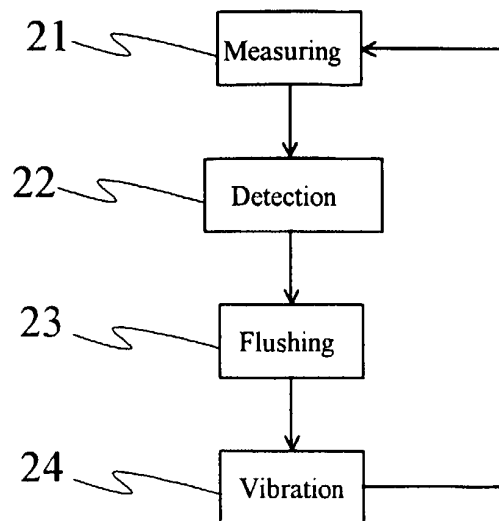


Fig. 2