

Triggering of a cleaning, ventilating and/or
disinfecting procedure

The present invention relates to a method according to the precharacterizing clause of Claim 1, as well as to an apparatus for carrying out the method and to applications of the method.

A self-cleaning toilet is known from the firm CWS International AG, Baar, having a toilet seat which rotates after actuation of the water flushing system. In one version, the rotation is triggered by an electrical contact (microswitch; infrared sensor) connected to the actuating lever of the flushing cistern. In the second version, the inflowing flushing water, or the water mains system, drives a turbine which sets in motion, via a generator, the drive motors for the cleaning and disinfection of the toilet seat.

Generally, the known arrangements have proved successful in practice. However, it has been found that problems relating to areas of responsibility and competence in respect of installation and maintenance arise, since the installation cannot be dealt with by the ordinary sanitary fitter. In addition, the fact that the control and drive unit of the apparatus is connected to the flushing cistern brings further disadvantages owing to the highly specific nature of the arrangement, such as unintentionally initiated operations, as well as a system-related susceptibility to faults.



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- 2 -

It is therefore the object of the invention to trigger a physical/technical procedure only when this is intended by the user or operator of the installation. Instances of triggering due to incomplete flushing and/or inflow procedures are also to be eliminated; the procedure to be triggered must take place in an operationally reliable manner. A plurality of adjacent inflow and/or flushing procedures must also be possible without these influencing one another.

Furthermore, the need for intervention in the rest of the apparatus region is to be obviated; the responsibility of the installation and maintenance staff must be able to be clearly laid down, without tasks which are foreign to their trade being assigned to them.

The subject of the invention is to allow further damp-room-related applications over and above the direct toilet use.

This object is achieved by the features of Claim 1.

The location, mentioned in the claim, of an acoustic sensor in close proximity to the inflow of a liquid causes a first, spatial and selective differentiation in the event of a plurality of identical or similar sound sources being present.

In the following dependent claims, advantageous developments of the subject of the invention are characterized.

The method according to Claim 2 results in an improved differentiation of the triggering sound source from interfering sources which may be present.

- 3 -

According to Claim 3, the dimensioning of the filter and thus the method can be optimized by a spectral analysis.

The method according to Claim 4 is advantageously suitable for the calibration of the specific procedure.

After the calibration, the activation of the physical/technical device can be reproducibly realized in accordance with Claim 5; in particular, this allows incomplete flushing and/or inflow procedures to be detected. Other inflow procedures which occur during use are also reliably detected as such, that is to say the device cannot be unintentionally activated.

A band filtering in accordance with the apparatus according to Claim 6 is particularly suitable for monitoring the flushing inflow into a toilet bowl.

Active band filter can be realized outstandingly well and economically according to Claim 7.

The apparatus according to Claim 8, composed of four commercially available operational amplifiers, is very efficient.

The electret microphone mentioned in Claim 9 is particularly advantageous owing to its selective reception characteristic and its robust design.

An application according to Claim 10 prevents triggering of a cleaning procedure on a toilet seat at the wrong time. In

- 4 -

addition, there results the great practical advantage of the cleaning and disinfection being completely independent of the rest of the sanitary installation and thus of a clear separation of fields, between sanitary fitter and equipment supplier or equipment technician, in respect of the fitting and also maintenance of the devices being ensured.

The control of the extractor in a toilet and/or in the toilet room in accordance with Claim 11 allows ventilation which is favourable in terms of energy, and prevents unpleasant draughts.

Deodorant procedures can also be triggered, Claim 12, when these are necessary, i.e. instances of inappropriate and material-consuming regular triggering associated with ordinary door actuations can be eliminated.

Applications according to Claim 13 can be used to reduce the water consumption; moreover, they allow the inclusion of further cleaning procedures associated with the use, for example, of a public toilet.

According to Claim 14, devices which are additionally present can be disabled and/or activated in order to allow, for example, their use only in conjunction with a controlled toilet use.

Exemplary embodiments of the subject of the invention are described in more detail below with reference to drawings, in which:

Fig. 1 shows a block diagram of an electronic circuit for carrying out the method,

- 5 -

Fig. 2 shows the flow diagram relating to a program which allows calibration and adaptation of the acoustic sensor and the evaluation circuit to the characteristic of the sound source,

Fig. 3 shows the signal detection sequence for triggering a proper toilet seat cleaning cycle and

Fig. 4 shows a simplified representation of a toilet with cleaning and disinfecting apparatus and a targeted extraction of unpleasant odours at the place where they arise.

In Figure 1 a commercially available quad amplifier is denoted by A100. This amplifier comprises series-connected operational amplifiers A1 to A4 which are operated or fed back in the customary fashion according to their function.

The series of amplifiers thus comprises a single four-stage wide-band operational amplifier A100; one of the type LM 837N (National Semiconductors, USA) has proved successful.

This operational amplifier A100 is fed an input signal e, the frequency-selective output signal from an acoustic sensor; the amplified and demodulated control signal is denoted by S. The characteristic earthing of the amplifier A100 is necessary for electrical and safety reasons.

- 6 -

It is essential for the characteristic of the specific sound source to be reproducibly stored. This purpose is served by a calibration program, shown in Fig. 2.

A memory value m1 is preset as initial value in a non-volatile memory (EEPROM) and fed to a decision node D1 and checked for its plausibility. At one output of the decision node D1 is a basic-value memory M1 which stores the checked value m1 as initial value; connected to the second output of D1 is a function element F1 which is designed as a status display (LED). Connected downstream is a further decision node D2 which checks the button position, the switch-on state, via a feedback. The output of D2 is fed to a function element F2, an electret microphone, at the output of which a further decision node D3 checks the signal level and switches on a delay time of 200 ms (dead time) via F3. After this 200 ms period, a function element F4, the electret microphone, again comes into operation. The node D4 connected downstream checks the signal level once again; an element F5 switches on a delay time of 500 ms. Subsequently, an element F6 performs 10 measurements, from which an average value is determined. This average value is fed to an element F7 and confirmed in the element F8, the LED display.

A further decision node D5 checks whether the procedure has been completely repeated a sufficient number of times, in the present case, a flushing procedure three times, and a waiting time of 20 s has been observed between the individual procedures. This period of time corresponds to the minimum time for filling the flushing cistern. The check is performed by the element F9, together with the decision nodes D4 and D3. If the check

- 7 -

produces a positive result, a single average value is determined by F10 from the three previous procedures.

The following function elements F11 to F13 have the tasks of adding a safety value, of storing the resultant value, again in the EEPROM, and of setting the signal display.

All the resultant values are included in the new basic setting M2.

According to Fig. 3, a cleaning cycle is triggered by the microphone signal analysis illustrated here. In this case, the signal e1 is read in by a control program (main program) known per se; F14 switches on the microphone and D6 checks the latter's signal level for its minimum level using the preset single average value determined by the calibration procedure.

If the minimum level is undershot, a signal e2 which resets the program being executed back to the main program is generated.

The elements F15 and F16 connected downstream cause a delay of 200 ms and a renewed switching-on of the microphone. The decision node D7, together with D6, checks the admissible level value once again. The subsequent function elements F17 and F18 perform a counting function; they serve, together with a further delay element F20, which is set to 50 ms, for checking the coherence of the signal flow over time, D8 checking that the counters are reset to zero and emitting a corresponding control signal S if the microphone, i.e. the element F19, does not deliver any new signals.

- 8 -

The control signal S starts the function element F100 with its actuators such as drive motors, spray valves, etc.

In practical application, the circuit arrangements in Figs. 1 to 3 are located in a toilet with self-cleaning toilet seat, denoted by 1 in Fig. 4.

The toilet 1 has a cleaning unit 2 with electronic control. A cover 5 with bearings for a seat 4 is articulated at hinges 3. The whole is located on a commercially available toilet bowl 6; the cover 5 rests on the latter via rests 7.

Located in the interior of the bowl 6 is a water inflow 8 for the flushing procedure, which is well known. A corresponding outflow spout 10 is revealed in a partially cutaway view; located beside this is a bore 9 in which an electret microphone M is arranged, slightly set back. This microphone delivers an output signal e which is fed to a terminal, not illustrated specifically here.

The spout 10 is connected in the customary fashion to a water supply 11, which leads to a flushing cistern - denoted by H_2O . An extraction pipe 12, which transports gases G to an exhaust-air nozzle 16 by means of a fan 15, leads transversely into the water supply 11.

When the microphone M has been impinged by sound in accordance with the conditions as specified by the program in Fig. 3, as a result of the flushing inflow procedure, a control signal S is generated which moves out a cleaning and disinfecting station 14

- 9 -

and simultaneously rotates the toilet seat 4 in the direction of the arrow via drive motors, which are not illustrated here.

The LED status display 13 is located on the upper part of the cover of the cleaning unit 2. A customary mains connection 17 is used for the power supply.

All the components used are commercially available; the programming of the EEPROM was likewise done conventionally; the electret microphone used (type WM 56A103 from Panasonic, JP) has a lower limit frequency of 2 kHz, so that essentially ambient noises are not evaluated at all.

Instead of driving a fan 15, as illustrated in Fig. 4, for the purpose of extracting unpleasant odours, a direct connection of an exhaust-air valve (type EVISIT from Danfos, DK) leading into the building ventilation system has also proved successful. The duration of the ventilation after each actuation of the toilet flushing system is limited to 5 min. in order to avoid disturbing draughts and to save energy.

The subject of the invention is suitable for the controlled activation of numerous procedures which are expedient in connection with the use of toilets and washrooms. Among other things, the triggering of periodic cleaning procedures, for example the flooding of toilets after a certain number of flushing procedures, etc., is also conceivable.

- 10 -

List of reference numerals

1	Toilet with self-cleaning toilet seat
2	Cleaning unit with electronic control
3	Hinge
4	Seat (ring)
5	Cover with bearings
6	Toilet bowl
7	Rests
8	Water inflow (flushing)
9	Bore (for microphone)
10	Outflow spout
11	Water supply (pipe to the flushing cistern)
12	Extraction pipe (odours)
13	Status display
14	Cleaning and disinfecting station (capable of being moved out)
15	Electric fan
16	Blow-out (exhaust-air) nozzle
17	Mains connection
A1-A4	Stages of operational amplifier
A100	Quad operational amplifier (wide-band amplifier)
D1-Dn	Decision nodes
e-e2	Input signals
F1-Fn	Function element
G	Exhaust air (gases)
m1	Memory value
M	Electret microphone (acoustic sensor)
M1	Basic setting (signal value)
M2	Modified, new basic setting

- 11 -

(signal value)
r Direction of rotation (toilet seat)
S Control signal

- 12 -

Claims

1. A method for triggering a cleaning, ventilating, disinfecting and/or deodorizing procedure in washrooms and/or toilet rooms, characterized in that an acoustic sensor is arranged in close proximity to a flushing and/or inflow procedure of a liquid and activates, by its output signal, at least one physical/technical device.
2. A method according to Claim 1, characterized in that a frequency band filter tuned to the characteristic frequencies of the triggering procedure is connected downstream of the acoustic sensor.
3. A method according to Claim 2, characterized in that the frequency band filter is tuned to the spectral range of the triggering procedure in which the sound frequencies with the maximum energy lie.
4. A method according to Claim 2, characterized in that the flushing and/or inflow procedure is repeated at least twice and in that the output signal emitted by the acoustic sensor is checked, after its amplification, for the signal level which it is expected to have, and in that an average value is determined from a plurality of sequential measurements for the same flushing and/or inflow procedure, which average value is stored, together with the average value of at least one further flushing and/or inflow procedure, as a sum average value in a non-volatile, electronic memory as the basic setting.

- 13 -

5. A method according to Claim 3, characterized in that the output signal emitted by the acoustic sensor is repeatedly fed, after its analysis and after a time delay, to a comparator circuit which compares the output signal with a preset signal value, in that the duration of the signal is checked in this procedure, and in that only then is the physical/technical device activated.

6. Apparatus for carrying out the method for triggering a cleaning, ventilating, disinfecting and/or deodorizing procedure in washrooms and/or toilet rooms according to one of Claims 1 to 5, characterized in that the acoustic sensor (M) is arranged in a toilet bowl above the inflow (8) or beside the latter, close to the flushing system, and in that the useful signal (e1) for activating the physical/technical device lies in the range from 8 kHz +/- 1 kHz and has a half-width value of less than 1 kHz.

7. Apparatus according to Claim 6, characterized in that a 2nd order active band filter is connected downstream of the acoustic sensor (M).

8. Apparatus according to Claim 6 and 7, characterized in that four operational amplifiers (A1-A4) are connected downstream of the acoustic sensor (M), the first (A1) having a signal amplification of at least a factor of 50, the second (A2) having a signal amplification of at least a factor of 5 and at the same time being operated as a band filter, in that the third operational amplifier (A3) is a demodulator, and in that the fourth operational amplifier (A4) is operated as a current amplifier to obtain a switching signal.

- 14 -

9. Apparatus according to one of Claims 6 to 8, characterized in that the acoustic sensor (M) is an electret microphone.

10. Application of the method according to one of Claims 1 to 5, characterized in that the device to be activated is an apparatus for cleaning and disinfecting a toilet seat.

11. Application of the method according to one of Claims 1 to 5, characterized in that the device to be activated is an extractor in the toilet and/or in the toilet room.

12. Application of the method according to one of Claims 1 to 5, characterized in that the device to be activated is a spraying and/or evaporating apparatus for disinfecting and/or deodorizing a toilet room.

13. Application of the method according to one of Claims 1 to 5, characterized in that the device to be activated is an electromechanical water valve of a flushing system or of a urinal or which is in connection with a toilet.

14. Application of the method according to one of Claims 1 to 5, characterized in that the device to be activated is an electromechanical relay which enables further devices, such as soap dispensers, towel dispensers, shower and/or drying devices, for use.