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(54) Automatic urinal flushing system

(57) An automatic urinal flushing system for flushing one or more urinals (2) installed together in a gentlemen's toilet. The system includes a cistern (14) having a flush pipe (15) connected to said urinal(s) (2), an inlet pipe (17) connected to a mains water supply (5), a float operated inlet valve (18) connected to said inlet pipe (17) to set the maximum level of water within the cistern (14), and a flush valve (16) connected to said flush pipe (15) and operable by a mechanically actuated mechanism. The system also includes an ultrasonic distance sensor (28) mountable adjacent the urinal to detect the presence of a urinal user within a predetermined range and an electrically operable mechanical actuator (19) mountable adjacent said cistern to actuate the mechanism.

An electronic control circuit (20) receives an input from the sensor (28), provides an output signal to the electrically operable mechanical actuator (19), and has a stored control program whereby in response to one or more inputs from the sensor (28), the time of the output signal is determined in accordance with the stored control program.

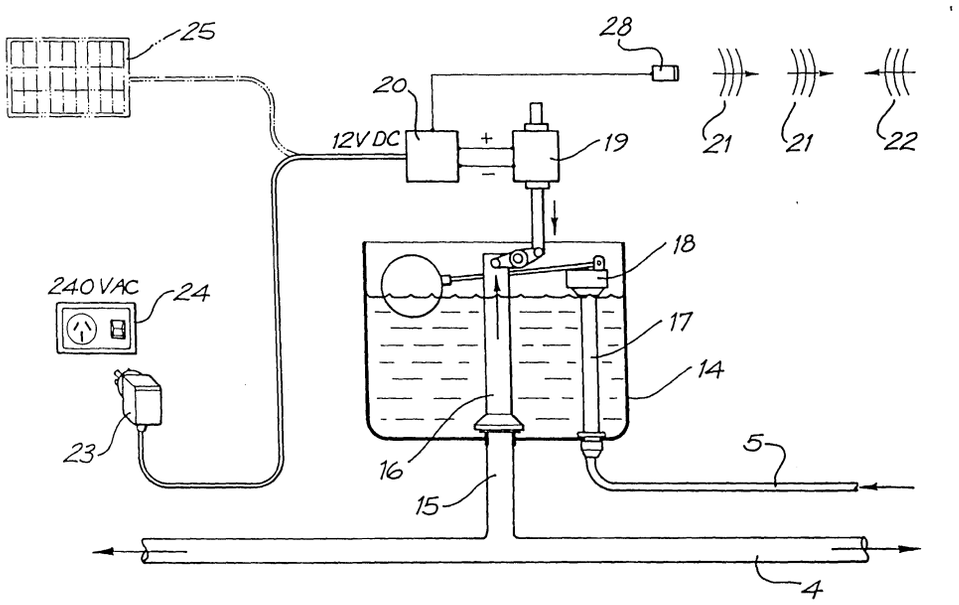

FIG. 3

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Description

Field of the invention

[0001] The present invention relates to an automatic urinal flushing system.

Background of the invention

[0002] Historically, urinals were flushed in the same way as toilet pans. That is, a cistern was provided and a mechanical actuator was used to actuate the cistern when a user had finished at the urinal. Since urinals are universally installed in public conveniences, places of work, and places frequented by the general public such as hotels and clubs, rather than in the home, urinals are used by members of the general public who feel no special obligation towards the premises and the maintenance of cleanliness in those premises. Therefore the regular operation of user actuated flushing cisterns could not be guaranteed with the usual result of a strong smell of dried urine.

[0003] In the last decade or so in order to overcome such problems automatic systems for the flushing of urinals have been installed and these have provided many advantages. Included amongst the advantages are the elimination of the problem of smell and, particularly since the advent of AIDS, an increased perception of hygiene since all users do not have to come into contact with a mechanical flushing actuator. In the simplest form these automatic flushing urinals operated on a time basis and flushed at regular time intervals irrespective of actual use. This therefore wasted substantial amounts of water. In order to overcome this problem it has been known to install a remote sensing system which is intended to detect the presence of a user at the urinal and thereby limit the times of flushing to times immediately after the detection of a user.

[0004] Such relatively sophisticated systems suffer from a number of problems. These include the cost of a solenoid valve which controls the flushing operation. The power requirements of the solenoid valve which must be held open for the duration of the flush, dictate that the power be supplied by a 240 volt AC mains supply. This applies whether the valve is 240 volt AC or whether it is 12 volt DC (in which case an expensive transformer (and rectifier) are required). This therefore necessitates the provision of two separate trades (plumbers and electricians) at the installation, especially on new building sites where trade demarcations are more rigidly enforced. Also the concerns of management about safety are heightened since there is a fear of use of 240 volt AC power in conjunction with water and metal pipes as potentially constituting a safety hazard. All these factors contribute substantially to the cost of installation, the cost of maintenance of such systems, and the reluctance to install same.

[0005] It is the object of the present invention to provide an automatic urinal flushing system which has both a low manufactured cost and a low installation cost.

Summary of the invention

[0006] According to the present invention, there is disclosed an automatic urinal flushing system for flushing one or more urinals installed together in a gentlemen's toilet, said system comprising:

a cistern having a flush pipe connected to said urinal (s), an inlet pipe connected to a mains water supply, a float operated inlet valve connected to said inlet pipe to set the maximum level of water within the cistern, and a flush valve connected to said flush pipe and operable by a mechanically actuated mechanism;
an ultrasonic distance sensor mountable adjacent said urinal to detect the presence of a urinal user within a predetermined range;
an electrically operable mechanical actuator mountable adjacent said cistern to actuate said mechanism; and
an electronic control circuit receiving an input from said sensor, providing an output signal to said electrically operable mechanical actuator, and having a stored control program whereby in response to one or more inputs from said sensor the time of said output signal is determined in accordance with said stored control program.

Brief description of the drawings

[0007] An embodiment of the present invention will now be described with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a prior art urinal installation;
Fig. 2 is a similar view of another prior art urinal installation;
Fig. 3 is a schematic representation of the automatic urinal flushing system of the preferred embodiment; and
Fig. 4 is a schematic side elevation of the installation of the arrangement of Fig. 3.

Detailed description of the preferred embodiment

[0008] Fig. 1 shows a prior art urinal installation in which a gentlemen's bathroom 1 is provided with three individual stall urinals 2 each of which is supplied with flushing water via concealed piping 4. The piping 4 is directly connected to a mains water supply 5 via a solenoid valve 6 which is connected directly to the 240 volt AC mains 7.

[0009] Each of the urinals 2 is provided with a corresponding infrared sensor 8 which is commonly mounted

at chest height, or similar, and generally central relative to each urinal. Each sensor 8 is connected by concealed wiring 9 to a control unit 10 which is in turn connected to the solenoid valve 6.

[0010] Traditional practice is for a maximum of three single stall urinals 2 to be supplied by a single solenoid valve 6. Therefore if more than three urinals 2 are provided in a given installation, it is necessary to have more than one solenoid valve 6 and its associated equipment.

[0011] The above described prior art arrangement suffers from the disadvantage that the three single stalls are supplied by the one valve 6 in order to reduce installation costs. But this increases water usage since all three stalls are flushed even if only one is used. Since one stall has a required flush volume of approximately 2 litres, significant amounts of water can be wasted.

[0012] Fig. 2 shows another prior art urinal installation in which like items to those shown in Fig. 1 are allocated like designation numbers. In Fig. 2, a bathroom 30 is provided with three slab urinals 32 each of which has a spreader pipe 33 that is individually supplied with flushing water via a corresponding cistern 31. The flush is controlled by a solenoid valve 36 which is schematically illustrated as being in the flush pipe connected between the cistern 31 and spreader pipe 33.

[0013] One advantage of the cistern 31 is that the solenoid valve 36 need not be so expensive as to include a flow reversal protection valve since the mains supply is protected by the inlet valve (not illustrated but conventional) of the cistern 31.

[0014] The slab urinals 32 require a flushing volume of approximately 2 litres for each 600mm of urinal length. There is also a problem in using the valve 6 or 36 to control the flush volume since in fact the valve time of opening does not directly control the volume. Instead the volume is determined in large part by the constriction to flow presented by the pipework 4 including the spreader pipes 33. Thus in general it is necessary for each valve 6, 36 to be set up to open for a different time (generally in the range of 5-10 seconds) for each installation.

[0015] Further problems with the above prior art installations are as follows.

[0016] Firstly, the infrared sensors 8, being directly located in full view of the user of the urinal, represent a tempting target for vandalism. Such sensors 8 are commonly blocked by chewing gum and like substances which thereby easily renders them inoperative. In addition, the bathrooms 1, 30 in modern times are supplied with hot air dryers 12 and the heat generated by the use of such dryers often results in false triggering of the infrared sensors 8.

[0017] The solenoid valve 6, 36 (and its mounting bracket) is itself relatively expensive, typically having a purchase price of approximately $80. Either it, or its supply transformer, is generally directly wired into the 240 volt AC mains supply of the building. Therefore the wiring of the solenoid valve 6, 36 requires the presence of an electrical tradesmen on site at substantially the same time as the other installation is completed by a plumber.

[0018] In addition, the infrared sensors 8 are susceptible to being triggered by persons walking by, for example walking through the doorway adjacent the hot air dryer 12 and passing directly to stalls (not illustrated) containing lavatory pans. In attempts to prevent such false triggering, the sensors 8 are provided with a lens arrangement which enables the beam direction etc to be set, thereby increasing the cost and installation complexity of the overall system.

[0019] It is also known to overcome the problem of false triggering by infrared sensors 8 by using microwave devices, however these are much more expensive and therefore again increase the cost of the installation.

[0020] Fig. 3 shows a preferred embodiment of the automatic urinal flushing system according to the invention. The system includes a substantially conventional cistern 14 having a flush pipe 15 connected to the concealed piping 4 as before. The cistern 14 also includes a substantially conventional flush valve 16, which is actuated mechanically by lifting to operate the flushing action, and an inlet pipe 17 having a conventional float operated inlet valve 18 which determines the height of water within the cistern 14. The inlet pipe 17 is supplied from the mains water supply 5. The preferred form of cistern and actuating mechanism are those described in Australian Patents Nos 673,959 and 673,292.

[0021] Located immediately above the cistern 14 is an electrically operated actuator 19 which in its preferred form is a door lock actuator from an automobile. As a consequence it operates at 12 Volts DC and is of low manufactured cost and high reliability. The electric actuator 19 is positioned immediately above the flush valve 16 and is operable on supply of a pulse of energy (typically 2A or less for a duration of 500mSec or less) which therefore momentarily lifts the flush valve 16. Thereafter the flushing water maintains the flush valve 16 in its raised position until the water has substantially drained from the cistern 14. As a consequence of this arrangement, the electrical energy consumed to initiate the flush is low and the electrical energy consumed to maintain the flush for the desired duration of the flush is nil.

[0022] Preferably, the electric actuator 19 takes the form of a small DC electric motor, a gearbox and a rack and pinion mechanism. The moving rack initiates the flushing action. Preferably the rack moves against a spring which provides a restoring force. Alternatively, the cost of the spring can be avoided and a reverse polarity pulse applied to the motor to re-set the actuator 19.

[0023] The electric actuator 19 is connected to, and controlled by, a control unit 20 to which is connected one or more ultrasonic sensors 28. Again the ultrasonic sensors 28 are known from automotive applications where they are used as range finders at the rear of vehicles such as trucks which are intended to reverse into a loading bay. As with the actuator 19, the sensors 28 have a

low manufactured cost and high reliability. The sensors 28 are used to provide the driver of the vehicle with an indication as to the distance between the moving vehicle and the stationary loading bay. As indicated in Fig. 3, the ultrasonic sensor 28 operates by sending out one or more ultrasonic outgoing pulses 21 which are then reflected from an object so as to create an incoming echo pulse 22.

[0024] The control unit 20 is supplied with low current (eg 500 mA or less) from a low cost encapsulated battery recharging pack 23 which is simply plugged into an existing 240 volt AC power point 24 by the plumber. Therefore no electrician is required on site at the time of installation. Because of the low power to the electric actuator 19, the low cost encapsulated battery recharging pack 23 is able to be utilised as the supply of electric energy.

[0025] Alternatively, as indicated by dotted lines in Fig. 2, the control unit 20 can be supplied with energy from a solar cell 25 which derives its energy from the lighting provided within the bathroom 1. In the event that a solar cell 25 is used, the control unit 20 is provided with a small storage battery (not illustrated) to provide sufficient energy for a flush and is recharged by the solar cell 25 between flushes.

[0026] As indicated in Fig. 4, the ultrasonic sensors 28 are preferably located at approximately ankle height immediately below each individual urinal 2.

[0027] The overall arrangement provides a number of advantages.

[0028] Firstly, the sensors 28 are very difficult to see and therefore are not expected to come to the notice of vandals.

[0029] Secondly, the cistern 14 is able to have its internal level set at either 2, 4 or 6 litres flush volume. As a result each individual urinal 2 can have a corresponding cistern 14 (and because of the low overall cost of the arrangement this becomes feasible from an installation cost, it certainly being the most economical in terms of water usage). Or each pair of urinals 2 can share a cistern 14. The other possibility is for the one cistern 8 to supply three individual urinals 2. This is indicated in Fig. 4 by the three different water heights illustrated within the cistern 14.

[0030] In addition, the control unit 20 can be arranged so that any detection of a person for a period less than, say, 10 seconds is not regarded as a positive detection of a person using a urinal. This in large part overcomes the problem of false triggering. Thus the control unit 20 is not inadvertently triggered by persons walking past the urinal but not using them. Further, the ultrasonic sensors 28, being independent of any heat, are not falsely triggered by heat sources other than humans, such as a hot air dryer 12. An alternative arrangement, not illustrated, is to mount the sensors 28 in the ceiling and direct same downwardly towards the step (or similar) on which the user stands to urinate.

[0031] The above described arrangement provides a number of very substantial advantages. Firstly, the manufactured cost of the components of the system is very low since pre-existing units such as the battery recharging pack 23, the electric actuator 19 and the ultrasonic sensor(s) 28 are able to be used, the cistern 14 is a high volume production article of low cost, and the expensive solenoid valve 6 is avoided. As a consequence the manufactured cost of the embodiment illustrated in Fig. 2 (excluding the solar cell 25) is very substantially reduced compared with the manufactured cost of the solenoid valve arrangements illustrated in Figs. 1 and 2.

[0032] Further, on installation, only a plumber is required and therefore only a single trade is required to be supplied and coordinated, compared with two in the prior art.

[0033] Thirdly, the incidence of vandalism is expected to be much less since the ultrasonic sensors 28 are quite unobtrusive and are not thought to present a target to vandals.

[0034] The foregoing describes only one embodiment of the present invention and modifications, obvious to those skilled in the art, can be made thereto without departing from the scope of the present invention.

Claims

1. An automatic urinal flushing system for flushing one or more urinals installed together in a gentlemen's toilet, said system comprising:

   a cistern having a flush pipe connected to said urinal(s), an inlet pipe connected to a mains water supply, a float operated inlet valve connected to said inlet pipe to set the maximum level of water within the cistern, and a flush valve connected to said flush pipe and operable by a mechanically actuated mechanism;
   an ultrasonic distance sensor mountable adjacent said urinal to detect the presence of a urinal user within a predetermined range;
   an electrically operable mechanical actuator mountable adjacent said cistern to actuate said mechanism; and
   an electronic control circuit receiving an input from said sensor, providing an output signal to said electrically operable mechanical actuator, and having a stored control program whereby in response to one or more inputs from said sensor the time of said output signal is determined in accordance with said stored control program.

2. The system as claimed in claim 1 wherein said ultrasonic distance sensor and said electrically operable mechanical actuator are automotive components operable from a 12 volt DC supply.

3. The system as claimed in claim 1 wherein said electrically operated mechanical actuator comprises a DC electric motor, a gearbox, and a rack and pinion mechanism to convert rotary mechanical motion into linear mechanical motion.

4. The system as claimed in claim 1 wherein said electronic control circuit, said sensor, and said electrically operated mechanical actuator are supplied with power from an encapsulated battery recharging pack.

5. The system as claimed in claim 1 wherein said electronic control circuit includes a battery and said ultrasonic distance sensor, said electrically operable mechanical actuator, said electric control circuit and said battery are supplied with electrical energy from a solar cell receiving light from the gentlemen's toilet.

6. The system as claimed in claim 1 wherein said ultrasonic distance sensor is mountable at substantially ankle height relative to the user of said urinal.

7. The system as claimed in claims 1 wherein said ultrasonic distance sensor is mountable in the ceiling directly above said urinal.

8. The system as claimed in claim 1 including a plurality of urinals each supplied from said flush pipe.

9. The system as claimed in claim 8 wherein said number of urinals is three.

10. The system as claimed in claim 1 and including a plurality of urinals and a corresponding plurality of ultrasonic distance sensors.

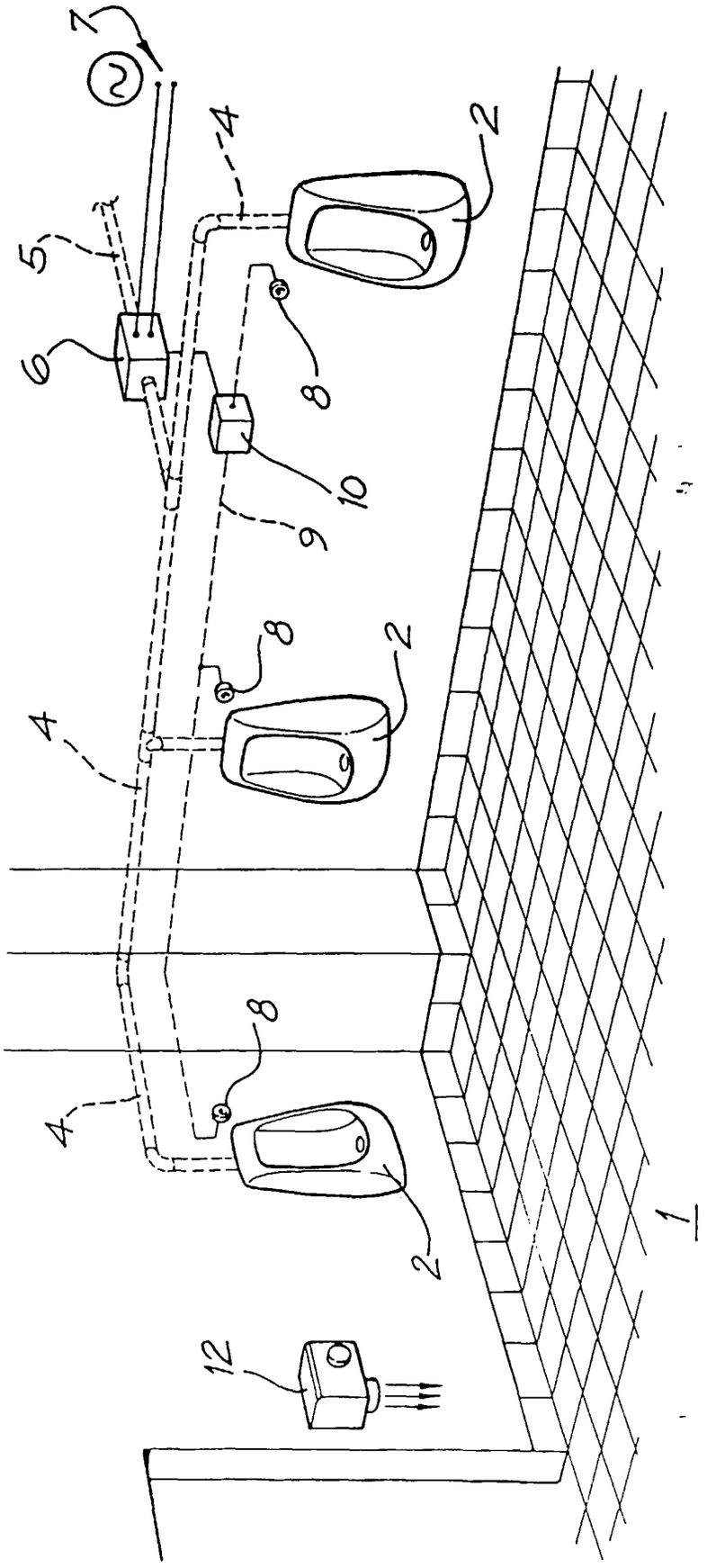

FIG. 1
PRIOR ART

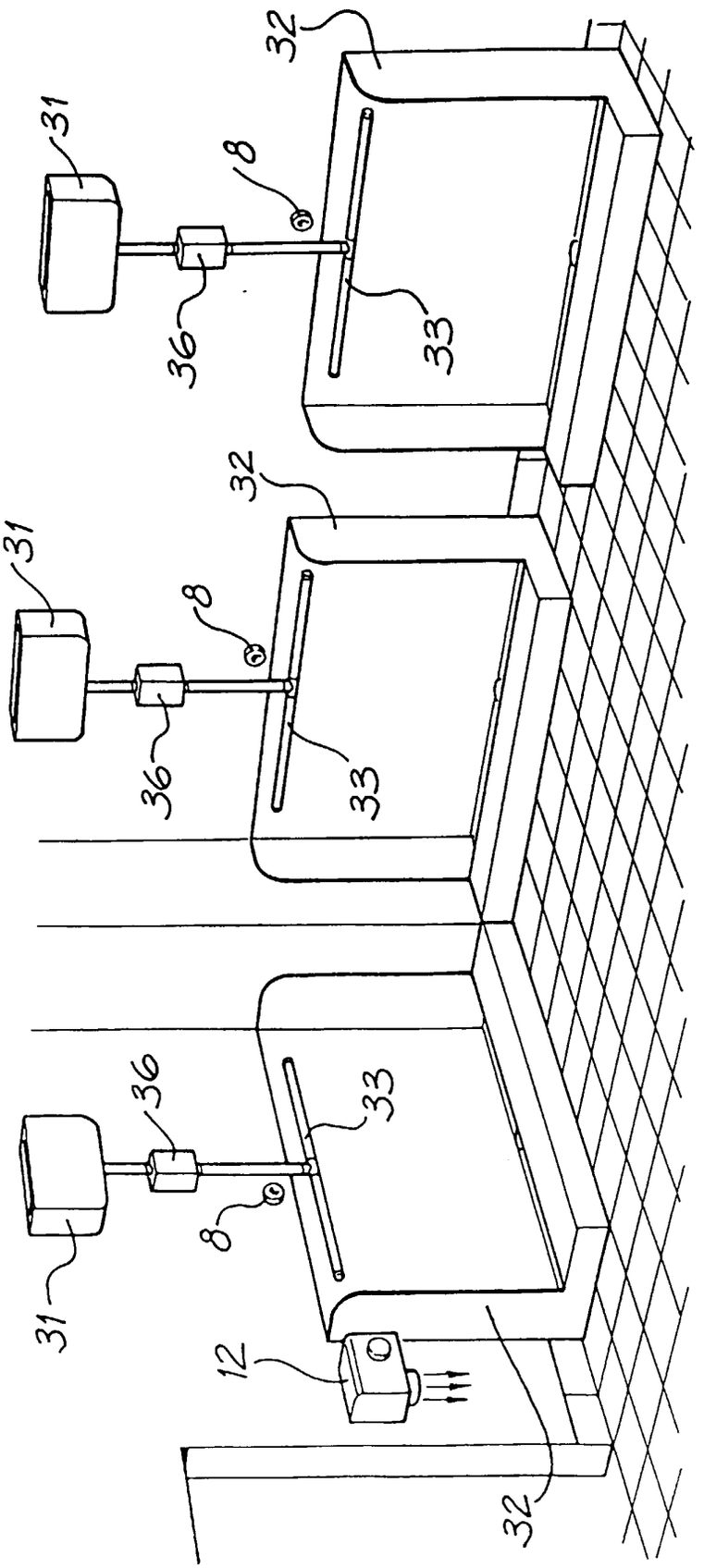

FIG. 2
PRIOR ART

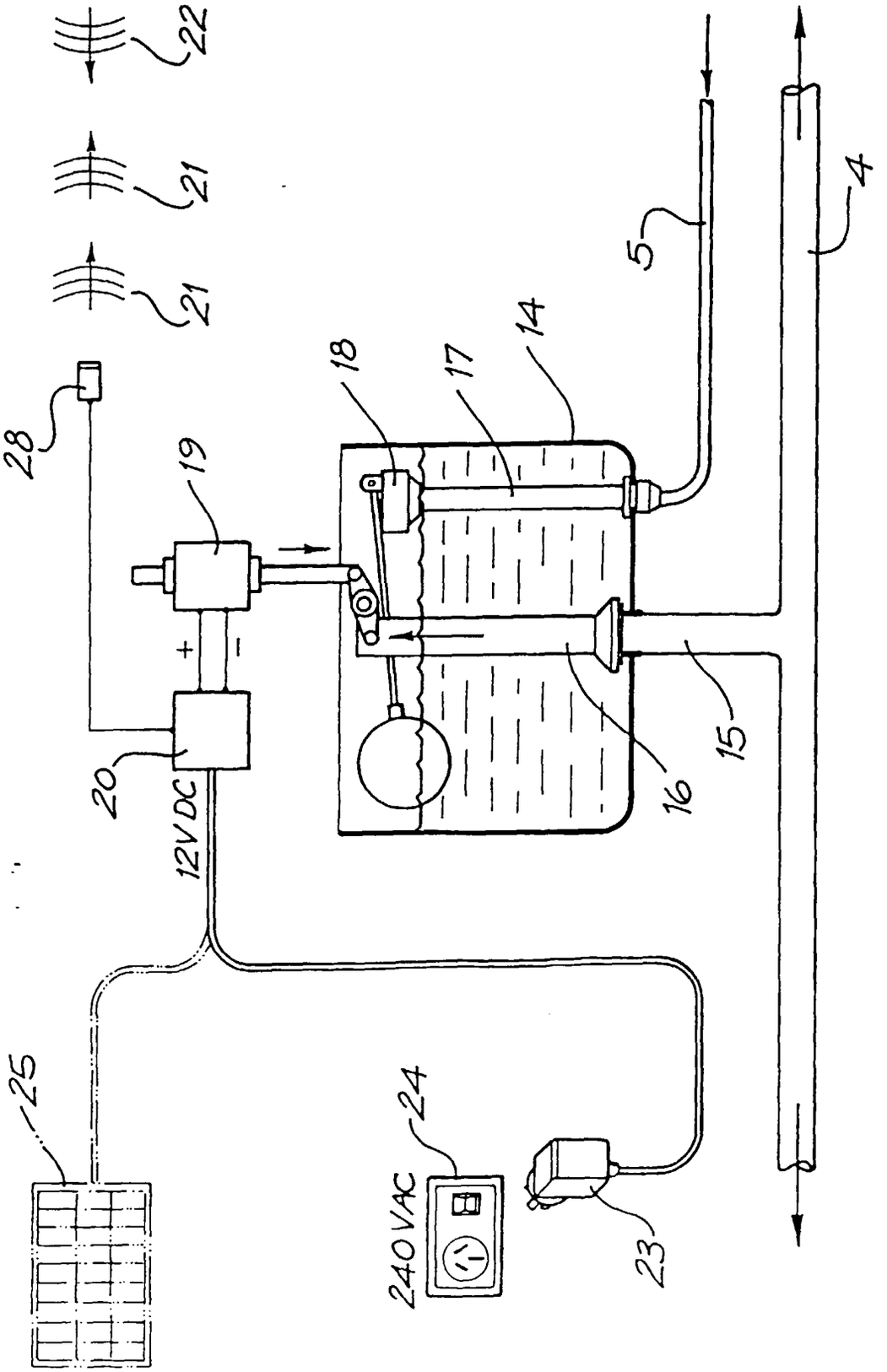

FIG. 3

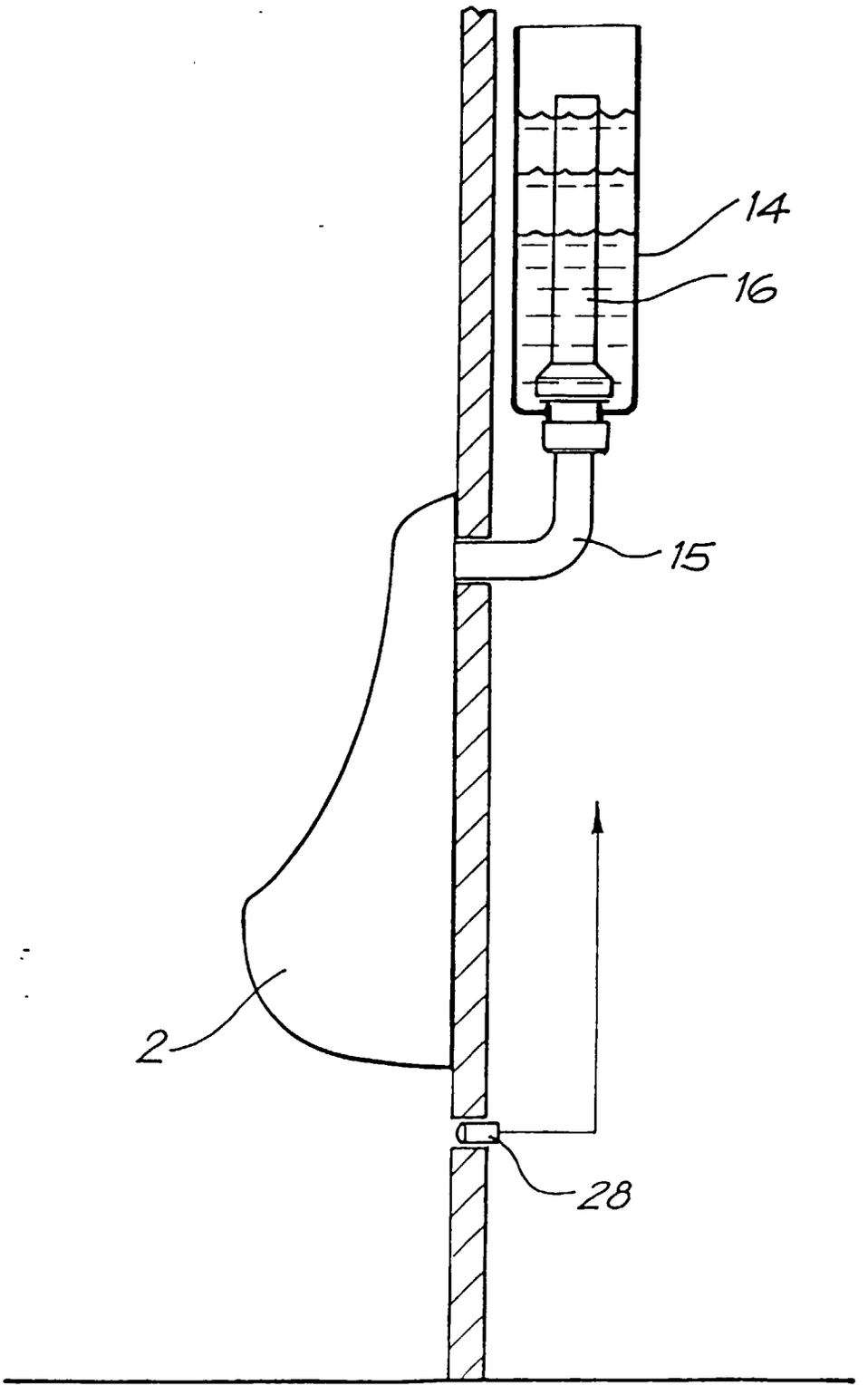

FIG. 4