TOILET VENTILATION SYSTEM

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Filed: Oct. 25, 2004

Publication Classification

Int. Cl. E03D 9/04 (2006.01)

A ventilation system for a toilet having a toilet bowl, a toilet seat for supporting a user of the toilet, and a tank mounted on the toilet bowl for holding water used in flushing the toilet. The ventilation system includes a fan adapted for connection to the toilet bowl to draw odorous air from the toilet bowl into the fan and to discharge the odorous air from the toilet. A fan water supply line is adapted for fluid communication with the fan wherein water from the water supply line is adapted to power the fan to evacuate the odorous air from the toilet.
TOILET VENTILATION SYSTEM

BACKGROUND OF THE INVENTION

[0001] This invention relates generally to a ventilation system and more particularly to a ventilation system for ventilating unpleasant odors from a toilet.

[0002] A variety of ventilation systems are common in the art to dissipate unpleasant odors present in a restroom or lavatory facility. Most commonly, ceiling ventilation fans have been used to continuously withdraw air from the restroom when the toilet is in use. However, ceiling ventilation fans only ventilate unpleasant odors after they have already diffused throughout the restroom facility. Consequently, ceiling fans are ineffective in eliminating odors before they are generally noticeable throughout the restroom. Also, ceiling fans are inefficient because they require venting large volumes of air from within the restroom in order to adequately vent the odorous air.

[0003] Ventilation systems have been provided that ventilate air directly from a toilet bowl. However, such systems are complicated and difficult to assemble. Further, such systems typically require electrical power to drive a motorized fan. As such, electrical wiring must be mounted in or near the toilet so that the electrical components are in frequent contact with water used in the toilet. The components of an electrically powered ventilation system mounted inside a toilet frequently short or fail making the use of electrical powered toilet ventilation systems expensive to supply, maintain, and repair.

[0004] Therefore, a need exists for a ventilation system that ventilates air from a toilet that is easy to install and reliable to operate.

SUMMARY OF THE INVENTION

[0005] Among the several objects of this invention may be noted the provision of a ventilation system that is easy to install and operate; the provision of such a ventilation system that is efficient; the provision of such a ventilation system that is free from electrical componentry; the provision of such a ventilation system that can be retrofitted into an existing toilet; and the provision of such a ventilation system that is disposed, at least in part, in a toilet. At least one of the preceding objects is met in whole or in part by the present invention described herein.

[0006] In general, a ventilation system for a toilet having a toilet bowl, a toilet seat for supporting a user of the toilet, and a tank mounted on the toilet bowl for holding water used in flushing the toilet comprises a fan adapted for connection to the toilet bowl. The fan draws odorous air from the toilet bowl and discharges the odorous air from the toilet. A fan water supply line is adapted for fluid communication with the fan wherein water from the water supply line is adapted to power the fan to evacuate the odorous air from the toilet.

[0007] In another aspect of the invention, a ventilated toilet system comprises a toilet having a toilet bowl and a tank for storing flush water of the toilet. A water-driven fan is disposed for being impinged by water supplied to the toilet. The water-driven fan is adapted to draw odorous air from the toilet bowl into the fan and to discharge the odorous air to a location remote from the toilet bowl.

[0008] In yet another aspect of the invention, a ventilated toilet system comprises a toilet with a toilet bowl having a drain, a plenum, and openings spaced around the toilet bowl in fluid communication with the plenum, a tank for storing flush water of the toilet, and a toilet seat mounted on the toilet bowl. A water-driven fan is disposed for being impinged by water supplied to the toilet. The water-driven fan is adapted to draw odorous air from the toilet bowl and to discharge the odorous air to a location remote from the toilet bowl. The water-driven fan comprises a water-powered motor adapted for communication with a water supply line and fan blades driven by said water powered motor to evacuate odorous air from the toilet. An air inlet conduit is in communication with the plenum and the fan for drawing odorous air into the fan. An air outlet conduit is mounted in the tank and connected to the fan. The air outlet conduit comprises a passage in the toilet bowl in fluid communication with the drain of the toilet bowl for discharging odorous air from said toilet. A water supply valve in the fan water supply line controls the flow of water to the fan. The water supply valve has an actuator operable upon the application of pressure to the toilet seat to permit operation of the fan.

[0009] Other objects and features of the present invention will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a front perspective of a toilet having a ventilation system of the present invention;

[0011] FIG. 2 is a view similar to FIG. 1 but showing a tank of the toilet partially broken away to show details of the ventilation system;

[0012] FIG. 3 is a back perspective of the toilet showing the tank partially broken away to reveal details of the ventilation system;

[0013] FIG. 4 is a cross-section of the toilet;

[0014] FIG. 5 is an exploded perspective of a fan of the ventilation system;

[0015] FIG. 6 is a top plan view of the fan;

[0016] FIG. 7 is a cross-section taken along the plane including line 7-7 of FIG. 6.

[0017] Corresponding parts are designated by corresponding reference numbers throughout the drawings.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] Referring to FIGS. 1 and 2, a ventilation system of the present invention is designated in its entirety the reference numeral 1 and is shown installed on a toilet, generally designated 5. The toilet 5 has a base, generally designated 9, a toilet bowl 13 having a moveable toilet seat 15 for supporting a user of the toilet, and a tank 19 mounted on the toilet bowl 13 for storing water used to flush the toilet. It is understood that the ventilation system 1 of the present invention may be supplied as part of the toilet 5 or as part of a retrofit kit for an existing toilet. The ventilation system 1 is operable to remove odorous air from the toilet bowl 13 prior to detection by a user of the toilet 5.

[0019] A handle 25 mounted on the exterior of the tank 19 is operatively connected to a flush valve 29 located in the
bottom of the tank to control the flow of water from the tank to the toilet bowl 13. As shown in FIG. 3, the handle 25 is operatively connected to the flush valve 29 by a lever 33 extending from the handle and connected to a chain 37 attached to the valve 29. The pivoting movement of the handle 25 causes the toilet 5 to flush by raising the end of the lever 33 connected to the flush valve 29 to pivot the valve away from its seat and allow water to flow from the tank 19 into toilet bowl 13. In the illustrated embodiment, the flush valve 29 is shown in the closed position to seal against the flow of water from the tank 19 to the toilet bowl 13. A toilet water supply line 43 is connected to a manually operated water valve 47 that provides on/off control of the toilet water supply from a main water source (not shown). Typically, this would be, for example, a municipal water supply.

As shown in FIG. 4, the toilet bowl 13 comprises a plenum 55 having a rear portion below the tank 19 and a front portion defined by a hollow rim 61 of the bowl. The plenum 55 receives flush water from the tank 19 upon opening of the flush valve 29 and directs the water from the tank into the toilet bowl 13 to create the flushing action of the toilet 5. The plenum 55 has a plurality of openings 65 spaced around the hollow rim 61 to allow flush water to be discharged from the plenum into the toilet bowl 13 when the toilet 5 is flushed. When the flush valve 29 is closed, the plenum 55 is substantially free of water so that air from within the toilet bowl 13 may flow into the plenum through the openings 65 in the hollow rim 61. The toilet bowl 13 has an interior space 69 and a bottom opening 73 leading to a drain 77 in the base 9 of the toilet 5. The drain 77 has an outlet 81 for connection with sewer piping (not shown) below the toilet 5.

As shown in FIGS. 2 and 3, the tank 19 houses a water valve 85 that provides on/off control of the water used to fill the tank after flushing the toilet 5. The water valve 85 controls water from a water line 89 connected to a tee 93 located downstream from the manual water supply valve 47. The water valve 85 is controlled by a float 97 that closes the valve when the water level in the tank 19 reaches a predetermined level. An overflow tube 99 in the tank 19 is connected to the plenum 55 and protects against overflowing the tank in the case of malfunction of the water valve 85 or float 97. If the water level in the tank 19 reaches the top of the overflow tube 99, water flows through the overflow tube and into the plenum 55 and the toilet bowl 13.

The ventilation system 1 of the present invention comprises a water-driven fan 109 mounted in the tank 19 in fluid communication with the interior space 69 of the toilet bowl 13. The water-driven fan 109 is free from any electrical circuitry and is operable to evacuate the toilet 5 of odorous air based on the pressure and flow of water entering the fan. Upon operation of the fan 109, the ventilation system 1 evacuates odorous air from the toilet bowl 13 and discharges the odorous air from the toilet 5.

In the illustrated embodiment, the ventilation system 1 has a fan water supply line 113 that branches off from the tee 93 downstream of the manual water valve 47 to supply water to the water-driven fan 109 mounted in the tank 19. In the illustrated embodiment, the fan water supply line 113 is routed to a control valve 117 located on the top of the toilet bowl 13 that is positioned for contact with the bottom surface of the toilet seat 15 in the lowered position of the toilet seat. The fan water supply line 113 extends from the control valve 117 into the tank 19 and has an outlet 121 mounted on the water-driven fan 109 for discharging water into the fan. In one embodiment, the control valve 117 has a push-button actuator 125 that contacts the bottom surface of the toilet seat 15 in the closed position of the seat. When the toilet seat 15 is lowered, the actuator 125 is depressed causing the control valve 117 to open so that water is supplied to the water-driven fan 109. It is understood that the control valve 117 may be other types of valves having other types of actuators 125. Further, the control valve 117 may be otherwise located for remote operation by a pressure switch (not shown) mounted on the toilet bowl 13 or a wall-mounted switch (not shown) without departing from the scope of this invention.

As shown in FIGS. 5 and 7, the water-driven fan 109 comprises an upper housing 135, a lower housing 139, a water-powered motor, generally designated 145 and located in the upper housing in fluid communication with the outlet 121 of the fan water supply line 113, and fan blades 149 in the lower housing operatively connected to the water-powered motor. The fan 109 has an air inlet conduit 153 connected to the plenum 55 for the flow of air into the fan and an air outlet conduit 157 for conveying air discharged from the fan. The air inlet conduit 153 and air outlet conduit 157 are connected to the bottom wall of the tank 19 for supporting the fan 109 in the tank. In the illustrated embodiment, the inlet conduit 153 and the outlet conduit 157 are connected to respective mounting sleeves 151 attached to the bottom wall of the tank 19 by conventional fastening means (e.g. adhesive). It will be understood that the inlet conduit 153 and the outlet conduit 157 may be attached to the tank 19 by any means to support the fan 109 and allow communication between the fan and the plenum 55. A check valve 161 in the air inlet conduit 153 prevents the flow of air from the fan 109 back into the plenum 55. As shown in FIG. 4, the air outlet conduit 157 is connected to a discharge pipe 167 at the back of the toilet 5 below the tank 19. In the illustrated embodiment, the discharge pipe 167 has an outlet 173 connected to the drain 77 of the toilet 5 at a location spaced above the drain outlet 88 so that odorous air can be discharged into the main sewer line connected to the toilet. It is understood that the ventilation system 1 may be otherwise arranged such that the fan 109 discharges odorous air to other locations to prevent detection of the odorous air by a user of the toilet 5. For example, the fan 109 could discharge air through a wall (not shown) enclosing the toilet 5 or to an air filler device (not shown) that cleanses or conditions the air to remove offensive odors prior to discharging the air to the environment surrounding the toilet.

As shown in FIGS. 5 and 7, the water-powered motor 145 has vanes 181 connected to a rotatable shaft 185 that extends downward into the lower housing 139 of the fan 109. The outlet 121 of the fan water supply line 113 (FIG. 4) is positioned to impinge the vanes 181 of the motor 145 with water discharged from the outlet. It is understood that the outlet 121 of the fan water supply line 113 may comprise a nozzle for increasing the velocity of the water impinging the vanes 181. The fan blades 149 are connected to the shaft 185 so that the fan blades, the shaft, and the vanes 181 of the motor 145 rotate together. The force of the water impinging the vanes 181 rotates the vanes and the shaft 185 causing the fan blades 149 in the lower housing 139 to rotate. The rotation of the fan blades 149 in the lower housing 139...
discharges air from the outlet conduit 157 of the fan 109 creating a vacuum in the lower housing that draws air into the fan through the inlet conduit 153. Air from the interior space 69 of the toilet bowl 13 is conveyed into the lower housing 139 of the fan 109 through the openings 65 spaced around the rim 61 of the toilet bowl, the air plenum 55, and the air inlet conduit 153 connected to the plenum. The odorous air drawn into the fan 109 is discharged from the toilet 5 to the sewer line through the air outlet conduit 157 and the discharge pipe 167 connected to the drain 77 of the toilet.

[0026] As shown in FIGS. 2-4, the fan 109 has a drain line 191 connected to the upper housing 135 of the fan for the flow of water from the water-powered motor 145 to a water saving container 195 mounted in the tank 19. The water saving container 195 receives water from the water-driven fan 109 after the potential energy of the water exiting the outlet 121 of the fan water supply line 113 has dissipated by contact with the vanes 181 of the motor 145. The water saving container 195 conserves the water used to operate the fan 109 by storing the water discharged from the fan for use when the toilet 5 is next flushed. The water saving container 195 could be omitted from the ventilation system 1 so that the water from the fan 109 would not be used in the flushing cycle of the toilet and would flow into the sewer line via the overflow tube 99, toilet bowl 13, and drain 77.

[0027] As shown in FIGS. 2 and 3, the water saving container 195 has a drain valve, generally indicated 199, that discharges water from the container when the toilet 5 is flushed. In one embodiment, the drain valve 199 comprises a float 205 housed in a sleeve 209 below an opening in the bottom wall of the water saving container 195. The float 205 is vertically moveable in the sleeve 209 to close the opening in the water saving container 195 when the water level in the tank 19 is raised above the bottom wall of the container. When the water level in the tank 19 drops below the bottom wall of the container 195 (e.g., during flushing), the float 205 drops below the opening in the bottom wall of the container so that water drains from the container. It is understood that the drain valve 199 of the water saving tank may be otherwise configured to be actuated by the float 97 of the water valve 85 used to fill the tank 19 or by any other actuator without departing from the scope of this invention. For example, the drain valve 199 could comprise a gate valve in a side wall of the water saving container 195 that opens and closes based on the position of the float 97 that raises and lowers based on the water level in the tank 19. Also, the water saving container 195 may be other sizes, may be otherwise located in the tank, or may be mounted externally of the tank without departing from the scope of this invention.

[0028] In use, the ventilation system 1 of the present invention evacuates odor from the interior space 69 of the toilet bowl 13 to prevent detection by a user of the toilet 5. Upon lowering of the toilet seat 15, the control valve 117 opens to supply water to the water-driven fan 109 mounted in the tank 19 of the toilet 5. The water discharging from the outlet 121 of the fan water supply line 113 contacts the vanes 181 of the water-powered motor 145 to cause the shaft 185 and fan blades 149 to rotate. The rotation of the fan blades 149 discharges air from the fan 109 and creates a vacuum in the fan that draws in odorous air from the interior space 69 of the toilet bowl 13. As indicated by arrows A1 of FIG. 4, air flows from the interior space 69 of the toilet bowl 13 into the plenum 55 via the openings 65 in the rim 61 of the toilet bowl and into the air inlet conduit 153 of the fan 109. The air discharged from the fan 109 flows through the air outlet conduit 157, the discharge pipe 167, and into the main drain pipe 77 of the toilet 5 connected to the sewer line. The water used to turn the water-powered motor 145 flows from the drain line 191 into the water saving tank 195 where it is stored until the toilet 5 is flushed. Upon raising the toilet sent 15 from the lowered position, the control valve 117 closes to shut off water to the fan 109 which stops the rotation of the fan blades 149 and the flow of air from the interior space 69 of the toilet bowl 13. When the toilet 5 is flushed, the water in the tank 19 is discharged into the toilet through the flush valve 29 and the water in the water saving container 195 exits through the drain valve 199 in the bottom of the water saving container. After flushing, the flush valve 29 closes and the tank 19 is filled with water from the water valve 85 for use in the next flush cycle of the toilet 5.

[0029] It is understood that the ventilation system 1 of the present invention could be supplied as a kit of parts for retrofit of an existing toilet 5 or the ventilation system could be supplied as part of a new toilet without departing from the scope of this invention.

[0030] When introducing elements of the present invention or the preferred embodiment(s) thereof, the articles “a”, “an”, “the” and “said” are intended to mean that there are one or more of the elements. The terms “comprising”, “including” and “having” are intended to be inclusive and mean that there may be additional elements other than the listed elements.

[0031] In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

[0032] As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A ventilation system for a toilet comprising a toilet bowl, a toilet seat for supporting a user of the toilet, and a tank mounted on the toilet bowl for holding water used in flushing the toilet, said ventilation system comprising:
   a fan adapted for connection to the toilet bowl to draw odorous air from the toilet bowl and to discharge the odorous air from the toilet,
   a fan water supply line adapted for fluid communication with the fan wherein water from said water supply line is adapted to power said fan to evacuate the odorous air from the toilet.
2. The ventilation system of claim 1 wherein said ventilation system is free from any electrical circuitry and is operable based on pressure and flow of said water exiting the fan water supply line.
3. The ventilation system of claim 1 wherein the fan is sized for mounting in the toilet.
4. The ventilation system of claim 1 wherein said fan comprises a water-powered motor adapted for communication with said fan water supply line and fan blades driven by said water-powered motor.
5. The ventilation system of claim 1 wherein said ventilation system comprises an air inlet conduit for drawing odorous air into said fan and an air outlet conduit for discharging odorous air from said toilet.

6. The ventilation system of claim 5 wherein said air inlet conduit is adapted for connection to a plenum in fluid communication with openings spaced around the toilet bowl in fluid communication with an interior space of the toilet bowl, the fan being adapted to draw odorous air from the interior space of the toilet bowl through said openings and the plenum.

7. The ventilation system of claim 6 wherein said air inlet conduit includes a check valve for the control of air flow into said fan.

8. The ventilation system of claim 6 wherein said air outlet conduit is adapted to convey air from an outlet of said fan to a drain of said toilet to discharge odorous air from the toilet.

9. The ventilation system of claim 5 wherein said fan is adapted to be supported in said tank by the air inlet conduit and the air outlet conduit.

10. The ventilation system of claim 1 further comprising a water saving container for receiving and storing water discharged from the fan.

11. The ventilation system of claim 10 wherein said water saving container comprises a drain valve operable based on the level of water in said toilet tank.

12. The ventilation system of claim 1 further comprising a control valve in said fan water supply line controlling the flow of water to said fan, said control valve comprising an actuator operable upon the application of pressure to said toilet seat.

13. The ventilation system of claim 12 wherein said actuator is a push-button actuator adapted to be in contact with the toilet seat in a lowered position of said toilet seat and moveable between a first position in which the valve is closed and no water is supplied to the fan and a second position in which the valve is open and water is supplied to the fan to evacuate air from the toilet.

14. A ventilated toilet system comprising:

a toilet comprising a toilet bowl and a tank for storing flush water of the toilet,

a water-driven fan disposed for being impinged by water supplied to the toilet, said water-driven fan being adapted to draw odorous air from the toilet bowl and to discharge said odorous air to a location remote from the toilet bowl.

15. The ventilated toilet system of claim 14 wherein said water-driven fan comprises a water-powered motor adapted for communication with a water supply line and fan blades driven by said water powered motor to evacuate odorous air from the toilet.

16. The ventilated toilet system of claim 15 wherein the motor is disposed in the tank and is adapted for communication with the same water supply line that supplies flush water to the tank.

17. The ventilated toilet system of claim 16 wherein said water-driven fan is disposed in the tank and is free from any electrical circuitry.

18. The ventilated toilet system of claim 15 wherein said water-driven motor has vanes adapted to be impinged by water supplied to the fan and said fan blades being operatively connected to said vanes.

19. The ventilated toilet system of claim 18 further comprising an air inlet conduit for drawing odorous air into said fan and an air outlet conduit for discharging odorous air from said toilet.

20. The ventilation system of claim 19 wherein the toilet bowl has a drain, a plenum, and openings spaced around the toilet bowl in fluid communication with the plenum, and wherein the air inlet conduit is in communication with the plenum and the fan, said air outlet conduit being mounted in the tank in fluid communication with the fan and the drain of the toilet bowl.

21. A ventilated toilet system comprising:

a toilet comprising a toilet bowl having a drain, a plenum, and openings spaced around the toilet bowl in fluid communication with the plenum, a tank for storing flush water of the toilet, and a toilet seat mounted on the toilet bowl,

a water-driven fan disposed for being impinged by water supplied to the toilet, said water-driven fan being adapted to draw odorous air from the toilet bowl and to discharge said odorous air to a location remote from the toilet bowl, the water-driven fan comprising a water-powered motor adapted for communication with a water supply line and fan blades driven by said water powered motor to evacuate odorous air from the toilet,

an air inlet conduit in communication with the plenum and the fan for drawing odorous air into said fan,

an air outlet conduit mounted in the tank and connected to the fan, the air outlet conduit comprising a passage in the toilet bowl in fluid communication with the drain of the toilet bowl for discharging odorous air from said toilet,

a fan water supply line adapted for fluid communication with the fan wherein water from said water supply line is adapted to power said fan to evacuate odorous air from the toilet, and

a control valve in said fan water supply line controlling the flow of water to said fan, said control valve comprising an actuator operable upon the application of pressure to said toilet seat to permit operation of the fan.

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