This invention relates generally to ventilators for toilet bowls, and more particularly relates to a ventilating apparatus necessary in the form of a self contained unit adapted for ready installation to existing toilet bowls.

Basically, the ventilating apparatus according to the present invention includes a housing adapted to be secured to the floor beside the toilet bowl, which housing is provided with a top air inlet opening and a bottom air outlet opening which is normally closed against the passage of air from the basin when the toilet lid is closed, the housing including therewithin an electrically actuated exhaust fan and operatively associated electromagnetically operated means for opening the trap whenever the fan is operated and for closing the trap when the fan is not operated. The apparatus is further provided with suitable intake and venting conduit lines through which the noxious odors are withdrawn from the toilet bowl and vented to the sewer line. Operation of the electrical portions of the apparatus is controlled by a switch which is openable and closable in response to the position of the toilet seat.

Accordingly, it is a primary object of this invention to provide a novel toilet bowl ventilating apparatus in the form of a relatively small and unobtrusive self contained unit readily adapted for installation to existing toilet bowl devices with a minimum of labor and time.

Another object of this invention is to provide a novel toilet bowl ventilating apparatus as aforesaid having an intake line in the form of a flexible conduit terminating at a free end in an air intake device so shaped that it fits over and secures to the rim of the toilet bowl at an elevation higher than the level to which flushing water rises in the bowl when the toilet is flushed.

Still another object of this invention is to provide a novel toilet bowl ventilating apparatus which is relatively inexpensive to make, which is of small size and thus inconspicuous in use and which is also very quiet in operation.

Another object of this invention is to provide a novel toilet bowl ventilating apparatus as aforesaid which includes a novel type of composite exhaust fan and electromagnetically operated trap sealing mechanism which also includes anti-aspirating means effective to prevent the trap sealing liquid from being drawn out of the trap when the toilet is flushed.

The foregoing and other objects of the invention will become clear from a reading of the following specification in conjunction with an examination of the appended drawings, wherein:

FIGURE 1 is a front to back vertical sectional view taken through a toilet structure which has the novel ventilating apparatus combined therewith;

FIGURE 2 is a horizontal sectional view through the toilet structure of FIGURE 1 as would be seen when viewed along the line 2—2 thereof;

FIGURE 3 is a fragmentary vertical sectional view through the toilet bowl sewer discharge line showing the connection of the ventilating apparatus outlet vent thereto as would be seen when viewed along the line 3—3 of FIGURE 1;

FIGURE 4 is an enlarged vertical sectional view through the novel ventilating apparatus according to the invention with some of the interior parts illustrated in elevation, and showing the apparatus in operative connection with its outlet vent open for free air flow through the device;

FIGURE 5 is similar to the showing of FIGURE 4, differing only in that the apparatus is shown in its inoperative condition with the outlet vent closed off by the liquid sealed trap arrangement of the lower end of the unit;

FIGURE 6 is a horizontal cross sectional view through the ventilating apparatus as would be seen when viewed along the line 6—6 of FIGURE 4;

FIGURE 7 is a horizontal cross sectional view through the ventilating apparatus as would be seen when viewed along the line 7—7 of FIGURE 4; and

FIGURE 8 is a perspective view showing the air intake fitting operatively mounted upon the toilet bowl rim.

In the several figures, like elements are denoted by like references characters.

Referring first to FIGURES 1 and 2, there is observed an ordinary construction of a toilet bowl having the usual catch basin 10 of downwardly convergent form connected at its lower end with a siphon arrangement formed by the downwardly extending basin rear wall 11 and upwardly extending web wall 12 together with the rear wall 13 of the bowl structure. The downwardly extending portion of the siphon formed by the walls 12 and 13 connects at its lower end to the usual waste pipe 14.

Flushing water is supplied to the bowl in a suitable manner from a tank 15 which delivers the water into a chamber 16 at the rear of the toilet bowl, and from which chamber the water flows downward over the basin rear wall 11 and outward into the manifold 17 formed in the upper rim of the bowl for delivery downward over the surface of the basin through the rim holes 18, 18.

Seated on the floor 19 beside the toilet bowl is the ventilating unit according to the invention, designated generally as 20, having connected to its upper end a flexible air inlet conduit 21 and to its lower side an air venting outlet conduit 22. As best seen in the showing of FIGURE 3, the outlet conduit 23 communicated with the waste line passage by means of a bore 23 drilled through the side of the toilet bowl and within which bore is disposed a fitting 24 to the outer end of which is secured the outlet conduit 22. The outer end of the inlet conduit 21 is coupled to an air intake fitting designated generally as 25 and best seen in the showings of FIGURES 1, 2 and 8.

The air intake fitting 25 preferably is in the form of a hollow member of generally inverted L-shape having a leg portion 27 extending horizontally across the upper surface of the bowl rim and connecting with an open-bottomed vertical leg portion 28 extending downward along the inside surface of the bowl rim into the open upper end of the catch basin. The lower end of the air intake leg 27 is open, as at 28a, and thus provides free communication between the interior of the toilet bowl and the ventilating unit 20 by way of the air intake conduit 21. The inner surface of the vertical leg portion 28 is also provided with holes or apertures 29 through the side wall thereof below the level of the hollow passage of the horizontal leg portion 27. As is best seen in the showing of FIGURE 2, the outward side of the intake unit horizontal leg portion 27 is provided with a pair of oppositely extending pipe fittings 20, one of which is closed off by means of the cap or plug 31 and the other which has been fitted upon it the upper end of the flexible inlet conduit 21.

Also carried by the air intake unit 25 is a micro-switch having an upwardly extending switch button 32, the switch being in open condition when the button 32 is up and being in a closed condition when the button 32 is depressed. From the location of the switch button 32 it is evident that the switch lies immediately beneath the...
The air intake unit 25 is so formed that it results in a clamping or compression fit about the upper rim of the toilet bowl, or alternatively any suitable type of clamping mechanism may be employed to hold the intake unit in proper position. The cuffed pipe fitting 30 is provided so that the air intake unit may optionally be secured to the toilet bowl at the opposite side thereof, in which event the inlet conduit would be projected onto the pipe fitting illustrated as capped, and the cap 31 would be used to plug the pipe fitting which is illustrated in the drawing as that to which the inlet conduit is connected.

Referring now also to FIGURES 4 through 7 which illustrate the ventilating unit 20 on a larger scale and in much clearer detail, it is observed that the unit includes a base 35 secured to the floor and a plurality of bolts 36, and to the upper surface of which base 35 is secured by bolts 37 a generally vertically extending hollow housing 38. The housing 38 has a central section 39, an upper section 40 converging toward the top in a fitting 41 to which is adapted to be secured the lower end of the inlet conduit 21, and a lower section 42 which is tapered in a downwardly converging direction and from the side of which at the lower end thereof angularly upwardly extends an outlet vent line 43 terminating in a fitting 44 upon which is secured one end of the outlet conduit 22. As seen from the horizontal cross-sectional views of FIGURES 6 and 7, the housing 38 is observed to be of circular cross-section, at least, as shown with respect to the central section 39 and lower section 43, although it will be appreciated that such circular cross-section form is not mandatory but is nevertheless convenient.

Centrally disposed within the central section 39 of the housing and secured to the housing walls by support pins 45 is the stator 46 of the fan whose rotor 47 is fitted with a plurality of blades 48. The blades 48 are rotatable in a horizontal plane and so inclined that air is drawn downward into the housing 38 through the upper fitting 41 and forced out through the lower outlet vent line 43, as shown by the air flow direction arrows in the illustration of FIGURE 4. The fan stator 46 is of course of smaller cross sectional area than the inside housing 38 in order to prevent obstruction of the desired air flow. Secured to the underside of the fan stator 48 and extending downward therefrom is a cylindrical solenoid 49 positioned with its axis extending vertically and substantially centrally with respect to the housing 38.

Disposed within the solenoid 49 and axially shiftable piston structure composed of a cylindrical sleeve 51 surrounding the sides of the solenoid 49 and terminating at its lower end in a transversely extending solid circular disc or plate 52. The lower end of the plunger 50 is integrally secured to the central portion of the upper face of the disc 52, the piston as illustrated showing the plunger 50 and cylindrical sleeve 51 and circular disc 52 as a unitary structure. However, as far as the solenoid action is concerned it is only necessary that the plunger 50 portion be formed of a mechanically susceptible material.

Fixed upon the cylindrical sleeve 51 of the piston proximate the upper end thereof is a frusto-conical annular seal 53 of rubber or other suitable material, the outer circumferential wall 54 of which is tapered in a vertically therewithin is a plunger 50 which is part of a 75 response with the taper of the inside surface of the housing lower section 42 and is of such diameter that it close fittingly engages the lower section side wall completely peripherally therewithout and the piston structure is in a downwardly shifted position as shown in FIGURE 5, but is disengaged from the housing side wall when the piston is in its raised position as shown in FIGURE 4 so as to provide an annular flow path for the air and gases being downwardly driven by the operation of the fan.

The fan and solenoid are simultaneously energized and deenergized from an appropriate source of electrical power through the micro-switch controlled by button 32 and via electrical conductors 55, 56 and 57. When the toilet seat 33 is in its dotted line somewhat raised position, as shown in FIGURE 1, due to the action of spring 34, the switch contacts are open and the fan and solenoid are deenergized. The solenoid plunger 50, of its own weight and under the influence of gravity, is therefore in its axially depressed position as shown in FIGURE 5, carrying with it the entire piston structure, so that it displaces a substantial amount of the oil 58 lying in the bottom of the housing 38. The oil 58 which is so displaced moves laterally outward and upward until its level rises sufficiently high to effectively seal the outlet vent line 43 in the manner seen in FIGURE 5. Sewer gases are thus prevented from passing backward through the vent line 43 and upward through the outlet vent hole 44 lying in the bottom of the bowl of the toilet. Additionally, when in its raised position as shown in FIGURE 5, the seal 53 prevents the oil 58 from being drawn into the waste line by aspiration when the toilet is flushed. In communities where the plumbing code does not require a liquid sealed trap, the oil 58 may be omitted by insuring that the member 53 makes a complete seal with the housing when the solenoid 49 is deenergized.

When now the toilet is used so as to depress the seat 33 against the bias of spring 34 and to close the micro-switch controlled by button 32, the fan and solenoid are both energized. Energization of the solenoid of course causes the plunger and piston to rise vertically into the position illustrated in FIGURE 4 and thereby open the outlet vent line 43 by lowering the level of the oil 58 and unsealing the seal 53 from engagement with the housing wall. The rotating fan exhausts the toilet bowl gases as previously described. Therefore, when the toilet seat 33 rises upon departure of the occupant, the fan and solenoid are again deenergized and reestablish the physical conditions illustrated in the showing of FIGURE 5.

Having now described my invention in connection with a particularly illustrated embodiment thereof, it will be appreciated that variations and modifications of the same may now occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of my invention, and accordingly it is intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed to be new and useful is:

1. A toilet ventilating device adapted for connection to an existing toilet bowl, comprising in combination,
   (a) a hollow housing having an inlet thereto proximate its upper end and an outlet conduit line projecting laterally upward therefrom proximate its lower end, said outlet line being a part of a longitudinal hollow housing a liquid sealable trap structure,
   (b) an electrically energizable fan disposed substantially centrally entirely within and supported from the walls of said housing with the fan blades disposed for rotation in a horizontal plane and effective when energized to move gases downward from the said housing inlet toward the said housing outlet,
   (c) a cylindrical piston within said housing axially shiftable vertically upward from a lower position at the bottom of said housing to an upper position spaced thereabove, by energization of a solenoid carried by and extending downward from the said
fan, said piston returning to its lower position when said solenoid is deenergized,

(d) a well formed in the bottom of said housing containing a substantially fixed volume of said trap-sealing liquid in which said piston is immersed only when in its lowered position,

(e) operating means for selectively raising said piston free of the well liquid for opening said trap structure and lowering said piston into said well liquid to raise the level thereof for closing said trap structure,

(f) an annular seal extending peripherally about and carried by said piston effective to close the gas flow path between said housing inlet and trap when said piston is at its said lower position by engagement of the seal with the inside surface of the housing walls completely peripherally thereof to thereby prevent any of said trap sealing liquid from being aspirated into the waste line when the trap is closed and the toilet is flushed, said seal being disengaged from the housing walls to open the gas flow path when said piston is at its said upper position,

(g) and selectively operable control means for simultaneously energizing said fan and solenoid to thereby withdraw gases from the toilet bowl for discharging the same through the opened trap into the waste line.

2. The apparatus as set forth in claim 1 wherein the internal surfaces of said hollow housing and the external surfaces of said annular seal are concentrically disposed and correspondingly tapered whereby the same engage one another to seal the gas flow path therebetween when the piston is in its lowered position.

3. The apparatus as set forth in claim 1 including means for conducting gases from the toilet bowl through said housing to the toilet bowl waste line having a flexible conduit connected at one end to said hollow housing inlet and connected at the other end to an air intake unit, said air intake unit comprising

(a) an inverted L-shaped end fitting having a horizontal hollow leg connected to an open-bottomed vertical hollow leg, the horizontal leg being adapted to extend across the toilet bowl rim beneath the toilet seat while the vertical leg is adapted to extend downward along the inside surface of the bowl rim toward the open upper end of the bowl catch basin,

(b) and a pair of identical pipe fittings extending in opposite directions from the outer side of the intake unit horizontal leg and communicating with the hollow interior of the latter, said fittings being each adapted to have connected thereto interchangeable closure means or air inlet conduit connecting means.

4. The apparatus as set forth in claim 1 including means for conducting gases from the toilet bowl to said housing inlet comprising a hollow member mounted upon the toilet bowl beneath the toilet seat, said member having an air intake opening in free communication with the interior of the toilet bowl and an air discharge opening connected to said housing inlet and a normally-open electrical switch carried by said member connected in circuit with said fan and solenoid, said switch being actuable upon closing of the toilet seat to simultaneously energize said solenoid and effect operation of said fan.

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