VENTILATED TOILET APPARATUS AND DUAL FUNCTION TOILET SEAT

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(57) ABSTRACT

A ventilated toilet apparatus includes a toilet seat assembly (1), a hinge assembly (3) and an air purification system (102). The toilet seat assembly comprises a number of intake apertures (5), air passageways (11), pivots (14), and an exhaust conduit (6). The hinge assembly comprises a receptacle opening (15) and an axial post (17). The receptacle opening receives the pivot which is attached to the toilet seat assembly. The axial post allows an airflow communication between the toilet seat assembly and the suction device (4). Addition of a heating unit to a toilet seat body provides a dual function apparatus which can be warmed to several temperature settings. The air purification system includes a filter (104) for arresting odorous smells, a blower (110) for drawing the noxious odors from the toilet bowl, and a UV lamp (122) for killing harmful bacteria and viruses.
FIG. 7
VENTILATED TOILET APPARATUS AND DUAL FUNCTION TOILET SEAT

PRIORITY CLAIM


FIELD OF THE INVENTION

[0002] This invention relates to toilet seat body, pivots and hinges in close communication to draw foul air from the toilet bowl and discharge to a remote location by a remotely controlled suction device. In addition, the present invention is concerned with the utilization of the toilet seat body which can be warmed to several temperature settings to relieve the chilly feeling on the toilet seat during the cold season. Ultimately, the current invention discloses how to incorporate these two different functions in a single unit to provide an additional comforting feeling to the bathroom users.

BACKGROUND OF THE INVENTION

[0003] To accommodate various needs in the bathrooms, a number of bathroom accessories and products are available. One of the products designed to provide a comforting feeling to the bathroom users during the cold season is a warm seat of which upper surface can be heated by means of an electric heating coil encased within the seat body and relieve the chilly feeling from the cold seat.

[0004] The houses and buildings located in the area of cold climate are prone to have poor ventilation and the residents may frequently experience unpleasant smells in some areas, especially around the bathroom. Although deodorants or air fresheners are typically applied to deal with foul odors generated in the bathroom, they just simply mask the foul odors but do not eliminate them.

[0005] Alternatively, foul odors from the bathroom are evacuated by electric fans installed on the ceiling or wall of the bathroom. This type of ventilation method needs to evacuate a large volume of air, so the lingering unpleasant smell may persist until the bathroom is completely filled up with fresh air. Since the dispersion of gases from the toilet bowl to the surrounding atmosphere is the main cause of unpleasant smells in the bathroom, removal of gases directly from the toilet bowl prior to the diffusion of gases to the surrounding area has been suggested as a more efficient method to eliminate foul odors from the bathroom than the conventional ventilation system employing electric fans on the ceiling.


[0007] Many toilet seats disclosed in the previous art are to be assembled by attaching at least two separate pieces to form internal air passageways, which results in a large area of seams or unsightly apertures. Toilet seats constructed in this manner not only need a frequent cleaning to remove contamination problems, but also the structural integrity are prone to be compromised to lead a potential leakage of air flow communication.


[0009] However, none of the prior arts teaches or suggests a dual function toilet seat body or an apparatus in one unit that enables a ventilation of gases from the toilet bowl to the outside atmosphere and also provides means to raise the temperature of the seat body as needed. These dual function capability in a single unit would provide the bathroom users maximum comfort and enjoyment.

BRIEF SUMMARY OF THE INVENTION

[0010] The general purpose of the present invention is to provide an apparatus which will draw foul odors from the toilet bowl and expel to a remote area, or pass the contaminated air through a filter and recirculate the purified air in the bathroom.

[0011] It is a further object of the present invention to provide an apparatus which eliminates cold toilet seat discomfort by allowing users adjust the seat's temperature. This feature will provide bathroom users an added comforting feeling.

[0012] It is a further object of the present invention to provide a toilet seat with dual functions in one body seat unit: the first function to draw foul odors from the toilet bowl and expel to the outside atmosphere by means of a proper suction device, and the second function to raise the temperature of the seat body. These two functions may be engaged simultaneously or only one of the functions may be selected by users as needed.

[0013] It is a further object of the present invention to provide an apparatus of which the outside figure is similar to a conventional toilet seat, therefore has a pleasing aesthetic appearance.

[0014] It is a further object of the present invention to provide an apparatus which will be easily retrofitting a variety of existing toilets.

[0015] It is a further object of the present invention to provide a durable ventilated toilet apparatus that can be manufactured economically and is easy to sanitize.
In order to achieve the above objects, the present invention provides a ventilated toilet apparatus that includes a toilet seat assembly that comprises a seat body that comprises an upper surface, which is adapted to contact the body of a user, and a lower surface which is adapted to be positioned adjacent to a toilet bowl, a hinge assembly; and a pivot device with which the toilet seat assembly is pivotally attached to the hinge assembly. The toilet seat assembly further comprises a pivot receiving part that is formed in the seat body, and a plurality of intake apertures that are provided on the lower surface.

The ventilated toilet apparatus further comprises an exhaust conduit provided in the pivot receiving part, and a cleaning port that is provided below the exhaust conduit and communicates with the exhaust conduit, and a plurality of air passageways that connects the intake apertures and the exhaust conduit. The pivot receiving part encloses the pivot device.

The ventilated toilet apparatus further comprises a cleaning port cap that seals the cleaning port airtight.

The intake apertures are substantially vertical to the lower surface, and the air passageways are substantially parallel to the lower surface.

The exhaust conduit comprises a junction to which the air passageways are connected, a tubular opening that is connected to the junction. The tubular opening receives the pivot device.

The pivot device comprises a hollow pivot tube.

The pivot tube is made of copper, copper alloy, polymeric resin or plastics.

The pivot tube is fixed in the tubular opening of the exhaust conduit.

The junction comprises a junction opening that is open rearward of the toilet seat assembly, and a junction cap that seals the junction opening airtight.

The exhaust conduit comprises a junction, to which the air passageways are connected, two tubular openings that are connected to the junction. The tubular openings receive the pivot device.

The pivot tube comprises a hollow pivot tube and a plurality of pivot apertures. The pivot apertures are provided in the middle section of the pivot tube. The pivot tube is fixed in the tubular openings of the exhaust conduit.

The seat body comprises a bumper that is provided on the lower surface and is adapted to contact the toilet bowl. The bumper surrounds the intake apertures.

The hinge assembly comprises a hollow hinge case, a receptive opening that receives the pivot device, and an axial post  that is adapted to fix the hinge assembly to the toilet bowl.

The pivot device is rotatably received in the receptive opening. The hinge assembly further comprises an O-ring that is provided in a groove formed in the receptive opening.

The axial post comprises a hollow hinge tube.

The hollow hinge tube comprises a notch and is threaded whereby the hinge assembly is fixed to the toilet bowl by fastening a nut with the tube.

The axial post further comprises a pin hole that accepts a pin across the notch of the hollow hinge tube.

The ventilated toilet apparatus further comprises a suction device that is connected to the hinge assembly. The suction device sucks air through the hinge assembly.

The ventilated toilet apparatus further comprises a heating unit with which the seat body is heated, an air passageway that connects the intake apertures and the pivot device. The seat body comprises a hollow space between the upper surface and the lower surface.

The heating unit comprises a resistive wire that is attached below the upper surface in the hollow space, an electrical cord that connects the resistive wire to a control device, a sensor that reads the temperature of the seat body, and a sensor that connects the sensor to the control device. The control device receives information from the sensor and controls the amount of electricity flowing to the resistive wire.

The ventilated toilet apparatus further comprises a cord fastener that secures the electrical cord and the sensor cord within the hollow space of the seat body, and a grommet that secures the electrical cord and the sensor cord within the hinge assembly.

The seat body comprises two tubular openings that receive the pivot device, and at least one bumper that is provided on the bottom surface and is adapted to contact the toilet bowl. The bumper surrounds the intake apertures.

The present invention is explained again based on individual components.

A ventilated toilet apparatus includes a ventilated toilet seat assembly, a pivot and at least one hinge assemblies disposed in communication with remotely controlled suction device to withdraw foul air from the interior of the toilet bowl into the intake apertures, through air passageways, junction, pivot hinge assembly, and suction device to the outside atmosphere.

The ventilated toilet apparatus is used as a single unit or multiunits where a number of units is connected to a single suction device. The ventilated toilet apparatus being used in conventional toilets, buses, recreational vehicles, trains, movable toilets. The ventilated toilet apparatus may be used in combination with a bidet.

A ventilated toilet seat includes a plurality of intake apertures at the bottom of the toilet seat, an exhaust conduit constructed at the rear end of the toilet seat, an exhaust conduit including a junction, a junction cap, tubular openings and a cleaning port, a plurality of air passageways connecting the intake apertures and the junction, at least one bumper around intake apertures, a pivot secured at tubular openings to form a ventilated toilet seat assembly which communicate with air suction device for removal of foul air in the toilet bowl, and a cleaning port which can be opened for extraction of liquid during sanitization of the toilet seat.

A hollow tube includes a plurality of apertures in the middle section to form a pivot. The pivot is made of copper, other metals, composite material, polymeric resin or plastics. The pivot is fixed in the tubular opening of the ventilated toilet seat.

A hinge assembly includes a receptive opening including an inside groove to house an O-ring for an air tight seal with the pivot when a suction device is operating, an axial post, a hollow threaded tube, a washer and a nut to fasten the hinge assembly to the toilet bowl through the axial post, a ventilated toilet seat assembly with a pivot secured through the receptive opening so as to permit a pivotal movement of the toilet seat assembly and air flow communication between the toilet bowl and the suction device.

At least one of the hollow threaded tubes is connected to a remotely controlled suction device.

It is an advantage of the present invention that the toilet seat assembly does not have any prominent unsightly
apertures, seams, or gaskets, which have been used in most of the prior art. In the present invention, special care was taken to minimize the number of apertures and area of seam in the toilet seat and hinge assembly so that the chance of contamination is significantly reduced.

Although the present invention is briefly summarized, the fuller understanding of the invention can be obtained by the following drawings, detailed description and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will become better understood with reference to the accompanying drawings, wherein:

FIG. 1 is a perspective view of a ventilated toilet seat assembly, a hinge assembly and a suction device constructed in accordance with a first embodiment of the present invention;

FIG. 2a is a bottom view of the unfinished ventilated toilet seat and a junction cap, both formed by injection molding;

FIG. 2b is a rear elevation view of the unfinished ventilated toilet seat formed by injection molding;

FIG. 3a is a bottom view of the ventilated toilet seat with air passageways being built;

FIG. 3b is a rear elevation view of the ventilated toilet seat with air passageways being built;

FIG. 4 is a cross sectional view of the ventilated toilet seat sitting on a toilet bowl, taken along line 4-4 of FIG. 3a;

FIG. 5 is an elevation view of a pivot;

FIG. 6a is a top view of a hinge with a hinge cap detached from the hinge;

FIG. 6b is a side elevation view of the hinge;

FIG. 6c is an another side elevation view of the hinge along with the hollow tube and the pin;

FIG. 7 is a perspective view of the hinge assembly showing a hinge cap, a hollow tube and a pin attached to the hinge;

FIG. 8a is a side elevation view of the hinge of a second embodiment;

FIG. 8b is an another side elevation view of the hinge of a second embodiment;

FIG. 9 is a perspective view of the hinge assembly of a second embodiment showing a hollow tube and pin attached to the hinge of a second embodiment;

FIG. 10 is a perspective view of the ventilated toilet seat assembled with the pivot and hinges, with some parts and bumpers deleted for clarity of illustration;

FIG. 11a is a bottom view of a ventilated toilet seat of a second embodiment;

FIG. 11b is a rear elevation view of the ventilated toilet seat; and

FIG. 11c is an elevation view of a pivot;

FIG. 12 shows a bottom view of a dual function seat body illustrated with a portion cut away, pivots, and hinge assemblies. The schematic arrangement of the dual function toilet seat assembly relative to the hinge assemblies, the suction device, and control device are also shown in FIG. 12;

FIG. 13 is a bottom view of a bottom portion of the dual function seat body;

FIG. 14 is a cross sectional view of the dual function seat body, taken along line 14-14 of FIG. 12.

FIG. 15 is a cross sectional view of the dual function seat body, taken along line 15-15 of FIG. 12;

FIG. 16a shows a bottom view of a dual function seat body of a second embodiment illustrated with a portion cut away;

FIG. 16b is a bottom view of a bottom portion of the dual function seat body of a second embodiment.

FIG. 17a is a side elevation view of an air purification system with a portion of body cut away for clarity of illustration;

FIG. 17b is an electrical schematic view of the air purification system;

FIG. 18 is a perspective view of an air purification system with a portion of body cut away for clarity of illustration;

FIG. 19 is a perspective view of an arrangement of a dual function toilet seat assembly and an air purification system;

FIG. 20a is a side elevation view of a cordless air purification system with a portion of body cut away for clarity of illustration;

FIG. 20b is an electrical diagram of the cordless air purification system;

FIG. 21 is a perspective view of an arrangement of a ventilated toilet seat assembly over a conventional toilet bowl and a cordless air purification system communicating wirelessly with a transmitter.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 illustrates that a toilet seat assembly 1 and a hinge assembly 3 on a toilet bowl 2 are disposed in communication with a remotely controlled suction device 4 to withdraw foul air from the interior of the toilet bowl 2 and expel to the outside atmosphere.

FIG. 2a shows that the toilet seat assembly 1 includes internally-formed intake apertures 5 and an exhaust conduit 6 and a cleaning port 7. The intake apertures 5 are arranged adjacent the rear bottom of toilet seat assembly 1.

The inner edge of the toilet seat assembly 1 near the intake apertures 5 is molded pointing downward as depicted in FIG. 4. This configuration is advantageous in protecting the intake apertures 5 from spilling or splashing during the use of toilet as well as providing a better aesthetic view.

Referring back to FIG. 2a, the exhaust conduit 6 is a hollow opening formed at the rear end of toilet seat assembly 1. The exhaust conduit 6 includes a junction 8, a junction cap 9, and tubular openings 10 which are molded to the rear edge of the toilet seat assembly 1.

FIGS. 3a and 3b show that air passageways 11 are built to connect the intake apertures 5 and the junction 8 so that movement of air is possible between them when an appropriate suction is applied. The tubular openings 10 house a pivot 14 (see FIG. 5), which mediates air flow communication between the junction 8 and the hinge assembly 3.

Once the construction of internal air passageways 11 is finished and the pivot 14 is fixed inside the tubular openings 10, the junction cap 9 is attached to a junction opening 32 to provide air tight seal.

FIG. 4 shows that the cleaning port 7 at the rear bottom edge of the toilet seat assembly 1 is provided with a cleaning port cap 13 which can be easily installed or removed. At upright position of the toilet seat assembly 1, the cleaning port 7 can be fitted to a wet vacuum or an aspirator (or
conveniently a nasal suction ball) so that liquid can be collected and captured during sanitization of the intake apertures 5.

[0086] FIGS. 2a and 2b illustrate the unfinished toilet seat assembly 1, in which a number of the intake apertures 5, the junction 8 and the junction cap 9, the tubular openings 10, and the cleaning port 7 are formed advantageously by injection molding.

[0087] The toilet seat assembly 1 is initially manufactured by injection molding. Then the internal air passageways 11 are drilled through the junction 8. In this way, the present invention provides the ventilated toilet seat assembly 1 being built virtually as a one-unit, which allows the structural robustness of toilet seat. Because the relatively small area of seam around the junction cap 9 is located at the rear end of the toilet seat assembly 1, users usually do not notice any unsightly difference of the ventilated toilet seat assembly 1 of this invention from the conventional toilet seats.

[0088] Bumpers 12 surrounding the intake apertures 5 are provided to maintain a close contact to the toilet bowl 2 to prevent any leakage of the foul air from the toilet bowl 2, so that the air flows from the anterior of the toilet bowl 2 to the intake apertures 5.

[0089] The pivot 14 is an about 6 inch-long hollow tube having a plurality of apertures 34 (about ½" to ¾" diameter) in the middle section as depicted in FIG. 5. The pivot 14 may be manufactured using a commercially available copper tube or copper alloy (0.500" OD x 0.430" ID x 0.035" Wall thickness) by simple cutting of the tube to the desired length and drilling of the apertures 34.

[0090] The pivot 14 is of about the same size as the tubular openings 10 and is to be fixed therein by sliding the pivot 14 through the tubular openings 10. The pivot 14 provides a means to secure the toilet seat assembly 1 to the toilet bowl 2 through the hinge assembly 3 and also establishes an air flow communication between the junction 8 and the hinge assembly 3.

[0091] A toilet seat cover 36 (refer to FIG. 1) can be assembled to a pair of hinge assemblies (3 and 30) that allow both the toilet seat assembly 1 and the seat cover 36 a pivotal movement.

[0092] Both ends of the pivot 14 can be attached to a pair of hinge assemblies (3 and 30) for an air flow communication. Alternatively, one end of the pivot 14 can be capped or blocked if a user does not want to use both side of the pivot 14 for an air flow communication. It is desired that the pivot 14 is structurally robust, anti-corrosive, and less prone to contamination. In respect of these desired characters, the copper alloy is a preferred raw material for manufacturing of the pivot 14, but other metallic, composite, or plastic material can be used to make the pivot 14 too.

[0093] FIGS. 6a, 6b, 6c, and 7 show how the hinge assembly 3 secures the toilet seat assembly 1 to the toilet bowl 2. The hinge assembly 3 comprises a receptive opening 15, a hinge cap 16, an axial post 17, a threaded hollow tube 18, a pin 22, a pin hole 68, and a seat cover support 70. The receptive opening 15 receives the pivot 14 horizontally to provide an airtight seal and also allows a pivotal movement of the toilet seat assembly 1. The threaded hollow tube 18 is threaded at the one end and has a notch 19 near the end of the opposite side. The axial post 17 receives the threaded hollow tube 18 which can be attached to the hinge by inserting the pin 22 through the pin hole 68 and across the notch 19. This threaded hollow tube 18 fixed to the axial post 17 provide means to mount the hinge assembly 3 in an airtight manner to the toilet bowl 2 using a matching nut. The threaded hollow tube 18 is connected to the remotely controlled suction device 4 through a connection hose 38. The seat cover support 70 receives a toilet seat cover 36 horizontally and allows a pivotal movement.

[0094] The hollow space in the hinge assembly 3 between the receptive opening 15 and the axial post 17 allows a free air flow. Ultimately, the hinge assembly 3 plays a role to permit an air flow communication between the pivot 14 and the suction device 4.

[0095] The receptive opening 15 may have a groove 20, which can house an O-ring 21 to provide an airtight seal with the pivot 14 when the suction device 4 is operating.

[0096] Preferably, a second hinge assembly 30 having a mirror image configuration of the hinge assembly 3 is provided to form a pair of hinge assemblies (3 and 30) to accept a ventilated toilet seat assembly 1.

[0097] Here, there are a wide variety of toilet bowls having different shapes and sizes. Especially, the horizontal distance from the rear end of the toilet rim to the toilet bowl holes may differ among the toilet bowls. For any ventilated toilet seat designed to retrofit to various existing toilet bowls, it is advantageous to have multiple hinges or some flexibility in hinge systems that may adjust the geometrical distance of the toilet seat relative to the toilet bowl as needed. As a solution to this objective, a hinge assembly of a second embodiment 3 is provided in the present invention as illustrated in FIGS. 6a, 6b, and 9. The hinge assembly of a second embodiment 3 comprises a receptive opening 15', an axial post 17', a threaded hollow tube 18', a pin 22', a pin hole 68', and a seat cover support 70'. The receptive opening 15' receives the pivot 14 horizontally to provide an airtight seal and also allows a pivotal movement of the toilet seat assembly 1. The axial post 17' receives the threaded hollow tube 18' which can be attached to the hinge by inserting the pin 22' through pin hole 68' and across the notch 22'. This threaded hollow tube 18' fixed to the axial post 17' provide means to mount the hinge assembly of a second embodiment 3 in an airtight manner to the toilet bowl 2 using a matching nut. The seat cover support 70' receives a toilet seat cover 36' horizontally and allows a pivotal movement. The receptive opening 15' may comprise a groove 20' which receives an O-ring 21' to provide an airtight seal with the pivot 14' when the suction device 4' is operating.

[0098] There exists a geometrical distance (L, FIG. 6b) between the axes of receptive opening 15 and the axis of axial post 17 of the hinge assembly 3. This horizontal distance (L) is in the range of 1.5 to 2.0 centimeter for the hinge assembly 3, and this horizontal distance is zero in the case of hinge assembly of a second embodiment 3' of which the axis of receptive opening meets the axis of axial post at right angle in a plane. When a ventilated toilet seat assembly 1 is mounted to a toilet bowl 2 using a pair of hinge assemblies, the seat engaged with the hinge assembly 3 will be located farther away from the bowl holes by 1.5 to 2.0 centimeter compared to the seat which is engaged with the hinge assembly of a second embodiment 3'. Since the pivotal axis of the ventilated toilet seat corresponds to receptive opening axis of a hinge, the horizontal distance between the axis of receptive opening (15 or 15') and axial post (17 or 17') determines the geometric location of the toilet seat assembly 1 relative to the toilet bowl 2 when toilet seat is lowered and also the angle of the toilet seat leaning against the water tank when the toilet seat is raised. In order to mount a ventilated toilet seat to the existing
toilet bowl, either of the two different types of the hinge assemblies (3 or 3') may be chosen to optimally adjust the seat to the bowl 2 for an efficient evacuation of foul odors from the toilet bowl.

[0099] FIG. 10 shows a perspective view of the toilet seat assembly 1, the pivot 14, a pair of hinge assemblies (3 and 30) which are arranged to mediate an air flow communication between the toilet bowl 2 and the suction device 4. As seen in FIG. 10, either side of the hinge assemblies (3 or 30) can be utilized for an air flow communication between the pivot 14 and the suction device 4 through the connection hose 38 (see FIG. 1) if only one hinge is engaged with a tube connected to a suction device, and the hinge at the opposite side may be sealed by a conventional manner.

[0100] Though the bumpers 12 and some parts are deleted in FIG. 10 for the clarity of illustration, it is still obvious to the skilled in the art that the ventilating toilet apparatus described in this invention does not have any prominent difference from the conventional toilet seat, which is one of the important factors to be well accepted by the users.

[0101] FIGS. 11a and 11b illustrate an alternative toilet seat assembly 40 having the same features as described in FIG. 3 except that there is only one tubular opening 10 capable of conveying an air flow communication between the junction 8 and the hinge assembly 3 mediated by the aid of a pivot 23 tightly fixed in the tubular opening 10. A tubular opening 24 is prepared to secure the toilet seat assembly 40 to the toilet bowl 2 through the hinge 30. As depicted in FIG. 11c, the pivot 23 is a hollow tube of the same size as the tubular opening 10. The toilet seat assembly 40 including the components illustrated in FIGS. 11a-11c can be advantageously manufactured at the reduced cost compared to that of the toilet seat assembly 1 constructed using the toilet seat illustrated in FIG. 3 and the pivot 14.

[0102] FIG. 12 shows a dual function toilet seat assembly which is arranged with the hinge assemblies 3 and 30, the suction device 4, the control device 60. The dual function toilet seat assembly includes a dual function seat body 45 and pivots 23 with which the toilet seat assembly is pivotally attached to the hinge assemblies. The dual function seat body further includes a heating unit except for a control device 60, tubular openings 57, a plurality of intake apertures 46, and an air passageway 52.

[0103] The dual function seat body 45 is comprised of a top portion 42 and a bottom portion 44. The top portion 42 has an open air passageway 52, a cord fastener 56, and two tubular openings 57. As shown in FIG. 13, a plurality of intake apertures 46 are formed in the rear rim of the bottom portion 44. Bumpers 48 are provided on the bottom portion 44 and are adapted to contact the toilet bowl 2. The bumpers 48 surround the intake apertures 46. The top portion 42 and the bottom portion 44 are attached together to form a dual function seat body 45, and the seat body has a hollow space 51 and an air passageway 53. The hollow space 51 is utilized to accommodate resistive wires 50, a sensor 61. At the rear end of the top portion are formed two tubular openings 57 which accept a pivot 23.

[0104] Attachment of the top and bottom portion in an air and water tight manner constructs an air passageway 53 which allows an air flow communication between the intake apertures 46 and a pivot 23 housed in one of the tubular openings 57. The other pivot 23 in the tubular opening on the opposite side is utilized as a passage of electrical cords 54 and a sensor cord 62 which extend to the control device 60. The top and bottom portions are attached together by any conventional technique.

[0105] The heating unit includes resistive wires 50, electrical cords 54, a sensor 61, a sensor cord 62, and a control device 60.

[0106] The resistive wires 50 are hermetically encapsulated and are electrically insulated within a thermally-conductive polymeric coating. The resistive wires use electricity to provide warmth, and are laid in the hollow space 51 of the dual function seat body 45, preferably close to the horizontal part of the top portion 42 in order to distribute the heat efficiently to the upper surface of the dual function seat body 45. Thermocoductive- and heat resisting polymeric resin or adhesive may be used to hold the resistive wires 50 and sensor 61 in the hollow space.

[0107] The electrical cords 54 connect the resistive wires 50 to the control device 60.

[0108] The sensor 61 reads the actual temperature of the dual function toilet seat and the sensor cord 62 relays this information to the control device 60. The electrical cords 54 and sensor cord 62 are secured within the hollow space of the seat body by the cord fastener 56. The middle section of the electrical cords and sensor cord, from which conductors extend to the control device 60, is tightly fastened by a grommet 58 in the hollow space of the hinge assembly 3. The slack portion of cords between the cord fastener and the grommet reduces a fatigue on the cords when the seat body is pivotally raised or lowered relative to the hinge assemblies 3 and 30 which was mounted on the toilet bowl 2.

[0109] The control device 60 is connected by the electrical cords 54 to the resistive wires 50 for controlling the resistive wires, and is also connected by the sensor cord 62 to a sensor 61. The control device receives information from the sensor and controls the amount of electricity flowing to the resistive wires.

[0110] The dual function seat body 45, a pivot 23, and a hinge assembly 30 are disposed in communication with a suction device 4 to move foul air from the interior of the toilet bowl 2 into the intake apertures 46, through an air passageway 53, a pivot 23, a hinge assembly 30, a hose 38 and a suction device 4. In addition to ventilation, this dual function seat body 45 can be heated by resistive wires 50 which are evenly distributed across the surface of the top portion. Therefore, the dual function toilet apparatus described in this invention can be used in combination for toilet bowl ventilation and toilet seat heating, or used separately for each of the dual functions as needed.

[0111] As depicted in FIG. 14, the top and bottom portions were attached in an air- and water-tight manner to ensure the hollow space 51 and air passageway 53 are protected from potential leakage. To distribute heat efficiently to the upper surface of the dual function seat body 45, resistive wires 50 are evenly spread to cover the horizontal part of the upper portion. Thermostable polymeric resin or adhesive may be used to keep the resistive wires 50 in contact with the horizontal part of the top portion as well as to seal the contact area of top and bottom portion.

[0112] The cross section at the rear end of the dual function seat body shows the tubular opening 57 which is preferably formed during the injection molding of the top portion (see FIG. 15). The tubular opening receives a pivot 23 horizontally
to provide airtight seal, and the pivot fixed in the tubular opening 57 allows a pivotal movement of the dual function seat body 45.

[0113] FIGS. 16a and 16b illustrate the bottom view of an alternative dual function seat body. The dual function seat body 45' is comprised of a top portion 42' and a bottom portion 44'. The top portion 42' has an open air passageway 52', a cord fastener 56', and two tubular openings 57'. As shown in FIG. 16b, a plurality of intake apertures 46' are formed in the rear rim of the top portion 44'. Dampers 48' are provided on the bottom portion 44' and are adapted to contact the toilet bowl 2. The dampers 48' surround the intake apertures 46'. The top portion 42' and the bottom portion 44' are attached together to form a dual function seat body 45'.

[0114] The resistive wires 50' are hermetically encapsulated and are electrically insulated within a thermally-conductive polymeric coating. The resistive wires use electricity to provide warmth, and are laid in the hollow space of the dual function seat body 45', preferably close to the horizontal part of the top portion 42' in order to distribute the heat efficiently to the upper surface of the dual function seat body 45'. Thermoconductive-heat resisting polymeric resin or adhesive may be used to hold the resistive wires 50' and sensor 61' in the hollow space.

[0115] The electrical cords 54' connect the resistive wires 50' to the control device 60.

[0116] The sensor 61' reads the actual temperature of the dual function toilet seat and the sensor cord 62' relays this information to the control device 60. The electrical cords 54' and sensor cord 62' are secured within the hollow space of the seat body by the cord fastener 56'.

[0117] The dual function seat body 45', a pivot 23, and a hinge assembly 30 can be disposed in communication with a suction device 4 to move foul air from the interior of the toilet bowl 2 into the intake apertures 46', through an air passageways 52', a pivot 23, a hinge assembly 30, a hose 38, and a suction device 4. In addition to ventilation, this dual function seat body 45' can be heated by resistive wires 50'. Although the shape of the seat body shown in FIG. 16 is different from the shape of the seat body shown in FIG. 12, each component of the alternative dual function seat body is designed to function the same way as the components described in FIG. 12 does.

[0118] FIGS. 17a, 17b and 18 illustrate a preferred embodiment of the suction device 4 which can be adapted to the ventilated toilet seat. An air purification system 102 comprises a filter unit that removes foul odor, a blower unit that passes air through the filter unit, a lamp unit 120, a switch unit, a warm seat switch knob 116 and an electric control device 118. The filter unit includes a filter 104, a filter cage 106 and a filter cage cap 108. The filter 104 is packed with activated charcoal and receives foul air carried by a connection hose 38 through the filter cage cap 108. The filter cage 106 is sealed to ensure all the foul air entering the filter cage 106 pass through the filter 104, and the purified air exit the filter unit toward the blower unit. The blower unit includes a blower 110 and a blower cage 112. The blower 110 is rotatably driven by electricity and provides a constant airflow of pressure/vacuum even in application with a filter 104 which may have a high backpressure. The filter 104 can be replaced periodically as needed by the user. The lamp unit 120 is equipped with an UV lamp 122 which kills microorganisms by emitting effective range of UV spectrum. This lamp unit is configured that the air flow entering the unit is exposed to the germicidal light before exiting the unit. The UV lamp 120 is easily detached or attached for change when replacement is needed. The switch unit activates or deactivates both the blower 110 and the lamp unit 120 simultaneously.

[0119] In the preferred embodiment, the blower 110 is a regenerative blower (also known as ring blower) that can offer a controlled delivery of airflow in the range of 2-5 cubic feet per minute (SCFM) with maximum pressure/vacuum in the range of 2-5 inches of water. The blower 110 and the lamp unit 120 can be operated by an AC power provided in the wall outlet. Alternatively, the blower motor can be converted to be operated by a low voltage DC power (9-15 V) provided by a rechargeable battery or by an AC to DC converter. The blower cage 112 encloses the blower 110 which is connected to the filter unit through an opening provided in the blower cage 112. The blower cage 112 is well sealed and provided with sound absorbing materials so that the noise generated by the blower 110 during operation can be reduced significantly. The air exiting the blower is allowed to circulate the hollow space of the blower cage 112 so that the blower 110 is exposed to the constant flow of air during operation and does not need a separate cooling device. Some vibration dampening means 114, such as rubber, are used to attach the blower 110 to the blower cage 112. Electrical wires 142 extending from the switch unit and electric control device 118 are connected to the blower 110 and the lamp unit 120 so that the activation or deactivation is controlled by the switch unit. Through an air tight fit provided in the blower cage exit opening, the air leaves the blower cage 112 for the lamp unit 120 where bacteria and viruses present in the air are succumbed by the germicidal ultraviolet light as well known. The purified air exiting the lamp unit 120 passes through a noise reducer 124.

[0120] The switch unit includes an on switch 130, an off switch 132, a foot switch 134 and a time delay device 136 which are all interconnected together. The on switch 130 is a push button type which activates the blower 110 and the lamp unit 120 when pushed on, and a time delay device 136 may deactivate the blower 110 and the lamp unit 120 after a predetermined period of time after activation, such as 2, 6, or 12 minutes as selected by the users. The on switch 130 and time delay device 136 may be coordinated in a way that a cycle of predetermined period of time is repeated, for example, 2 minutes on the first push, 6 minutes on the second push, 12 minutes on the third push which completes a cycle, then 2 minutes again on the fourth push to start a new cycle. A number of indicators, such as LEDs 140 which would display the predetermined period of time for deactivation, are lit to indicate the blower 110 and lamp unit 120 are activated. The off switch 132 is also a push button type and may be pushed to deactivate the blower 110 and the lamp unit 120 instantly. The foot switch 134 may be located at the front part of the purification systems 102 so that activation or deactivation of the blower 110 and lamp unit 120 can be done by a foot. This foot switch 134 may be an on/off switch, such as a push button, a toggle switch or a light-recognition switch. At “on” position, the foot switch 134 may activate the blower 110 and lamp unit 120 for a predetermined period of time, such as 2 minutes, which is also displayed by a lit LED 140. A user can select a desired operation time with the on switch 130 or deactivate the blower 110 and lamp unit 120 by touching the off switch 132. If the blower 110 and lamp unit 120 are still running when a user is finished using the toilet, the user can...
move a foot to turn the foot switch 134 off, which will deactivate the blower 110 and lamp unit 120 just like a pushing of the off switch 132 does.

[0121] The electric control device 118 is disposed to communicate with the switch unit and a warm seat switch knob 116. The electric control device 118 is connected by the electrical cords 54 to the resistive wires 50 encapsulated in the hollow space 51 of the dual function seat body 45, and is also connected by the sensor cord 62 to a sensor 61 in the seat body. The electric control device 118 receives information from the sensor 61 and adjusts the amount of electricity flowing to the resistive wires 50 by operation of a warm seat switch knob 116 which functions as an on/off switch as well as a current regulator. By turning the warm seat switch knob 116 clock wise or counter-clock wise, the resistive wires 50 can be warmed to a several predeterminate temperatures from 30° C. to 40° C.

[0122] Both of the switch unit and the electric control device 118 are connected to a power cord 156 which extend from the rear side of the air purification system 102 into the electrical outlet 158 near the toilet bowl.

[0123] FIG. 19 shows a dual function seat body 45 which is arranged with a seat cover 174, a pair of hinge assemblies (3 and 30), a connection hose 38 and the air purification system 102. Though a toilet bowl 2 and a conventional nuts for mounting the hinge assemblies (3 and 30) to the toilet bowl 2 are deleted in FIG. 19 for the clarity of illustration, it is still obvious to the skilled in the art that the arrangement shows the air purification system 102 near the toilet bowl 2 within the reach of the user. One of the hinge assemblies 3 receives a pivot 23 for an air flow communication, and the other hinge 30 on the opposite side is engaged with a pivot 23 carrying electrical cords 54 and a sensor cord 62 which are connected to the electric control device 118 of air purification system 102. The flow of foul air in the toilet bowl is as follows. The air enters the intake apertures 46 and passes through air passageway 53 and reaches to the pivot 23. Through the pivot, the air continues to pass the hinge assembly 3 and enters into the connection hose 38 and move toward the filter unit. The air in filter cap 108 passes through the filter 104 and is sucked into the blower 110 and blown out to circulate the blower cage 112. The air leaves the blower cage 112 through the exit and enter into the lamp unit 120. The purified air exit the lamp unit 120 and pass through the attenuator 124 and leave the purification system 102 through an opening 180.

[0124] Alternatively, the purification unit may be located at places hidden from the users, such as outside the bathroom or behind the toilet bowl. In such case, a remote control device 182 may be provided to operate the switch unit and the warm seat switch which are equipped with a receiver to accept the signals transmitted by the remote control device.

[0125] FIGS. 20a and 20b show a cordless air purification system 102. The air purification system 102 comprises a filter unit, a blower unit, a lamp unit 120, a switch unit, an electric control device 118 and a rechargeable battery 192. The filter unit includes a filter 104, a filter cage 106 and a filter cage cap 108. The filter 104 is packed with activated charcoal and receives foul air carried by a connection hose 38 through the filter cage cap 108. The filter cage 106 is sealed to ensure all the foul air entering the filter cage 106 pass through the filter 104, and the purified air exit the filter unit toward the blower unit. The blower unit includes a blower 110 and a blower cage 112. The blower 110 is rotatably driven by electricity and provides a constant airflow of pressure/vacuum even in application with a filter 104 which may have a high backpressure. The filter 104 can be replaced periodically as needed by the user. The lamp unit 120 is equipped with an UV lamp 122 which kills microorganisms by emitting effective range of UV spectrum. This lamp unit is configured that the air flow entering the unit is exposed to the germicidal light before exiting the unit. The UV lamp 120 is easily detached or attached for change when replacement is needed. The switch unit activates or deactivates both the blower 110 and the lamp unit 120 simultaneously.

[0126] The blower 110 is a regenerative blower that can offer a controlled delivery of airflow in the range of 2-5 cubic feet per minute (CFM) with maximum pressure/vacuum in the range of 2-5 inches of water. The blower 110 and the lamp unit 120 can be operated by a low voltage DC power (9-15 V) provided by a rechargeable battery. The blower cage 112 encloses the blower 110 which is connected to the filter unit through an opening provided in the blower cage 112. The blower cage 112 is well sealed and provided with sound absorbing materials so that the noise generated by the blower 110 during operation can be reduced significantly. The air exiting the blower is allowed to circulate the hollow space of the blower cage 112 so that the blower 110 is exposed to the constant flow of air during operation and does not need a separate cooling device. Some vibration dampening means 114, such as rubber, are used to attach the blower 110 to the blower cage 112. Electrical wires 142 extending from the switch unit and electric control device 118 are connected to the blower 110 and the lamp unit 120 so that the activation or deactivation is controlled by the switch unit. Through an air tight fit provided in the blower cage exit opening, the air leaves the blower cage 112 for the lamp unit 120 where bacteria and viruses present in the air are succumbed by the germicidal ultraviolet light as well known. The purified air exiting the lamp unit 120 passes through a noise reducer 124.

[0127] The switch unit includes an on switch 130, an off switch 132, a foot switch 134 and a time delay device 136 which are all interconnected together. The on switch 130 is a push button type which activates the blower 110 and the lamp unit 120 when pushed, and a time delay device 136 may deactivate the blower 110 and the lamp unit 120 after a predetermined period of time after activation, such as 2, 6, or 12 minutes as selected by the users. The on switch 130 and time delay device 136 may be coordinated in a way that a cycle of predetermined period of time is repeated, for example, 2 minutes on the first push, 6 minutes on the second push, 12 minutes on the third push which completes a cycle, then 2 minutes again on the fourth push to start a new cycle. A number of indicators, such as LEDs 140 which would display the predetermined period of time for deactivation, are lit to indicate the blower 110 and lamp unit 120 are activated. The off switch 132 is also a push button type and may be pushed to deactivate the blower 110 and the lamp unit 120 instantly. The foot switch 134 may be located at the front part of the purification systems 102 so that activation or deactivation of the blower 110 and lamp unit 120 can be done by a foot. This foot switch 134 may be an on/off switch, such as a push button, a toggle switch or a light-recognition switch. At “on” position, the foot switch 134 may activate the blower 110 and lamp unit 120 for a predetermined period of time, such as 2 minutes, which is also displayed by a lit LED 140. A user
can select a desired operation time with the on switch 130' or deactivate the blower 110' and lamp unit 120' by touching the off switch 132'.

The electric control device 118' is disposed to communicate with the switch unit and the lamp unit 120'. Both of the switch unit and the electric control device 118' are connected to the rechargeable battery 192 by the electrical wires 142'.

The functions and operational procedures of the units in the cordless air purification system 102' are the same as described for the air purification system 102 described in Figs. 17 and 18 except that the electric power for the blower and lamp units comes from a rechargeable battery 192 which can be charged wirelessly by the transmitter 194 or can be detached from the cordless air purification system 102' to be charged using a conventional charger (see Fig. 21). The rechargeable battery 192 may be provided with a receiver chip or a rectifying antenna which converts electromagnetic wave energy from the transmitter 194 into direct-current (DC) electricity. The transmitter 194 generates electromagnetic wave and can be placed at the electric outlet within about 15 feet from the cordless air purification system 102'. This eliminates the needs for electrical cords and physical power connection of high voltage to the cordless air purification system 102'. The ventilated toilet seat assembly 1 employing the hinge assemblies (3 and 30) can be connected to the cordless air purification system 102' by a connection hose 38 to evacuate foul air. This cordless air purification unit is suitable for area where high voltage electric outlet is not allowed in a room where toilet is located by strict building codes or a bathroom which does not have an electric outlet near the toilet bowl.

While the invention has been shown and described with reference to different embodiments thereof, it will be appreciated by those skilled in the art that variations in form, detail, compositions and operation may be made without departing from the spirit and scope of the invention as defined by the accompanying claims. For example, the toilet seats are usually provided in two different shapes, horseshoe or U-shaped type and oval or closed type. Although only oval type toilet seat was used to describe several novel features presented in the current invention, the same features of the present invention can be applied to a horseshoe type.

1. A ventilated toilet apparatus comprising:
   a) a toilet seat assembly that comprises a seat body that comprises an upper surface, which is adapted to contact the body of a user, and a lower surface which is adapted to be positioned adjacent to a toilet bowl;
   b) a hinge assembly; and
   c) a pivot device with which the toilet seat assembly is pivotally attached to the hinge assembly;
   wherein the toilet seat assembly further comprises a pivot receiving part that is formed in the seat body, and a plurality of intake apertures that are provided on the lower surface.

2. The ventilated toilet apparatus of claim 1, further comprising an exhaust conduit provided in the pivot receiving part, and a cleaning port that is provided below the exhaust conduit and communicates with the exhaust conduit, and a plurality of air passageways that connects the intake apertures and the exhaust conduit, wherein the pivot receiving part encloses the pivot device.

3. The ventilated toilet apparatus of claim 2, further comprising a cleaning port cap that seals the cleaning port airtight.

4. The ventilated toilet apparatus of claim 2, wherein the intake apertures are substantially vertical to the lower surface, and the air passageways are substantially parallel to the lower surface.

5. The ventilated toilet apparatus of claim 2, wherein the exhaust conduit comprises a junction to which the air passageways are connected, a tubular opening that is connected to the junction, wherein the tubular opening receives the pivot device.

6. The ventilated toilet apparatus of claim 5, wherein a pivot tube comprises a hollow pivot tube.

7. The ventilated toilet apparatus of claim 6, wherein the pivot tube is made of copper, copper alloy, polymeric resin or plastics.

8. The ventilated toilet apparatus of claim 6, wherein the pivot tube is fixed in the tubular opening of the exhaust conduit.

9. The ventilated toilet apparatus of claim 5, wherein the junction comprises a junction opening that is open rearward of the toilet seat assembly, and a junction cap that seals the junction opening airtight.

10. The ventilated toilet apparatus of claim 2, wherein the exhaust conduit comprises a junction, to which the air passageways are connected, two tubular openings that are connected to the junction, wherein the tubular openings receive the pivot device.

11. The ventilated toilet apparatus of claim 10, wherein the pivot tube comprises a hollow pivot tube and a plurality of pivot apertures, wherein the pivot apertures are provided in the middle section of the pivot tube, wherein the pivot tube is fixed in the tubular openings of the exhaust conduit.

12. The ventilated toilet apparatus of claim 2, wherein the seat body comprises a bumper that is provided on the lower surface and is adapted to contact the toilet bowl, wherein the bumper surrounds the intake apertures.

13. The ventilated toilet apparatus of claim 2, wherein the hinge assembly comprises a hollow hinge case, a receptive opening that receives the pivot device, and an axial post that is adapted to fix the hinge assembly to the toilet bowl.

14. The ventilated toilet apparatus of claim 13, wherein the pivot device is rotatably received in the receptive opening, wherein the hinge assembly further comprises an O-ring that is provided in a groove formed in the receptive opening.

15. The ventilated toilet apparatus of claim 13, wherein the axial post comprises a hollow hinge tube.

16. The ventilated toilet apparatus of claim 15, wherein the hinge tube comprises a notch and is threaded whereby the hinge assembly is fixed to the toilet tube by fastening a nut with the tube.

17. The ventilated toilet apparatus of claim 16, wherein the axial post of hinge further comprises a pin hole that accepts a pin across the notch of hollow hinge tube.

18. The ventilated toilet apparatus of claim 13, wherein the distance between the axis of the receptive opening and the axis of the axial post is in the range of about 1.5 to about 2.0 centimeters.

19. The ventilated toilet apparatus of claim 13, wherein the axis of the receptive opening meets the axis of the axial post at right angle in a plane.

20. The ventilated toilet apparatus of claim 1, further comprising a heating unit with which the seat body is heated, an air passageway that connects the intake apertures and the pivot device, wherein the seat body comprises a hollow space between the upper surface and the lower surface.
21. The ventilated toilet apparatus of claim 20, wherein the heating unit comprises a resistive wire that is attached below the upper surface in the hollow space, an electrical cord that connects the resistive wire to a control device, a sensor that reads the temperature of the seat body, and a sensor cord that connects the sensor to the control device, wherein the control device receives information from the sensor and controls the amount of electricity flowing to the resistive wire.

22. The ventilated toilet apparatus of claim 21, further comprising a cord fastener that secures the electrical cord and the sensor cord within the hollow space of the seat body, and a grommet that secures the electrical cord and the sensor cord within the hinge assembly.

23. The ventilated toilet apparatus of claim 20, wherein the seat body comprises two tubular openings that receives the pivot device, and at least one bumper that is provided on the bottom surface and is adapted to contact the toilet bowl, wherein the bumper surrounds the intake apertures.

24. The ventilated toilet apparatus of claim 20, further comprising a suction device that is connected to the hinge assembly, wherein the suction device sucks air through the hinge assembly.

25. The ventilated toilet apparatus of claim 2, further comprising a suction device that is connected to the hinge assembly, wherein the suction device sucks air through the hinge assembly.

26. The ventilated toilet apparatus of claim 25, wherein the suction device comprises a filter unit that removes foul odor and a blower unit that passes air through the filter unit, wherein purified air exits the filter unit toward the blower unit.

27. The ventilated toilet apparatus of claim 26, wherein the filter unit comprises a filter that contains activated charcoal, a filter cage that encloses the filter, and a filter cage cup that is adapted to receive a connection hose.

28. The ventilated toilet apparatus of claim 26, wherein the blower unit comprises a blower that induces air flow and a blower cage that encloses the blower, wherein the air exiting the blower circulates inside the blower cage.

29. The ventilated toilet apparatus of claim 26, wherein the suction device further comprises a lamp unit that kills microorganisms, wherein the lamp unit comprises a UV lamp.

30. The ventilated toilet apparatus of claim 29, wherein the suction device further comprises a switch unit that turns on and off the suction device.

31. The ventilated toilet apparatus of claim 30, wherein the switch unit comprises a time delay device that deactivates the blower and the lamp unit after a predetermined time after activation.

32. The ventilated toilet apparatus of claim 30, wherein the switch unit comprises a foot switch that is adapted to be operated by the foot of a user of the ventilated toilet apparatus.

33. The ventilated toilet apparatus of claim 26, wherein the suction device further comprises a warm seat switch knob that turns on and off resistive wires that are adapted to heat a toilet seat.