United States Patent

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[73] Assignee **Raritan Engineering Co., Inc. Millville, N.J.**

[54] **GRINDER AND PUMP UNIT**
1 Claim, 6 Drawing Figs.

[52] **U.S. Cl.** **241/46.02,** 241/46.08
[51] **Int. Cl.** **B02c 13/04,** B02c 13/28, B02c 13/286
[50] **Field of Search** ..... 4/13, 77, 78, 90, 89, 80, 81, 82, 76, 74, 222; 103/117 R

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ABSTRACT: An electrically driven marine toilet including an integral grinder assembly for operating upon the waste discharged from a commode. The grinder assembly cooperates with a centrifugal impeller-type discharge pump for effectuating disposal of waste from the commode. An electric motor also drives a rotary pump which supplies the commode with a supply of water. A check valve assembly connected with the rotary pump intake is adapted to receive a chlorinated liquid to be mixed with the commode water supply. Accordingly, an electric motor simultaneously drives the grinder and discharge pump assemblies as well as the commode water supply pump.

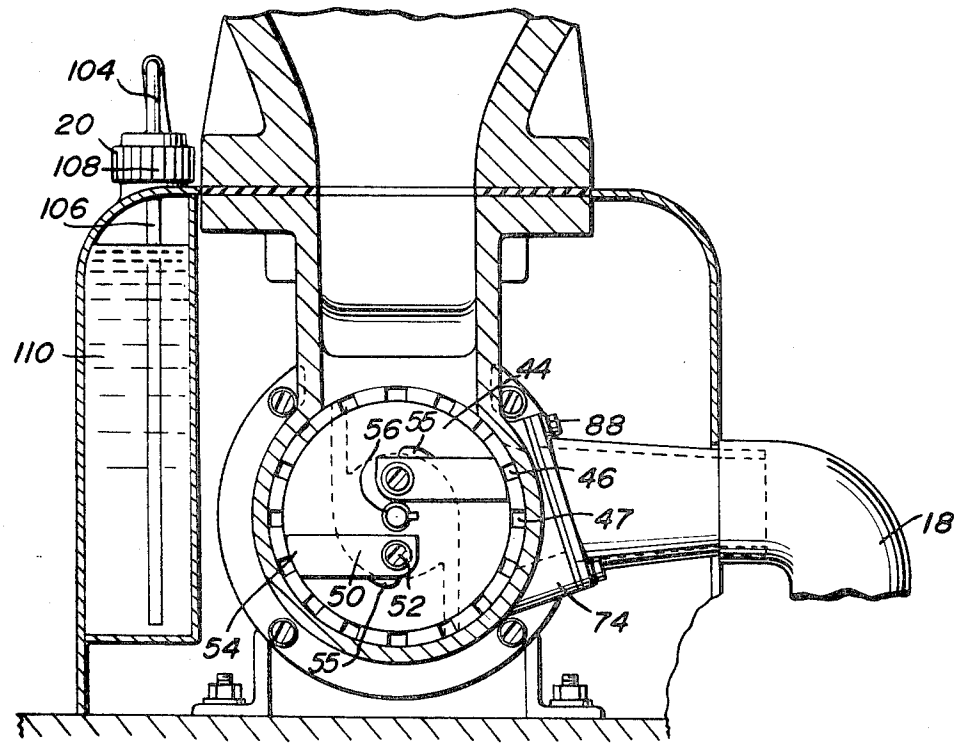


Fig. 1

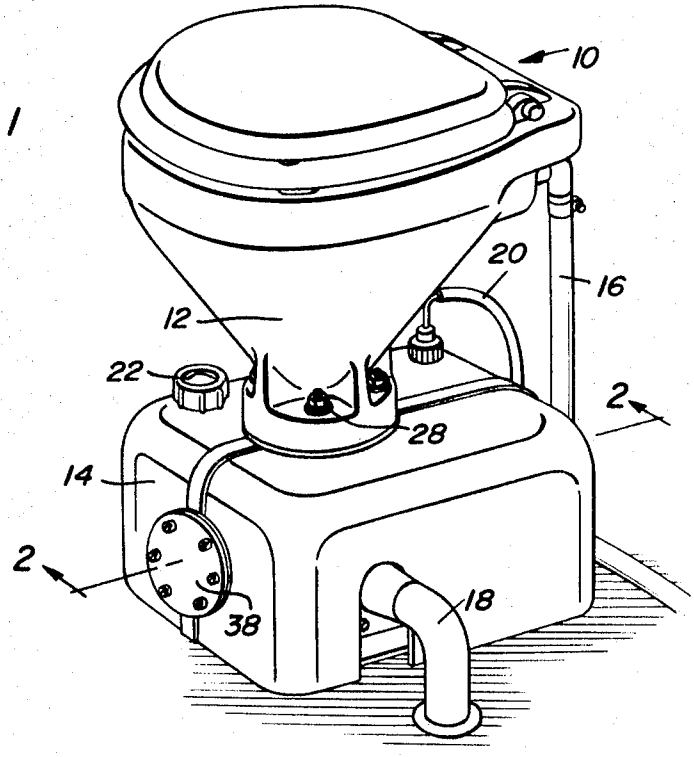
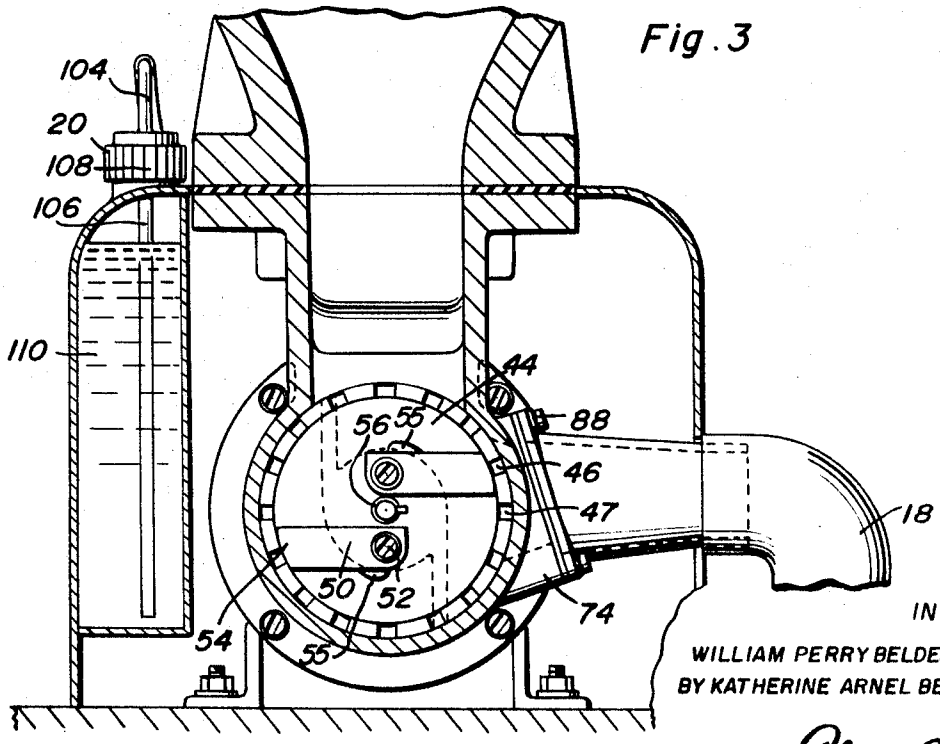


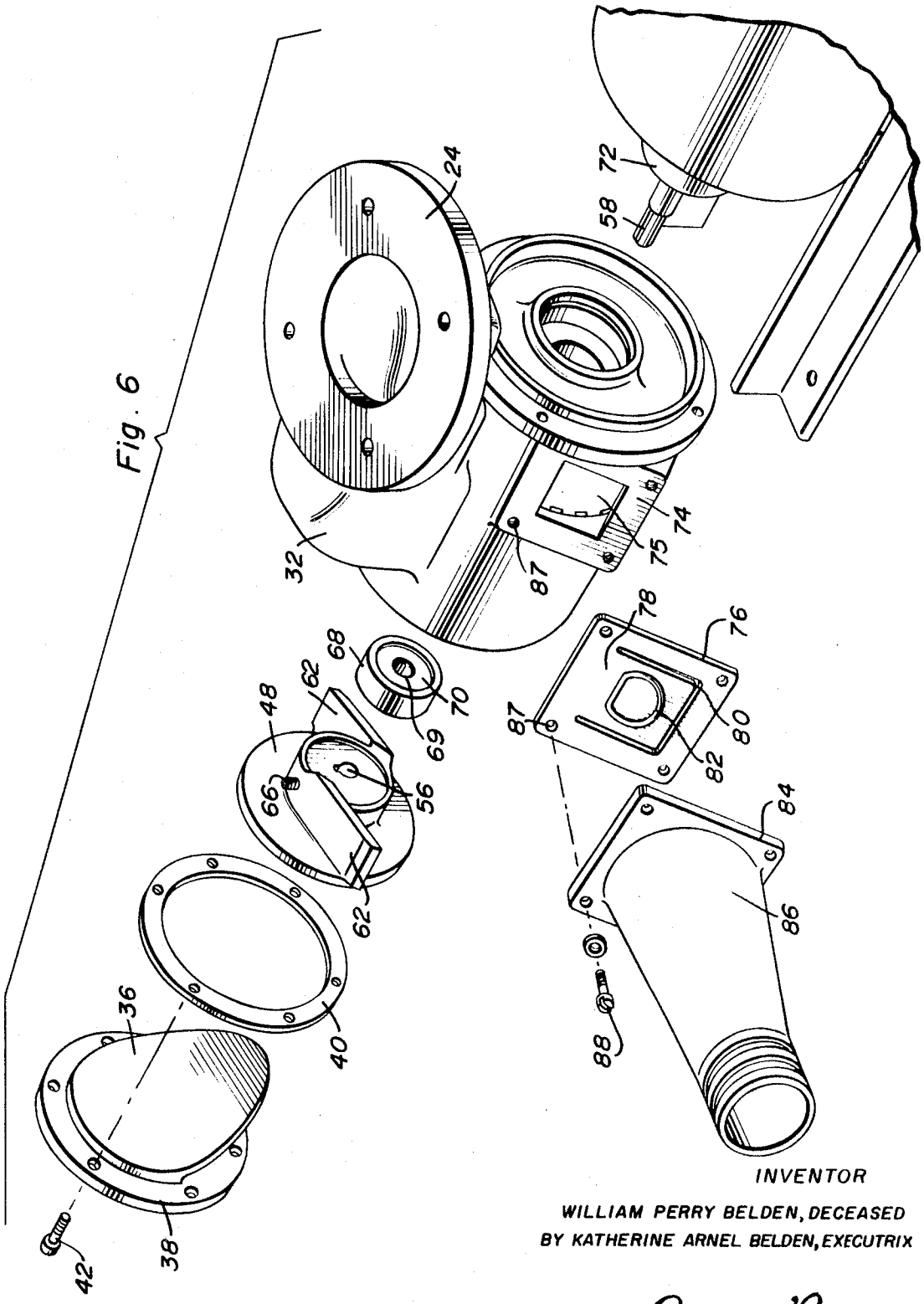
Fig. 3



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Fig. 6



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Fig. 2

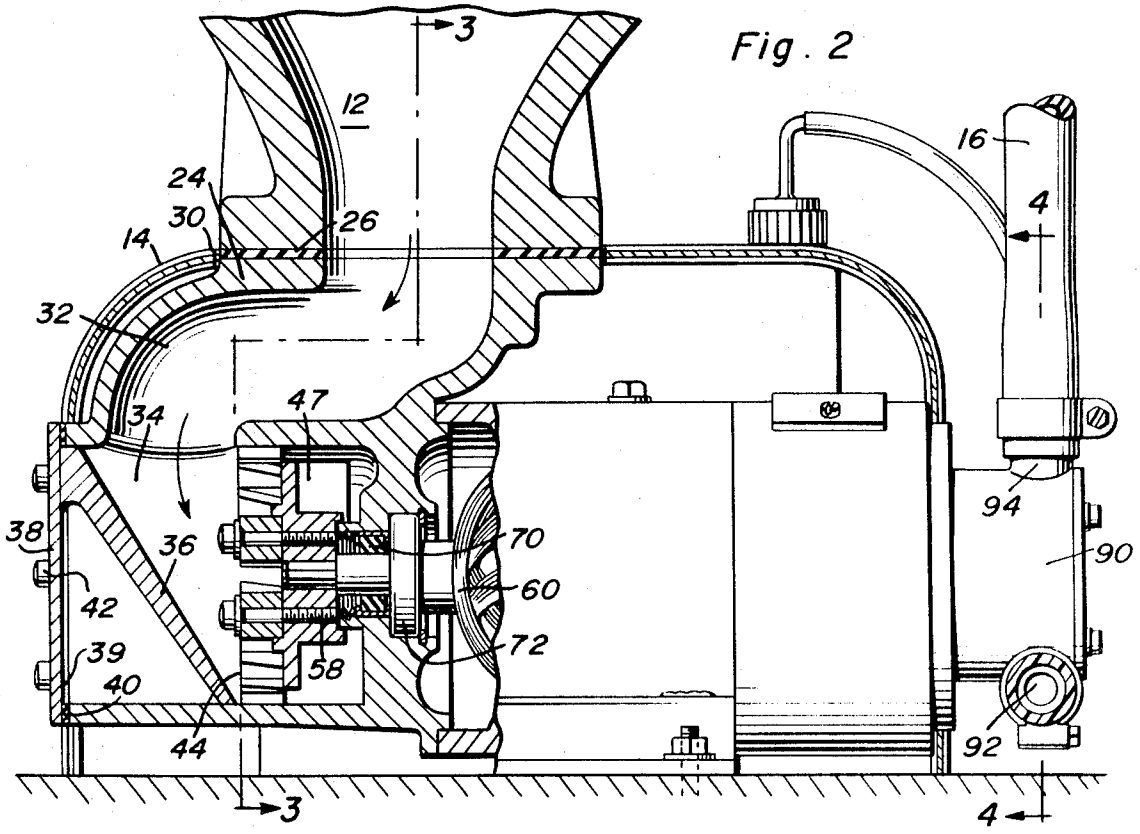


Fig. 4

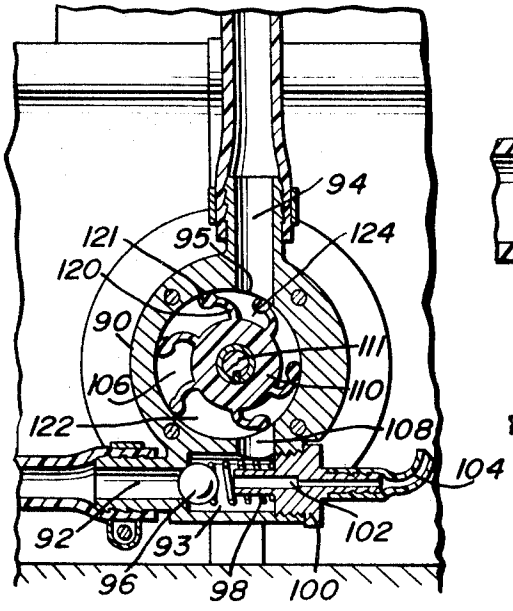
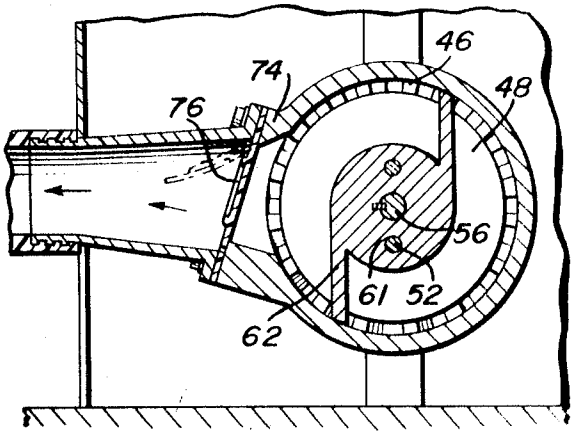


Fig. 5



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GRINDER AND PUMP UNIT

The present invention relates to the field of electric marine toilets and more particularly to a marine toilet with a macerator unit and commode water supply pump operative simultaneously with a waste discharge pump.

In the past, the prior art has provided electric marine toilets which are adapted to discharge a commode and supply the same with a water intake. In actual operation of these devices, the pump assemblies have been frequently fouled and jammed due to the depositing of large foreign matter within the commode. The result of such a situation has caused inconvenience and time consuming maintenance in order to restore the toilet to normal operation.

In summary, the present invention includes an electric motor with a shaft that extends outwardly of each end thereby simultaneously driving a waste discharge pump at one shaft end and commode water supply pump at the other end. The present invention includes a macerater or grinder assembly serially connected between the commode drainage section and the discharge pump. The macerater is adapted to grind toilet and galley waste into fine particles never more than three-sixteenth inch maximum. In addition, the present toilet includes a tank assembly which provides the commode water intake supply with a chlorinated liquid to be mixed with the commode water intake so that waste discharged overboard is treated to avoid pollution as required by law in many states. Accordingly, among the more salient objects of the present invention are to provide:

An electric toilet which discharges waste overboard at a point either above or below the waterline;

A macerator unit integral with an electric toilet for grinding toilet and galley waste into fine particles;

A chlorinated liquid supply tank for providing commode water supply with an antipollution treatment.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is a perspective view illustrating the exterior appearance and waterline connections to the present electric marine toilet.

FIG. 2 is a transverse sectional view taken along the plane passing through section line 2—2 of FIG. 1.

FIG. 3 is a transverse sectional view taken along the plane passing through section line 3—3 of FIG. 2.

FIG. 4 is a transverse sectional view of the commode water supply pump taken along the plane passing through section line 4—4 of FIG. 2.

FIG. 5 is a transverse sectional view illustrating the centrifugal discharge pump.

FIG. 6 is an exploded group perspective view illustrating the electrically driven components of the present marine toilet.

Referring specifically to the drawings, a preferred embodiment of the present invention is generally designated by the reference numeral 10. A commode section 12 extends downwardly through a motor and pump housing 14. A commode water supply line 16 is connected between the rear section of the housing 14 and a vertically aligned fitting in the commode 12. A discharge pipe 18 is connected between the discharge pump within the housing 14 and an overboard discharge port. A conduit 20 is connected between a supply tank enclosed within the housing 14 at one end of the conduit and is connected at the opposite end thereof to a commode water supply pump. A filler cap 22 permits access to the liquid storage tank which is filled with a chlorinated liquid that is conducted to and added with the commode water intake supply thereby treating this water supply with an antipollution liquid.

Referring to FIGS. 2 and 3 of the drawings, the end drainage section of the commode 12 extends into a disclike flange portion which overlies and coincides with a similar flange portion 24 integrally connected with a commode discharge conduit casing or endbell 32. These flanges sandwich a disclike gasket 26, the assembly being retained in a secured position by suitable fasteners 28 as seen in FIG. 1. An aperture 30 formed within the top surface of the housing 14 permits the extension of the aforementioned flange portions through the housing 14. A discharge conduit integrally formed within the bell 32 continues downwardly to a lower conduit section 34 terminated in downwardly and rearwardly angled deflection plate 36, the latter integrally appends from a disclike plate 38 which is disposed outwardly of the front end of the housing 14. A gasket 40 seals the plate 38 to the housing 14 by utilizing suitable fasteners 42. A grinder intake port 44 is disposed inwardly of and concentric with a horizontal profile of the deflection plate 36. The intake port 44 is characterized by radial slots 46 formed through the peripheral edge of the grinder intake port. A cylindrical chamber 47 is disposed concentrically inward of the intake port 44 and extends rearwardly therefrom. A circular disc 48 is disposed concentrically within the chamber, the disc being characterized by a diameter smaller than the diameter of the chamber. Two polygonal grinder bars 50 are rotatably secured onto the outward surface of the disc by means of suitable fasteners 52. The bars are mounted in a laterally spaced relation and their respective pivot points are disposed equidistantly of the disc center along a diameter of the disc. The outward ends 54 of the bars are curved to conform with the periphery of the disc 48. Radially spaced abutments 55 assure that the bars 50 will be limited to parallel semichordal positions under the influence of centrifugal force during disc rotation. When obstructions are encountered by the bars they will yield from this position thereby causing the obstruction to move to a new position where maceration can occur. The center of the disc includes an aperture 56 formed therein which is generally circular but includes a rectangular notch appending from the circular aperture thereby providing a keyway. An electric motor 60 is positioned rearwardly of the disc 48, the motor including a forward shaft section extending through the plate aperture 58, the shaft includes a key which fits within the keyway of the aperture 56.

In FIG. 5, attention is drawn to the opposite surface of the disc 48 to which is affixed a generally cylindrical section 61. The axis of the section 61 is collinear with the center of the aperture 56. Two impeller vanes 62 append tangentially from the cylindrical section 61 in parallel spaced relation. The vanes extend outwardly and oppositely each other. The impeller vane structure cooperates with the cylindrical chamber in which it is disposed thereby functioning as a centrifugal pump. The impeller vane assembly is driven by the motor shaft 58 which extends through the aperture 56, the latter extending through the cylindrical section 61 and the disc 48. The shaft 58 of the motor 60 is keyed within the aperture 56 and a setscrew 66 recessed within the cylindrical section 61 and extending through the aperture 56 provides additional fastening of the impeller vane assembly to the shaft, as seen in FIG. 6.

Referring to FIG. 6 of the drawings, a cylindrical bushing 68 including an axial bore 69 therein is disposed inwardly of said cylindrical section 61 in abutting relation thereto. The inward end of the bushing includes a circular recess 70 for permitting the positioning of the bushing on the motor shaft 58 so that the recess is received by a cylindrical shoulder portion 72 fixedly mounted and concentric with the shaft of the motor. A cylindrical wall section of the endbell 32 includes a rectangular flange portion 74 extending outwardly from said wall. The central portion of the flange is characterized by a square aperture extending from the interior chamber 47 to the outward surface of the flange 74. This aperture provides a waste discharge port for the commode.

A square flapper valve 76 fabricated from a suitable resilient material is positioned outwardly of and in overlying relation with the outward surface of the flange 74. The valve is

characterized by a central body 78 peripherally defined by a generally Urshaped slit 80. The solid body portion disposed between the free ends of the U-shaped slit provides a hinge for the central body. A generally D-shaped rib 82 is formed upon the outward surface of the flapper valve 76 thereby rigidifying the hinged central portion thereof. The peripheral dimensions of the U-shaped central body are smaller than the peripheral dimensions of the underlying aperture 75 thereby preventing the central body of the valve from swinging inwardly of the aperture 75. Further, it is noted that the outward surface of the square flange 74 is angled upwardly and outwardly so that the flapper valve 76 positioned thereon is aided by gravity to retain the memory characteristics of the resilient central portion of the valve. A pipe section 86 including an angularly disposed flange portion 84 completes support for the flapper valve 76 by sandwiching the same between identically dimensioned flanges. The flange 84 includes a square aperture with larger peripheral dimensions than the central portion of the flapper valve merely permitting the central portion to swing outwardly. Each of the flanges 74 and 84 and the flapper valve 76 includes aligned apertures in each corner therein. Suitable fasteners 88 are passed through these apertures and are fastened within the outlet port flange 74 thereby retaining the aforementioned flanges and flapper valve in a sealed relation.

As seen in FIG. 2 of the drawings, a pump assembly 90 orientated rearwardly of the electric motor 60 provides the commode 12 with an inlet supply of water through the pipe section 16. A tubular section 92 provides the pump with water intake. The tubular section extends tangentially of the cylindrical wall of the pump casing 90 and is further orientated in a horizontal manner. The pump outflow is directed through a tubular section 94 which extends vertically from the cylindrical wall of the pump casing 90. Considering the internal pump structure in more detail, attention is directed to FIG. 4. The intake tubular section 92 is seen to include dual chambers 93 extending inwardly of the tubular end. The inner chamber of larger diameter than the outwardly disposed chamber includes a spring-biased ball 96 which normally occludes communication between the chambers thereby functioning as a check valve. A compression spring 98 is positioned concentrically within the central chamber, one end of the spring biasing the ball and the opposite end of the spring bearing against a screwplug 100. The screwplug 100 includes a concentrically bored passageway 102 connecting the inner chamber with the outward end of the plug. One end of a pipe section 104 is fastened onto the outward end of the plug 100 for purposes to be explained hereinafter. The interior of the pump casing 90 includes a longitudinally disposed impeller chamber 106 the center of which is horizontally aligned with the shaft of the electric motor extending rearwardly into the bore. This shaft and the center of the bore are disposed eccentrically for reasons to be made apparent presently. A cylindrical bore 108 is vertically disposed between the inner check valve chamber 93 and the impeller chamber 106, thereby providing the impeller chamber with an inlet port.

A rotary impeller 110 is disposed within this chamber. The impeller is characterized by a central cylindrical body from which append resilient and flexible vanes 120 the outward end of each vane terminating in a beadlike enlargement 121. Each enlargement acts as a cam against the interior bored surface of the chamber. The central portion of the cylindrical section 110 includes an apertured section 111 thus permitting the mounting of the impeller rotor onto the shaft of the motor 60. The horizontal displacement between the axis of the pump chamber and the axis of the impeller results in the volumetric variation between adjacent vanes during the revolution of the impeller thus rendering pump action as follows: The maximal radial distance between the axis of the impeller and the enlargements of the vanes occur along the chamber wall surface adjacent the intake port 108. Accordingly, the dimension between adjacent vanes communicating with the intake port is at a maximum volume 122. The outflow port 95 is located on the top surface of the chamber. This section of the chamber provides the minimal radial distance between the impeller axis and the chamber wall. Therefore, in the vicinity immediately adjacent the outflow port 95, maximum compression of the resilient vanes occurs accompanied by a minimal volume 124 formed in communication with the outflow port 95. In actual operation of the pump device, the volume obtained at the inflow port becomes decreased thereby producing a commensurate increase in pressure between adjacent vanes thereat resulting in a release of the compressed volume when the associated adjacent vanes reach the outflow port 95. Thus, in the steady state rotation of the impeller, a continuing intake and outflow of water occurs.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A grinder-pump unit comprising a disc keyed to a driving shaft, a pair of bars freely rotatably secured at radially spaced points to a first surface of said disc in sliding overlying relation thereto, said disc surface including abutments for retaining said bars in spaced parallel relation when the disc rotates, the outward end of each of said bars being shaped to conform with the periphery of said disc, a second opposite surface of said disc serving as pump means wherein the second surface has a hub and a plurality of vanes disposed perpendicularly of said second surface in tangential relation to said hub, and further wherein the disc is transversely disposed in a pipe section having internally formed peripheral slots allowing restricted flow from the first surface to the second surface of the disc thereby insuring nonclogging action of the pump, a horizontally oriented discharge port communicating with the vanes, and a flapper check valve with a memory disposed in the port for gating discharge therethrough, the valve being slightly offset from a true vertical position for realizing the combined benefits of horizontal discharge as well as subjecting the valve to gravity which reinforces the valve memory and tightly seals the port in the absence of discharge.