

[54] MARINE TOILET
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[73] Assignee: Nautron Corporation, Braintree, Mass.
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[51] Int. Cl. E03d 5/012, E03d 11/11
[58] Field of Search 4/8-10, 12, 4/69, 71, 76-78, 80, 89, 90, 93, 95, 115, DIG. 3; 210/152, 167

[56] **References Cited**

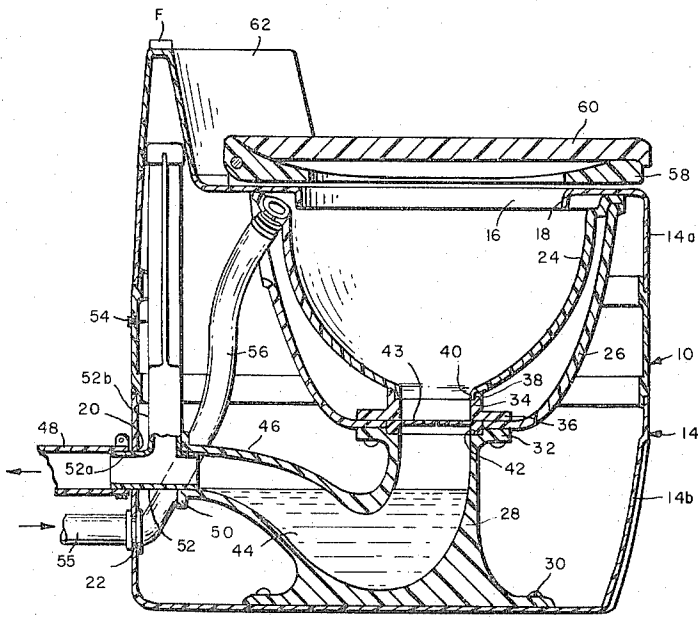
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[57] **ABSTRACT**
A marine toilet having a bowl connected to a decontamination tank and a combination pump, macerator and valve operable to take clean water into the system, flush the water and effluent into the decontamination tank and at the end of a predetermined interval discharge the innocuous mixture of water and effluent from the tank overboard. A control circuit and flush button therein provide for initiating a flush cycle, a dispenser is connected into the circuit operable in response to initiation of a flush cycle to deposit chemical decontamination tablets into the water and effluent leaving the bowl at the time of flushing, and there are controls for preventing flushing in the event that the decontamination tank is filled and/or the dispenser is partially or completely empty.

12 Claims, 11 Drawing Figures



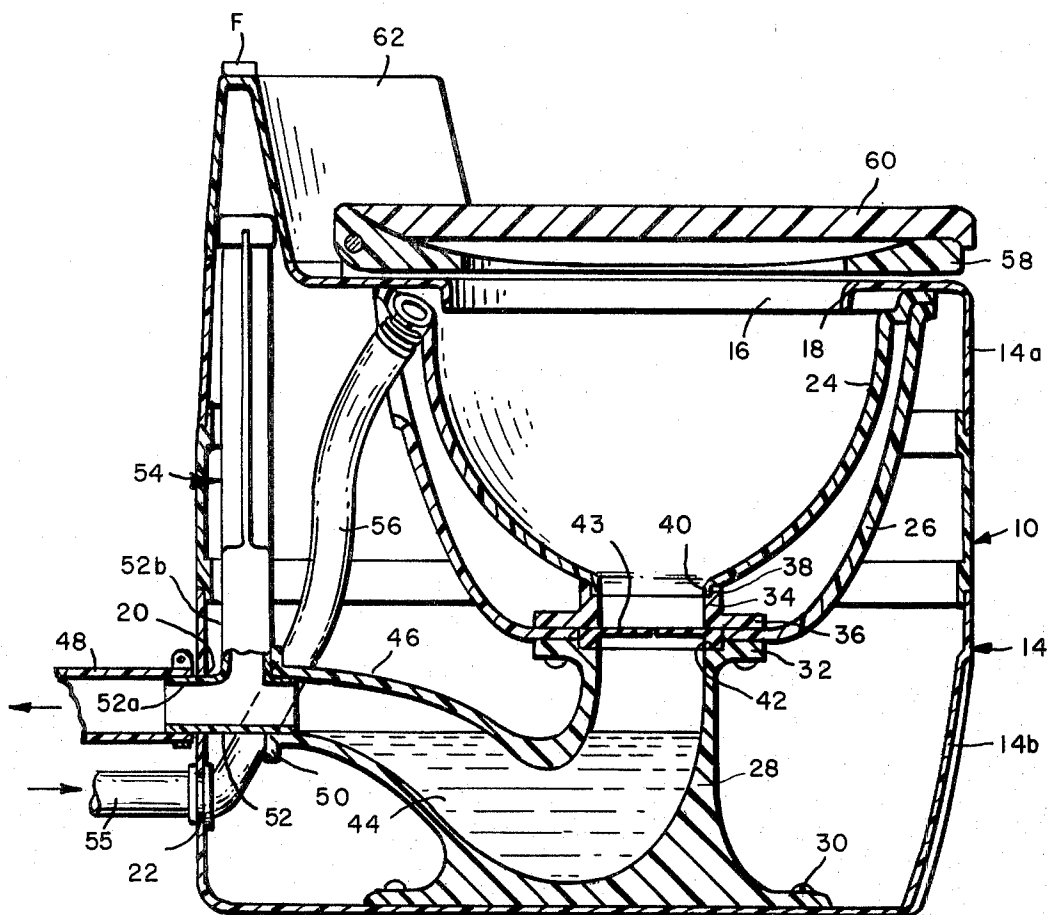


FIG. 1

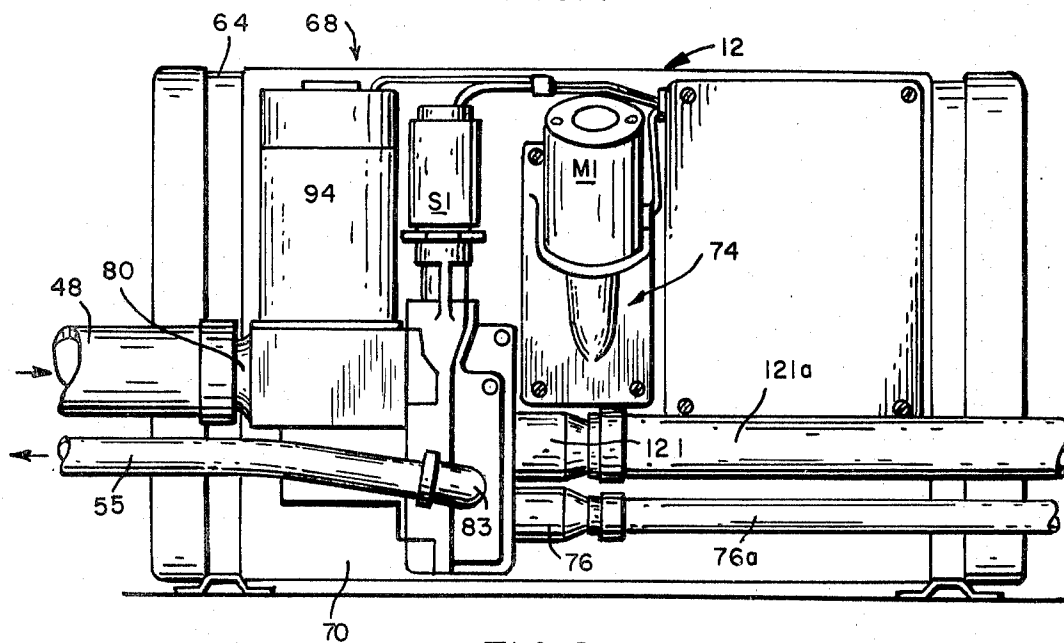


FIG. 2

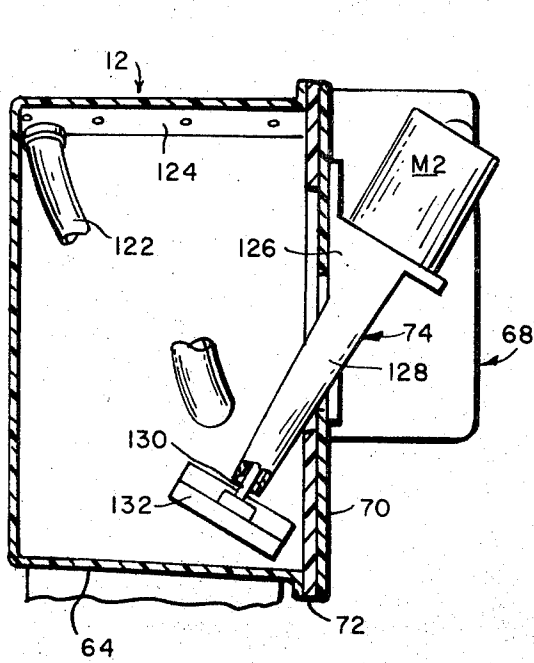


FIG. 3

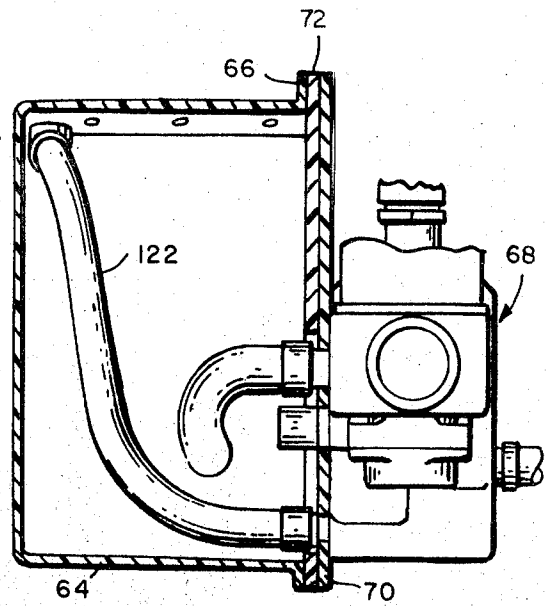


FIG. 4

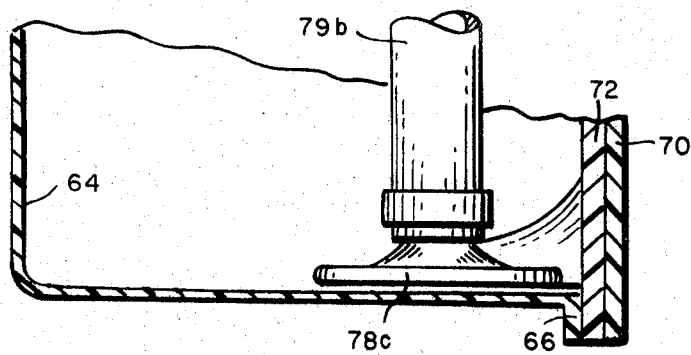


FIG. 5

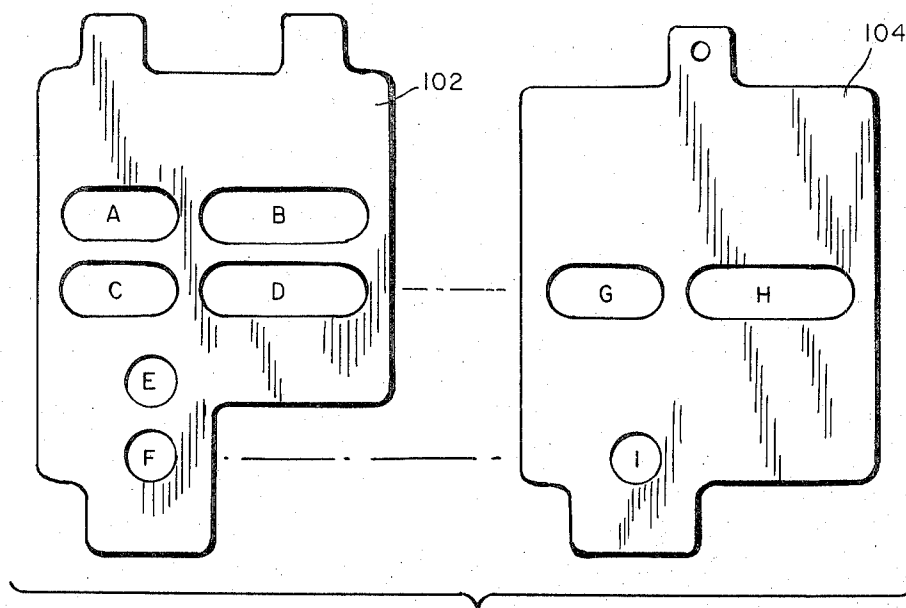


FIG. 8

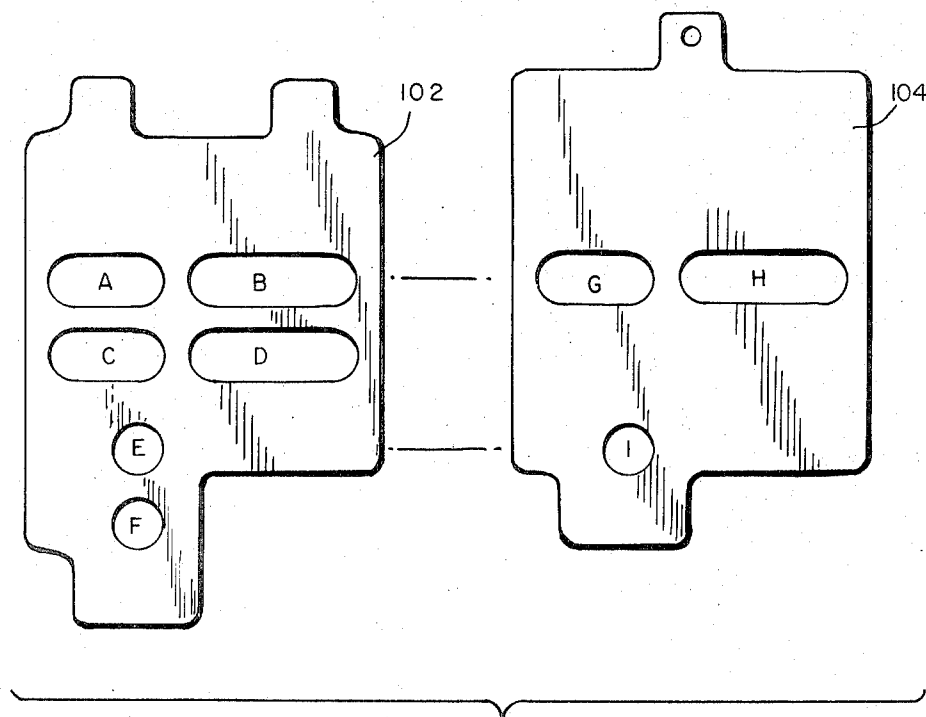


FIG. 9

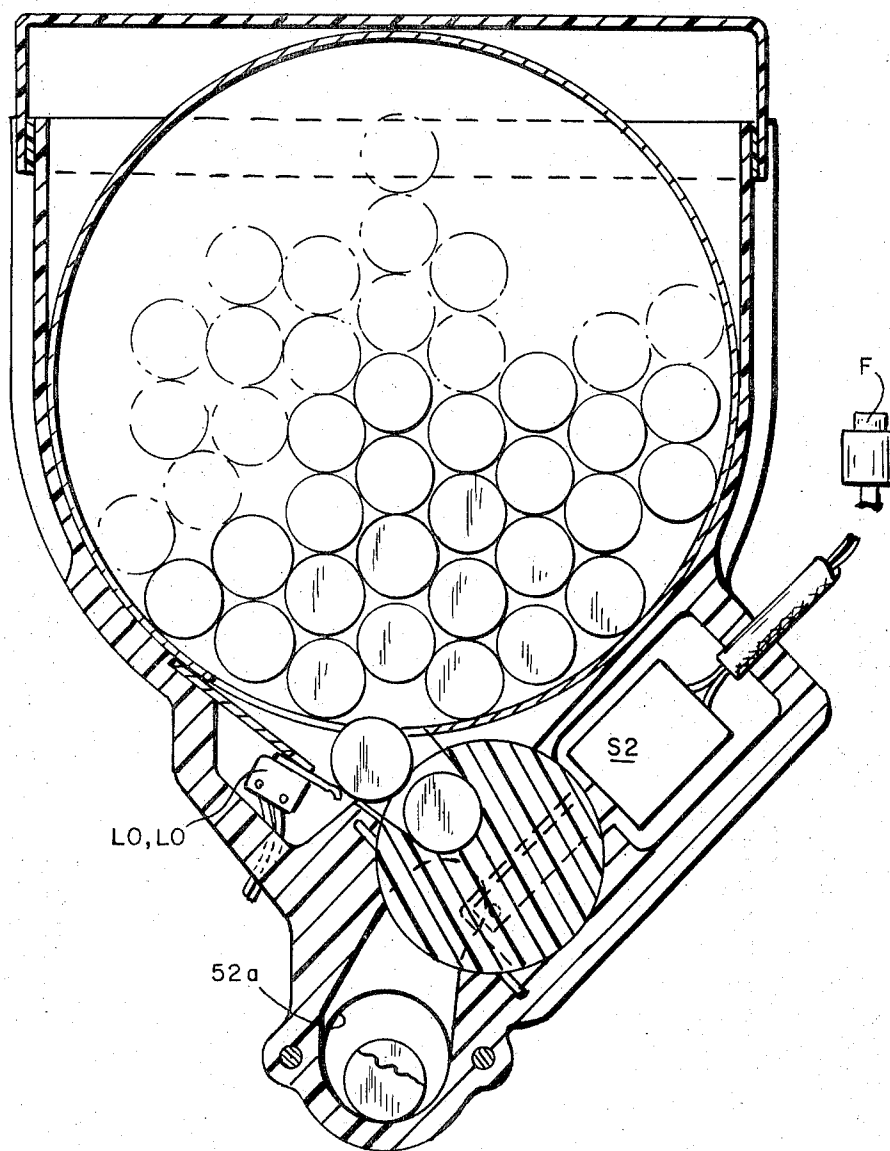


FIG. 10

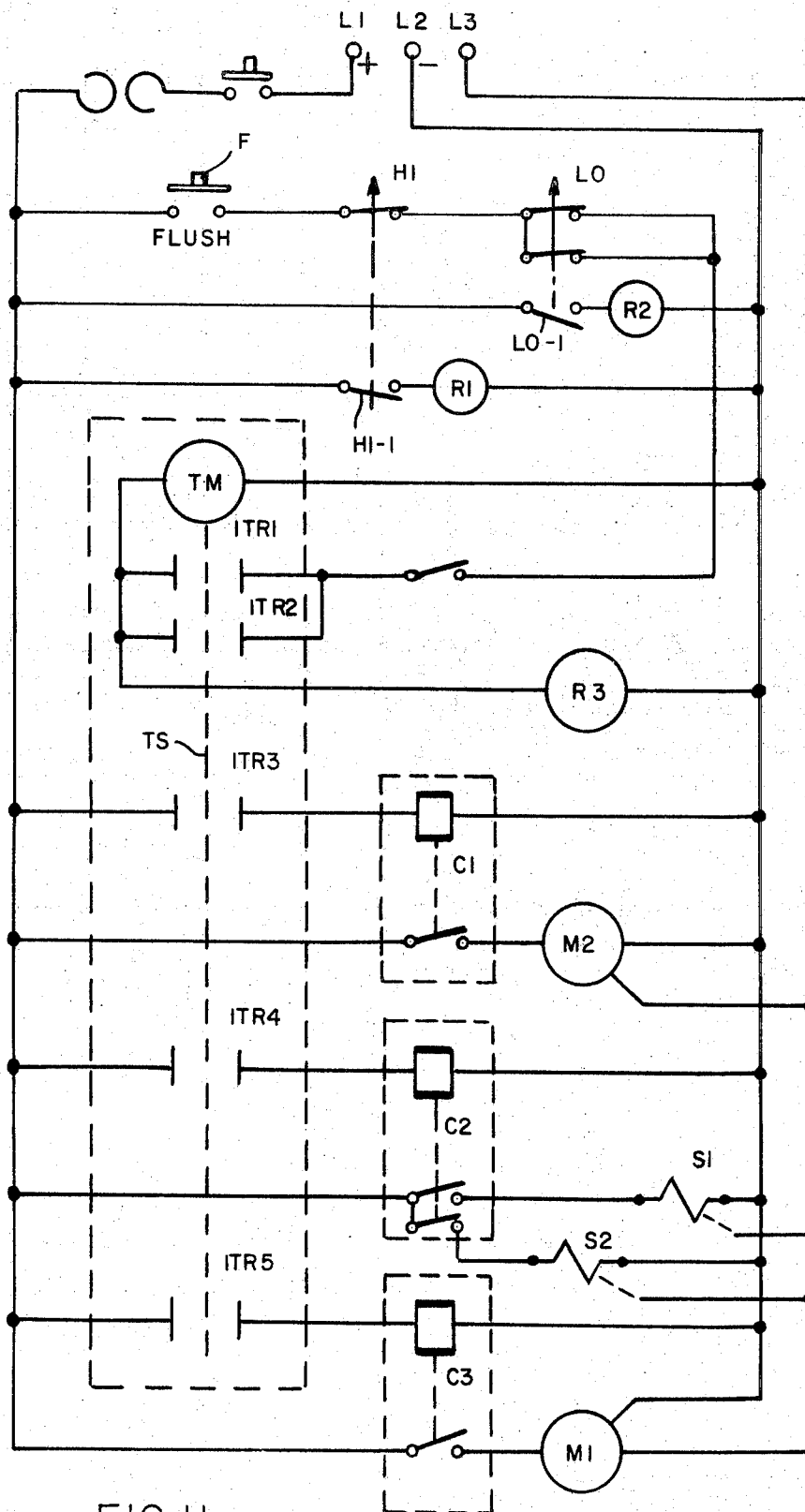


FIG. II

1

MARINE TOILET

BACKGROUND OF THE INVENTION

In our pending application there is shown a marine toilet wherein there is a bowl connected to a storage tank of comparatively large capacity into which water and effluent from the bowl is discharged and retained until it is rendered innocuous whereupon it is discharged from the storage tank overboard.

In the aforesaid apparatus the tank is designed to hold enough of the water and effluent so that it is possible to use the toilet a number of times without having to discharge the material overboard. Also, in the aforesaid toilet, the bowl and tank are embodied in a single unit which is rather bulky and takes up a considerable amount of space and the valve of the combination pump, macerator and valve unit is of the rotary type and is thus prone to stick if the toilet is used only infrequently. The purpose of the improved toilet illustrated herein is to separate the tank from the bowl so as to enable using a small bowl which takes up less useful living space in the vessel and to remove the tank to an out of the way part of the vessel; further to reduce the size of the bowl and the tank by using the tank solely for the purpose of decontamination and not for storage; and finally to insure operation even though the toilet may be used infrequently by improving the valve.

SUMMARY

The marine toilet according to this invention comprises a bowl open at the top and bottom, a trap connected to the bottom opening, a decontamination tank, a combination pump, macerator and valve and conductors interconnecting the bowl and tank to intake and discharge conductors so arranged that clean water entering the intake conductor passes through the valve and is delivered to the bowl by the intake side of the pump and the mixture of water and effluent is withdrawn from the trap into the macerator and delivered to the decontamination tank by the discharge side of the pump, said valve comprising flat valve plates containing ports aligned by shifting of one of the flat plates relative to the other to provide for the aforesaid introduction of clean water into the bowl and delivering as a mixture of water and effluent to the decontamination tank, a solenoid-operated plunger connected to the movable one of the valve plates, said solenoid when energized being operable to move the movable one of the valve plates in a direction to initiate a flushing cycle and a starting or flush button electrically connected to the solenoid operable to energize the solenoid. A timer is operable to de-energize the solenoid at the end of a predetermined length of time whereupon the movable valve plate is moved relative to the fixed valve plate so that clean water is supplied to the decontamination tank and to the discharge conductor and simultaneously a mixture of water and effluent is withdrawn from the decontamination tank through the valve into the pump and discharged thereby through the discharge conductor. An agitator is supported in the decontamination tank for keeping the mixture of water and effluent mixed and there is a spray head mounted in the decontamination tank and a conductor for delivering clean water to the spray head during the discharge part of the cycle. A spring seated valve in the intake conductor blocks reverse flow of fluid through

2

the system. A tablet dispenser is interposed between the discharge side of the trap and the macerator in the line conducting the mixture of water and effluent from the trap to the macerator and from thence to the pump and decontamination tank by means of which tablets are dropped into the stream of mixed water and effluent. A flexible member is interposed between the bowl and trap embodying displaceable fingers which when undeflected extend across the opening between the bowl and trap forming a seal and antisplash guard. The combination pump, macerator and valve are mounted as a unit exteriorly of the decontamination tank so as to be accessible and removable as a unit to permit access to the tank.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

FIG. 1 is an elevation, partly in section, of the toilet bowl and housing therefor;

FIG. 2 is an elevation of the decontamination tank showing the combination pump, macerator and valve mounted to one side thereof;

FIG. 3 is a vertical section taken through the decontamination tank showing the agitator;

FIG. 4 is a horizontal section taken through the decontamination tank showing the combination pump, macerator and valve mounted on one side thereof;

FIG. 5 is a fragmentary section at the bottom of the decontamination tank showing the connection for removing the mixed water and effluent therefrom;

FIG. 6 is an elevation of the combination pump, macerator and valve with portions in section;

FIG. 7 is a top view looking down on FIG. 6;

FIG. 8 is a plan view of the two valve plates showing the alignment of the ports therein when the valve is in the intake position;

FIG. 9 is a plan view of the two valve plates showing the alignment of the ports therein when the valve is in the discharge position;

FIG. 10 is a section showing the dispenser for the chemical tablets; and

FIG. 11 is a diagram of the control circuit.

Referring to the drawings (FIGS. 1 and 2), the toilet unit 10 and decontamination tank 12, unlike our pending application, are designed to be installed at a distance from each other with connecting flexible conductors so that the size of the toilet unit may be kept small thus to make the most efficient use of limited living space afforded in a vessel and to enable placing the decontamination tank in an out of the way part of the vessel which is not useful for living purposes.

The toilet unit 10 (FIG. 1) comprises a housing 14 made up of top and bottom shells 14a, 14b of molded plastic telescopically interengaged to enable removing the top shell for the purpose of inspection or repair. The top shell 14a has at the top an opening 16, peripherally of which there is a downwardly projecting flange 18 and around the back side at the top a raised arcuate back 62. The bottom shell 14b has at the back side openings 20 and 22. A bowl 24 having top and bottom openings provided with a jacket 26 is mounted within the housing in registration with the opening 16 with its lower open end connected to a trap 28, the latter being supported at the bottom of the housing and fastened thereto by suitable fastening means 30. The connection between the bowl, jacket and trap is provided for by a flange 32 at the upper end of the trap on which the

lower part of the jacket rests and an adapter ring 34 mounted between the jacket of the bowl and provided with a flange 36 which overlies the edge of the jacket resting on the flange 32. A rabbetted groove 38 at the top of the adapter ring 34 receives a flange 40 at the lower open end of the bowl. The upper end of the trap is rabbetted at 42 and a flexible member 43 is mounted in the groove 42 across the opening extending from the bowl into the trap, the flexible member being divided diametrically along two or more diameters to provide flexible fingers which will bend downwardly to let water and effluent in the bowl pass through into the trap and return to their undeflected positions following passage of such material thus serving as a means for blocking unpleasant odors and also as an antisplash guard. The trap 28 as is conventional in toilet apparatus provides for holding a quantity of water 44 thus to block flow of gases from the decontamination tank backwardly through the piping to the bowl and has an elevated, rearwardly extending portion 46 which is adapted to be connected to a discharge conductor 48 through which water and effluent are flushed from the bowl and transferred to the decontamination tank. The portion 46 has a flange 50 on it by means of which it is attached to a T-shaped coupling member 52. The coupling member 52 has a part 52a which extends through the opening 20 and is connected to the discharge conductor 48 and a part 52b which is connected to a tablet dispensing device 54 (FIG. 10) by means of which the tablets are introduced into the effluent and flush water as the latter pass from the trap to the decontamination tank. The dispenser which is the subject matter of our pending application Ser. No. 299,177, filed Oct. 19, 1972 is designed to dispense two tablets of predetermined chemical composition into a shuttle valve which in turn is rotated by a solenoid when the flush button is actuated to deliver the two tablets into the stream of water and effluent passing through the coupling member 52. There are two sensing switches in the device which are operable, in the absence of one or more tablets ready to be dispensed from the table container into the rotary valve, to disable the control circuit.

A conductor pipe 55 provides for supplying clean water to the bowl to effect flushing and is connected thereto through the opening 22 to one end of a flexible conductor 56, the other end of which enters the bowl near the top, as shown in FIG. 1.

A seat ring 58 and cover 60 of conventional kind are mounted at the top of the housing above the opening 16. The control button F for effecting flushing and purging together with indicators, which will be described hereinafter, are mounted on the back 62 in a convenient position.

The decontamination tank 12 (FIGS. 2, 3, 4 and 5) because it is not intended to be a storage tank is of lesser volumetric capacity than that disclosed in the aforesaid pending application and comprises a substantially rectangular receptacle 64 which may be mounted in any suitable out of the way space in the vessel. One side of the receptacle 64 is open and around the opening there is a flange 66. A combination pump, macerator and two-position valve 68 is mounted to the open side of the decontamination tank by means of the cover plate 70 which is fastened over the open side with a gasket 72 between it and the flange 66. There is also mounted on the cover plate 70 an agitator 74 (FIGS.

2 and 3) which will be described hereinafter. The pump, macerator and valve are thus readily accessible without dismantling the toilet unit and may be removed as a unit from the tank to provide access to the tank for cleaning.

The combination pump, macerator and valve 68 provide for drawing clean water into the bowl to effect flushing, removing mixed water and effluent from the trap, macerating the effluent, delivering the mixture of water and macerated effluent to the decontamination tank for a period of time sufficient to effect decontamination and discharging the innocuous mixture of water and effluent overboard and also at times for drawing clean water into the system to effect purging.

The combination pump, macerator and valve, as shown in FIGS. 6 and 7, is provided with a coupling element 76 to which clean water is supplied through an intake conductor 76a, coupling elements 78 and 78a connected to the decontamination tank, a coupling element 80 to which the conductor element 48 from the trap is connected, a coupling element 83 connected to the conductors 54 and 56 which supply clean water to the bowl and a coupling element 121 connected to an overboard discharge conductor 121a. The pump comprises intake and discharge chambers 84 and 86 within which are intake and discharge pump elements 88 and 90 mounted on a shaft 92 which extends into the chambers from a motor M¹ supported in a housing 94. The macerator comprises a chamber 96 through which the shaft 92 extends from the motor to the pump chambers within which there is mounted on the shaft a macerator blade 98.

The valve comprises ported sections 101, 103 between which there are valve plates comprising a fixed valve plate 102 and a movable valve plate 104 mounted to the pump macerator unit adapted to supply clean water to the pump for flushing effluent from the bowl to the decontamination tank and discharging the decontaminated effluent overboard and to provide also for flushing the system to clear it of accumulated debris. In contrast to the rotary type valve shown in the pending application the valve employed herein comprises flat plates supported for movement in face-to-face engagement with each other by means of a plunger-type solenoid S¹ connected to the movable plate so as to reduce to a minimum any tendency for the parts to become stucked together especially from non-use over a long period of time.

The valve plates 102 and 104 are shown in plan view in FIGS. 8 and 9. In FIG. 8 the movable valve plate 104 is shown in the position to which it is moved by activating the solenoid S¹ to initiate intake and illustrates the alignment of the ports in this position, to wit, the alignment of ports C and G, D and H and F and I. FIG. 9 shows the retraction of the movable plate 104 relative to the fixed plate 102 when the timer de-energizes the solenoid S¹ and in this position the ports A and G, B and H and E and I are in registration.

Referring to FIGS. 6 and 7, when the flush button F (FIG. 1) is depressed the motor M¹ is started and the intake pump element 88 draws water from overboard through the intake conductor 76a into the coupling element 76 through ports in the valve plates and a passage 108 into the pump chamber 84 and from thence through ports in the valve plates to a passage 110 (FIG. 7) connected to the coupling element 83 which in turn is connected to the conductors 55 and 56 leading to the

bowl. The intake coupling element 76 contains as shown in FIG. 6 a spring seated valve element 76b which blocks reverse flow of the fluid in the system. The clean water delivered to the bowl together with the effluent is transmitted by the discharge conductor 48 through the coupling element 80 to the macerator chamber 96. From the macerator chamber the macerated effluent passes to the pump chamber 86 by way of ports in the valve plates and passage 114 and is discharged from the pump chamber through passage 119 at the discharge side of the pump element 90 and ports in the valve plate and through the coupling 78 to the decontamination tank. At the end of the decontamination cycle which is suitably timed the decontaminated effluent is withdrawn from the decontamination tank by way of the coupling element 78a, ports in the valve plates into the chamber 86 and discharged therefrom through passage 118, ports in the plates, passage 120 and discharge coupling 121 through the overboard conductor 121a. Simultaneously, clean water is drawn in through the coupling element 76 through the ports in the valve plates into the pump chamber 88 and a part of this clean water is delivered by the pump through a bypass passage 122 directly to the discharge passage 121 and another part is discharged through the passages 110 and 123 to the spray head 124 located in the tank. A pipe 78b is connected at one end to the coupling 78a and is provided at its other end with a wide mouth nozzle 78c which is supported at the bottom of the tank for emptying the tank during discharge.

As was just mentioned there is a spray 124 in the decontamination tank for supplying clean water to the tank to clean the latter. The aforesaid agitator 74 referred to above is for the purpose of keeping the effluent thoroughly mixed with the water and decontaminant and comprises an electric motor M² fastened by means of a bracket 126 to the cover plate 70. The bracket embodies a shaft housing 128 which extends through the plate into the bottom of the tank and a shaft 130 is journaled in the shaft housing and connected at one end to the motor M² and has at its other end a blade 132 which operates to thoroughly mix and agitate the effluent within the tank.

The pump motor, agitator motor and solenoid which effect operation of the valve are all connected in a control circuit shown in FIG. 11, the latter being provided with interlocks to prevent initiating the flushing cycle if the decontamination tank is full or the tablet dispenser is not ready to supply tablets at the moment of flushing and a timer for controlling the length of the decontamination. Referring specifically to FIG. 11 the circuitry is connected by lines L¹, L² and L³ to the positive and negative sides of a source of current which may comprise 12 or 32 volt direct current or 110 volt alternating and/or direct current. The flushed cycle is initiated by depressing the button F which, as referred to above, is mounted on the back of the bowl housing and will be effective if the switch HI is closed and the switches LO-LO are closed. The switch HI remains closed as long as the tank is not filled to capacity and the switches LO-LO remain closed so long as there are decontamination tablets in the dispenser ready to be dispensed. Signal lights R¹ and R² are closed by means of switch elements HI-1 and LO-1 when either of the switch elements HI and LO-LO are open to indicate, respectively, the fact that the tank is filled and/or that the dispenser either does not have tablets for dispens-

ing or is malfunctioning. Assuming that conditions are proper for flushing the timer motor TM will be started and this motor drives a cam shaft TS along which there are disposed contacts 1TR1, 1TR2, 1TR3, 1TR4 and 1TR5. The contacts 1TR1 and 1TR2 are normally closed and the remaining contacts are normally open. Since the contacts 1TR1 and 1TR2 are normally closed the timer motor will start to turn the cam shaft TS and will turn it through a complete revolution so as to cycle the toilet provided the flush button is not again depressed before the end of the normal flush cycle. If it is depressed a second time before the first cycle is completed the first switch 1TR1 will restore the timer to its initial position and the second switch 1TR2 will then recycle the toilet. A light R3 will indicate that the timing motor is recycling the system.

Assuming that the flushing cycle has been started the cam shaft closes the switch 1TR3 and this energizes a coil which closes contact C1 which in turn starts the agitator motor M2. The cam shaft also closes the switch 1TR4 which energizes the coil and closes contact C2 which in turn energizes the solenoid S1 for operating the valve and solenoid S2 of the rotary valve in the dispenser. Finally the switch 1TR5 is closed to energize the coil and close contact C3 which energizes the motor M. At the end of the cycle of operation the switches are opened, stopping the motors M and M2 and de-energizing the solenoid S1, S2.

Switch HI is connected to a float valve such as shown in our pending application by means of which it is actuated when the level of the fluid in the tank rises to too high a level and switches LO-LO are operated when one or more tablets fails to be discharged into the discharge passage leading from the trap to the decontamination tank as shown in our pending application Ser. No. 299,177.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents falling within the scope of the appended claims.

We claim:

1. In a marine toilet, a bowl open at the top and bottom, a trap connected to the bottom opening, a decontamination tank, a combination pump, maserator and valve, a conductor interconnecting the trap and tank, intake and discharge conductors connected respectively to the intake and discharge sides of the pump so that clean water entering the intake conductor passes through the valve and is delivered to the bowl by the intake side of the pump and the mixture of clean water and effluent is withdrawn from the trap into the maserator and delivered into the decontamination tank by the discharge side of the pump, said valve comprising flat plates containing parts aligned by shifting of one of the valve plates relative to the other to provide for the aforesaid introduction of clean water into the bowl and delivery of the mixture of clean water and effluent to the decontamination tank, said plates being arranged to have sliding engagement with each other and so that the edges of the ports have shearing engagement with each other and a solenoid operated plunger connected to the moveable one of the plates, said solenoid when energized being operable to slide the moveable one of the valve plates on the fixed one of the valve plates in a direction to initiate a flushing cycle and a flush button electrically connected to the solenoid operable to energize the solenoid.

2. Apparatus according to claim 1, wherein there is a control circuit in which the flush button is electrically connected for initiating the flush cycle, and a switch adapted to be actuated when the decontamination tank fills to a predetermined level to disable the flush button.

3. Apparatus according to claim 2, comprising a timer in the control circuit operable to de-energize the solenoid at the end of a predetermined length of time whereupon the movable valve plate is moved relative to the fixed valve plate to a position such that clean water is supplied to the decontamination tank and to the discharge conductor and simultaneously a mixture of water and effluent is withdrawn from the decontamination tank through the valve into the pump and discharged therefrom through the discharge conductor.

4. Apparatus according to claim 3, wherein there is an agitator supported in the decontamination tank for keeping the water and effluent mixed.

5. Apparatus according to claim 3, wherein there is a spray head mounted in the decontamination tank and a conductor connected to the pump delivers clean water to the spray head during the discharge part of the flush cycle.

6. Apparatus according to claim 3, wherein a tablet dispenser is interposed between the discharge side of the trap and the macerator in the line conducting the mixture of clean water and effluent from the trap to the macerator and from there through the pump to the decontamination tank by means of which decontamination tablets are dropped into the stream of mixed water and effluent.

7. Apparatus according to claim 1, wherein there is a tablet dispenser interposed between the trap and the

decontamination tank for introducing decontamination tablets into the water and effluent as it leaves the trap on its way to the decontamination tank, a control circuit in which the flush button is electrically connected for initiating a flush cycle, and switch means adapted to be actuated when the dispenser is depleted to disable the flush button.

8. Apparatus according to claim 1, wherein there is a control circuit containing a flush button for initiating a flush cycle and a recycling switch operable to effect a second flushing cycle in the event that the flush button is depressed a second time before the first flush cycle has been completed.

9. Apparatus according to claim 1, wherein there is a spring seated valve element in communication with the intake conductor which blocks reverse flow of fluid in the system.

10. Apparatus according to claim 1, wherein there is a flexible member interposed between the bowl and trap embodying displaceable fingers which, when undeflected, extend across the opening between the bowl and trap, forming a seal and antisplash guard.

11. Apparatus according to claim 1, wherein the combination pump, macerator and valve are mounted as a unit exteriorly of the decontamination tank so as to be accessible without dismantling the toilet unit from the decontamination tank.

12. Apparatus according to claim 1, wherein a cover plate mounts the combination pump, macerator and valve to the tank so as to enable removing the pump, macerator and valve from the tank to provide access to the tank.

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