United States Patent

Roberts et al.

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[54] MARINE RECIRCULATING AND HOLDING TANK

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[51] **Int. Cl.** **C02c 1/18**

[58] **Field of Search** 210/167, 299, 312, 248, 416, 210/141, 60, 70, 198, 532; 4/115, 120, 10

[56] **References Cited**

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[57] **ABSTRACT**

A holding tank is provided to convert a conventional marine toilet into a recirculating toilet system. The tank is provided with a horizontal partition dividing the tank into a lower, clear liquid portion and an upper waste material holding portion. One longitudinal wall of the tank is angled, and a perforated screen is aligned parallel and adjacent this angled wall, connecting to the horizontal partition. A conventional, pump operated marine toilet is then connected to the tank so that flushing liquid is drawn from the bottom of the tank and toilet discharge is applied to the upper portion of the tank. The tank is cleaned by pumping fresh liquid into the lower portion of the tank and pumping the contents of the tank from an intake position immediately above the horizontal partition. When the tank is evacuated by the clean-out pump, a premeasured charge of clear liquid remains in the lower portion.

11 Claims, 3 Drawing Figures

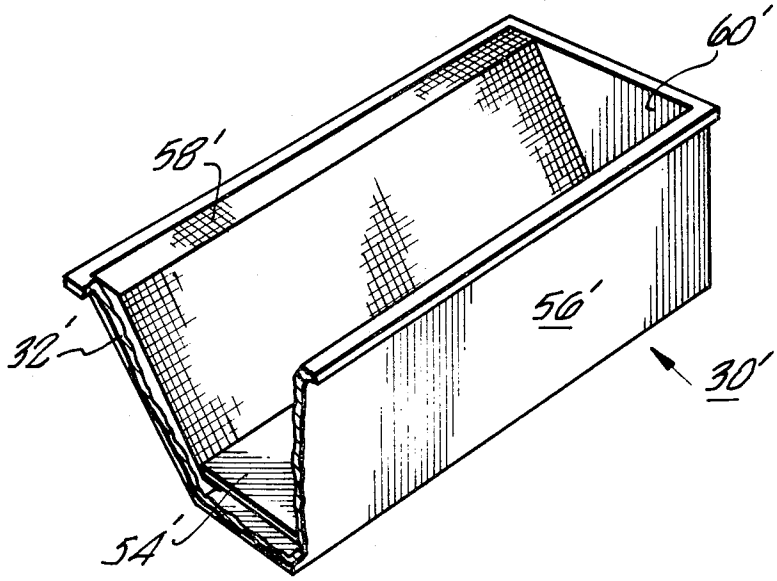


FIG. 1

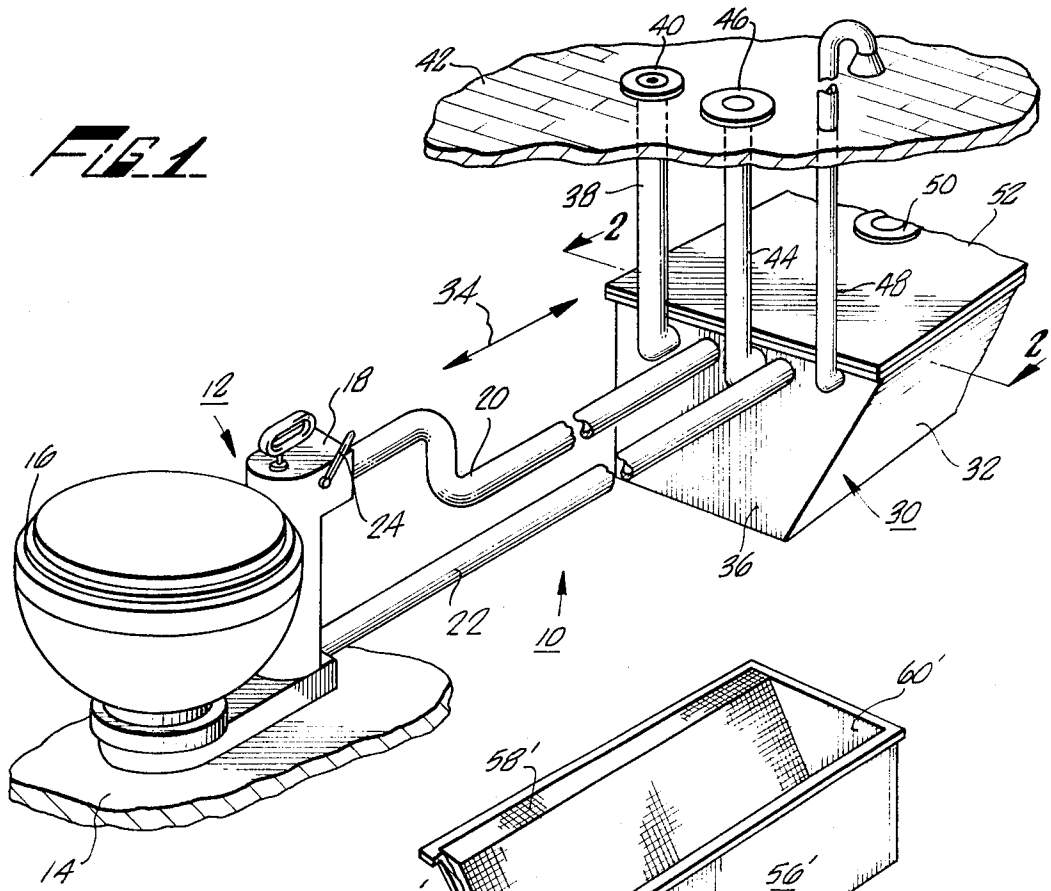


FIG. 3

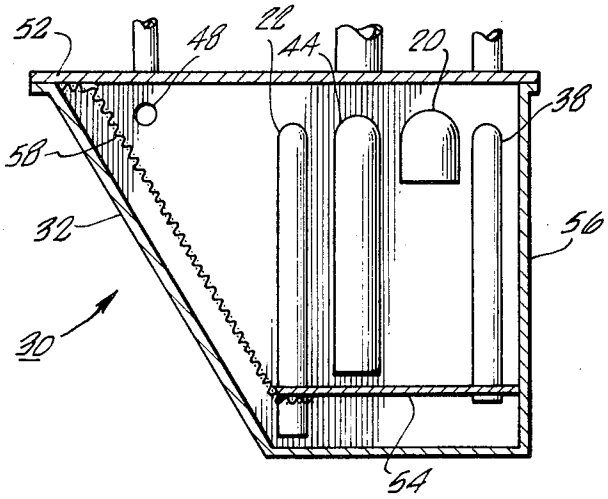


FIG. 2

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MARINE RECIRCULATING AND HOLDING TANK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to recirculating toilet systems and, more particularly, to a holding tank adapted to convert conventional marine toilets to a recirculating toilet system.

2. Description of the Prior Art

In prior years, virtually every pleasure boat of any size has been equipped with a marine toilet or "head." Most recently, such toilets have been recirculating toilet systems such as those sold by the assignee of the present invention under the trademark "MONOMATIC" and which are electrically operated, recirculating toilet systems wherein the contents of a holding tank are filtered and recirculated to flush the toilet.

Prior to the "MONOMATIC" and similar toilet systems, the marine toilet has included a bowl and a pump, which is alternatively operable to pump water from an intake, which may be external to the craft, into the toilet and, by throwing a valve to empty the contents of the toilet from the boat and into the environment. Obviously, for health and aesthetic reasons such a toilet cannot or should not be utilized when moored, or when in waterways where such discharge could pollute the environment.

Most recently, public reaction to environmental pollution has led to the passage of many regulations which tend to forbid or, severely limit the normal use of the marine toilet in the fashion set forth above. Certainly such use would be restricted in harbors or inland waterways. Accordingly, most owners of small boats are faced with the alternatives of replacing their existing toilets with a recirculating toilet system or to modify the existing toilet to operate with some form of holding tank.

Prior art devices have been provided which include a tank and appropriate interconnections as between the toilet and the tank. Such connections assure that flushing liquid is withdrawn from the tank and waste products are returned to the tank. The tanks of the prior art generally have some form of filtration so that the pump intake to the head is separated, by the filter from the head discharge.

Other prior art devices, adapted for vehicular use, have suggested a two-compartment tank in which solids are separated from liquids. One such system has been described and shown in the patent to Garver, U.S. Pat. No. 3,042,933, in which a pneumatically operated toilet is mounted upon a holding tank. A partition system is fitted in the bottom of the tank which slopes downwardly diagonally across the tank to a drain plug at one corner thereof.

The vehicle toilet of Garver is intended to be substantially self-contained, integral unit which is adapted to connect to the pneumatic system of the vehicle. Flushing action is achieved by introducing air under pressure into the lower portion of the tank, thereby forcing fluid into the flush line.

A substantially vertical screen, slightly inclined to cause solids to settle away from the screen, separates the main portion of the tank from a filter assembly. A perforated plate and screen communicate with the lower portion of the tank to permit liquid return.

The vertical screen is aligned to be at right angles to the vehicle longitudinal axis. Accelerations and decelerations of the vehicle maintain the fluid in agitation tending to wash the screen.

What is needed and what is provided by the present invention is a tank which in combination with existing marine toilets, converts them into recirculating sanitary systems, with appropriate interconnections for the draining and refilling of the holding tank.

In a preferred embodiment of the present invention, a holding tank is provided with an angled, longitudinal wall which permits the installation of the tank adjacent nonvertical sections of the hull of the vessel in awkward locations that might be otherwise unused.

A partition member extends horizontally across the tank, ending just short of the angled wall, dividing the tank, as in Garver, supra, into an upper or solids carrying portion and a lower or clear liquid portion.

A filter member, which may be a screen or perforated plate, is placed parallel to the inclined wall and adjacent thereto, and is anchored to the edge of the horizontal partition to provide a fluid flow passage from the upper portion of the tank to the lower portion of the tank.

The tank of the present invention is aligned with the angled wall and the filter adjacent thereto aligned parallel to the boat longitudinal axis. Normal rolling motions of the boat tend to prevent solids from adhering to the filter member and provide a limited back flow through the filter. Further, placing the filter member at an angle permits a larger filter area to serve the fluid as the fluid level rises in the tank.

According to the present invention, the horizontal partition which separates the tank into its upper and lower portions provides other incidental benefits. The toilet intake line and a backflush line both penetrate the partition and communicate with the lower portion of the tank. The waste discharge line, however, terminates just above the partition and evacuates only the contents of the tank above the partition.

To drain and precharge the tank, one need only connect a source of clean water to the backflush line which then recirculates water through the lower portion of the tank, through the filter member, and into the upper portion. A discharge pump is connected to the drain line and empties the contents of the upper portion. Clean water flowing through the lower portion tends to circulate the contents of the tank to facilitate the draining of the tank.

When the backflushing source is cut off, the pump continues to discharge the contents of the upper portion of the tank. When the upper portion is emptied, the pump can be shut down, and a premeasured quantity of clear water will remain in the lower portion of the tank.

The novel features which are believed to be characteristic of the invention, both as to organization and method of operation, together with further objects and advantages thereof will be better understood from the following description considered in connection with the accompanying drawings in which a preferred embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a prior art marine toilet connected to an improved recirculating and holding tank according to the present invention;

FIG. 2 is a side-sectional view of the tank of FIG. 1 taken along the line 2—2 in the direction of the appended arrows; and

FIG. 3 is a perspective view of the tank of FIG. 1 with the top removed and with one end broken away.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning first to FIG. 1, there is shown a perspective view of a marine toilet system **10** which includes a recirculating holding tank according to the present invention. A conventional, pump-operated marine toilet or head **12** is mounted to a deck **14** of a boat. The head **12** includes a toilet bowl **16** and a manually operated pump **18**. Obviously, other marine toilets utilizing automatic pumps or other fluid circulation systems can be substituted for the head **12** without departing from the principles of the present invention.

In the prior art, a waste line **20** has been connected to discharge the waste matter through an appropriate port in the side of the craft, into the water. An intake line **22** was connected to an intake port in a side of the craft to draw in "-clean" water for flushing purposes. A lever **24** operates a valve which alternatively directs "clean" water into the head **12** and empties the contents of the head **12** into the waste line **20**.

According to the present invention, a holding tank **30** is placed within the structure of the boat. The tank **30** is of generally rectangular shape with an angled long side **32**. The long axis of the tank **30** is aligned to be parallel with the longitudinal axis of the craft, indicated by the double-ended arrow **34**.

The holding tank **30** is provided with a plurality of fittings placed in a side wall **36** which enable connection to the waste line **20** and the intake line **22**. In addition to these fittings, a backflush line **38** is provided, which terminates in a fitting **40** that is inset in an upper deck **42** for easy access. A second or clean-out line **44** also terminates in a fitting **46** in the deck **42**. A vent **48** extends through the deck **42** and is adapted to connect to the exterior of the hull. A removable plate **50** is provided in the tank cover **52** for servicing and inspection purposes.

Turning next to Fig. **2**, there is shown a side-sectional view of the tank **30** of FIG. **1** illustrating the interior construction of the tank **30** according to the present invention. The tank **30** is provided with a horizontal partition **54** which extends the length of the tank and substantially the full width of the tank **30**.

The partition **54** is sealingly joined to the three straight sides of the tank **56**. Extending from the top of the tank to the partition **54**, substantially parallel to the angled side **32** is a permeable partition member **58** which acts as a filter to separate solid wastes from the liquid, and which permits the liquid to flow into the area beneath the partition **54**.

The intake line **22** terminates below the partition **54** and is adapted to withdraw liquid from the lower portion of the tank **30** in the area beneath the partition **54**. The backflush line **38** also extends beneath the partition **54** for clean-out and refilling purposes. The waste discharge line **20** terminates just inside the tank, and the waste matter is permitted to fall to the partition **54** where the solid wastes are generally retained. The clean-out line **44** extends to just above the partition **54** and when connected to a discharge pump can evacuate the contents of the upper portion of the tank **30**.

In FIG. **3**, there is shown an improved holding tank of the present invention with the top removed. The holding tank illustrated in FIG. **3** might be considered the "mirror image" of the tank of FIGS. **1** and **2**, in that the end panel that is not shown would be the end panel containing the fittings and inlet and outlet tubes. Accordingly, the reference numerals of FIGS. **1** and **2** will be used with primes to refer to corresponding elements in FIG. **3**.

In the tank **30'**, the horizontal partition **54'**, as shown, is fastened to the vertical wall **56'** and extends less than the full width of the tank **30'** at the bottom. The permeable partition **58'** is formed in a generally *z*-shape and is adapted to be fastened between the longitudinal top edge of the angled side **32'** and the free, longitudinal edge of the horizontal partition member **54'**. With this arrangement, fluid communication is established as between the upper and lower portions of the tank **30'**.

In operation, and with reference to FIG. **1**, when the head **12** is operating in a "fill" mode, the valve lever **24** is appropriately set, and the pump **18** is operated. Clear liquid from the lower portion of the tank **30** is withdrawn through the intake line **22**. An appropriate amount of fluid is then pumped into the bowl **16**. To empty the bowl **16**, the valve lever **24** is moved to its alternate position, and the pump **18** is again operated. The contents of the bowl **16** are then pumped through the waste line **20** and discharged into the tank **30**. Solid materials are retained above the partition **54** in the upper portion of the tank **30**. Liquids pass through the permeable partition member **58** to replenish liquid retained under the partition **54** in the lower portion of the tank **30**.

Appropriate liquid level sensors can be provided to signal when the contents of the tank have reached a predetermined level at which time it is appropriate to drain the tank **30**. This is accomplished, in conformity with most statutes or regulations, by coupling a waste discharge pump (not shown) to the deck fitting **46**. A water supply line is then connected to the deck fitting **40** and the supply line **38**.

As is best seen from FIG. **2**, clean water applied through fitting **40** into the backflush pipe **38** is introduced below the partition **54** and causes a recirculation of the liquid in the lower portion of the tank **30**. As additional fluid is added, the flow is directed through the permeable partition member **58** in the "reverse" direction.

At the same time, the waste discharge pump starts to withdraw the contents of the upper portion of the tank **30**. Since the waste intake is located just above the partition **54**, all of the solids retained within the tank tend to be removed. As additional clear water is pumped in through the line **38**, the partition member **58** is subjected to a cleaning action, and the circulation of fluid within the tank **30** tends to keep the solid matter in agitation, aiding in the cleaning of the upper portion of the tank **30**.

After a reasonable pumping interval which is best determined through experience with the system, the clean water supply is cut off with the discharge pump continuing to run. The fluid level of the tank **30** will then drop to the intake of the waste discharge line **44**, and the pump can be secured. By spacing the intake end of the discharge line **44** close to the surface of the partition **54**, the contents of the upper portion of the tank can be substantially evacuated. The lower portion of the tank, however, is filled with clean fluid and represents a premeasured initial charge. This premeasured initial charge is automatically achieved whenever the tank **30** is drained and cleaned.

Thus there has been shown an improved holding and recirculating tank for converting existing marine toilets or heads into recirculating sanitary systems. An improved retention tank is provided with a "false" bottom separating the tank into upper and lower portions. An angled long wall of the tank has a filter member positioned parallel thereto and spaced therefrom to provide a fluid circulation path between the upper portion and the lower portion of the tank. The angled wall of the tank is oriented to be parallel to the boat longitudinal axis so that rolling motions of the craft tend to keep the fluid in the tank in circulation and to prevent clogging of the filter member.

In use, flushing liquid is withdrawn from the lower portion of the tank and waste is discharged into the upper portion of the tank. To clean out the tank when full, a waste discharge pump is coupled to the discharge line whose intake is positioned in the upper portion of the tank at a point adjacent the false bottom or dividing partition. A back flush line has its outlet in the lower portion of the tank. The application of cleaning liquid to the back flush line causes a recirculation of the fluid from the lower portion through the filter member in the "reverse" direction into the upper portion.

The waste discharge pump is operable to evacuate the contents of the upper portion of the tank. After the source of back flushing liquid has been cut off, the waste discharge pump continues to operate and substantially empties the upper portion of the tank, leaving a premeasured charge of clean liquid in the lower portion of the tank.

It is clear that the tank of the present invention could be inverted to have a wider bottom than top. In such an embodiment, the filter member would be angled from the false bottom extending inwardly over the upper portion of the tank, as in Garver, supra.

What is claimed as new is:

1. A holding and recirculating tank adapted to be coupled to a marine toilet comprising:

an elongated tank of trapezoidal cross section having parallel top and bottom sides and an angled, elongated side wall extending outwardly from the base;

a partition, parallel to said bottom side of said tank and separated therefrom, extending substantially across the width of said tank, one edge of said partition being spaced apart from said angled side wall; and

a filter member extending the length of said tank from the top of said angled side wall to said edge of said partition, said filter member being substantially parallel to said angled side wall;

whereby said partition divides said tank into an upper portion and a lower portion with fluid communication therebetween through said filter member,

means adapted for connecting said upper portion of said tank to the waste discharge of a marine toilet;

and means adapted for connecting said lower portion of said tank to said marine toilet to permit recirculation of the fluid for flushing.

2. In the tank of claim 1, said lower connecting means including a flush intake conduit, said flush intake conduit being adapted to be connected to the fluid intake of the marine toilet, whereby flushing liquid is withdrawn from said lower portion of said tank.

3. In the tank of claim 1, said upper connecting means including a waste outlet conduit communicating with said upper portion of said tank, said waste outlet conduit being adapted to be connected to the waste outlet of the marine toilet, whereby discharge wastes are applied to said upper portion of said tank.

4. In the tank of claim 3 said lower connecting means including a flush intake conduit, said flush intake conduit being adapted to be connected to the fluid intake of the marine toilet, whereby flushing liquid is withdrawn from said lower portion of said tank.

5. The tank of claim 1 further including means for cleaning said tank, said means comprising:

a backflush conduit adapted to be connected to a source of clean fluid, said conduit extending into said lower portion of said tank; and

a waste discharge conduit in said upper portion of said tank, having an intake adjacent said partition, said waste discharge conduit adapted to be connected to the inlet of a discharge pump,

whereby clean fluid applied through said backflush conduit recirculates fluid through said filter member in the reverse direction and agitates the contents of said upper portion of said tank, enabling a more complete evacuation of the contents of said upper portion of said tank by said waste discharge conduit.

6. In the tank of claim 1, said top being wider than the bottom, and the tank being constructed and arranged so that its longitudinal axis may be placed substantially parallel to the boat longitudinal axis whereby rolling motion of the boat agitates the fluid contents to prevent clogging of the filter member.

7. A holding and recirculating tank adapted to convert a marine toilet into a self contained, recirculating toilet system, the tank comprising:

an elongated tank body having an axis, and adapted to be installed with said axis parallel to a boat longitudinal axis;

a partition member located in said tank substantially parallel to and spaced apart from the bottom of said tank, said partition having an edge separated from one of the elongated walls of said tank for separating said tank into an upper and lower portion; and

a filter member extending from said partition edge and coupled to said elongated wall to provide fluid communication between said upper and lower portion of said tank through said filter member,

said tank having an inclined side wall extending upwardly and outwardly from the base, and said filter member being substantially parallel to said inclined wall,

and means enabling connection of said upper and lower portions of said tank to said marine toilet for permitting recirculation of fluid for flushing.

8. The tank of claim 7, wherein said means enabling connection including a flush intake conduit extending through said partition, said flush intake conduit being adapted to be connected to the fluid intake of the marine toilet, whereby flushing liquid is withdrawn from said lower portion of said tank.

9. The tank of claim 7, wherein said means enabling connection including a waste outlet conduit communicating with said upper portion of said tank, said waste outlet conduit being adapted to be connected to the waste outlet of the marine toilet, whereby discharged wastes are applied to said upper portion of said tank.

10. The tank of claim 9 wherein said means enabling connection including a flush intake conduit extending through said partition, said flush intake conduit being adapted to be connected to the fluid intake of the marine toilet, whereby flushing liquid is withdrawn from said lower portion of said tank.

11. The tank of claim 7 further including means for cleaning said tank, said means comprising:

a backflushing conduit adapted to be connected to a source of clean fluid, said conduit extending through said partition and into said lower portion of said tank; and

a waste discharge conduit in said upper portion of said tank, having an intake adjacent said partition, said waste discharge conduit adapted to be connected to the inlet of a discharge pump,

whereby clean fluid applied through said backflush conduit recirculates fluid through said filter member in the reverse direction and agitates the contents of said upper portion of said tank, enabling a more complete evacuation of the contents of said upper portion of said tank by said waste discharge conduit.

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