United States Patent [19]

Sargent et al.

[11] **3,751,735**

[45] **Aug. 14, 1973**

[54] **RECIRCULATING TOILET WITH FILTER SCREEN ASSEMBLY**

[75] Inventors: **Charles L. Sargent,** Ypsilanti; **Marshall W. Miller,** Ann Arbor, Gary R. Adiska, Milan, all of Mich.

[73] Assignee: **Thetford Corporation,** Ann Arbor, Mich.

[22] Filed: **Dec. 17, 1971**

[21] Appl. No.: **209,308**

[52] **U.S. Cl.** **4/10,** 4/78, 4/89, 4/109

[51] **Int. Cl.** **E03d 5/01,** E03d 5/016

[58] **Field of Search** 210/167, 411; 4/8, 4/10, 11, 68, 77, 78, 90, 89, 109, 115, 287, 288, 292

[56] **References Cited**

UNITED STATES PATENTS

3,628,196	12/1971	Quiram	4/115
3,593,345	7/1971	Wells	4/115

FOREIGN PATENTS OR APPLICATIONS

645,683	7/1962	Canada	210/411

Primary Examiner—John Petrakes
Assistant Examiner—Stuart S. Levy
Attorney—Olsen & Stephenson

[57] **ABSTRACT**

Apparatus in a self-contained toilet system that protects the recirculating pump from becoming clogged, improves cleaning of the liquids in the system and facilitates improved evacuation of the waste materials from the holding tank of the system. The apparatus includes a filter cone of wire mesh that is positioned in the holding tank between the tank and the toilet bowl for confining solid matter in a selected location of the tank spaced from the inlet of the circulating pump but in direct communication with the evacuation opening of the tank.

8 Claims, 4 Drawing Figures

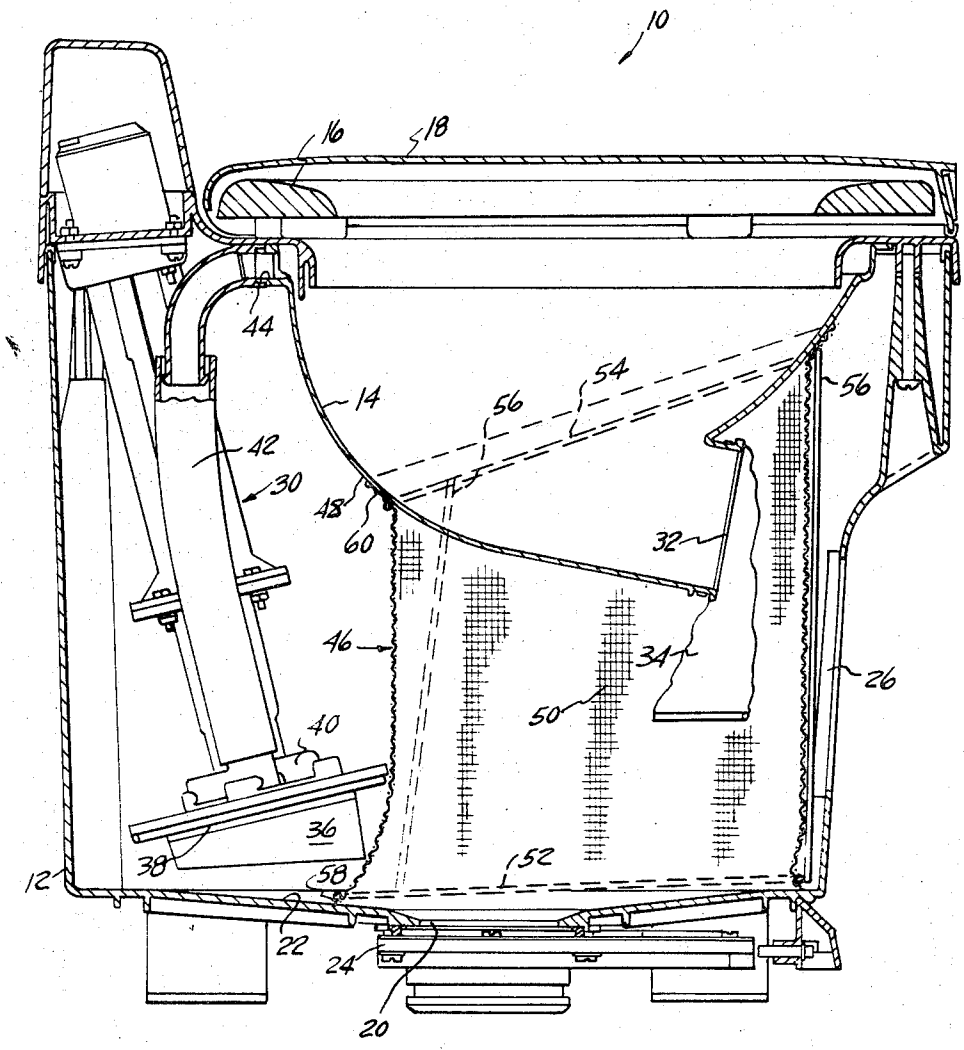

FIG. 1

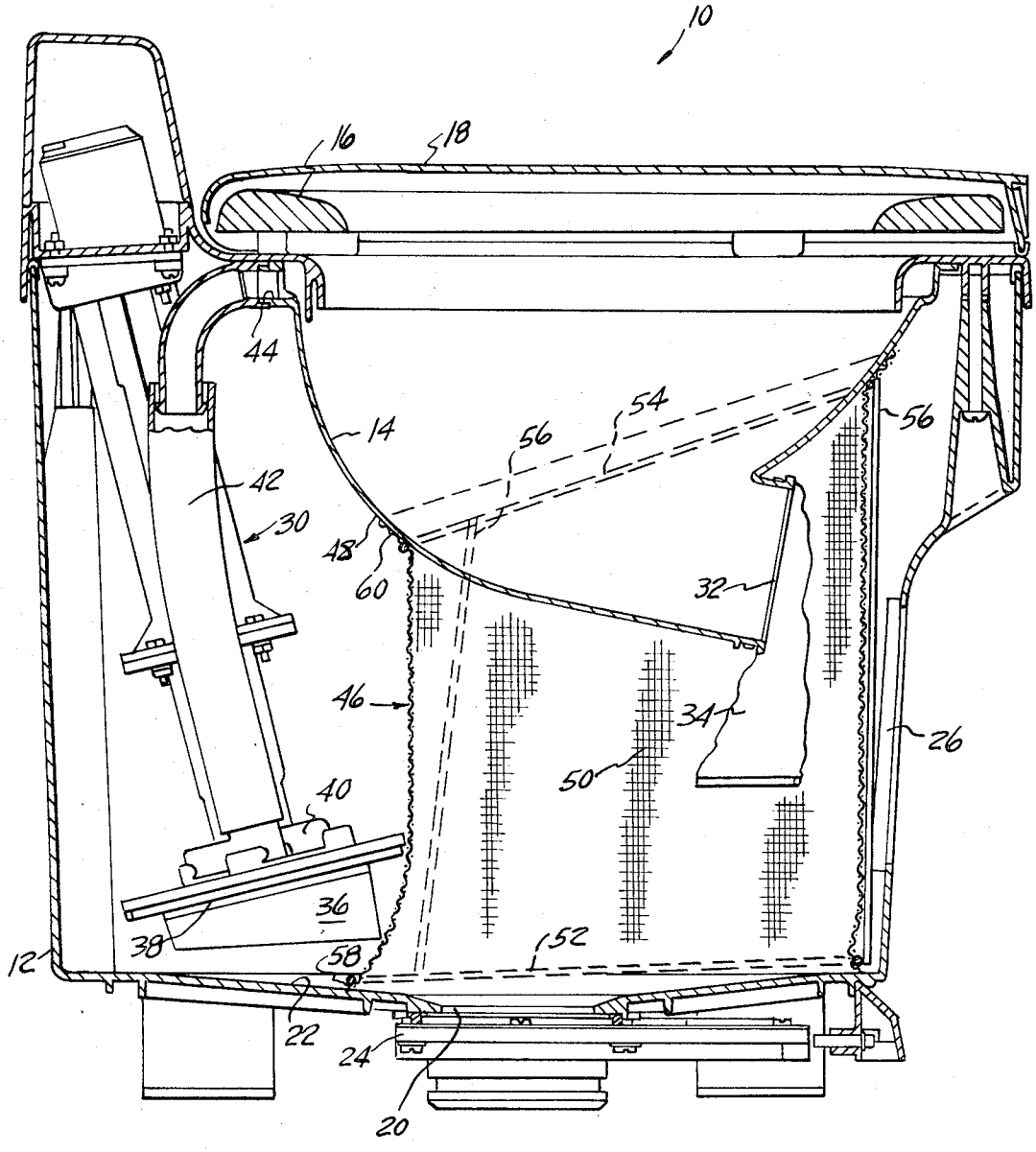
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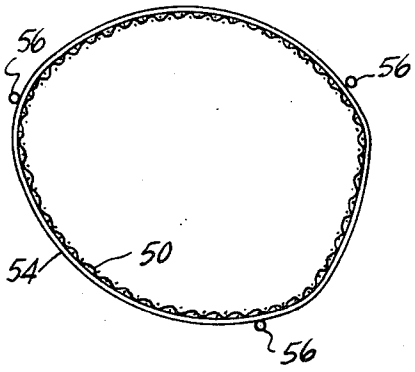
FIG. 3



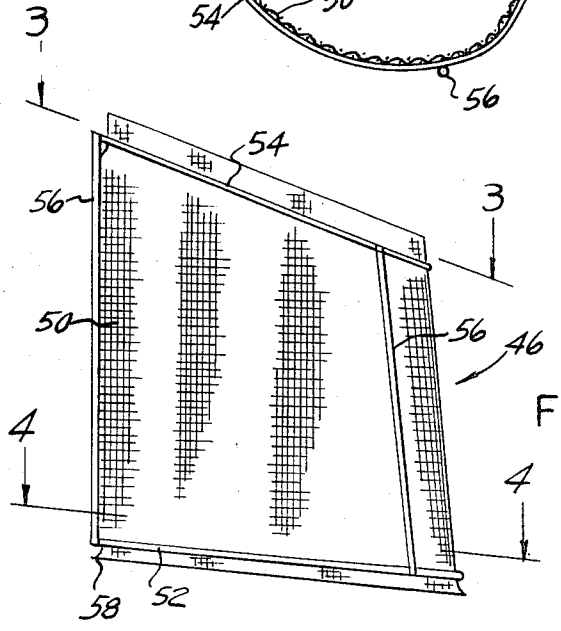


FIG. 2

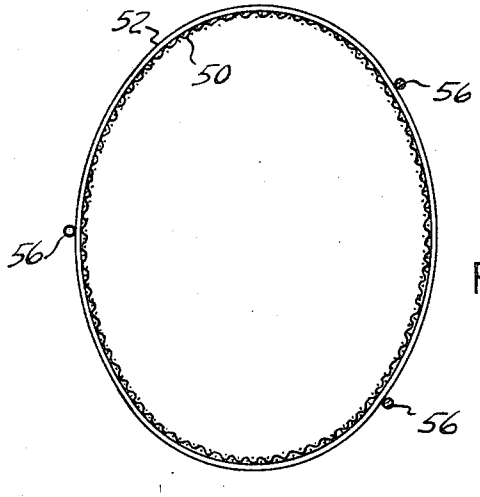


FIG. 4

RECIRCULATING TOILET WITH FILTER SCREEN ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATION

A portion of the disclosure of this application relates to pending U.S. application Ser. No. 181,735, filed Sept. 20, 1971 in the name of Marshall W. Miller.

BACKGROUND OF THE INVENTION

The present invention relates to improvements in a self-contained recirculating toilet system and to a filter cone for use in such a toilet system.

In recirculating toilets of the type disclosed in U.S. Pat. No. 3,593,345, issued July 20, 1971 to Charles B. Wells, the optimum results desired from the system are not always realized because of the treatment and manner of use to which the system is subjected. For example, in some instances toilet paper may be used which is of a quality that may cause it to clog the filter apparatus, or in other instances foreign matter for which the system is not designed may be discharged into the holding tank.

It is also desired in toilet systems of this character to provide recirculated liquid for flushing purposes which is as clear as is possible. For such purposes additional filters may be provided but clogging of these filters remains a serious problem necessitating either periodic replacement or cleaning of them. Further, there has been a continuing need for improvements in connection with the evacuation of the holding tanks of these systems so that solid matter can be removed during evacuation and the system restored to its maximum efficiency with minimum effort on the part of the operator.

SUMMARY OF THE INVENTION

The present invention is directed to a simple-low-cost filter screen assembly that can be inserted into the self-contained recirculating toilet systems now in use, or the assembly can be made a part of a new system, and when in use will alleviate undesirable conditions that may have existed in the past in systems of this character.

According to a preferred form of the present invention, a self-contained toilet system is provided which includes a tank for holding liquid and waste material, a toilet bowl mounted in said tank and having an outlet in the lower portion of the bowl for discharge of material and liquid into the tank, pump and filter apparatus for circulating a quantity of relatively clear liquid from the tank to the bowl for return through the bowl outlet to the tank, and a filter screen assembly positioned in the tank, extending between the bottom wall of the bowl and the bottom wall of the tank and enclosing the outlet of the bowl so that liquid and waste material discharged through the bowl outlet will flow into the confines of the screen assembly. The pump and filter apparatus has a suction inlet end located in the tank outside the confines of the filter screen assembly, and the tank has a normally closed evacuation opening in its bottom wall that is positioned within the confines of the filter screen assembly.

By virtue of this construction and arrangement, the filter screen assembly protects the recirculating pump from becoming clogged, because toilet paper and other solid materials will be retained within the confines of the filter screen assembly. Not only does the filter screen assembly perform this useful function, but it also converts certain pump clogging materials, such as toilet paper, into an efficient filtering agent which reduces the particle size of the solid matter that may be carried through the system in the flush liquid.

The filter screen assembly preferably is a screen supported on a frame and the screen is a truncated cone which has its base seated on the bottom wall of the tank and its upper surface seated against the bottom wall of the toilet bowl and encloses the outlet from the toilet bowl. The screen is relatively large so that the volume confined within the screen can readily retain all of the solid material, and when the pump functions to draw the liquid into the inlet or suction end of the pump, the toilet paper within the filter screen assembly will be sucked against the screen and will act as a filter for the liquid passing through the toilet paper. The volume of the tank outside the confines of the filter pump assembly is sufficiently large so that problems will not arise from pump starvation and consequent cavitation during operation of the pump.

Not only does the present invention provide the protection against clogging of the recirculating pump and improved filtration of the recirculated liquid, but it also concentrates solids near the outlet of the tank for improved evacuation. The cone shape of the screen also assists back flush and cleansing during evacuation because of the negative slope of the filter area. Thus, it is among the objects of the present invention to provide an improved self-contained toilet system, and in particular to provide apparatus which minimizes clogging of the recirculating pump, improves filtration of the recirculated liquid, and which improves evacuation of the holding tank of the system.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical section through a self-contained recirculating toilet system embodying features of the present invention;

FIG. 2 is a side elevational view of the filter screen assembly shown in the self-contained recirculating toilet system illustrated in FIG. 1;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2; and

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring now to the drawings, the invention will be described in greater detail. The self-contained toilet system **10** includes the toilet tank **12** in which is mounted the toilet bowl **14**. A conventional toilet seat **16** and cover **18** are suitably mounted over the toilet

bowl 14. The toilet tank 12 has a discharge opening 20 in its bottom wall 22 which is normally closed by a suitable gate valve 24 of the type that is shown in U.S. Pat. No. 3,333,814 granted Aug. 1, 1967 to Ronald J. Sargent. For a more detailed description of the gate valve 24, reference is made to the cited U.S. Pat. No. 3,333,814.

The tank 12 has in its front wall a liquid level indicating device 26 for indicating the level of the liquid within the tank 12, and for a more detailed description of the liquid indicator device, reference is made to copending application Ser. No. 181,735 filed Sept. 30, 1971 in the name of Marshall W. Miller.

A pump and filter apparatus 30 is mounted at the rear of the toilet tank 12 for pumping a quantity of relatively clear liquid from the tank 12 to the bowl 14 and for return to the tank 12 through the discharge outlet 32 in the lower portion of the bowl 14. If desired, a vinyl skirt 34 may be connected around the outer periphery of the outlet 32 to guide solid matter into the tank 12.

The pump and filter apparatus preferably is of the type disclosed in U.S. Pat. No. 3,593,345, issued July 20, 1971 in the name of Charles B. Wells, and it includes a filter basket 36 mounted at the lower or suction inlet end 38 of the recirculating pump 40. The pump is adapted to discharge through the flexible conduit 42 to the bowl 14 via the port 44.

A filter screen assembly 46 is positioned in the tank 12 extending between the bottom wall 22 of the tank and the bottom wall 48 of the bowl 14. In its assembled position, the filter screen assembly encloses the outlet 32 of the bowl 14 so that the liquid and waste material discharged through this outlet will flow into the confines of the screen assembly. The opening 20 in the bottom wall 22 also is located within the confines of the filter screen assembly 46 so that solid matter which is discharged from the bowl 14 into the tank 12 will be retained within the filter screen assembly 46 and when it is desired to evacuate the tank 12, this can readily be accomplished merely by opening the gate valve 24.

The inlet or suction end of the pump 40 is located outside the confines of the filter screen assembly 46 so that when the pump is in operation it will suck liquid from the tank 12 which has passed through the filter screen assembly 46 at some time during operation of the recirculating system. Thus, large pieces of solid matter or toilet paper will not be available at the pump inlet to clog filter basket 36 or the pump 40. Furthermore, because of the location and relative volume of the liquid within the confines of the filter screen assembly 46 and the volume of the tank outside the confines of the assembly 46, toilet paper and the like will flow against the filter screen assembly 46 during recirculating operations and will act as additional filtering material for filtering the fluids that subsequently pass through the pump 40.

The filter screen assembly 46 preferably is a number 18 wire mesh 50 that is supported by a frame having a lower ring member 52, an upper ring member 54, and a plurality of vertical support members 56. The wire mesh 50 projects below the lower ring member 52 and above the upper ring member 54, and is flared outwardly as shown at 58 and 60. Also, the wire mesh is in the shape of the truncated cone so that when it is desired to evacuate the tank 12, the liquid within the tank will flow through the wire mesh 50 and will backwash the same during discharge through the outlet 20. It will be appreciated that because of the negative slope of the interior surface of the wire mesh screen 50, an effective cleaning action will occur. Also, the bottom wall of the tank 12 will be effectively cleaned. Not only does the screen assembly 46 allow cleaning of the screen merely as an incident to draining the liquid from the tank 12, but it also functions to concentrate the solid matters adjacent to the outlet opening 20, so as to facilitate the removal of the same. Still further, the filter screen assembly 46 can be manufactured at relatively low cost so as to provide an economical filter apparatus which is not readily subject to damage or to maintenance problems because it has no moving parts.

It is claimed:

1. In a self-contained toilet system that includes a toilet bowl with an outlet, a tank for holding the liquid of the system and in which said bowl is supported, and pump-and-filter apparatus for circulating a quantity of relatively clear liquid from the tank to the bowl for return to the tank, the improvement comprising a filter screen assembly positioned in said tank extending between said bowl and the bottom wall of the tank and enclosing the outlet of the bowl so that solid matter discharged from the bowl will be enclosed within the filter screen assembly, the portion of the filter screen assembly nearest said inlet end of the pump-and-filter apparatus converging from the bottom to the top so that cleansing of the screen assembly during evacuation through said discharge opening is facilitated because of the negative slope.

2. In the self-contained toilet system that is defined in claim 1, wherein said tank has a normally closed discharge opening in said bottom wall and said filter screen assembly also encloses said discharge opening.

3. In the self-contained toilet system that is defined in claim 2, wherein said pump-and-filter apparatus has an inlet end located within said tank outside the confines of said filter screen assembly.

4. In a self-contained toilet system that is defined in claim 1 wherein said filter screen assembly has a screen with about a number 18 wire mesh.

5. In a self-contained toilet system that is defined in claim 4, wherein said filter screen assembly includes a frame with members that encircle the screen adjacent to the upper and lower ends of the screen, and the lower end of the screen is flared radially outward and projects under the member that encircles the screen at the lower end.

6. In a self-contained toilet system that is defined in claim 5, wherein the upper end of said screen is flared radially outward and projects along the lower wall of said bowl.

7. A self-contained toilet system comprising a tank for holding liquid and waste material, a toilet bowl mounted in said tank and having an outlet in the lower portion of the bowl for discharge of material into said tank, pump apparatus for circulating a quantity of relatively clear liquid from the tank to the bowl for return through said outlet to the tank, and a filter screen assembly positioned in said tank extending between the bottom wall of said bowl and the bottom wall of said tank and enclosing the outlet of the bowl so that liquid and waste material discharged through said outlet will flow into the confines of said screen assembly, said filter screen assembly including a screen in the shape of a truncated cone, the base of the cone being located on

the bottom wall of the tank and the upper end being adjacent to the bottom wall of the bowl in enclosing relation to the outlet from the bowl, said pump apparatus having a suction inlet end located in said tank outside the confines of said filter screen assembly, and said tank having a normally closed evacuation opening in its bottom wall within the confines of said filter screen assembly.

8. The self-contained toilet system that is defined in claim 7, wherein the interior surface of the cone nearest to the suction inlet of said pump has a negative slope.

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