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Drouhard, Jr. et al.

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[54] APPARATUS FOR PNEUMATIC TRANSPORTATION OF SANITARY WASTE FROM A TOILET TO A HOLDING TANK

[72] Inventors: **Alfred J. Drouhard, Jr.**, Mansfield; **Joseph B. Stinson**, Fremont, both of Ohio

[73] Assignee: **Mansfield Sanitary, Inc.**, Perrysville, Ohio

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[52] **U.S. Cl.** **4/111**

[51] **Int. Cl.** **A47k 11/02**

[58] **Field of Search** 4/9, 10, 14, 15, 71, 76, 77, 4/80, 90, 92, 111, 115, 116, 120, 128, 252, 286; 137/205; 217/152

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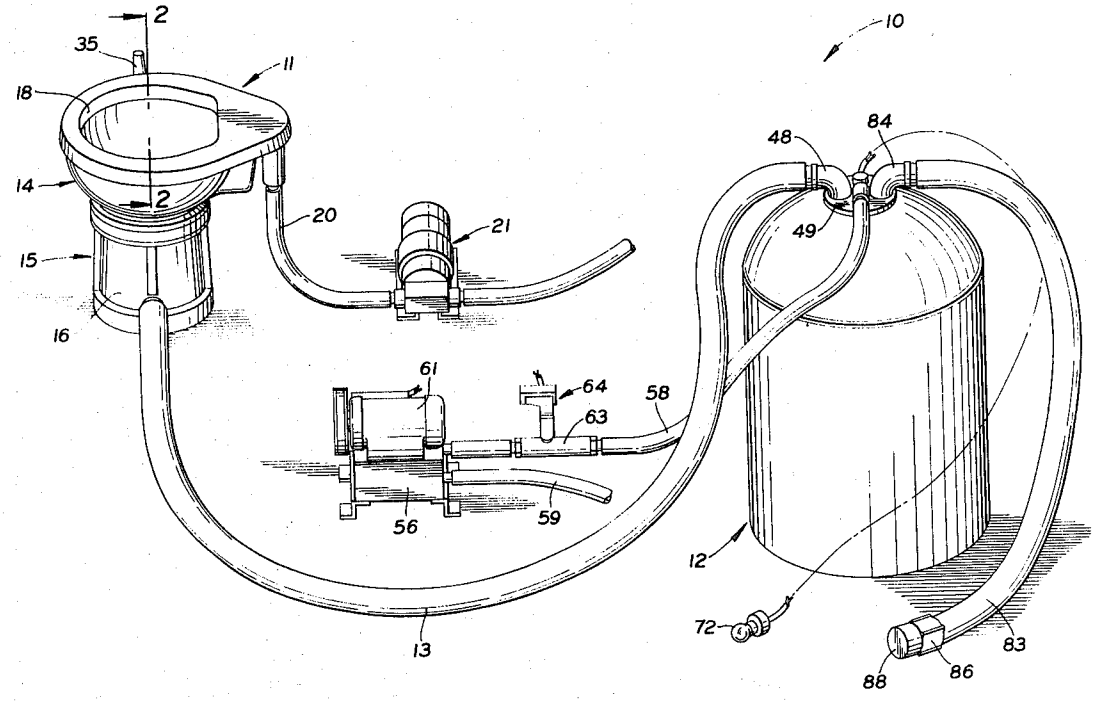
Primary Examiner—Herbert F. Ross
Assistant Examiner—Donald B. Massenberg
Attorney—Hamilton, Renner & Kenner

[57] **ABSTRACT**

A system for pneumatically transporting sanitary waste from a toilet to a holding tank. The holding tank communicates with the toilet through a relatively small diameter transfer conduit. The toilet has a trapless bowl portion with a valve means selectively to open and close a drain in the bowl portion. Beneath the bowl portion is a macerating portion. A vacuum pump is provided to reduce the pressure within the holding tank, transfer conduit and the macerating portion of the toilet below atmospheric. The effluent is swept through the transfer conduit to the holding tank in a series of pulsations that mark the discontinuous entrance of the heterogeneous agglomeration into the orifice means. The tank itself includes a discriminating means to prevent the material therein from being pumped out by the vacuum pump.

14 Claims, 5 Drawing Figures



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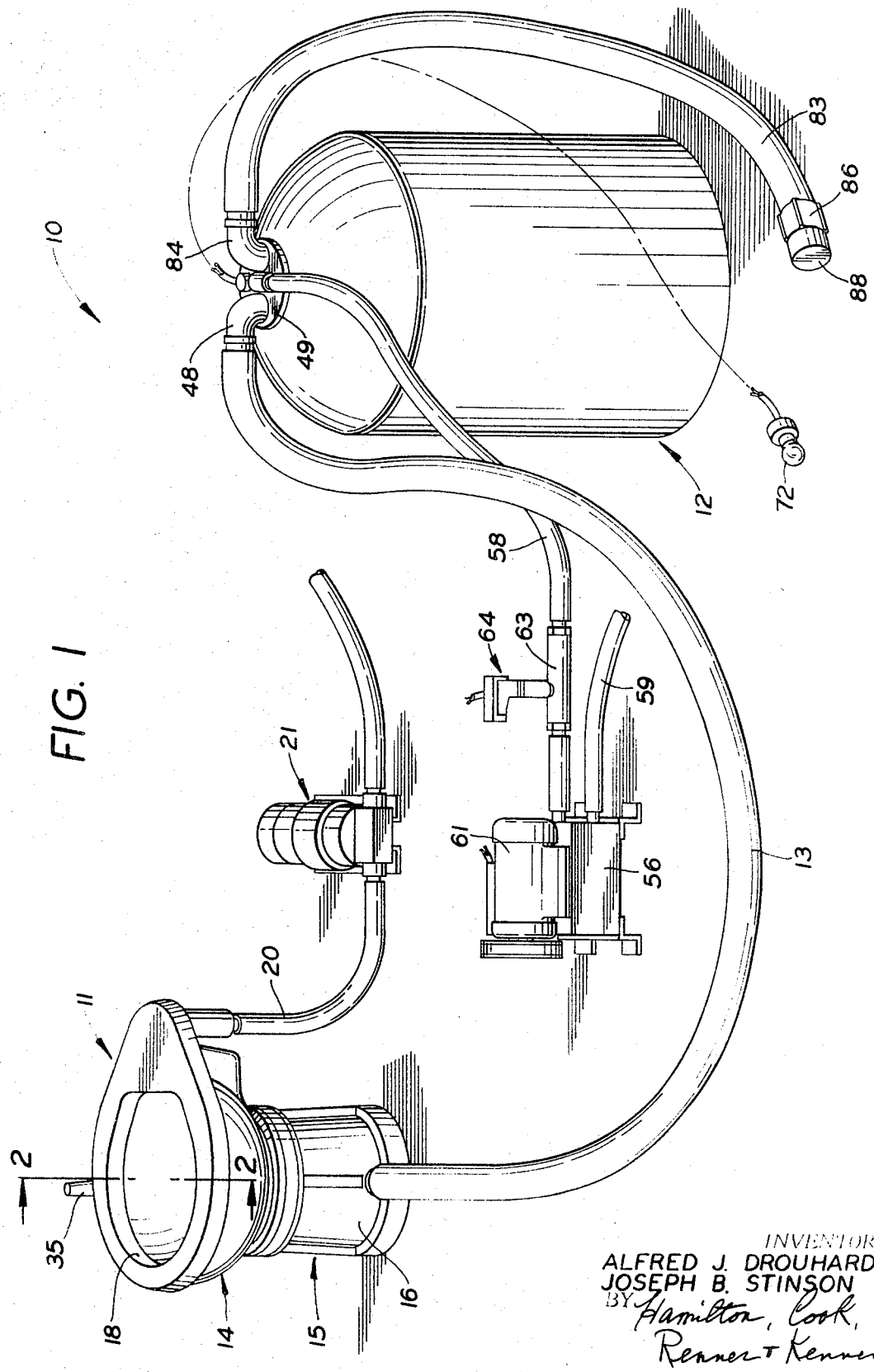


FIG. 1

INVENTORS.
ALFRED J. DROUHARD, JR
JOSEPH B. STINSON
BY Hamilton, Cook, Kenner & Kenner
ATTORNEYS

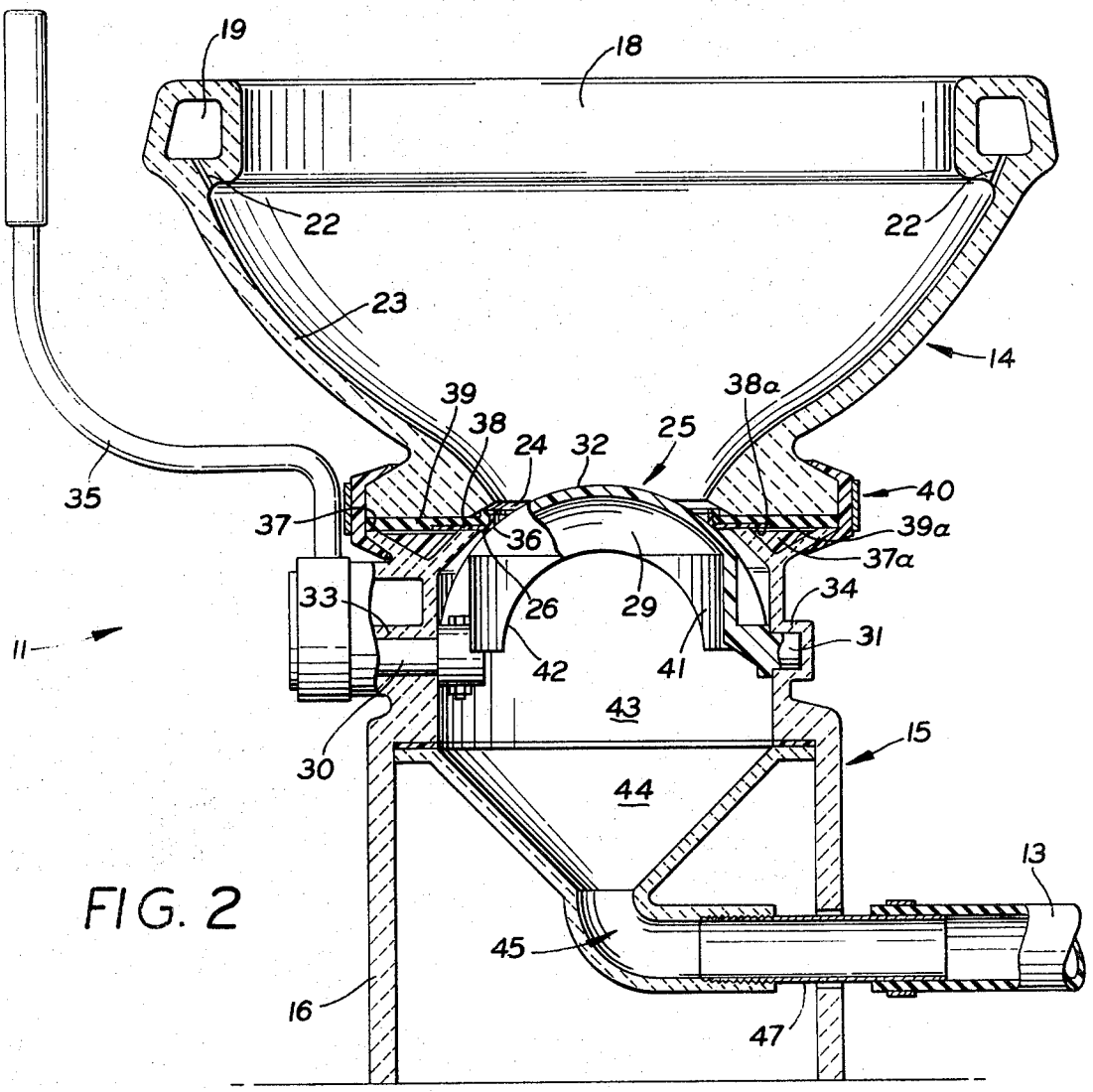


FIG. 2

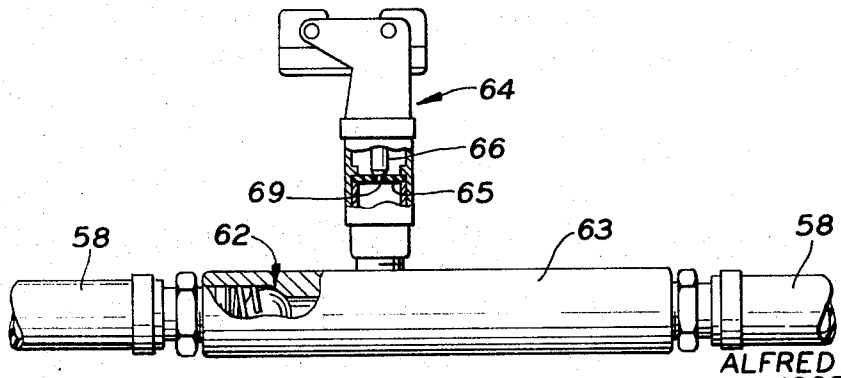
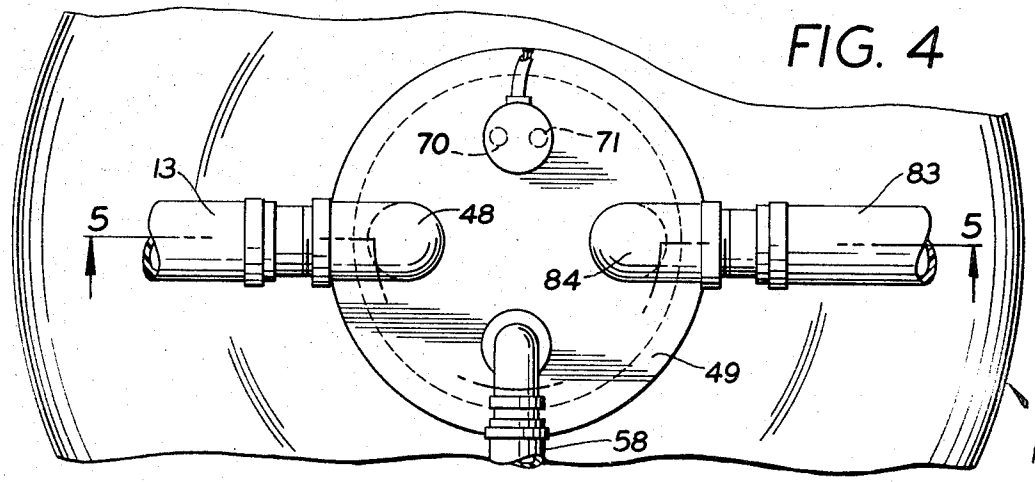


FIG. 3

INVENTORS.
ALFRED J. DROUHARD, JR.
JOSEPH B. STINSON
BY Hamilton, Cook, Renner & Kenner
ATTORNEYS

FIG. 4



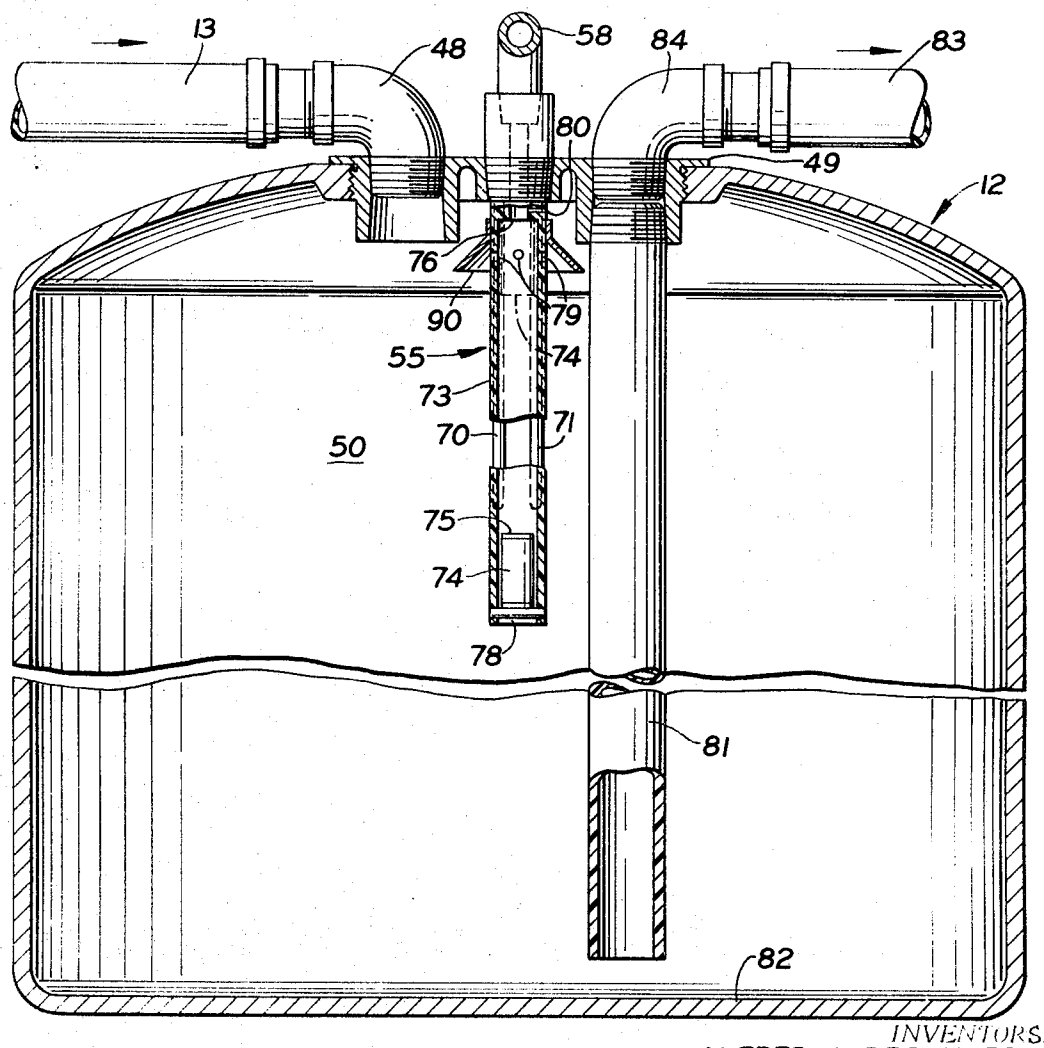


FIG. 5

INVENTORS.
ALFRED J. DROUHARD, JR.
JOSEPH B. STINSON
BY Hamilton, Cook,
Renner & Kenner
ATTORNEYS

APPARATUS FOR PNEUMATIC TRANSPORTATION OF SANITARY WASTE FROM A TOILET TO A HOLDING TANK

BACKGROUND OF THE INVENTION

The present invention relates generally to a self-contained sewage handling system. Specifically, the present invention relates to an apparatus for receiving sanitary sewage in a trapless bowl with a relatively small volume of flush fluid and transferring it to a remote holding tank through a relatively small diameter conduit. The water and waste material is mixed with air and then fragmentized so that it will be swept through the conduit in a series of pulsations.

As is becoming more and more apparent the healthy existence of mankind requires an adequate, potable water supply and adequate collection and disposal of sewage. Of particular importance is the collection and disposal of sanitary sewage, and the present invention relates to the removal of sanitary waste from a bowl to a temporary storage facility, or holding tank, located in spaced relation to the bowl, as is desired in an environment either remote from, or inconvenient to, a sewerage system. As such, it is particularly suitable for use in mobile homes, airplanes, busses, railway cars, boats or the like.

Self-contained sewage handling systems can be broadly classified in four general categories: viz., gravity systems; soil pump systems; recirculating systems; and, pneumatic systems, although this last named system has heretofore been employed only to a minimal extent.

In a gravity system the relative location of the toilet bowl and the holding tank is absolutely fixed — the holding tank must be located on a level lower than the discharge drain from the toilet bowl, and, to minimize the volume of flush water required, must be in rather immediate proximity to an orientation beneath the bowl. This interdependence as to the location of the components in a gravity system seriously limits the locations wherein such an arrangement can be installed.

In a soil pump system the contents of the toilet bowl are emptied into a holding tank by a generally hand operated piston pump — the inlet to the pump communicating with the discharge drain in the toilet bowl and the discharge from the pump communicating with the holding tank. Although this system does permit the holding tank to be located remotely of the toilet bowl, effective operation of the soil pump requires rather large amounts of liquid to effect a flush. This directly affects the size of the holding tank required for this type system. Moreover, the soil pump requires check valves on both the inlet and discharge sides thereof so that clogging of those valves is a constant threat to the satisfactory operation of the system.

In a recirculating system a pump, generally powered, forces liquid from a holding tank, through a filter and back into the bowl from which this fluid returns to the holding tank as the toilet is next flushed. Often the bowl assembly, pump, filter and holding tank are contained in a single unit, and such an arrangement is rather bulky. Although bulk is itself a definite drawback in the environment for which such a system is intended, there are other drawbacks which some users find highly offensive. As an example, because the fluid from the holding tank is recirculated to the bowl for flushing, chemicals are added to the system not only to mask the appearance of the flushing fluid but also to deodorize and disinfect the flushing fluid. To some users, however, the cure is as bad as the illness. Moreover, routine maintenance to a recirculating system can also be highly unpleasant, particularly inasmuch as the filter and pump are generally mounted within the holding tank.

Relatively little has been done in the field of self-contained pneumatic sewage handling systems. In fact, the pneumatic systems heretofore tried have been intended for larger installations and their concepts have several inherent drawbacks that make them generally unsatisfactory for adaptation to portable, self-contained systems. One such system utilizes

large diameter conduits and relies on the flow of a large volume of water and air to entrain the material to be moved therethrough. Such a system becomes inoperable if water is allowed to accumulate in the conduits, a situation that can readily occur by the use of too much water and/or too little air flow.

A second, more recent pneumatic system obviated the inherent drawbacks to the use of relatively large diameter conduits by substituting conduits of much smaller diameter. This system, however, was conceived for use in relatively extensive installations — i.e., large buildings or even municipalities — so that the inventor apparently envisioned, and therefore disclosed, that the waste material to be conveyed through the conduit, together with the flushing liquid, must be maintained as a coherent plug. That inventor thus required the waste and flushing fluid to be introduced into the conduit as a plug and conveyed through the conduit by maintaining a subatmospheric pressure in front of the plug and permitting a material volume of air at a higher pressure to follow behind the plug.

The coherent plug formation is disclosed as being critical to this latter system, both to impart the initial velocity to the plug, and, should the distance between the origin of the plug and its destination be sufficient that the plug degrades as a result of frictional resistance to flow through the conduit, to allow a reformation of the waste material and flushing liquid along the conduit into a further plug that will be propelled along the conduit by subsequent exposures to differential air pressures.

The coherency of such a plug, however, in a self-contained system wherein the conduit can not be disposed to permit reformation of plugs at predetermined spacings therealong and wherein only a modest pressure differential is available can well clog the conduit and thereby render the system inoperable.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of the present invention to provide an improved apparatus for a pneumatic sewage handling system.

It is another object of the present invention to provide a sewage handling system, as above, wherein the holding tank can be spaced from the toilet and the course of the conduit communicating therebetween is not limited to a predetermined orientation.

It is still another object of the present invention to provide a sewage handling system, as above, which will accomplish a flush with a minimal amount of liquid in the toilet so that the holding tank may be relatively small.

It is yet another object of the present invention to provide a sewage handling system, as above, in which the small amount of liquid acts in conjunction with a flow of air established by the flush and in conjunction with the configuration of the passage from the bowl into the conduit to effect a maceration, or fragmentizing, of the waste material to preclude obstruction of the conduit.

It is a further object of the present invention to provide a sewage handling system, as above, wherein the flushing liquid and the fragmentized sanitary waste is forced from the toilet in a series of pulsations through a conduit to the holding tank by a modest pneumatic pressure differential between the toilet (at atmospheric pressure) and the holding tank (at subatmospheric pressure); the pneumatic pressure differential being readily established — even in a mobile installation — and rather rapidly recycled.

It is an even further object of the present invention to provide a sewage handling system, as above, wherein provision is made to prevent unintentional discharge from the holding tank during the cycling of the pressure differential between the interior thereof and atmosphere.

These and other objects, together with the advantages thereof over existing and prior art forms which will become

apparent from the following specification, are accomplished by means hereinafter described and claimed.

In general, a sewage handling system embodying the concept of the present invention employs a toilet communicating with a remote holding tank by a relatively small diameter conduit. The toilet has a bowl portion separated from a macerating portion by a valve means having an open and a closed position, although the valve means is normally closed to seal the bowl portion from the macerating portion. The macerating portion has an air entraining drop well immediately beneath the valve means. The drop well merges into a throat portion that tapers to a restricting orifice means of lesser cross sectional area than that of the conduit. For most efficient fragmentization of the waste material as it passes through the macerating portion, the restricting orifice is incorporated in an elbow.

The bowl portion opens to atmosphere and is also provided with means by which flushing liquid may be selectively admitted, at least when the valve means is in its normally closed position.

Pump means are operatively connected to the holding tank for reducing the pressure therein at least modestly below atmospheric. However, a valve means is also provided to obviate inadvertent removal of the liquid or waste material within the tank by operation of the pump means. Upon opening the valve means the contents of the bowl — the effluent — will fall from the bowl portion into the macerating portion.

By providing a valve means for selectively sealing the macerating portion of the toilet from the bowl portion thereof, by providing a relatively small volume of water in the toilet, by applying a partial vacuum to the interior of the holding tank, the conduit connecting the holding tank to the toilet and the interior of the macerating portion, and by providing a drop well in the macerating portion, as the valve means is opened air will be drawn into the macerating portion.

This air tends to be entrained in, and mix with, the effluent before it reaches the orifice means to form a heterogeneous agglomeration so that as the pressure differential across the restricting orifice forces the agglomeration therethrough, the agglomeration is fragmentized and emitted from the orifice in a series of interrupted discharges that fairly explode the fragmentized material into a conduit through which it is pulsatingly swept by the initial velocity of the fragmentized material leaving the orifice as well as the intermittent air flow between discharges.

One preferred embodiment of the present invention is shown by way of example in the accompanying drawings and described in detail without attempting to show all of the various forms and modifications in which the invention might be embodied; the invention being measured by the appended claims and not by the details of the specification.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic perspective of a sewage handling system embodying the concept of the present invention — the conduit communicating between the toilet and the holding tank is depicted as being connected to the side of the toilet in order to reduce the number of cross sectional views required fully to disclose the interior of the toilet and the conduit connection therewith and thereby simplify the disclosure when, in fact, it is generally more desirable to make the connection to the rear of the toilet;

FIG. 2 is an enlarged vertical section through the toilet taken substantially on line 2—2 of FIG. 1;

FIG. 3 is an enlarged area of FIG. 1 depicting the manifold portion of the conduit communicating between the holding tank and the vacuum pump, the manifold being represented in side elevation partly broken away;

FIG. 4 is an enlarged partial top plan of the holding tank; and,

FIG. 5 is a vertical cross section taken substantially on line 5—5 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings; a sewage handling system embodying the concept of the present invention is designated generally by the numeral **10** and comprises a toilet **11** that communicates with a holding tank **12**, as by the relatively small diameter transfer conduit **13**.

As best shown in FIG. **2**, the toilet **11** is of the type commonly referred to as a "trapless" toilet and has a bowl portion **14** supported on a macerating portion **15**, the outer surface **16** of which presents a pedestal. The upper rim **18** of the bowl portion **14** has a passageway **19** therein connected to a fresh water supply, as by a tube **20** and pump **21** (FIG. **1**). One or more apertures **22** pierce the lower side of rim **18** adjacent the wall **23** of the bowl portion **14** to admit the flush fluid — e.g., water. The wall **23** of the bowl portion **14** curves convergingly downwardly from the rim **18** in the conventional fashion to a drain **24**.

A valve means **25** is operative to open and close the drain **24**, and a valve seat **26** may be employed to assure a seal between the bowl portion **14** and the interior of the macerating portion **15**.

The movable element **29** of the valve means **25** may be of the ball variety and is mounted for rotation through approximately 90° on a pair of opposed gudgeons **30** and **31** that extend diametrically with respect to the spherical outer surface **32** of the movable valve element **29** and are journaled in bearings **33** and **34**, respectively, provided in the macerating portion **15**. The one gudgeon **30** extends shaft-like through the macerating portion **15** and is secured to a flush lever **35** located conveniently to the side of the bowl portion **14** for selectively rotating the valve element **29**.

The spherical outer surface **32** of the valve element **29** slidingly engages the annular perimeter **36** presented by the valve seat **26**. If desired, the perimeter **36** may be presented by an annular facing ring **38** supported on a resilient base **39** interposed between the bowl portion **14** and the macerating portion **15** and secured therebetween by a conventional clamping arrangement **40**. As shown, the facing ring **38** may be embedded in, and bonded to, the resilient base **39** so that the lower surface **38***a* of the facing ring **38** will lie within the same plane as the lower surface **39***a* of the resilient base **39**. The facing ring **38** is preferably made from a solvent resistant material having a low coefficient of friction and inherent lubricity, such as tetrafluoroethylene resin.

It is customary in trapless toilet arrangements — to provide the desired seal between the bowl and the pedestal on which it rests — for the bowl portion **14** to be seated on a V-shaped receiving edge **37** as is represented (FIG. **2**) on the upper perimeter of the macerating portion **15**. However, it has been found that when a subatmospheric pressure is applied to that side of the valve element **29** opposite the bowl portion **14**, the pressure differential across the resilient base **39** will distort the latter (and thus the facing ring **38**) by drawing portions of the base **39** into the receiving edge **37** when the customary V-shape is employed. This destroys the efficacy of the seal between the valve element **29** and the facing ring **38**. As a result, it has been found highly desirable substantially to fill the V-shaped edge **37** with a backing material **37***a*, such as the rigid urethane depicted, in order to support the base **39** and preclude deleterious distortion. This objective can be obtained consistently with the assurance of a proper seal between the bowl and macerating portions **14** and **15**, respectively, by filling the V-shaped edge with backing material **37***a* to a level just slightly beneath the upper extent of the edge **37**.

The spherical surface **32** (which is of sufficient magnitude to engage and seal the full perimeter **36** of valve seat **26** when the valve means is closed) of the valve element **29** merges with a pair of spaced side walls, such as wall **41** depicted in FIG. **2**, each of which has a semicircular opening **42** of a diameter at least equal to the diameter of the drain **24** and oriented in a plane substantially parallel to the axis of the gudgeons **30** and **31** and such that an unobstructed passageway is provided beneath the drain **24** into the macerating portion **15** when the valve element **29** is rotated to open the valve means **25**.

The macerating portion 15 presents a substantially cylindrical drop well portion 43 immediately beneath the drain 24, and the drop well 43 merges into a throat portion 44 that tapers conically downwardly to communicate with a restricting orifice means 45 that is preferably in the form of an elbow. The orifice means 45 communicates with one end of the transfer conduit 13, as by a nipple 47 that extends through the outer surface 16 of the macerating portion 15. The other end of the transfer conduit 13 is secured to an inlet 48 (FIGS. 1, 4 & 5) that extends through the cap 49 of the holding tank 12 to communicate with the interior 50 thereof.

A fluid discriminator 55 also extends through the cap 49 to communicate with the interior 50 of the holding tank 12. Outwardly of the holding tank 12 the fluid discriminator 55 communicates with the intake side of a vacuum pump 56, as by a conduit 58. The exhaust side of the pump 56 may communicate, as by conduit 59, with atmosphere through a vent (not shown) that opens exteriorly of the confines defined by the vehicle, or the like, in which the system 10 is installed.

It has been found that pump 56 may be of the inexpensive diaphragm variety driven by a small, battery powered, electric motor 61 and yet produce excellent results. It should be appreciated, however, that such pumps are not well sealed so that a check valve 62 is preferably incorporated in conduit 58. As best seen in FIG. 3, the check valve 62 may be incorporated in a manifold 63 comprising a portion of conduit 58.

Automatic operation of pump 56 is also highly desirable and this can be quite easily achieved by mounting a vacuum switch 64 on the holding tank side of the check valve 62. As is also shown in FIG. 3, the switch 64 may be mounted on the same manifold 63 in which the check valve 62 is contained. The vacuum switch 64 may be of the standard variety in which the distention of the diaphragm 65 actuates contacts (not shown) by reciprocating a plunger 66 to make and break an electrical circuit across the contacts, the motor 61 being controlled by this circuit. However, when employing a diaphragm variety of vacuum pump 56 the pressure pulsations incident to that type pump have been found to prevent a smooth shutoff of the motor 61 as the desired pressure reduction within the holding tank is reached — instead, the pulsation of the pump is reflected by a corresponding reciprocation of plunger 66. Provision of a relatively small aperture 69 through the diaphragm 65 in the switch 64 modulates the effect of these pulsations on diaphragm 65 and effects a crisp on and off operation of the switch means 64.

Even though a pair of probes 70 and 71 (FIG. 5) may depend from the cap 49 into the interior 50 of the holding tank 12 for actuation of a signal, such as light 72 (FIG. 1), when the holding tank is full, it is important — and particularly when the pump 56 is automatically cycled — to preclude the possibility of drawing any of the material within the holding tank 12 out through the conduit 58. The fluid discriminator 55 precludes this eventuality by closing the access of conduit 58 to the interior 50 of the tank 12 in response to a partial vacuum within conduit 58, but only when the level of the contents within the holding tank 12 reaches a predetermined level.

As best seen in FIG. 5, the fluid discriminator 55 has a tubular housing portion 73 that is secured to, and depends from, cap 49. A float 74 is slidably received within the tubular portion 73 to move vertically from a lower, open position to an upper, closed position. A valve element 75 carried on the float 74 sealingly engages a valve seat 76 mounted within the tubular portion 73 when the float 74 is in the upper, closed position.

The lower end of the tubular portion 73 is provided with a grille 78 to permit access to the float 74 by the contents of the holding tank 12 and yet retain the float 74 within the tubular portion 73. Beneath the valve seat 76 the tubular portion 73 is provided with a plurality of radial bores 79 to provide ready access from the conduit 58 to the interior 50 of tank 12 above the liquid level therein.

A relatively small relief bore 80 is provided through the discriminator 55 upwardly of the valve seat 76 to permit the valve element 75 to unseat after the holding tank is drained, as will be hereinafter more fully described.

A drain tube 81 is also dependingly secured to the cap 49 and extends to within a short distance of the base wall 82 of tank 12. One end of a drain conduit 83 may be secured to an elbow 84 that communicates with the drain tube 81. The other end of the drain conduit 83 is fastened to a coupling means 86 to which a service element, not shown, can be connected to drain the tank 12. A removable cap 88 sealingly closes the coupling means 86 to permit the application of a partial vacuum to the interior 50 of tank 12.

In order that the subject system may be fully understood, a brief description of its operation is in order.

With the cap 88 closing the coupling means 86 and the valve means 25 closing the drain 24, operation of the pump 56 will apply a partial vacuum to at least:the interior 50 of the holding tank 12; the transfer conduit 13; and, the macerating portion 15 of the toilet 11 beneath the valve means 25. A rather inexpensively constructed diaphragm pump 56 powered by a 12 volt electric motor 61 will readily draw an 11 inch vacuum, quite adequate for the exemplary construction depicted. In fact, the pressure differential between the partial vacuum within the system, as described above, and atmosphere is sufficient to carry the fragmentized effluent to a gradient several feet above the toilet 11 should it be desired to locate the holding tank 12 at a level higher than that of the toilet 11.

Either before or after the desired pressure differential is established across the valve means 25, a relatively small quantity of water, or other flushing liquid, is admitted to the bowl portion 14 of the toilet 11. Whereas a conventional water closet would require at least 3 gallons of water to effect a flush, only one or two cups full of water are necessary for flushing the toilet 11 into a system embodying the concept of the present invention, and this water may be admitted through the apertures 22 leading from the passageway 19 in the rim 16 under line pressure from supply tube 20 or, as shown, a pump 21 may be incorporated to provide water to the toilet.

In the present system the flush water tends primarily to insure a pneumatic seal between the waste material and the orifice means 25 as the agglomerated effluent is forced therethrough. This seal tends to improve both the fragmentizing effect and the velocity of which the fragmentized material is initially discharged from the orifice means 45.

In order to entrain sufficient air into the effluent, it is highly desirable that the drop well 43 be of sufficient magnitude to allow a dispersion of the effluent as it leaves the bowl portion 14. For example, in the standard trapless toilet 11, the drain 24 is approximately 3 inches in diameter. The drop well 43 should be at least as wide as, and preferably wider than, the drain 24. In conformity with this requirement a drop well 43 having approximately a 5 inch diameter has been found to work quiet well. To insure sufficient entrainment of air into the effluent as it passes between the drain 24 and the orifice means 45 it has also been found that the orifice means 45 should be spaced well below the drain 24. Continuing the aforesaid example, the orifice means 45 works most satisfactorily when spaced at least three and one-half inches below the drain 24.

At this point it should also be explained that the internal diameters of the orifice means 45 and the transfer conduit 13 may be relatively small by comparison to the internal diameter of piping used in conventional soil systems. For example, it has been found to be quite satisfactory if the internal diameter of the orifice means 45 is only on the order of one inch and the internal diameter of the transfer conduit 13 is only on the order of one and a quarter inches.

The smaller the internal diameter of the orifice means 45, the greater the efficiency with which the effluent would be fragmentized and the higher the velocity with which the fragmentized effluent will be discharged through the transfer conduit 13 into the holding tank 12, but the internal diameter of the orifice means 45 must not be so small that the system will

tend to jam. An internal diameter on the order of one inch has been found to provide a satisfactory balance between these antipodal criteria.

The relatively modest amount of flush fluid required is quite conductive to the use of fresh water — even in environments where fresh water is not available in abundance. Moreover, the modest amount of flush fluid required is directly responsible for the need to use only a relatively small holding tank **12**.

Located within the tank **12**, the fluid discriminator **55** prevents the material within the tank from being inadvertently pumped out through conduit **58** by operation of the pump **56** after the tank **12** is full. The dimension of the float **74** and the location of the valve seat **76** are chosen such that when the tank **12** is full the valve element **75** on float **74** will, upon operation of the pump **56**, be drawn against the valve seat **76** (chain-line representation in FIG. **5**) to seal the interior **50** of the holding tank **12** from the conduit **58** to the extent sufficient to preclude the admission of the stored effluent into the conduit **58**. In this regard a conical slosh baffle **90** may be secured to the housing **73** of discriminator **55** beneath the relief bore **80** to protect the bore **80** from inadvertent entry of liquid therein by mere jostling of the tank **12**.

Although the laws governing many installations would prohibit a self-contained sewage handling system from incorporating means by which the holding tank **12** can be emptied, in other situations such a restriction would not be apposite. Where permitted, therefore, the intake and exhaust sides of the pump **56** may pass through a four-way flow valve, not shown, and by-pass the check valve **62** so that reverse operation of the pump will pressurize the interior **50** of the tank **12** and thereby evacuate the tank **12** through the tube **81** and drain conduit **83**. Where the inclusion of a self-contained means for evacuating the holding tank **12** would be illegal, the tank may be emptied either by siphoning through the tube **81** and conduit **83** or by applying an independent pumping means to the conduit **83**. In this latter situation one should open the valve means **25** to facilitate draining of the tank **12**.

It should now be apparent that a sewage handling system embodying the concept of the present invention permits the effluent from a toilet bowl to be pneumatically fragmentized and transferred through a conduit of relatively small diameter to a remote holding tank without requiring a large amount of flush water and otherwise accomplishes the objects of the invention.

What is claimed is:

1. A sewage handling system comprising, a holding tank, a toilet having a bowl portion and a macerating portion terminating in an orifice means, the bowl portion communicating with the macerating portion across a drain, a conduit connected between said orifice means and said holding tank, the cross sectional area of said orifice means being less than the cross sectional area of said conduit, a valve means operative to open and sealingly close said drain, means for applying a partial vacuum to said holding tank, conduit and the macerating portion of said toilet at least when said valve means sealingly closes said drain, means to admit fluid into said bowl portion and means selectively to actuate said valve means whereby agglomerated waste material after passing from said bowl portion through said drain and the valve opening of said valve means is fragmentized by a pressure differential across said orifice means.

2. A sewage handling system, as set forth in claim **1**, in which said orifice means is an elbow.

3. A sewage handling system, as set forth in claim **1**, in which said macerating portion has a throat portion that tapers downwardly to said orifice means.

4. A sewage handling system, as set forth in claim **1**, in which said macerating portion has a drop well immediately beneath the drain of said bowl, said drop well adjoining a throat portion that tapers downwardly to said orifice means.

5. A sewage handling system, as set forth in claim **4**, in which said drop well has a cross sectional area at least equal to the area of said drain and said orifice means is spaced at least 3 to 5 inches below said drain.

6. A sewage handling system, as set forth in claim **1**, in which the means for applying a partial vacuum comprises a pump connected to said holding tank through a fluid discriminating means to prevent inadvertent drainage of the material in said holding tank to said pump.

7. A sewage handling system, as set forth in claim **6**, in which said fluid discriminating means comprises a housing, a valve seat within said housing, a float movable in said housing, a valve element carried on said float and movable into sealing engagement with said valve seat.

8. A sewage handling system, as set forth in claim **7**, in which the discriminating means has a relief bore communicating between the interior of the holding tank and the interior of said discriminating means, said bore being located between said valve seat and said pump.

9. A sewage handling system, as set forth in claim **6**, in which a check valve is incorporated between said pump and said holding tank.

10. A sewage handling system, as set forth in claim **6**, in which said pump is of the diaphragm variety, a vacuum switch communicates with that portion of the system to which the partial vacuum is supplied, said switch having a distensible actuating diaphragm, an aperture provided through said diaphragm to modulate the pulsating effect of said pump.

11. A sewage handling system, as set forth in claim **4**, in which the valve means comprises a movable element mounted in the macerating portion and engaging a valve seat to close the drain.

12. A sewage handling system, as set forth in claim **11**, in which said valve seat employs a resilient base interposed between said bowl and macerating portions.

13. A sewage handling system, as set forth in claim **12**, in which said resilient base has a lower surface, a facing ring being embedded in and bonded to said base, said facing ring having a lower surface, the lower surface of said facing ring lying coplanar with the lower surface of said base.

14. A sewage handling system, as set forth in claim **13**, in which said macerating portion has a V-shaped receiving edge over which said bowl is seated, a backing material within said V-shaped edge, the level of said backing material lying just beneath the upper extent of said V-shaped edge, a portion of said base and a portion of said facing ring being captured between said bowl and macerating portions.

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