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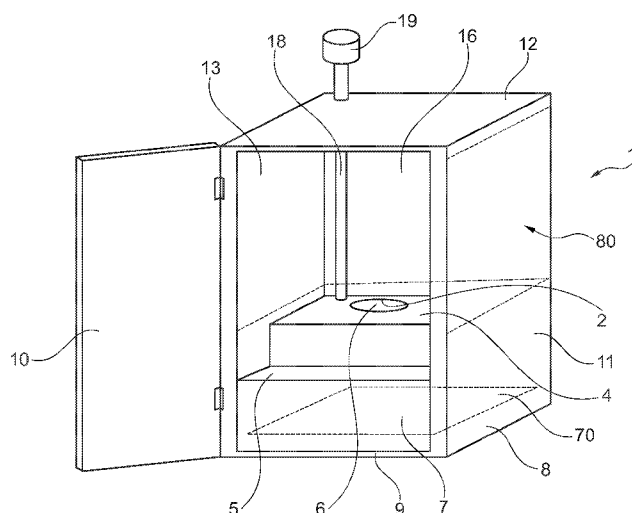


Fig. 1

(57) Abstract: The present invention relates to a system for composting feces and for treating urine, comprising a housing (11,12,13,16) enclosing an interior space (10), a composting compartment (7) disposed within the housing including a feces inlet for receiving feces from a feces receiving means (2) disposed in the interior space (10), a liquid passage whereby liquid can be drained from the composting compartment (7) through the liquid passage (71), vent means (18) coupled to the composting compartment (7) for exposing the feces bed inside the feces compartment to sufficient air to allow the feces to compost, thereby forming a compost product, a urine-treatment tank (8) coupled to the liquid passage for receiving urine from the feces compartment. The aim of the invention is to provide an efficient way of overcoming health risks when treating human waste in a rest facility. This is achieved by using a transportable module based system, which may easily be disassembled and assembled.

MODULE BASED REST STATION COMPRISING COMPOSTING SYSTEM

TECHNICAL FIELD

5 The present invention relates to a system for composting feces and urine.

BACKGROUND

Handling of human waste in the form of urine and feces is a growing problem worldwide, which is linked to sanitary risks as many areas lack the necessary facilities for an efficient
10 and safe disposal thereof. For instance, many areas lack sewage treatment facilities or even a functioning sewage system. Also for boats this is a growing problem. Thus, often human waste materials risk being disposed of in an uncontrolled manner leading to a sanitary problem and a health risk for the people living in the area.

15 Taking care of feces and urine may pose a problem also in other situations, for instance whenever a temporary rest facility is needed, e.g. on a construction site or during an intense tourist season in more or less remote areas where a proper sewage system is not available and water supply is restricted. Known temporary rest facilities normally consist of a toilet positioned over a single, sealed vessel wherein urine and feces are collected until the vessel
20 needs to be emptied. Such conventional temporary rest facilities are very space demanding and are hard to move around as well as they are unpleasant to empty.

A known portable system for treating human waste is disclosed in W092 18442, wherein a transportable rest station is described where feces and urine are treated to be composted.
25 However, it has been shown that the composting rate of the system in W092 18442 is unsatisfactory, and thereby a new more efficient system is desired.

OBJECTS OF THE INVENTION

It is an object of the present invention to provide a transportable rest facility which may
30 easily disassembled as well as mounted together, meaning it is easy to transport as it requires very little space in a disassembled state as well as it is easily put together with minimal effort thanks to the uncomplicated construction. It is also an object of the present invention to provide an efficient system for handling human waste material in the form of urine and feces, wherein said waste is treated to be composted into sanitary safe waste

which does not pose any health risk for surrounding people nor for persons handling the waste after it has been composted. Other objects of the invention will become clear from the following description and drawings.

5 SUMMARY OF THE INVENTION

The objects of the invention are essentially achieved by means of a portable system for composting feces and for treating urine, comprising a base and a housing disposed on the base and a composting retainer disposed within the base, including a feces inlet for receiving feces from a feces receiving means disposed within the housing, a compost outlet
10 for removal of compost product from the retainer and a liquid passage, whereby liquid can be drained from the composting retainer through the liquid passage. Composting means are coupled to the composting retainer for exposing the feces to sufficient air and water to allow the feces to compost, thereby forming a compost product. A urine-treatment retainer is disposed within the base, including a urine inlet for receiving urine from a urine
15 receiving means disposed within the housing. A substrate is provided in the urine-treatment retainer whereon aerobic nitrifying bacteria is disposed. A liquid-product outlet is also provided, whereby urine is treated by the bacteria, thereby forming a liquid product. Further, a liquid-storage vessel is disposed in the base for receiving liquid product from the urine treatment retainer through the liquid-product outlet and for receiving liquid drained
20 from the composting retainer through the liquid passage.

Thanks to the system according to the invention there is provided a system for composting feces and urine which provides the advantages of a very environmental friendly rest facility with minimised maintenance required and which, thanks to the use of microorganisms, is
25 more or less odorless. Composting is the bio-chemical decomposition of organic matter by aerobic organisms, i.e., organisms which get oxygen from the atmosphere and give off carbon dioxide. Composting takes place in all soils which support plant and animal life. The compost toilet according to the invention employs the same process in the controlled environment of the compost chamber.

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This process is distinct from anaerobic decomposition, which takes place naturally in water-saturated environments such as swamps, and is typical of septic tanks. Anaerobic, or liquid-saturated, conditions produce methane and the offensive odors associated with septic systems.

Organisms found in the composter include bacteria, actinomycetes, fungi, arthropods, and earthworms and are added manually once the system is operating. Energy, carbon dioxide and water vapor are released by the organic matter in feces through the activity of the composting organisms. A less chemically complex, more chemically stable substance, rich in organic matter, is produced. Feces volume, which is mostly water, is hereby reduced by over 90%.

Temperatures in the compost toilet remain in the middle, or mesophilic, range (65-113°F) and don't exceed 100°F. Potential pathogens in feces are, therefore, not destroyed by heat. Those pathogens that require an aqueous environment die quickly in the non-saturated condition of the compost chamber. Others die because of the intense competition for nutrients; still others are consumed by predators which populate the system. The biological content of the dry end-product is similar to that found in topsoil. As a measure of its stability, the dry end-product from the System contains less than 200 MPN (Most Probable Number) of fecal coli form per 100 grams. This meets the level required under National Sanitation Foundation Standard 41 for Non-saturated Systems. The dry end-product contains a wide array of plant nutrients and is intended to be used as a fertilizer/soil conditioner. Its use may or may not be regulated by local authorities.

Urine is also transformed by the activity of microorganisms. As compared to feces, urine contains most of the nitrogen from food. The primary form of nitrogen in urine is urea. Left alone, urea will degrade into ammonia and carbon dioxide. Bacteria in the compost unit (specifically Nitrobacter and Nitrosomonas) prevent this degradation and, instead, convert urea into nitrite and nitrate. That these are forms of nitrogen required for plant growth indicates the value of the compost toilet for nutrient recycling. The liquid end-product from the System contains less than 200 MPN of fecal coliform per 100 ml. This also meets the level required under National Sanitation Foundation Standard 41 for Non-saturated Systems. The nitrogen-rich liquid end-product is intended to be used as a fertilizer. Use of the liquid-end product as a fertilizer may or may not be regulated by local authorities.

Moreover, the liquid end-product may be used to wash, disinfect the toilet seats, urinals, etc.

The system according to the invention is a better alternative than flush toilets, sewers and sewage treatment. Moreover, it is more or less odor free, easy to use and maintain, has an

appealing design, and functions in harmony with the environment. Thanks to the invention there is achieved an easy way of mounting a sanitary safe and well functioning portable rest facility, which means the system provides both logistic as well as economic advantages in one solution. Moreover, the system may provide an efficient solution for handling of feces and urine also in relation to non-portable rest rooms, e.g. to be used on boats.

BRIEF DESCRIPTION OF THE DRAWINGS

- Fig. 1 is a schematically illustrated view of an assembled rest station according to one embodiment of the invention, and
- 10 Fig. 2 is a vertical cross-sectional view of the rest station in Fig. 1,
- Fig. 3 shows a perspective view of a modification of a rest station according to the invention, seen in a perspective view,
- Fig. 4 shows a side view of the rest room in Fig. 3,
- Fig. 5 shows a station assembled by means of several modules according to the invention,
- 15 and
- Fig. 6 shows a the station of Fig. 5 seen from above.

DETAILED DESCRIPTION OF THE DRAWINGS

- In the following description, and with reference to Figs. 1 - 2, a rest station according to one embodiment of the invention is generally referred to as 1. As seen in the schematically illustrated view of Fig. 1, said rest station generally comprises essentially vertical side walls 11, 13, 16, a roof 12, a floor 9 and a door 10 together forming a housing and enclosing an interior space which is of sufficient size for a sitting person. A toilet opening 2 in a toilet base surface 4 defining a toilet seat 6 is disposed in the enclosed space and a step surface 5 is arranged in front of the toilet seat 6.
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- According to a preferred aspect of the invention said side walls 11, 13, rear wall 16, roof 12, base surface 4 and step-surfaces 5 are made as a modular system where said sub-units constituting a rest station 1 may be assembled into a rest station essentially using no tools.
- 30 For instance said side walls 11, 13 and said rear wall 16 may be joined together by means of some type of snap-together fastening. Further, also the interior (e.g. the step surface 5, the toilet seat 4 etc.) of the rest station 1 is preferably installed without any tools. This may for instance be accomplished by providing the innermost surface of each side wall 11, 13, 16 with attachment devices 130 prearranged with one piece of a snap-in connection for the

transversal pieces (e.g. 4 and 5). This leads to a modularized system and a rest station 1 which is extremely easy to store and transport since a dismounted station merely comprises a number of substantially flat sub-units (i.e. the side walls, rear wall, roof, step-surfaces etc.) which are easily assembled as a compact package which is easily transported and stored. Another advantage provided by the modularized rest station 1 according to the invention is that it is easily and quickly mounted together, essentially without the need of any working tools.

According to an alternative embodiment of the invention the rest station 1 may be furnished with a folding door 10 which is preferably spring biased to keeping a closed position after having been opened. Thereby the problem of open doors due to a user not closing after leaving the rest station 1 is avoided, as well as the door itself (thanks to being a folding door) is protected from e.g. winds that could otherwise damage an open door of conventional hinged type.

Fig. 2 shows a cross-sectional view of the rest station 1, according to one embodiment. In this figure, there is seen that each side wall 11, 13, 16 comprises different upper and lower sections. In the preferred embodiment of the invention each of the side walls 11, 13 and the rear wall 16 comprises a sandwich structure as illustrated in Figs. 2. Herein is seen that the wall structure is provided with an inner wall 161 (facing the interior space) and an opposite outer wall 162, said walls 161, 162 enclosing an intermediate space. Said outer 161 and inner 162 wall can be made of a composite material, plastic material or fiberglass but also steel plates are possible depending on the desired price level, climate and/or other needs. In the shown embodiment the lower section as well as at the top and the edges has an intermediate space filled with some sort of isolating material 84, such as expanded polystyrene. This provides the advantage of improved isolation, a less expensive wall material, as well as a reduced total weight of the rest station 1 meaning it is easier and more economical to transport.

The intermediate space 80 of the upper section is hollow to provide a liquid storage system, for the liquid collected in the urine compartment 8 (as will be described more in detail below). According to a further embodiment the hollow space 80 (or spaces due to existing in each wall 11, 13, 16) may be divided to store different liquids, e.g. also water storage system, which may be filled with water from the outside, e.g. via a sealable opening which

for instance may be accessed from outside the rest station 1. Said water storage system can beneficially be coupled to a washing bin (not shown) inside or outside the interior space 10, e.g. so that persons who have used the rest station 1 may wash the hands afterwards. As the water storage system is positioned inside the upper portions of the side walls, water will be transported from the system to said washing bin by means of gravity.

The rest station 1 is further provided with a composting system schematically illustrated in Fig. 2. According to one embodiment of the invention said composting system comprises in a non-limiting way the following features: a feces compartment inlet 6, a feces compartment 7 (also referred to as "composting unit " or "composting compartment"), a lower base 70 of the feces compartment 7, a urine compartment 8 and an air vent 18. In a preferred embodiment of the invention said composting system is positioned in its entirety within said interior space enclosed by the vertical walls 11, 13, 16, the roof 12 and the floor 9. In a preferred embodiment the walls of the feces 7 and urine compartments 8 respectively are formed by the inner walls 161 of the walls structures 11, 13, 16 to obtain a desired inner composting system as schematically illustrated in Fig. 2. The skilled person understands that the other parts (e.g. 4 and 5) of the housing and the inner compartments 7, 8 may or may not be made of the same material as the sandwich walls 161, 162. Preferably the components of the composting system (e.g. the feces compartment 7 and the urine compartment 8) are also made up by modular units/platforms which can be assembled in situ (i.e. on the spot where the rest station 1 is intended to be installed), and which can be transported in a collapsed or folded state requiring minimal volume and which can be assembled in a compact package until it is time to erect the station. Preferably, as already mentioned (but not limiting), said inner parts/compartments may be put together using some snap-together connection 130 into a complete structure. The feces and urine compartments 7, 8 preferably are sealed by some sealing agent 131 is preferably used when assembling the compartments, for instance by applying silicone along the junctions between two abutting platforms when they are mounted together by said snap-together fastening 130.

Being positioned in the lower portion of the interior space said composting system is protected by said lower, isolated wall portions which provide the advantage that the temperature of the composting system may be controlled more easily, as it will be protected from impact from exterior temperatures.

The rest station 1 and its composting function is now to be described by reference mainly to Fig. 2 wherein there is shown in a schematic way the components which are comprised in the rest station 1 and the composting system according to one embodiment of the invention.

5 It is to be understood that the invention is not restricted in any way to the dimensions of the components seen in Fig. 2, and that the Figure is to be seen as illustrating the mere principle of the function of the system.

The composting toilet according to the invention uses aerobic decomposition to slowly
10 break down both urine and feces into stable compounds within the feces compartment unit 7. According to the invention urine is separated from feces ensuring that feces remain in an aerobic environment. Organisms slowly break down feces into a compost material that has chemical, biological and aesthetic characteristics similar to topsoil and reduces its volume by over 90%. Consequently, there is no need for frequent removal of solid waste.

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The toilet 2 is connected to a feces compartment 7 via a feces compartment inlet 6. At bottom of the feces compartment 7 there is arranged a liquid drain outlet 71 through which urine is transferred out of the feces compartment 7 to separate urine from feces. Preferably the liquid drain outlet 71 is provided with a filter (not shown) which allows for passage of
20 liquid. The liquid drain outlet 71 leads to a urine compartment 8 positioned underneath said feces compartment 7. Preferably the lower base surface 70 of the feces compartment 7 is sloped (preferably at an angle between 2 - 7°, preferably 5°) creating a declination in a direction towards the liquid drain outlet 71 to promote efficient transfer of urine by means of gravity out of the feces compartment 7 and into the urine compartment 8. The collection
25 of urine is later to be described in more detail.

Preferably said rear wall 16 is furnished with an upper inspection hatch (not shown) and a lower emptying hatch (not shown). Said inspection hatch may for instance be positioned at the level of the upper part of the feces compartment 7 so that a user when opening the
30 inspection hatch can visually inspect the amount of feces therein and determine whether it is time to empty the compartment 7 or not. Preferably said emptying hatch may be positioned at the level of the lowermost portion of the feces compartment 7 so that feces are easily removed by e.g. scraping it out of the feces compartment 7.

Feces air outlet is achieved by means of an air vent 18, in the form of a vertical tube having its lower end disposed somewhere within the feces compartment 7. It is to be understood that said air outlet is not limited to the exact position shown in Fig. 2, but can vary somewhat. Air vent 18 is of sufficient size and shape to enable sufficient ventilation of feces compartment 7 to compost feces in feces bed inside the compartment 7. Air vent 18 includes an air vent outlet device 19 above the roof 12. Air vent 18 allows ventilation of air from feces bed. Air is drawn in through toilet 2 by ventilation fan within said outlet device 19. Ventilation fan at the outlet device 19 may preferably be powered by solar panels (not shown), alone or in combination with rechargeable batteries or wind fan or wind power generation. Ventilation fan is preferred to safeguard sufficient capacity to ventilate feces compartment 7, however in many environments the system may mostly (depending on surrounding temperature) create its own recirculation (possibly combined with a small external power source, e.g. merely long life batteries) thanks to the relatively high temperature in the feces compartment combined with a check valve for air inlet (not shown) to the housing 1, or possibly in a sealingly arranged toilet seat lid (not shown). A preferably continuously operating fan pulls air down the toilet fixture and out through a vent stack creating a completely odorless bathroom at all times.

The feces retained in the feces compartment 7 is arranged to compost therein whereby a decomposed organic waste is formed. "Compost", as that term is used herein, means decomposition of feces, to form decomposed organic waste which is suitable for sterilization and subsequent use as fertilizer or mixture with soil to form topsoil. Once initiated, composting of solid waste in feces bed building up inside the feces compartment 7 is continuous during exposure of feces bed to conditions sufficient to maintain composting of feces. Composting can be initiated spontaneously or can be initiated by combination of feces collected within feces retainer with a suitable filler, such as wood chips, to allow sufficient aeration and drainage of feces bed to cause composting. Preferably, the bacteria content of feces bed is reduced in feces compartment 7 by about ninety-five percent before removal from feces bed. Feces retainer has a volume sufficient to retain feces for composting in feces bed. In one embodiment, feces retainer has a volume of about seventy cubic feet. Feces in feces bed is exposed to conditions sufficient to substantially compost the feces, thereby forming compost product. According to the invention the composting of solid waste is further supported by means of introducing colonies of micro organisms, which feed on the solid waste, into the compartment 7. Suitable additive include

"biobacteria fragrance" which comprises a combination of micro organisms, enzymes and biologically degradable fragrances. Other additional micro organisms which may be introduced into the feces bed are black soldier fly larvae and the worm "Eisenia Foetida". The different micro organisms may be introduced in combination or separately into the feces bed. The micro organisms may be re-filled into the feces bed whenever needed. Thanks to the presence of micro organisms the composting rate is increased.

In one embodiment according to the invention the active composition is in the form of a stable liquid product that contains specifically developed bacteria spores, i.e. a formulation that is free of pathogenic bacteria. Further it does not contain any carcinogenic or hazardous compounds and is non-corrosive. The density will be about 1190 kg/m³, containing spores of Class-I (American Type Culture Collection Classification and Swedish Workers Protection Agency AFS1988: 12) microorganisms of the Bacillus family, surfactant, calcium nitrate, etheric oils and coloring matter. The pH will be about 7.0 to 7.5. The stability thereof in room temperature (<25°C) is a minimum 2 years and if refrigerated (3-5°C), minimum 3 years.

The sloping chamber bottom 70, the ventilation of the compost, micro-organisms and humidity allow the sewage to compost over a long period of time minimizing the required maintenance actions.

Anaerobic processes are essentially avoided in a composting system according to the invention thanks to that said ventilation prevents such a situation. Thus, anaerobic conditions (which would produce methane and offensive odors) are essentially avoided or at least minimised.

Since the mass of organic matter in the composting unit, available to the decomposer organisms, is relatively small, the temperature inside the composting unit never exceeds 37-40 degrees Celsius. Carbon dioxide (CO₂) and water vapor are the primary vent gases.

Potential human pathogens are either killed by predatory organisms or by the long retention time in the systems. The rest products in a rest station 1 according to the invention comprise composted solid waste and composted urine (liquid).

- 5 The total volume of an EcoLoo tank should be equal to about three times the first-year volume to be sufficient for the amount of people using the toilet during many years. In case the number of visitors exceeds the estimated calculations, additional toilets can easily be installed.
- 10 The rest products will, after many years, be found near the bottom of the feces retainer 7 and consists mainly of earthlike minerals, similar to topsoil, to be removed when necessary ready to go back to nature.

The collection and treatment of urine waste is now to be described.

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- Liquid waste consists mainly of composted urine and possibly some water, so-called "compost tea", nutritious and practically free from bacteria and odor. The compost tea is stable and can be stored for a considerable time in said urine compartment 8 and in the connected storage spaces 80 in the upper section of the walls 11, 13, 16. As urine moves by gravity to the lowest point of the composting unit 7 through the feces bed, bacterial action causes a chemical transformation that converts the chemically unstable components of urine (urea and ammonia) into a liquid end-product containing nitrite and nitrate. This liquid is biologically and chemically stable and contains nutrients valuable for fertilizer for different kinds of vegetation.
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- Nitrification bed is disposed within urine compartment 8 and is sufficiently dense to prevent uneven distribution or channeling of urine throughout nitrification bed. Nitrification bed includes a substrate which can support aerobic nitrifying bacteria and which is relatively stable. Also, suitable substrates can maintain a sufficient moisture content and allow sufficient aeration to support aerobic nitrifying bacteria for nitrifying a significant portion of ammonium ions in the urine collected in urine retainer. Examples of suitable substrates include loam, wood shavings and other cellulosic materials, etc. In a preferred embodiment, nitrification bed comprises peat moss. The amount of aerobic nitrifying bacteria supported by the substrate in nitrification bed is sufficient to nitrify a
- 30

significant portion of ammonium ions in urine collected under expected use-conditions of rest station 1. Nitrification of the ammonium ions causes the ammonium ions to form, for example, nitrites and nitrates. Aerobic nitrifying bacteria can be introduced to nitrification bed by indigenous bacterial growth or by artificially introducing aerobic nitrifying bacteria into nitrification bed. Examples of suitable aerobic nitrifying bacteria include nitrobacter, Nitrosomonas, etc.

The liquid waste is generated at a rate of about 0.2 liter for every user. As the compost tea exits through the liquid drain outlet 71 it is collected in said urine compartment 8. Within the compartment 8 there may be positioned a pumping arrangement 81, which via a conduit 82 pumps compost tea to one of the upper storage spaces 80. By means of sealed tube connections 83 there may be communication between the three spaces 80 allowing even filling of all spaces. The pumping arrangement 81 may be of varying kind, e.g. foot operated or electrically operated. According to another alternative the urine tea may periodically be emptied from the urine collection compartment 8 into an exterior tank (not shown), which preferably is arranged at a lower level (dug into the ground) than the urine compartment 8, such that gravity may be used (eliminating need of a pump) for the transfer.

One advantage provided by the inventive composting system is that said rest station produces no waste water except water from possible hand-washing. The water from hand-washing containing soap and certain amount of bacteria may be infiltrated into the ground. It breaks down much faster than waste water containing toilet waste and has only 1/10 the amount of nitrogen.

Another advantage is that blockage does not exist as the rest station 1 lacks pipes to be blocked. (Compare with water closets where paper often causes blockages, common in public toilets.) On the other hand, certain toilets might be too full, often because their location is closer than other facilities. The easiest thing is to close them for a certain time, push down the top of the heap and wait until the heap has somewhat receded.

In Figs. 3 and 4 there is shown a modification in accordance with the invention. Most of the details and accordingly also reference numbers are the same as in Figs. 1 and 2 and will therefore not be repeated. A first major modification is that the rest room is supplemented with two urinals 85. The urinals 85 are attached on the outside of two of the walls 13, 16.

There are channels provided (not shown) for draining urine from the urinals 85 into the interior of the feces chamber 7. As shown in Fig. 2 the urinals 85 are preferably positioned at a level below the upper limit of the feces chamber 7, allowing for simple through holes to be used as channels for draining the urine from the urinals 85 into the feces chamber 7. Of course the urinals 85 may also be positioned at other levels and then instead use tubings leading into the feces chamber 7. Thanks to the draft through the chimney 18 there is mostly no need for any one-way blockage of the urine channels, since the underpressure in the feces chamber 7 will provide for odor not to penetrate to the outside via said urine channels. However, in some embodiments it may be preferred to use some kind of valve or liquid trap to safeguard odors not to escape via said urine channels.

Secondly it is shown that there are arranged urine containers 84A, 84B, e.g. having a shape to form a rectangular when positioned around the rest room. Preferably these containers 84A, 84B are also in a modular form, wherein two larger, longer containers 84A may be positioned at each side of the rest room and two smaller containers 84B positioned in between two longer ones, thereby forming a continuous floor around the rest room. Accordingly the containers 84A, 84B are much wider and longer than the height, to allow for easy entering on top thereof, to either enter into the rest room or for use of a urinal 85. A channel (not shown) or several channels (e.g. tubings) are arranged from the urine collection chamber 8 leading urine into the containers 84A, 84B. If merely one channel is arranged to one of the containers 84A, 84B there is also arranged communicating channels between the containers 84A, 84B.

Thirdly there is shown that there is arranged a washbucket 101 below a tap 103, for washing of hands, etc. In this modified embodiment all of the hollow wall parts 100 may be used to store water, providing a larger storage capacity of water. In this connection it is to be noted that rain water may be used to refill the water storage spaces 100. Within the rest room there is also positioned a waste bin 102.

In Figs. 5 and 6 there is shown an assembly in accordance with the invention, formed by a number of modular rest rooms and other facilities that may be desired/needed in conjunction with rest rooms. A set of different modularized units 200, 300, 400 have been put together to form a station offering rest rooms and other utilities to fulfill different needs. At one end of the station there is a rest room module 200 adapted for handicapped people,

including a bridge 201 for allowing a wheelchair to enter and also handgrips 202 to enable a handicapped person to enter onto the toilet 4. At one side of the handicap unit 200 there are arranged two wash buckets 101 and also simple seats 105. In the middle of the station there are positioned two modules 300 generally in accordance with the Figs. 3 and 4, except
5 for the fact that merely one urinal 85 is positioned in connection with each module 300. Thanks to merely positioning one urinal 85, at the back side of each unit 300 it is possible to assemble these units with the side walls in contact and also other units 200, 400 with the walls in contact at the opposite side walls. Further, at the right hand end of the station there is shown a module 400 presenting a twin toilet, wherein two toilet seats 4 are positioned
10 back to back with a partitioning wall 401 in between, allowing one feces compartment 7 to be used for both toilets 4. At the right hand wall of the twin toilet 400 there are arranged a compartment with a shower 104 and preferably also a shelf 108 together with a mirror, and, at the other half thereof, another compartment having a shelf/table 106, e.g. to be used for handling babies.

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The invention is not limited by what has been described above but by the appended claims. For instance, it is evident that a skilled person will be able to choose between many well-known solutions, to achieve attachment of the elements of the housing, for example in order to achieve an easy tool free assembly of the modularized system. Hence it is evident that
20 any different kind of well-known male/female fastening devices may be used to accomplish the assembly of the housing, without the need of any tools, but possibly merely some kind of fixing/adhesives. Moreover, it is evident that also some kind of tools may be used in connection with the use of other kind of well-known "easy-to-use" attachment arrangements, e.g. connection arrangements merely needing an inset key for the assembly, as its well-known regarding furniture that are assembled at home. Further it is evident that
25 different kind of sealing arrangement may be used in connection with the housing, if desired, which sealing arrangements may be in the form of sealing lips or sealing arrangements that are to be applied by means of adhesives in situ or sealings that are to be applied in a form of viscous hardening paste. Furthermore it is evident to the skilled person
30 that many modifications may be performed regarding how to use the wall structures for creating a liquid containing spaces. For instance in many applications it is maybe possible to merely use the insulating/sealing intermediate layer 84 at the periphery of the structure to form a larger container space (possibly with discrete, strength increasing bridges), which of course in turn may be divided by partitioning walls to form two or more separate liquid

containers within one wall structure. In one embodiment the front half of a wall 11, 13 may be hollow all the way from the bottom to the top (to contain urine tea) whereas the back half only has the upper section hollow for water. In a further embodiment the feces compartment may be in the form of an exchangeable box, wherein there is a corresponding hatch in one of the sidewalls 11, 13, 16 that allows taking in and out of such a box. The air vent tube 18 would then preferably be moveable for movement in and out of an air vent hole in such a box. It is foreseen that the system may be combined with a sanitary vacuum system and if so the system will use small volumes of flush water. Otherwise the system neither uses nor pollutes water to transport the waste and has a very small overall energy demand. The only water that may normally be desired is water to clean the body and for hygiene purposes.

CLAIMS

1. A system for composting feces and for treating urine, comprising a housing (11, 12, 13, 16) enclosing an interior space (10), a feces compartment (7) disposed within the housing including a feces inlet (6) for receiving feces from a feces receiving
5 means (2) disposed in the interior space (10), a liquid passage (71) whereby liquid can be drained from the feces compartment (7), vent means (18) coupled to the composting compartment (7) for exposing the feces bed inside the composting compartment (7) to sufficient air to allow the feces to compost, thereby forming a compost product, a urine-treatment tank (8) coupled to the liquid passage (71) for
10 receiving urine from the feces compartment (7), a substrate, aerobic nitrifying bacteria disposed on the substrate whereby urine is treated by the bacteria forming a liquid product, wherein said feces bed is arranged to comprise micro organisms able to process said feces into fertile compost and wherein said system is a modular-based system where side walls (11, 13, 16) are essentially vertical and wherein said
15 feces compartment (7), and urine compartment (8) are positioned within said interior space (10).
2. A system for composting feces and for treating urine according to claim 1, wherein said feces compartment (7) is arranged with micro organisms selected from the
20 group consisting of biobacteria, black soldier fly larvae and Eisenia Foetida.
3. A system according to claim 1 or 2, wherein said urine compartment (8) is arranged below said feces compartment (7).
- 25 4. A system according to claim 3, wherein said compartments (7, 8) use at least on same inner side wall layer (161) as a compartment wall.
5. A system according to claim 4, wherein said wall layer (161) also form the inner surface delimiting said interior space.
- 30 6. A system according to any preceding claim, characterized in that at least one of the said side walls (11, 13, 16) comprises a first hollow space (80) connected to said urine compartment (8).

7. A system according to claim 6, characterized in that at least one of the said side walls (11, 13, 16) also comprises a second hollow space (80) that is separated from said first hollow space, arranged to contain water.
- 5 8. A system according to any preceding claim, characterized in that at least at one sidewall (11, 13, 16) there is arranged an urinal (85) on the opposite side in relation to the feces compartment (7).
9. A system according to claim 8, characterized in that said urinal (85) has its lowest
10 portion positioned at a level below the top level of said feces compartment (7).
10. A system according to any preceding claim, characterized in that at least one additional urine containers (84A, 84B) is positioned onto the ground next to at least one of said walls (11, 13, 16), wherein preferably said additional urine containers
15 (84A, 84B) form a walkable floor.
11. A system according to any preceding claim, characterized in that at least two modules (200, 300, 400) of rest rooms are positioned next to each other, wherein preferably said modules (200, 300, 400) present different designs fulfilling different
20 needs, and interfitting into a total assembly forming a station having a unitary look.
12. Method for composting feces and for treating urine, comprising the steps of providing a housing (11, 12, 13, 16) enclosing an interior space (10) a feces compartment (7) disposed within said housing including a feces inlet (6) for
25 receiving feces from a feces receiving means (2) disposed in the interior space (10), a liquid passage (71) whereby liquid can be drained from the feces compartment (7) vent means (18) coupled to the feces compartment (7) for exposing the feces bed inside the feces compartment to sufficient air to allow the feces to compost, thereby forming a composed product, a urine treatment tank (8) coupled to the liquid
30 passage (71) for receiving urine from the feces compartment (7), a substrate, aerobic nitrifying bacteria disposed on the substrate whereby urine is treated by the bacteria forming a liquid product, wherein said feces bed is arranged to comprise microorganisms able to process said feces into fertile compost, and by providing said system in modular form having side walls (11, 13, 16) that are essentially

vertical and wherein said feces compartment (7) and urine compartment (8) are positioned within said interior space (10).

- 5 13. A method according to claim 12 wherein said feces compartment (7) is arranged with microorganisms selected from the group consisting of biobacteria, black soldier fly larvae and *Eisenia Foetida*.
- 10 14. A method according to claim 13, wherein said urine compartment (8) is provided below said feces compartment (7).
- 15 15. A method according to any of claims 12-14, wherein at least two modules (200, 300, 400) are positioned next to each other to form a station comprising a plurality of rest rooms.

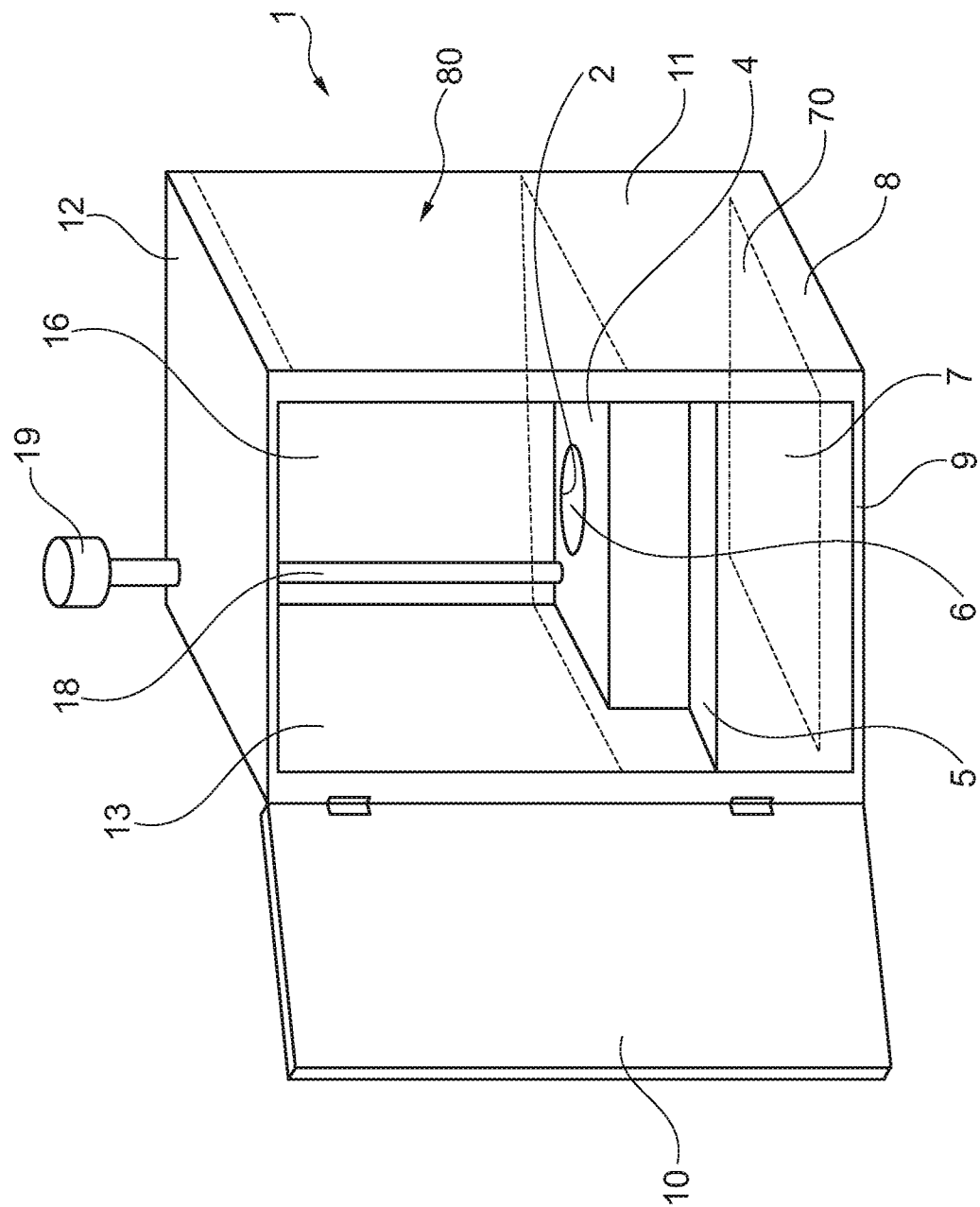


Fig. 1

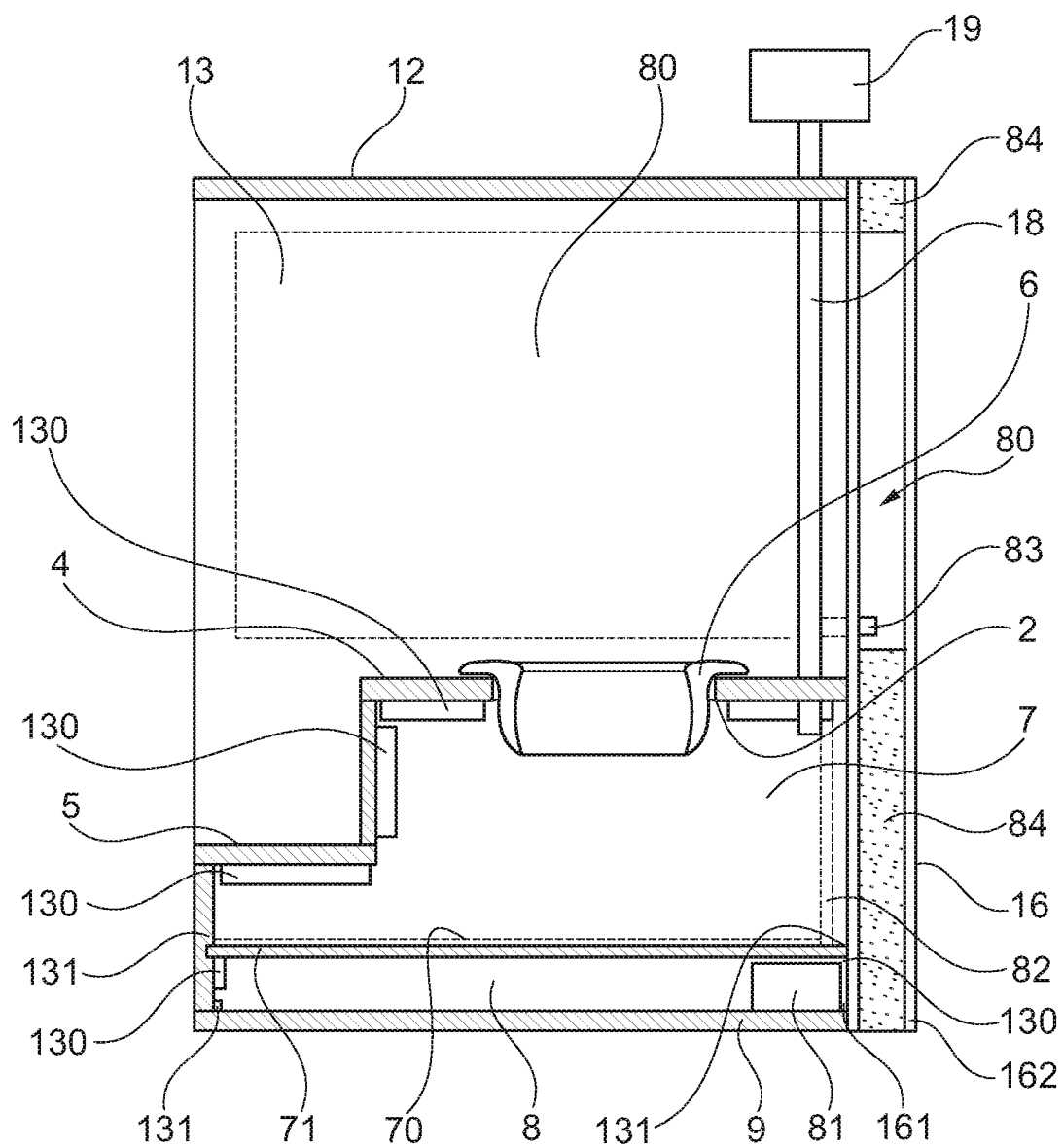
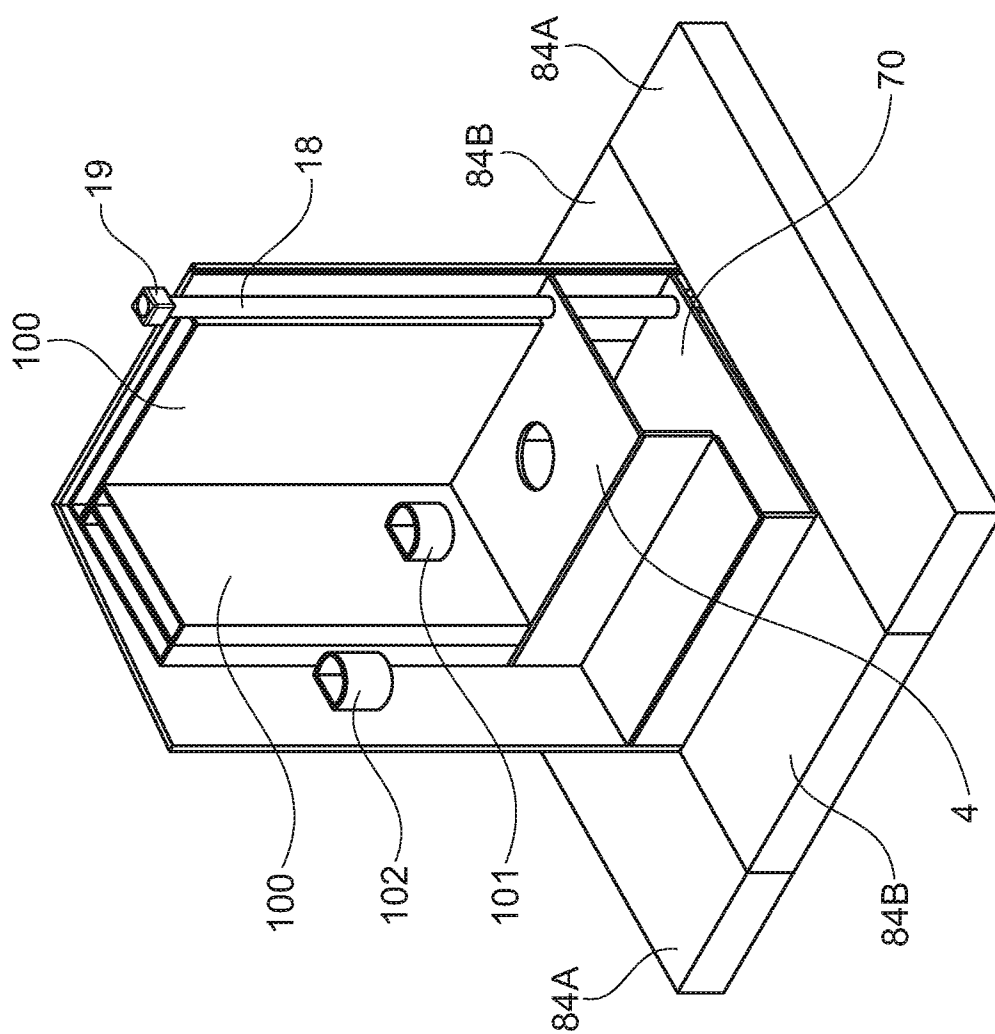


Fig. 2



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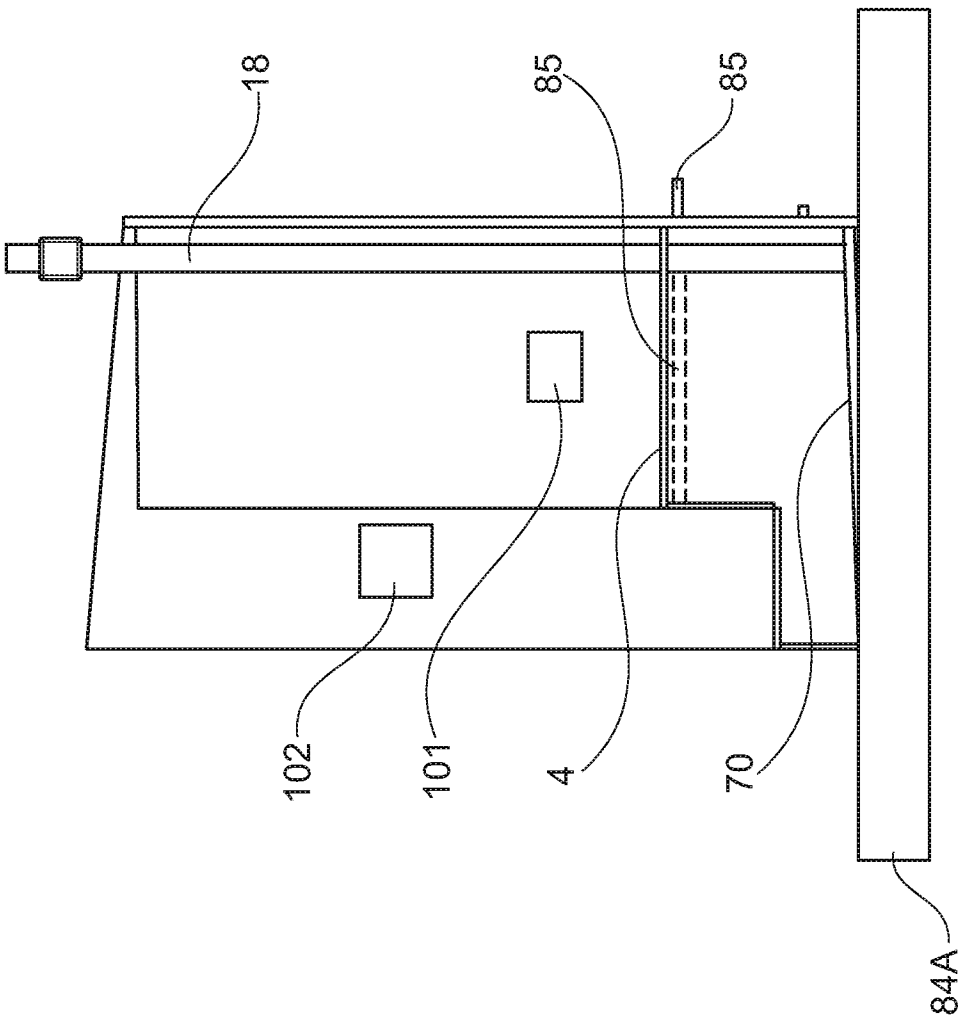


Fig. 4

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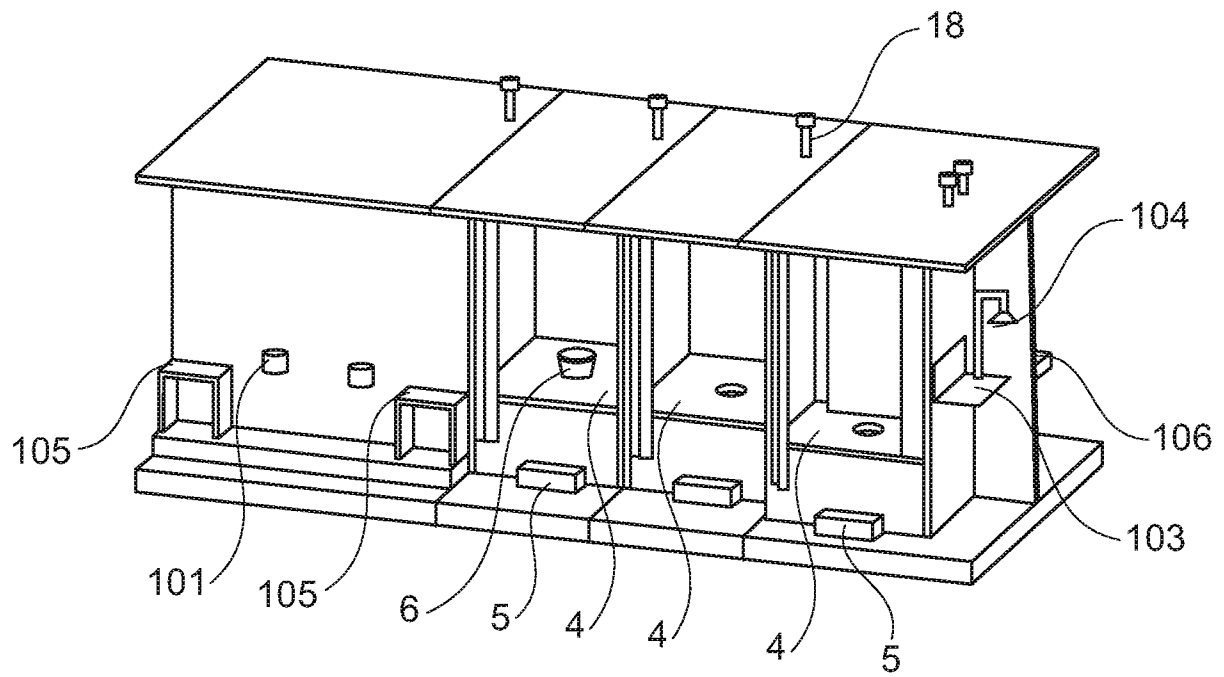


Fig. 5

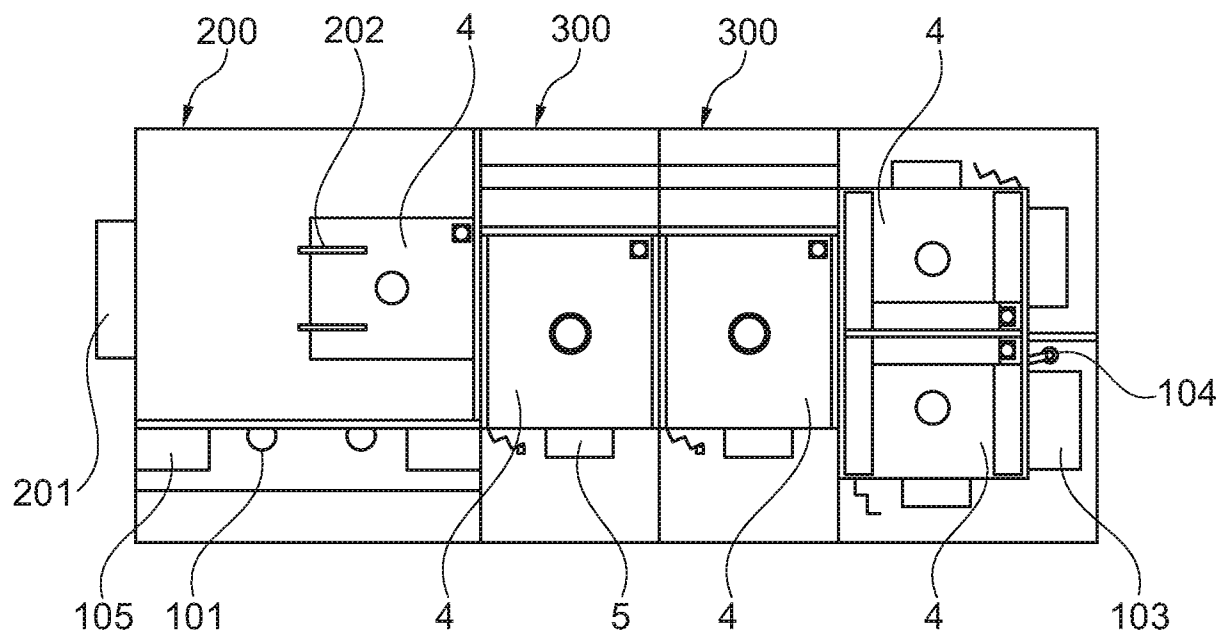


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE201 2/050267

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A47K, C02F, C05F, E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Intenal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9218442 A2 (CLIVUS MULTRUM INC), 29 October 1992 (1992-10-29); abstract; page 1, line 28 - page 2, line 8; page 4, line 1 - page 4, line 10; page 5, line 25 - page 6, line 7; page 8, line 8 - page 8, line 21; page 10, line 14 - page 10, line 16; page 11, line 26 - page 12, line 16; figure 1	1-5, 8-15
A	--	6-7
A	US 6391620 B1 (OLIVIER PAUL A), 21 May 2002 (2002-05-21); column 1, line 35 - column 1, line 42; column 18, line 42 .. column 18, line 50	2
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Further documents are listed in the continuation of Bos C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE201 2/050267

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4347632 A 1 (CRISS JEREMY F), 7 September 1982 (1982-09-07); abstract; column 3, line 42 - column 3, line 47 --	2
A	US 20040040081 A 1 (OSTBO BERTIL), 4 March 2004 (2004-03-04); paragraphs [0009], [0022]-[0035]; figures 1-5 --	11, 15
A	WO 2008044806 A 1 (KOREA WATER RESOURCES CORP ET AL), 17 April 2008 (2008-04-17); whole document --	1-15
A	WO 2006004333 A 1 (LEE GIL YONG), 12 January 2006 (2006-01 -12); whole document -- -----	1-15

Continuation of: second sheet

International Patent Classification (IPC)

A4ZK if/02 (2006.01)

C05F 3/04 (2006.01)

C05F 3/06 (2006.01)

C05F 17/02 (2006.01)

E04H 1/12 (2006.01)

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

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PCT/SE201 2/050267

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