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(71) Applicant: **AQUAVEST PTY LIMITED** [AU/AU]; c/- Suite 304, 37 Bligh Street, Sydney, New South Wales 2000 (AU).

(72) Inventor: **CRASTI, Leo**; Elamang Avenue, Kirribilli, New South Wales 2061 (AU).

(74) Agent: **GRIFFITH HACK**; Level 19, 109 St Georges Terrace, Perth, Western Australia 6000 (AU).

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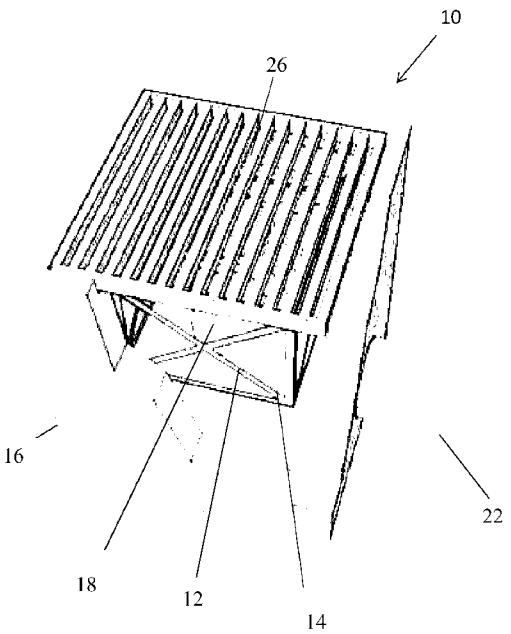

Figure 1

(57) Abstract: The present disclosure provides an apparatus for filtering polluted water. The apparatus has a housing with an inlet for receiving the polluted water. The apparatus also has a filter element for filtering the polluted water. The filter element is positioned such that in use polluted water is filtered by the filter element before exiting the housing. In addition, the apparatus comprises a bypass for throughput of the polluted water arranged in a manner to enable polluted water to bypass the filter element. The apparatus is arranged such that, when a level of the polluted water increases within the housing, the bypass is at least partially surrounded by the polluted water and, beyond a predetermined level of polluted water, polluted water flows into the bypass.

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AN APPARATUS FOR FILTERING POLLUTED WATER

Technical Field of the Invention

The present invention relates to an apparatus for filtering polluted water.

Throughout this specification the term "polluted water" is used for any water from industrial and non-industrial sources. Examples include drainage water, storm or rain water, water from dams, weirs, reservoirs, detention units, channelled water ways, trenches and the like. Further examples include waste water, such as waste water from industrial sources including contaminated water from industrial sites, such as mining sites, contaminated water that was used for watering coal piles and any other waste water.

Background of the Invention

Urbanisation including agriculture and industrial activities generates contaminants that can be washed off surfaces by rain water and may then accumulate in receiving waters or storm water harvesting systems.

In recent times filtration has become important, as storm water harvesting is now a viable way of sustaining water resources. In some areas, government regulations now mandate that in new developments storm water filtration must be provided.

Filtering systems that have mesh baskets suspended in a frame are often used to remove gross pollutants from polluted water, such as drainage water. Such filtering systems have the disadvantage that they allow litter and leaves etc. to line an inside surface of the mesh basket, which often creates an impervious layer when dried after rainfall. Further, such known systems are designed such that, if a bypass is provided to allow bypassing of the mesh basket when the mesh basket is blocked, the bypass occurs through a gap at an upper rim. This results in mobilisation of these contaminants, which are then often also discharged.

The present invention provides improvement.

Summary of the Invention

In accordance with a first aspect, the present invention provides an apparatus for filtering polluted water, the apparatus comprising:

a housing having an inlet for receiving the polluted water;

a filter element for filtering the polluted water, the filter element being positioned such that in use polluted water is filtered by the filter element before exiting the housing; and

a bypass for throughput of the polluted water arranged in a manner to enable polluted water to bypass the filter element;

wherein the apparatus is arranged such that, when a level of the polluted water increases within the housing, the bypass is at least partially surrounded by the

polluted water and, beyond a predetermined level of polluted water, polluted water flows into an opening of the bypass from directions around at least a portion of the opening of the bypass.

For example, the level of the polluted water within the housing may increase when the at least one filter element is at least partially blocked resulting in insufficient throughput through the at least one filter element. Additionally or alternatively, the level of the polluted water within the housing may increase when an inflow of polluted water received at the inlet portion is higher than the throughput of filtered water through the at least one filter element.

Throughout this specification the term "filter element" is used for any type of material or arrangement that filters. For example, the filter element may be provided in the form of a coarse mesh for filtering gross pollutants, but may alternatively also be provided in the form of a finer mesh or suitable foam or the like. Further, the filter element may comprise a combination of any type of finer filter elements with any type of coarse filter elements.

The bypass opening may in use be substantially horizontally oriented.

In accordance with a second aspect, the present invention provides an apparatus for filtering polluted water, the apparatus comprising:

a housing having an inlet portion comprising an inlet grate for receiving the polluted water;

a filter element for filtering the polluted water; and

a bypass for throughput of the polluted water arranged in a manner to enable polluted water to bypass the filter element;

wherein the inlet grate is arranged such that polluted water with buoyant material in use flows into the housing; and

wherein the bypass and the inlet grate are positioned relative to each other such that, when a level of the polluted water increases beyond a predetermined level, polluted water flows into the bypass, but at least a portion of the buoyant material is trapped in the housing.

The apparatus in accordance with the second aspect of the present invention may be arranged such that, when a level of the polluted water increases within the housing, the bypass is at least partially surrounded by the polluted water and, beyond a predetermined level of polluted water, polluted water flows into the bypass.

In one embodiment the predetermined level coincides with a level of a bypass inlet and is located below a bottom level of the inlet grate. Alternatively, the predetermined level and the level of the bypass inlet may be between a bottom portion of the inlet grate and a top portion of the inlet grate.

The bypass inlet may be positioned at a distance of 0.5 to 5cm or 0.5 to 2cm below a portion of the inlet grate that is positioned directly above the level of the bypass inlet. The inlet grate may have a substantially uniform height. Alternatively, the inlet grate have a recessed

portion that is recessed from a bottom portion of the grate and is arranged such that an end-portion of the bypass can be received within the recessed portion, in which case the bottom portion of the grate that is outside the recessed portion may be at a lower level than the bypass inlet.

In an embodiment, the inlet grate comprises a plurality of grate elements, such as straight or curved rods or blades that extend across at least a portion of the inlet grate. The grate elements may be positioned relative to each other such that in use a downward force resulting from inflowing polluted water is larger than an is larger than an upward (Venturi) force resulting from polluted water that in use may flow over spaces between adjacent grate elements, which has the advantage that trapping of buoyant material in the housing is facilitated. At least some of the grate elements may be spaced at a distance of 0.5 to 2.5 cm from each other, such as 1 cm.

In one specific embodiment the grate elements are provided in the form of blades that are angled relative to each other and about an axis that in use is substantially horizontal. For example, the blades may have a width of 5 - 7.5 cm, such as 5 cm and may be angled at an angle of 75° to 60°, such as 77.5° relative to a receiving plane of the grate.

The following will introduce features that embodiments in accordance with either the first or the second aspect of the present invention may have.

In one embodiment the bypass is positioned such that, when the polluted water is at the predetermined level in the housing, a flow of additional polluted water results in polluted water being directed into the bypass largely without generating turbulences for at least the majority of the polluted water below the predetermined level. In this embodiment the apparatus may be arranged such that, when the polluted water has reached the predetermined level in the housing, a flow of additional polluted water is substantially evenly distributed around at least a portion of the bypass.

The bypass may be provided in any suitable form. In one embodiment the bypass comprises a tube that may be entirely surrounded by an interior of the housing, which in use may be at least partially filled with polluted water. In an embodiment, the bypass is positioned at a central location within the housing and may be entirely surrounded by the polluted water when the polluted water is at the predetermined level within the housing. The bypass may be arranged to guide the polluted water though an entire depth of the housing or at least through a portion thereof.

The predetermined level may be determined by a position of an upper opening through which the bypass receives the polluted water when the polluted water is at the predetermined level within the housing.

The apparatus may be arranged such that in use an inflow of polluted water into the inlet portion of the apparatus is at a level that is in the proximity or of, or substantially equals, the predetermined level beyond which

polluted water is directed into the bypass. Alternatively, the apparatus may be arranged such that the inflow of polluted water into the inlet portion of the apparatus is at a level relative to the predetermined level such that for a particular application sufficient polluted water is filtered by the at least one filter element. For example, the level of the inflow of polluted water into the inlet portion is within a range of 20 - 10cm, 10 - 5cm or 5 - 1cm above the predetermined level.

The apparatus may be symmetrical relative to one or more planes through the apparatus. The apparatus may be arranged such that in use the one or more planes are oriented substantially along the direction of gravity.

The apparatus in accordance with embodiments of the first or second aspect of the present invention has further practical advantages. In particular early drainage water, for example caused by an onset of rainfall, usually includes a relatively large portion of contaminants as especially the onset of the rain washes the contaminants off surfaces and moves waste items. The apparatus may be arranged such that the housing portion is sufficiently large and the filter element suitably structured such that, even though these contaminants and waste items accumulate within the housing and cause partial blockage of the filter element, the apparatus can continue to operate until the filter elements are fully covered at which time polluted water will be directed into the bypass. When then further polluted water is directed into the bypass, the further polluted water usually carries significantly less contaminations and waste items after the initial wash off. As the bypass may be positioned such

that turbulences within the polluted water below the predetermined level can largely be avoided, it is less likely that the contaminants and the waste items that have accumulated within the housing are directed into the bypass and discharged.

In an embodiment, the housing of the apparatus comprises a container. The container may be positioned at a bottom portion of the apparatus such that only when the container is filled with polluted water, further polluted water received at the inlet portion of the apparatus can exit through the at least one filter element.

The apparatus may also be arranged such that the predetermined level is adjustable whereby a volume of polluted water that is filtered for a given inflow of polluted water is adjustable. For example, an upper opening of the bypass may be moveable.

The at least one filter element may form a wall portion of the housing and in one embodiment the apparatus comprises a plurality of filter elements that form wall portions of the housing. A person skilled in the art will appreciate that any suitable filter element is envisaged. For example, the filter element may be arranged to filter any suitable size of particles. In a specific embodiment, a first filter element is arranged to filter relatively coarse particles and a second filter element is arranged to filter relatively fine particles as well as hydro carbons. In a further example, the size of the mesh gradually decreases towards a bottom of the inner housing. Further, the filter element may comprise any suitable material or composite material. For example, the material

of the filter element may comprise metal or a polymer material such as plastics.

The apparatus may be arranged for throughput of water exclusively by gravity.

The apparatus may be arranged for positioning within the ground. In one variation an upper face of the apparatus is exposed for receiving the polluted water when the apparatus is positioned in the ground. Alternatively, the apparatus may be arranged for positioning entirely within the ground and may be structured for receiving the polluted water from a conduit, such as a downpipe or the like. In a further alternative the apparatus is arranged for positioning at least partially above ground, but is arranged to receive the polluted water from a conduit, such as a downpipe or the like. The apparatus may also be configured to receive polluted water from one or more conduits connected to the apparatus.

The housing of the apparatus may be an inner housing portion and the apparatus may also comprise an outer housing portion within which the inner housing portion is positioned. The apparatus may be arranged such that the inner housing portion is removable and the at least one filter element can be cleaned in a convenient manner. In one embodiment the apparatus is arranged such that the inner housing portion with the at least one filter element can be pulled out of the outer housing for example when the apparatus is positioned in the ground.

In one embodiment the apparatus is arranged such that the discharge rate of filtered water using substantially clean

filter elements is comparable or substantially equal to a discharge rate of the bypass or lower than the discharge rate of the bypass such that in use blockage of the filter element does not substantially reduce a flow of polluted water through the apparatus.

The apparatus may be arranged such that, when the filter element is partially blocked and/or an inflow of polluted water increases beyond a predetermined threshold level, polluted water is directed into the bypass even though the filtered polluted water still exits the apparatus via the at least one filter element. If the apparatus comprises the above-described container, at least a portion of the contaminants and waste items may still accumulate in the container even though a portion of the polluted water is directed into the bypass.

In some embodiments, the apparatus may be arranged such that in use at least a portion, or the entire, filter element is submerged in unfiltered polluted water at a first side and filtered polluted water at a second (typically opposite) side. If the filter element is entirely submerged in the polluted water, a pressure difference between the first and second sides is relatively low, which may be beneficial for the filtering properties of the filter element. The apparatus may comprise a receptacle element arranged to receive polluted water and disposed in a manner such that in use at least a portion of both the first and second sides are submerged in the polluted water. The bypass may be arranged in a manner such that polluted water bypasses the receptacle element.

The receptacle element may allow the filter element to be entirely submerged in polluted water, retained in the receptacle element, during use. The receptacle element may comprise a bottom portion for collecting contaminants filtered by the filter element. The receptacle element may be arranged in a manner such that in use polluted water contained inside the receptacle element overflows a portion of the receptacle element after being filtered by the filter element. That portion may be arranged such that polluted water flows from the receptacle element through an opening. The size of the opening may be adjustable to adjust a flow of polluted water.

In an embodiment, the receptacle element forms walls of the housing.

In some embodiments, the apparatus also comprises a second filter element for filtering the polluted water. The second filter element may comprise a particle capturing filter arranged to capture particles contained in the polluted water. The second filter element may be arranged to capture hydrocarbon particles. The second filter element may be disposed around at least a portion of the bypass and may entirely surround a portion of the bypass.

In an embodiment, the second filter element has a central hollow portion arranged to fit around the bypass and may comprise a plurality of radially projecting vanes arranged to increase the filtering surface.

In some embodiments, the apparatus further comprises a bypass cap disposed about an inlet opening of the bypass in a manner such that in use polluted water received from

the inlet is prevented from entering the bypass directly. The bypass cap may be disposed in a manner such that polluted water received from the inlet of the housing flows into the bypass only after having entered a body of polluted water surrounding the bypass in the housing.

The apparatus may further comprise an indicator for indicating a level of polluted water within the housing and/or a level of contaminants accumulated within the housing. For example, the indicator may be in any suitable form such as in the form of a visual pop up such as a floating device. Alternatively, the indicator may comprise a pressure switch and emitter that emits a signal to a remote computing device. However, other arrangements are envisaged.

In accordance with a third aspect, the present invention provides an apparatus for filtering polluted water, the apparatus comprising:

a housing having an inlet for receiving the polluted water;

a filter element for filtering the polluted water, the filter element being positioned such that in use polluted water is filtered by the filter element before exiting the housing; and

a container portion for containing polluted water;

wherein the apparatus is arranged such that, when a level of the polluted water increases to an upper edge of the housing, polluted water received beyond the upper edge of the housing is accumulated within the container portion of the apparatus.

The apparatus may in particular be suitable for Onsite Stormwater Detention.

In an embodiment, the apparatus is arranged such that polluted water flows through the container portion into the housing. For example, the container portion may comprise an open bottom portion and may be arranged directly above the housing.

In a specific example, the container portion has vertical wall portions and at least a wall portion has an edge that is lower than adjacent wall portions such that the polluted water received beyond a predetermined level within the container portion can flow over the edge of the at least one wall portion thereby bypassing the at least one filter element. By adjusting a height of the edge, a volume of the polluted water that is filtered can be controlled. For example, the height of the edge may be adjusted such that an entire inflow of polluted water is treated.

In accordance with a fourth aspect, the present invention provides a method of filtering polluted water, the method comprising the steps of:

directing polluted water into a housing having a filter element for filtering the polluted water;

filtering the polluted water through the filter element; and

bypassing the filter element through a bypass if a level of the polluted water within the housing increases beyond a predetermined level within the housing;

wherein the method is conducted such that when the level of the polluted water within the housing increases,

the bypass is at least partially surrounded by the polluted water within the housing.

The method may be conducted such that during the step of filtering the polluted water, a first and a second (typically opposite) second side of the filter element are at least partially submerged in the polluted water, or entirely submerged in the polluted water.

The method may further comprise filtering hydrocarbon particles in the polluted water using a further filter element.

The method may be conducted such that polluted water directed into an inlet of the housing does not directly enter the bypass.

The method may be conducted such that, when the polluted water reached the predetermined level in the housing, a flow of additional polluted water is substantially evenly distributed around at least a portion of the bypass.

The method may be conducted such that, when the polluted water has reached the predetermined level in the housing, polluted water is distributed around at least a portion of the second filter element.

The step of bypassing the filter element may comprise directing polluted water into the bypass at a level that is in the proximity of, or substantially at, a level at which the polluted water is directed into the housing. Alternatively, the step of bypassing the filter element may comprise directing polluted water into the bypass at a

level that is within a range of 20 - 10cm, 10 - 5cm or 5 - 1cm below the level at which the polluted water is directed into the housing.

The method may also comprise controlling or adjusting the predetermined level whereby a rate or volume of polluted water that is filtered for a given inflow of polluted water can be controlled or adjusted. For example, the method may comprise moving an upper opening of a bypass for bypassing the at least one filter element.

In accordance with a fifth aspect, the present invention provides an apparatus for filtering polluted water, the apparatus comprising:

a housing having an inlet for receiving the polluted water;

a filter element for filtering the polluted water, the filter element being positioned such that in use polluted water is filtered by the filter element before exiting the housing; and

a bypass for throughput of the polluted water arranged in a manner to enable polluted water to bypass the filter element;

wherein the apparatus is arranged such that, when a level of the polluted water increases within the housing, an opening of the bypass at least partially surrounds the polluted water and, beyond a predetermined level of polluted water, polluted water flows into the bypass from directions around at least a portion of the polluted water.

The opening of the bypass of the apparatus in accordance with the fifth aspect of the present invention may be

entirely open to allow unobstructed inflow of polluted water. Further, the opening of the bypass may in use surround the polluted water when the polluted water is at the predetermined level.

Brief Description of the Drawings

The embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 shows a schematic three-dimensional top view of an apparatus in accordance with an embodiment of the present invention;

Figure 2 illustrates a further three-dimensional top view of the apparatus of Figure 1 without a grating;

Figure 3 shows a three-dimensional side view of the apparatus of Figure 1;

Figure 4 shows a three-dimensional top view of an apparatus in accordance with a further embodiment of the invention; and

Figure 5 illustrates a three-dimensional side view of the apparatus of Figure 4;

Figure 6 shows an apparatus for On-Site Stormwater Detention (OSD) in accordance with a further embodiment of the invention; and

Figure 7 shows a perspective view of an apparatus in

accordance with another embodiment of the present invention;

Figure 8 shows a side cross-sectional view of the apparatus of Figure 7;

Figure 9 shows a perspective view of a bypass and a filter element in accordance with an embodiment of the present invention;

Figure 10 shows a side cross-sectional view of the apparatus in accordance with an embodiment of the present invention;

Figure 11, shows a side view of the top portion of an apparatus in accordance with an embodiment of the present invention; and

Figure 12, shows top views of two grates in accordance with embodiments of the present invention.

Figure 13 is a flow chart illustrating a method in accordance with an embodiment of the present invention.

Detailed Description of Embodiments

Embodiments of the present invention relate to an apparatus for filtering polluted water. The apparatus may for example be used for filtering rain water before the rain water is directed into receiving waters or storm water harvesting systems. However, a person skilled in the art will appreciate that the apparatus may also be used

filtering any other type of water from industrial or non-industrial sources.

The apparatus in accordance with embodiments of the invention comprises an inner housing that has an inlet portion for receiving polluted water, and at least one filter element at a wall portion of the inner housing. The filter element is arranged such that polluted water received at the inlet portion can exit the apparatus through the filter element. In addition, the apparatus comprises a bypass for directing polluted water in a manner to bypass the filter element. When a level of polluted water increases within the inner housing, the bypass is at least partially surrounded by the polluted water within the housing. Beyond a predetermined level of the polluted water within the housing, further polluted water that is received at the inlet portion of the apparatus exits the housing through the bypass thereby bypassing the filter element. For example, blockage of at least parts of the filter element at a suitable inflow of polluted water may cause an increase of a level of the polluted water within the housing such that further polluted water beyond the predetermined level flows into the bypass. Additionally or alternatively, if an inflow of polluted water that is received at the inlet portion of the apparatus is higher than a throughput of filtered polluted water through the filter element, the level of polluted water within the inner housing increases. In one embodiment the bypass is provided in the form of a tube or another type of conduit and is positioned at a central location within the inner housing.

For some applications, it may be advantageous if the inner housing is positioned within an outer housing and the apparatus is arranged such that the inner housing can be removed such as pulled out of the outer housing for cleaning of the filter element.

Conventional filtering systems typically have mesh baskets that have a bypass in the form of a slot at a top wall portion of the filtering system. Thus, if the mesh basket is blocked by contaminants, polluted water is bypassed through the slots at the top of the filtering system. This has significant disadvantages in that turbulences of the contaminants is increased and may be discharged through the bypass slots. Further, due to the position of the bypass slots, vertical space and volume of the mesh basket is limited and consequently, the size of the bypass slots is minimized. However, this may result in increased flow velocity of polluted water that is directed through the bypass slots.

In light of the design of conventional filtering systems, the apparatus in accordance with at least an embodiment of the present invention provides significant advantages. In particular, the apparatus is arranged such that, when the polluted water is at the predetermined level within the inner housing, inflow of subsequent polluted water causes no or only a reduced level of turbulences within the polluted water within the housing, which reduces the likelihood that contaminants accumulated within the inner housing are moved and directed into the bypass for discharge.

Furthermore, in an embodiment of the invention in which the bypass is positioned at a central location within the inner housing of the apparatus, the size and volume of the inner housing can be maximized.

Referring now to Figures 1 to 3 of the accompanying drawings, there is shown a schematic three-dimensional view of an apparatus 10 in accordance with an embodiment of the present invention. In this particular embodiment, the apparatus 10 is positioned in a stormwater pit. For example, the apparatus 10 may be retrofitted into an existing stormwater pit regardless of whether the existing stormwater pit has a grate, mesh top or is part of an in kerb slot entry.

The apparatus 10 comprises an inner housing 12 and a plurality of filter screens 14 (not shown) forming wall portions of the inner housing 12. The inner housing 12 is positioned in an outer housing 16 and is removable from the outer housing 16. It will be appreciated that the apparatus may or may not comprise the outer housing. In illustrated embodiment the outer housing 16 forms a part of storm water pit. A bypass 18 in the form of a tube is positioned in the inner housing 12.

The inner housing 12 has an inlet portion 20 for receiving polluted water such that an inflow of polluted water can enter the inner housing 12 and subsequently filtered polluted water can enter the outer housing 16 in which it is directed to an outlet 22. In this way, contaminants in the polluted water such as gross pollutants and sediments can be removed from the polluted water and accumulate within the inner housing 12.

The inlet portion 20 has an upper edge 21 and a tapered portion 23 which in use guides the polluted water into the inner housing 12. The bypass 18 has an inlet opening 24 that defines the predetermined level to which the polluted water increases within the housing until further polluted water flows in the bypass. In this embodiment, the inlet opening 24 of the bypass 18 is approximately level with the upper edge 21 of the inlet portion 20. However, a person skilled in the art will appreciate that the inlet opening 24 of the bypass 18 may have any suitable height relative to the inlet portion 20. For example, the inlet opening 24 of the bypass 18 may be within a range of 20 - 10cm, 10 - 5cm or 5 - 1cm below the inlet portion 20.

A person skilled in the art will appreciate that the relative position of the inlet opening 24 of the bypass 18 may be variable relative to the inlet portion 20. For example, by varying the relative position of the inlet opening 24 of the bypass to the upper edge 21 of the inlet portion 23, a throughput rate of filtered polluted water through the filter screens 14 can be controlled.
The inlet opening 24 of the bypass 18 is positioned at a central location of the apparatus 10 and consequently the apparatus 10 is arranged such that in use polluted water can flow substantially evenly from any transversal direction towards the bypass 18 when the level of polluted water increases to the predetermined level in the inner housing 12. By avoiding turbulences of the polluted water within the inner housing 12, a likelihood of movement and subsequent discharge of contaminants within the water drainage in the housing 12 through the bypass 18 can be reduced. However, it will be appreciated that in an embodiment of the present invention the bypass 18 may not

necessarily be positioned at a central location within the apparatus 10, but may alternatively be positioned off centre or at an edge portion such that in this case the inflow of further polluted water may be substantially evenly distributed around only a portion of the bypass 18.

Further, the apparatus 10 is arranged such that in use an inflow of polluted water into the apparatus 10 is at a relatively short distance above the predetermined level, which also contributes to reducing turbulences in the polluted water in the inner housing 12.

In the illustrated embodiment the bypass 18 is positioned to direct polluted water through the entire depth of the inner housing 12 and through a bottom wall of the inner housing 12. However, it will be appreciated that in variations of the illustrated embodiment the bypass 18 may direct the polluted water only though a portion of the depth of the inner housing 12. For example, the bypass 18 may be an angled tube that is positioned to direct polluted water through a side wall of the inner housing 12.

Figure 1 illustrates the apparatus 10 positioned in a typical stormwater pit. A grate 26 of the stormwater pit may be lifted to access the apparatus 10 and replace or clean the apparatus 10 in a convenient manner. In one specific embodiment the apparatus 10 may be arranged such that the apparatus can be pulled out of the stormwater pit for this purpose. Installation of the apparatus 10 within an existing stormwater pit or the like may or may not comprise use of an adaptor or suitable bracket, which also

allow installation of the apparatus 10 in non-standard stormwater pits or the like.

In the illustrated embodiment, the inner housing 12 has 4 side walls and each side wall comprises a filter element (not shown). The filter elements are in this example filter screens that comprise a mesh. A person skilled in the art will appreciate that any number of filter elements could be positioned at an any number of side walls, which could have any suitable shape (for example a square, rectangular or circular shape) to suit a particular application. Further, the filter elements may comprise any suitable material. For example, the material of the filter elements may comprise metal or polymer material such as plastics. Further, the material may be a composite material. In specific examples, the filter elements comprise multiple layers or form a three-dimensional screen.

Further, the mesh of the filter screens may have any suitable size or sizes. For example, the mesh may be relatively fine at the bottom of the housing and relatively coarse at the top of the housing.

The apparatus 10 may be formed from various materials. For example, the apparatus 10 may comprise galvanised steel, stainless steel or polymeric materials.

The inner housing 12 may further comprise an indicator for indicating a level of polluted water within the housing and/or a level of contaminants accumulated within the housing. For example, the indicator may comprise a floating element that indicates when the polluted water

exceeds a critical level within the housing 12. Alternatively, the indicator may comprise a pressure switch that detects a change of pressure within the housing 12. The indicator may further comprise an emitter that emits a signal indicative of a pressure change to a remote computing device. However, other arrangements are envisaged.

In a variation of the illustrated embodiment shown in Figures 1 to 3, a position of the bypass 18 within the inner housing 12 is adjustable by moving the bypass 18 up or down, which allows adjusting the predetermined level and consequently adjusting a volume of polluted water that is filtered before polluted water is directed into the bypass 18 (for a given flow of polluted water and a given level of contamination). For example, the apparatus may comprise a sliding sleeve and flange arrangement at a bottom region of the inner housing 12 such that the height of the inlet portion 24 of the bypass 18 can be adjusted.
Referring now to Figures 4 and 5, there is shown an apparatus 40 in accordance with a further embodiment of the present invention. Similar to the apparatus 10 shown in Figures 1 to 3, the apparatus 40 is implemented in the form of a storm drain that can be inserted into a stormwater pit.

The apparatus 40 also comprises an inner housing 42 that can be inserted into an outer housing such as a stormwater pit. The inner housing has an inlet portion 43 for receiving polluted water. The apparatus further comprises a plurality of filter screens 44 (not shown) forming vertical wall portions of the inner housing 42, and a

bypass 48 in the form of a tube that is positioned at a central location within the inner housing 42.

As described with reference to the apparatus 10 shown in Figures 1 to 3, a flow of polluted water enters the inner housing 42 and is filtered by the filter screens 44 that form wall portions of the housing 42. When the level of polluted water within the inner housing 42 rises, the bypass 48 is surrounded by polluted water and beyond a predetermined level of the polluted water within the inner housing 42, further polluted water flows through the bypass 48.

The level of polluted water within the inner housing 42 may increase due to at least partial blockage of the plurality of filter screens, for example by contaminants captured within the inner housing 42. Additionally or alternatively, the inflow of polluted water into the inlet portion 43 may be higher than the throughput of filtered polluted water through the plurality of filter screens thereby causing an increase of a level of polluted water within the housing 42.

In addition to the filter screens 44 forming vertical wall portions of the inner housing 42, the apparatus 40 comprises further filter elements 52. In addition, the further filter elements 52 may be arranged as cation exchangers. In this example, the further filter elements 52 are removably coupled to an outside of the filter screes 44. For example, Figure 5 illustrates the apparatus 40 in which the further filter elements 52 have been removed. The further filter elements 52 are filters that have a finer mesh than the filter screens 44. In

particular, the further filter elements 52 are arranged to filter relatively small particles and hydrocarbons from the polluted water.

In this embodiment, the inner housing 42 of the apparatus 40 further comprises a container 54 that is arranged at a bottom region of the apparatus 40. The apparatus 40 is arranged such that an initial inflow of polluted water received at the inlet portion 43 is collected within the container 54. When the container 54 is filled with polluted water, further polluted water received within the inner housing 42 can exit the inner housing 42 through the filter screens 44 and the further filter elements 52. Further, when the level of polluted water within the inner housing 42 increases beyond the predetermined level, further polluted water exits the inner housing 42 through the bypass 48.

Providing a container 54 at the bottom region of the inner housing 42 has significant advantages. For example, the container 54 increases the volume of the inner housing and thereby extends the service time of filtering polluted water without the need of removing contaminants from the inner housing. Further, during sequential rain fall events when contaminants accumulated within the inner housing 42 stay wet, the contaminants will eventually be broken down to finer materials. The finer materials then sink into the container 54 by virtue of gravity and are thereby maintained within the inner housing 42. In this way, the likelihood can be reduced that finer materials exit the inner housing 42.

Referring now to Figure 6, there is shown an apparatus 60 for On-site Stormwater Detention in accordance with an embodiment of the invention. OSD relates to a method of collecting polluted water, storing the polluted water temporarily and subsequently slowly releasing the stored polluted water to reduce the risk of flooding problems.

The apparatus 60 has a housing 62 and an inlet portion 63 for receiving polluted water from a pipe 68. Similar to the apparatus 40 shown in Figures 4 and 5, the housing 62 of the apparatus 60 comprises a container 66 at a bottom region of the housing 62 and filter screens 64 that form vertical wall portions of the housing 62.

In this particular embodiment, the apparatus 60 further comprises a container portion in the form of a shroud. The shroud 70 is mounted to a wall 72 that incorporates the pipe 62 through which polluted water enters the apparatus for flowing through the shroud 70 into the housing 62 of the apparatus 60. The shroud 70 has vertical wall portions wherein wall portion 74 which is substantially opposite of the pipe 68 has a top edge that is lower than remaining edges of wall portions 76. In this example, the top edge of the wall portion 74 is approximately at the same level as the lowermost edge of the pipe 68. The wall portion 74 is positioned such that a level of the edge of the wall portion 74 coincides with a top water level (TWL) of the OSD so that by-pass only occurs when an OSD maximum containment level is exceeded. This TWL is set by the edge of the wall 74 and can be varied to suit requirements. In this way, when a level of polluted water increases above the inlet portion 63, further polluted water is accumulated within the shroud 70 to a predetermined level

that is defined by the edge of the wall portion 74. Beyond this predetermined level, further polluted water can exit the apparatus 60 by flowing over the edge of the wall portion 74 thereby bypassing the filter screens 64. In OSD, polluted water typically only bypasses the filter screens 64 in exceptional situations. By adjusting the height of the wall portion 74, a volume of the polluted water that is filtered through the filter screens 64 can be controlled. Furthermore, by providing the shroud 70, the level of polluted water can increase within the housing 62 with a reduced likelihood for mobilizing the contaminants within the housing.

A person skilled in the art will appreciate that other arrangements of the container portion are envisaged. For example, the container portion may be located spaced relative to the housing 62. Further, the pipe 68 may be positioned at different locations. For example, the pipe 68 may be positioned at a base portion or bottom portion of the OSD. The filter screens 64 may then be positioned at any suitable orientation (vertical or horizontal) to satisfy design and performance requirements.

Referring now to Figure 7 of the accompanying drawings, there is shown a schematic three-dimensional view of an apparatus 70 in accordance with an embodiment of the present invention. The apparatus 70 is related to the apparatus 10 of Figure 1 and may be fitted into any stormwater pit.

The apparatus 70 comprises an inner housing 12 and a plurality of filter screens 14. The inner housing 12 is positioned in an outer housing 16 and is removable from

the outer housing 16. A bypass 18 in the form of a tube is positioned in the inner housing 12.

Water enters the inner housing 12 through inlet portion 20 (which has an inlet grate that is not shown in Figure 7) and is subsequently filtered by filter screens 14. Filtered water enters into a receptacle element, which is provided in the form of compartment 72. During use filtered water fills the compartment 72 and overflows from the compartment 72 into the outer housing 16. Heavier contaminant particles are captured by the screens 14 and accumulate within a contaminant portion 74. When the compartment 72 is filled with polluted water, filter screens 14 are entirely submerged in water so that the differential pressure between the internal surfaces of screens 14 and the external surfaces of screens 14 is minimised. A low differential pressure allows the filter screens to perform at a higher efficiency.

Polluted water that overflows the compartment 72 enters the outer housing 16 in which it is directed to an outlet 22. In this way, contaminants in the polluted water such as gross pollutants and sediments can be removed from the polluted water and accumulate in contaminant chamber 74.

Referring now to Figure 8, there is shown a side cross-sectional view of the apparatus 70. A rim of the compartment 72 forms openings 76 and 78 with a flanged portion of the top inlet to allow water contained inside the compartment 72 to overflow into the outer housing 16. The size of openings 76 and 78 is adjustable to adjust the flow and weir of polluted water overflowing. Further, the openings 76 and 78 may be positioned at different heights.

Figure 8 also shows a secondary inlet 82 of the apparatus 70, which is not shown in Figure 7. The secondary inlet 82 is positioned at a bottom level of the outer housing 16 and allows connecting the apparatus 70 to a polluted water network. Water that is inflowing through the inlet 82 is not filtered by apparatus 70 and can exit the apparatus 70 through outlet 22. This arrangement also allows multiple units to be connected in series in a drainage line or network.

The cross sectional representation shown in Figure 8 shows an internal second filter 84, which filters the polluted water before the polluted water exits to the outer housing 16. The filter 84 has a filtering function that is different to that of the filter screens 14. Importantly, the filter 84 is positioned around a portion of the bypass 18 and in use may be completely submerged by polluted water. The central position of filter 84 around the bypass 14 allows it to work efficiently and in good synergy with filter screens 14. During operation both filters are at least partially submerged and the flow path of polluted water circulating into compartment 72 is maximized allowing the filters to operate at high efficiencies.

Referring now to Figure 9, there is shown a perspective view of the bypass 18 of the apparatus 70 with the above mounted second filter 84. In this embodiment, the second filter 84 captures particles contained in the polluted water, in particular hydrocarbon particles. The second filter 84 is disposed around a section of bypass 18, which fits into a central hollow portion of the filter 84. To maximize the surface of contact with the polluted water, the second filter 84 has a plurality of radially

projecting vanes.

The configuration of the filters in the apparatus 70 provides a central position for the second filter 84, improves filtering efficiency and allows easy replacement and maintenance of the filters. For example, mounting bracket 92 can be removed and the second filter 84 can be replaced before remounting the second filter with the bypass 18 in the inner housing 12. As an alternative, the bypass 18 can be withdrawn, which facilitates cleaning or replacing of the filter 84.

Referring now to Figure 10, there is shown a side cross-sectional view of an apparatus 100 in accordance with another embodiment of the present invention. The apparatus 100 is configured in a manner that is similar to that of the apparatus 70. However, apparatus 100 has multiple inlet portions disposed at the top of the apparatus 100. The first polluted water inlet 20 is covered by an inlet grate 102. The inlet grate 102 is generally arranged for collection of storm water, for example, along a road gutter or pavement surface.

The apparatus 100 also comprises two additional inlets 104 and 106 which are used to connect the apparatus 100 to other water sources. For example, the inlets 104 and 106 could be connected to another stormwater pit without filtering capabilities. Polluted water incoming through the inlets 104 and 106 is filtered in the same way as polluted water entering the apparatus 100 through grate 102. However, in the case of water incoming from the inlets 104 or 106 at high pressure or velocity, there is a chance of water entering the bypass 18 directly without

flowing through the filters 14 and 84. To avoid this, the apparatus 100 also comprises a bypass cap above the top opening of the bypass for preventing polluted water received from the inlets 104 or 106 from entering the bypass 18 directly. The bypass cap is provided as lid 108. Water incoming at high pressure from the inlets 104 and 106 is prevented from entering bypass 18 by a skirt of the lid 108 and flows into the main body of water in the inner housing 12. Polluted water can only enter the bypass 18 through gap 109. The lid 108 can be set into place using a webbed portion connected to the bypass (not shown in Figure 10). A further function of the lid 108 is to prevent buoyant materials from entering into the bypass 18.

Referring now to Figure 11, there is shown a detail of a top portion 110 of an apparatus in accordance with an embodiment of the present invention. In the embodiment of Figure 11, the top inlet of the apparatus is covered by an inlet grate 112 and the bypass 18 is arranged such that the top entrance of the bypass 18 is disposed between the top and the bottom of the inlet grate 112. This drastically reduces the amount of buoyant material that can enter the bypass 18. Further, as will be described below, design feature of the grate 112 allow for the reduction of the influx of any buoyant material 113, floating on top of the body of water contained in the apparatus, into the bypass 18.

In the embodiment of Figure 11, the grate 112 comprises a plurality of blades 114 extending from the top to the bottom of the grate. During use, for example when the apparatus is disposed in a road gutter, the grate 112 is

positioned leveled with the road. When a heavy flow of water moves along the road gutter, a portion of the water may flow with a high velocity above the top of grate 112. This may create a differential pressure between the region below the bottom of the inlet grate 112, inside the apparatus, and the region on top of the inlet grate 112, where the water is flowing. This differential pressure could create a suction effect and promote movement of buoyant material from the inside of the apparatus to the outside through the grate 112. However, the blades 114 of the grate 112 are arranged to reduce this Venturi effect. In particular, the blades 114 are spaced at least 2 cm from each other to minimize suction. Further, the blades 114 are tilted by an angle of 15° about a horizontal axis. The angled blades 114 allow creating water currents inside the apparatus and which push buoyant material 113 away from the bypass 18. The angled blades 114 also improve the safety of grate 112 and the entire apparatus. The angled blades 114 in fact reduce potentially harmful interference of the inlet grate 112 with pedestrian or bicycle traffic by not allowing, for example, heels of a shoe or a bicycle wheel to be captured by the blades of the inlet grate.

Further, the inlet grate 112 comprises in the example a removable central section 116, which can be used to inspect and possibly service the apparatus.

Referring now to Figure 12, there are shown two possible implementations 120 and 125 that relate to the grate 112. The Grates 120 and 125 have respective removable central sections 122 and 126. The grate 120 is suitable for covering an apparatus with a square shape and the grate 125 is suitable for covering an apparatus circular shape.

The circular grate 125 provides further protection for bicycle riders.

Referring now to Figure 13, there is illustrated a method 130 of filtering polluted water using an apparatus such as the apparatus 10 shown in Figures 1 to 3, the apparatus 40 shown in Figures 4 to 6, the apparatus 70 shown in Figures 7 to 9 or the apparatus 100 shown in Figure 10. The method 130 comprises the initial step 132 of directing polluted water into the housing 12; 42 of the apparatus 10; 40. Step 134 filters the polluted water such that filtered polluted water exits the housing 12; 42 through a filter element 14; 44. Step 136 allows an increase of a level of the polluted water within the housing 12; 42 to a predetermined level beyond which the polluted water flows into the bypass 18; 48 such that then at least a portion of the bypass 18; 48 is at least partially surrounded by the polluted water in the housing 12; 42 at the predetermined level. Step 138 bypasses the filter element 14; 44 if blockage of the filter element 14; 44 results in insufficient throughput.

Although the invention has been described with reference to particular examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms. For example, the filter elements may not necessarily form wall portions of the inner housing but may be positioned at another suitable location (for example coupled to a suitable tubing system that directs polluted water out of the inner housing). Further, the filter elements may be provided in any suitable form and the apparatus may comprise any number of filter elements. In further variations the apparatus may also be provided

in the form of an in-line device that, for example, may be arranged for connection to a storm water pipe and may or may not be arranged for positioned in ground.

In addition, it will be appreciated by a person skilled in the art that the apparatus for filtering polluted water may, in a variation of the embodiment illustrated with reference to Figures 1 to 5, not necessarily comprise a bypass positioned at a central location and within the inner housing. For example, on opening of the bypass (the opening may be entirely open) may surround the inner housing such that, when the polluted water has reached the predetermined level, a substantially even flow of polluted water into the bypass opening positioned around the polluted water results.

The claims defining the invention are as follows:

1. An apparatus for filtering polluted water, the apparatus comprising:

a housing having an inlet for receiving the polluted water;

a filter element for filtering the polluted water, the filter element being positioned such that in use polluted water is filtered by the filter element before exiting the housing; and

a bypass for throughput of the polluted water arranged in a manner to enable polluted water to bypass the filter element;

wherein the apparatus is arranged such that, when a level of the polluted water increases within the housing, the bypass is at least partially surrounded by the polluted water and, beyond a predetermined level of polluted water, polluted water flows into an opening of the bypass from directions around at least a portion of the opening of the bypass.

2. The apparatus of claim 1 wherein the opening of the bypass is in use substantially horizontally oriented.

3. An apparatus for filtering polluted water, the apparatus comprising:

a housing having an inlet portion comprising an inlet grate for receiving the polluted water;

a filter element for filtering the polluted water; and

a bypass for throughput of the polluted water arranged in a manner to enable polluted water to bypass the filter element;

wherein the inlet grate is arranged such that polluted water with buoyant material flows into the housing; and

wherein the bypass and the inlet grate are positioned relative to each other such that, when a level of the polluted water increases beyond a predetermined level, polluted water flows into the bypass, but at least a portion of the buoyant material is trapped in the housing.

4. The apparatus of claim 3 wherein the apparatus is arranged such that, when a level of the polluted water increases within the housing, the bypass is at least partially surrounded by the polluted water and, beyond a predetermined level of polluted water, polluted water flows into the bypass.

5. The apparatus of claim 3 or 4 wherein the bypass inlet is positioned at a distance of 0.5 to 5cm below a portion of the inlet grate that is positioned directly above the level of the bypass inlet.

6. The apparatus of any one of claims 3 to 5 wherein the inlet grate comprises a plurality of grate elements that are positioned relative to each other such that in use a downward force resulting from inflowing polluted water is larger than an upward force resulting from polluted water that in use may flow over spaces between adjacent grate elements.

7. The apparatus of claim 6 wherein the grate elements are provided in the form of blades that are angled relative to each other and about an axis that in use is substantially horizontal.

8. The apparatus of any one of the preceding claims wherein the bypass is positioned such that, when the polluted water is at the predetermined level in the housing, a flow of additional polluted water results in polluted water being directed into the bypass largely without generating turbulences for at least the majority of the polluted water below the predetermined level.

9. The apparatus of any one of the preceding claims wherein the apparatus is arranged such that, when the polluted water has reached the predetermined level in the housing, a flow of additional polluted water is substantially evenly distributed around at least a portion of the bypass.

10. The apparatus of any one of the preceding claims wherein the bypass is positioned at a central location within the housing and is entirely surrounded by the polluted water when the polluted water is at the predetermined level within the housing.

11. The apparatus of any one of the preceding claims wherein the bypass comprises a tube.

12. The apparatus of any one of the preceding claims wherein the apparatus is arranged such that the predetermined level is adjustable whereby a volume of polluted water that is filtered for a given inflow of polluted water is adjustable.

13. The apparatus of any one of the preceding claims wherein the apparatus further comprises a receptacle element arranged to receive polluted water and disposed in

a manner such that in use at least a portion of both the first and second sides are submerged in the polluted water.

14. The apparatus of claim 13 wherein the filter element is in use entirely submerged in polluted water retained in the receptacle element.

15. The apparatus of claim 13 or 14 wherein the receptacle element comprises a bottom portion for collecting contaminants filtered by the filter element.

16. The apparatus of any one of claims 13 to 15 wherein the receptacle element is arranged in a manner such that in use polluted water contained inside the receptacle element overflows a portion of the receptacle element after being filtered by the filter element.

17. The apparatus of claim 16 wherein that portion is arranged such that polluted water flows from the receptacle element through an opening.

18. The apparatus of claim 17 wherein the size of the opening is adjustable to adjust a flow of the polluted water.

19. The apparatus of any one of the preceding claims wherein the apparatus further comprises a second filter element for filtering the polluted water, the second filter element being positioned such that in use polluted water is filtered by the second filter element before exiting the housing.

20. The apparatus of claim 19 wherein the second filter element comprises a particle capturing filter arranged to capture particles contained in the polluted water.

21. The apparatus of claim 19 or 20 wherein the second filter element is arranged to capture hydrocarbon particles.

22. The apparatus of any one of claims 19 to 21 wherein the second filter element is disposed around at least a portion of the bypass.

23. The apparatus of claim 22 wherein the second filter element entirely surrounds a portion of the bypass.

24. The apparatus of any one of claims 19 to 23 wherein the second filter element has a central hollow portion arranged to fit around the bypass.

25. The apparatus of any one of claims 19 to 24 wherein the second filter element further comprises a plurality of radially projecting vanes arranged to increase a filtering surface of the second filter element.

26. The apparatus of any one of the preceding claims wherein the apparatus further comprises a bypass cap disposed about an opening of the bypass in a manner such that in use polluted water received from the inlet is prevented from entering the bypass directly.

27. The apparatus of claim 26 wherein the bypass cap is disposed above the opening of the bypass in a manner such that polluted water received from the inlet enters the

bypass only after having entered a body of polluted water surrounding the bypass in the housing.

28. An apparatus for filtering polluted water, the apparatus comprising:

a housing having an inlet for receiving the polluted water;

a filter element for filtering the polluted water, the filter element being positioned such that in use polluted water is filtered by the filter element before exiting the housing; and

a container portion for containing polluted water;

wherein the apparatus is arranged such that, when a level of the polluted water increases to an upper edge of the housing, polluted water received beyond the upper edge of the housing is accumulated within the container portion of the apparatus; and

wherein the container portion has vertical wall portions and at least one of the wall portions has an edge that is lower than that of an adjacent wall portion such that the polluted water received beyond a predetermined level within the container portion can flow over the edge of the at least one wall portion thereby bypassing the at least one filter element.

29. The apparatus of claim 28 wherein a height of the edge is adjustable such that a volume of the polluted water that is filtered can be controlled.

30. A method of filtering polluted water, the method comprising the steps of:

directing polluted water into a housing having a filter element for filtering the polluted water;

filtering the polluted water through the filter element; and

bypassing the filter element through a bypass if a level of the polluted water increases beyond a predetermined level;

wherein the method is conducted such that when the level of the polluted water within the housing increases, the bypass is at least partially surrounded by the polluted water.

31. The method of claim 30 wherein the method is conducted in a manner such that during the step of filtering the polluted water the filter element is at least partially submerged in the polluted water.

32. The method of claim 31 wherein the filter element is entirely submerged in the polluted water.

33. The method of any one of claims 31 to 32 wherein the method is conducted such that, when the polluted water has reached the predetermined level in the housing, a flow of additional polluted water is substantially evenly distributed around at least a portion of the bypass.

34. The method of any one of claims 31 to 32 wherein the method is conducted such that, when the polluted water has reached the predetermined level in the housing, polluted water is distributed around at least a portion of the second filter element.

35. The method of any one of claims claim 31 to 34 wherein the step of bypassing the filter element comprises directing polluted water into the bypass at a level that

is in the proximity of, or substantially at, a level at which the polluted water is directed into the housing.

36. The method of any one of claims 31 to 35 comprising controlling or adjusting the predetermined level whereby a rate or volume of polluted water that is filtered for a given inflow of polluted water can be controlled or adjusted.

37. An apparatus for filtering polluted water, the apparatus comprising:

a housing having an inlet for receiving the polluted water;

a filter element for filtering the polluted water, the filter element being positioned such that in use polluted water is filtered by the filter element before exiting the housing; and

a bypass for throughput of the polluted water arranged in a manner to enable polluted water to bypass the filter element;

wherein the apparatus is arranged such that, when a level of the polluted water increases within the housing, an opening of the bypass at least partially surrounds the polluted water and, beyond a predetermined level of polluted water, polluted water flows into the bypass from directions around at least a portion of the polluted water.

38. The apparatus of claim 37 wherein the opening is entirely open to allow unobstructed inflow into the bypass.

39. The apparatus of claim 37 or 38 wherein the apparatus is arranged such that in use the opening of the bypass surrounds the polluted water when the polluted water is at the predetermined level.

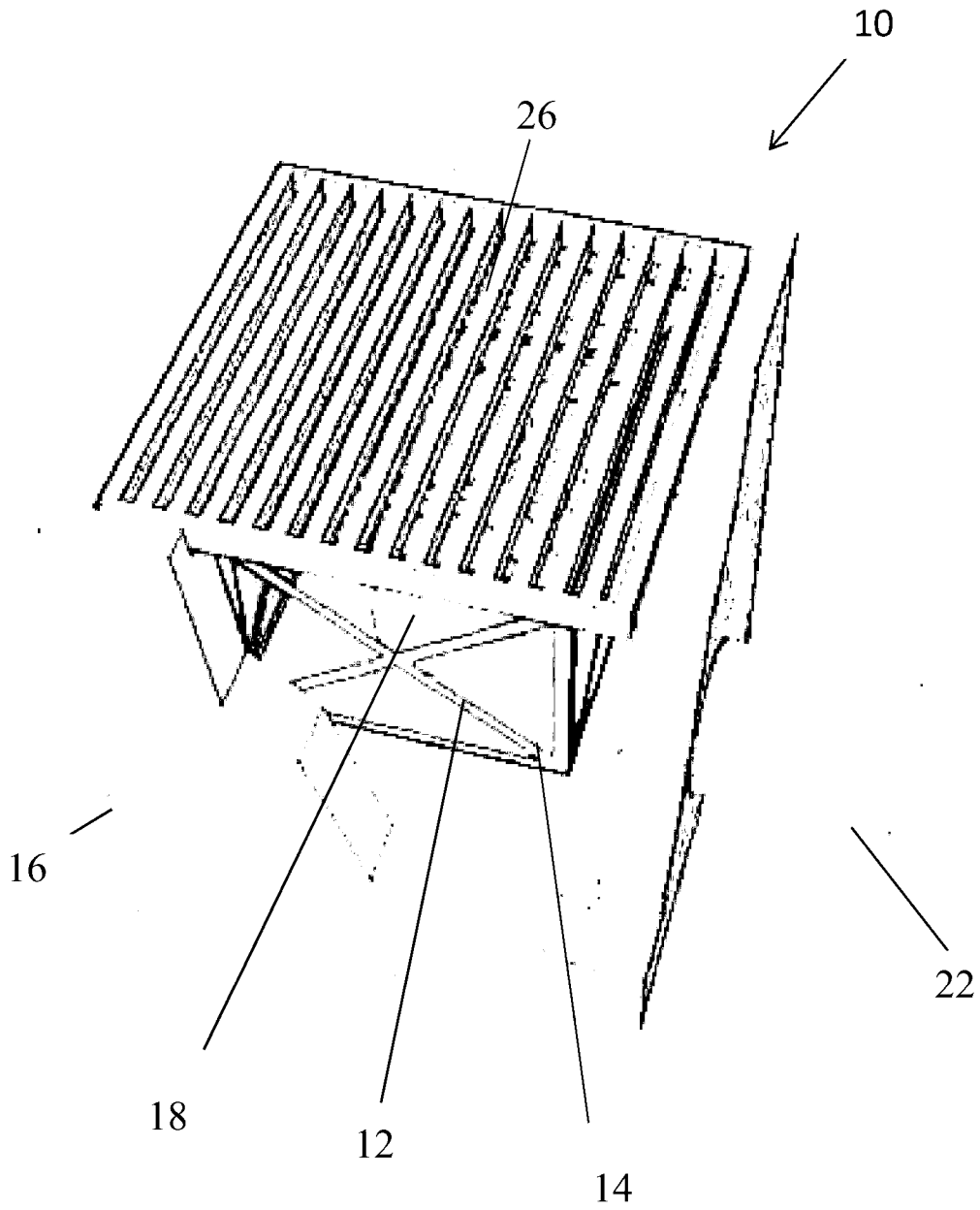

Figure 1

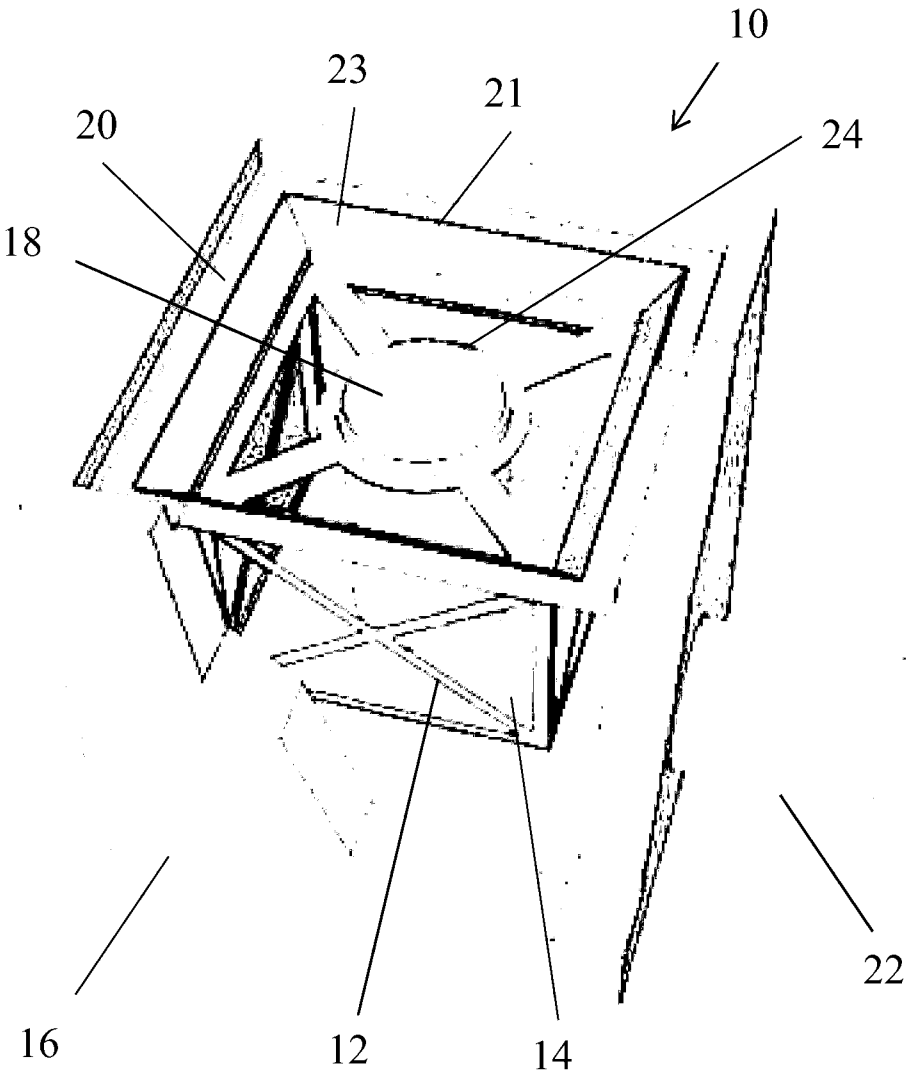

Figure 2

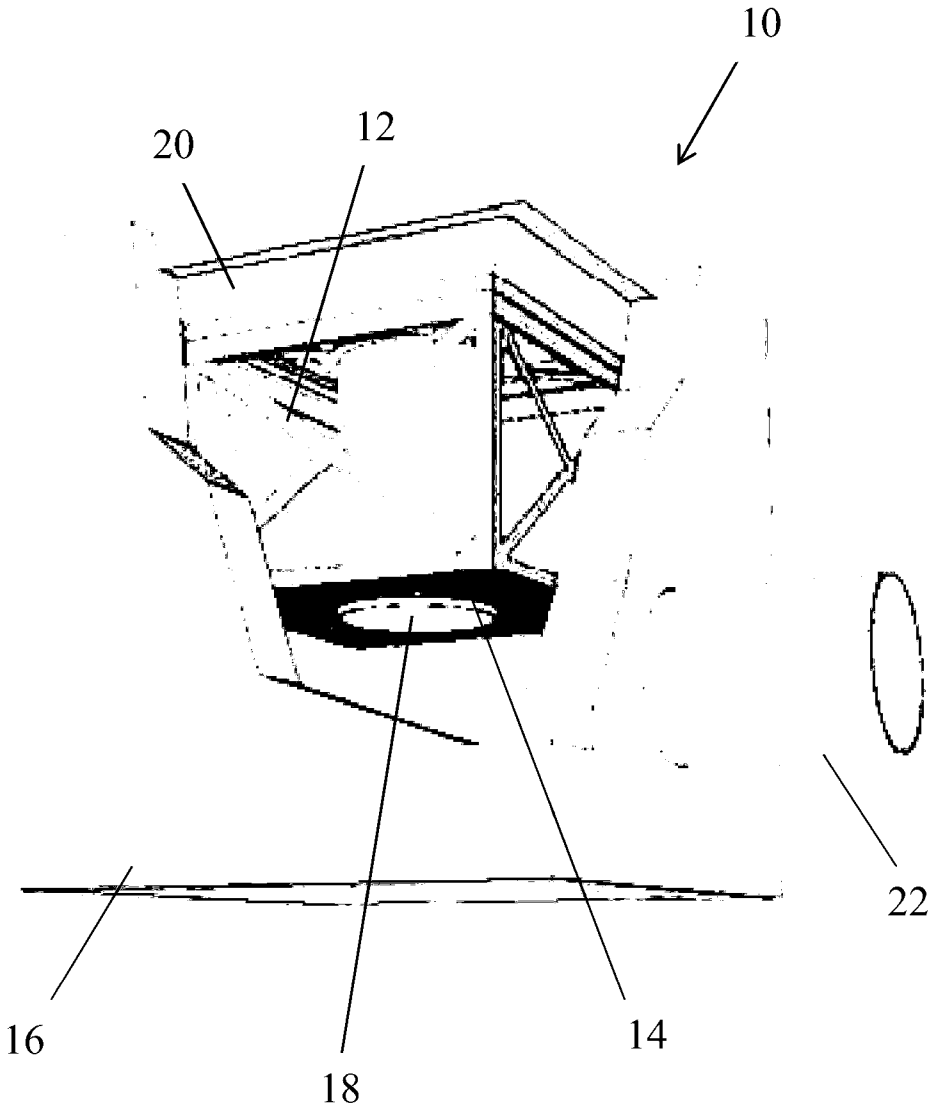

Figure 3

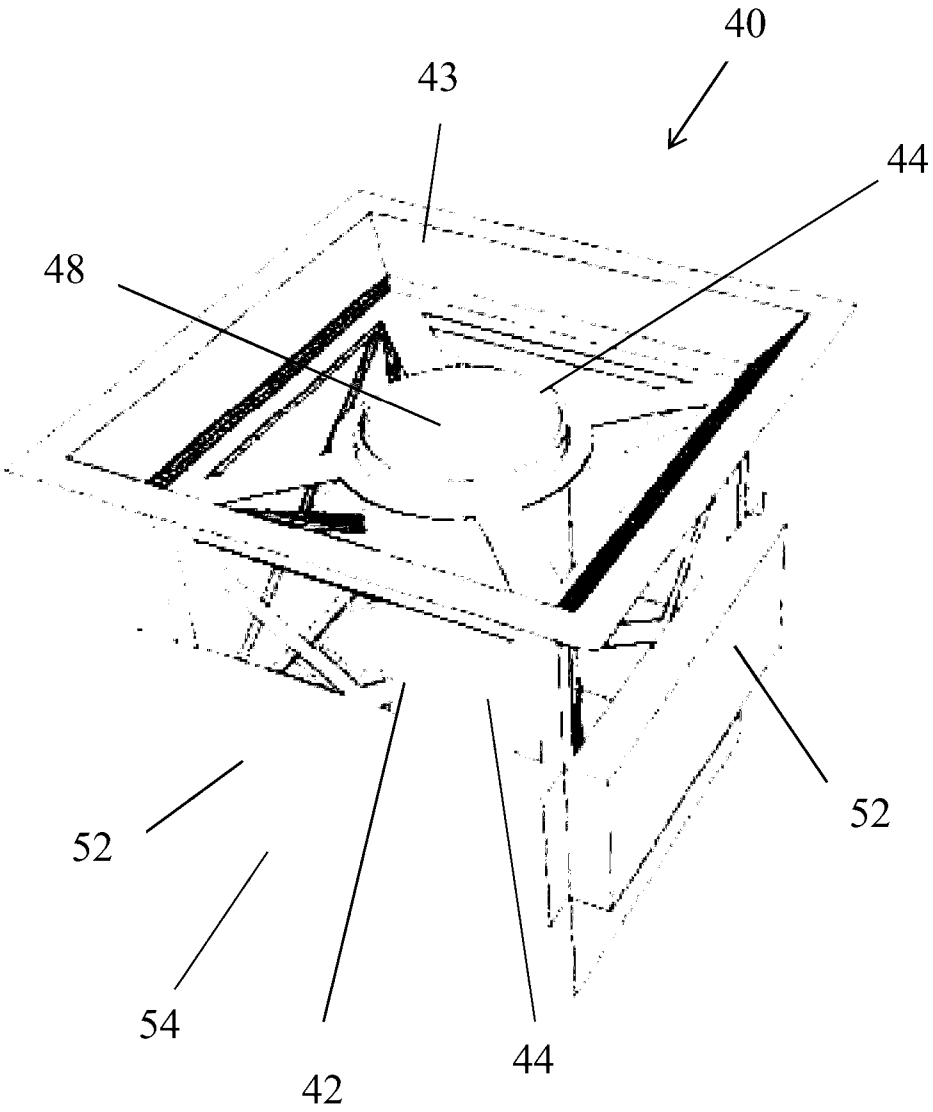

Figure 4

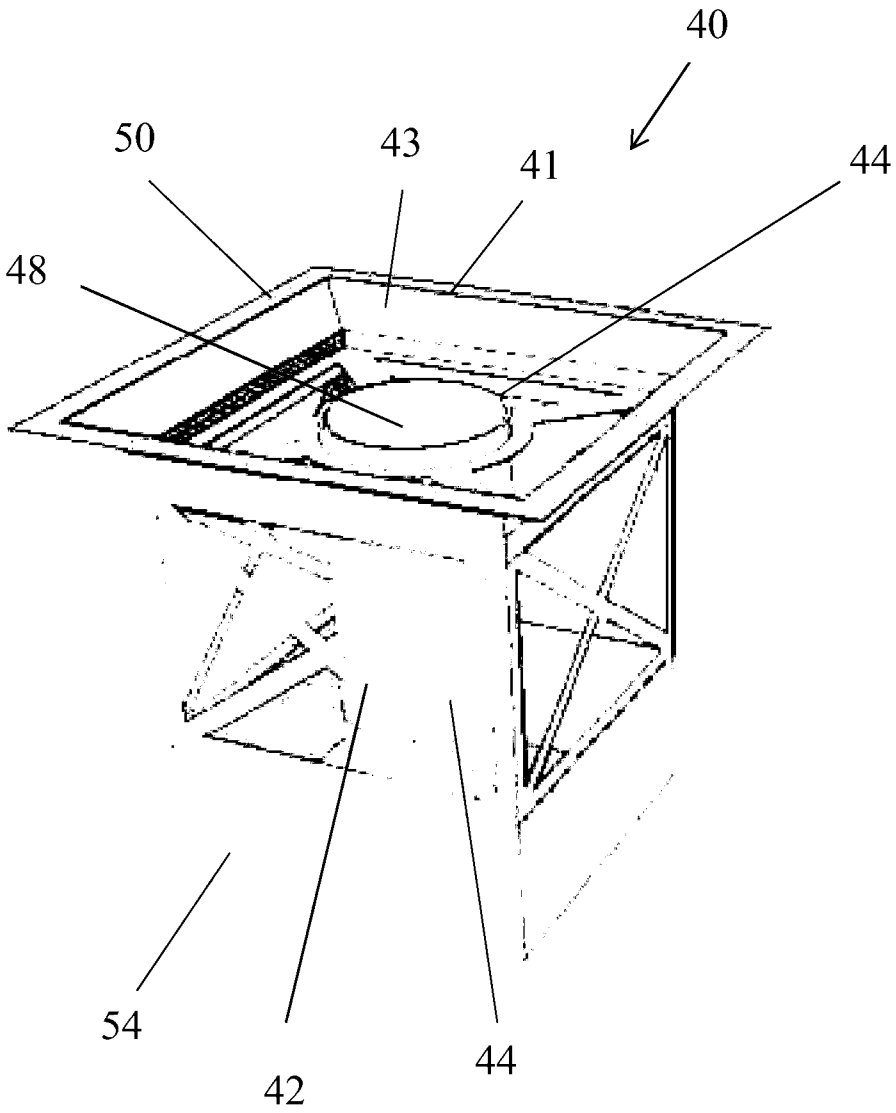

Figure 5

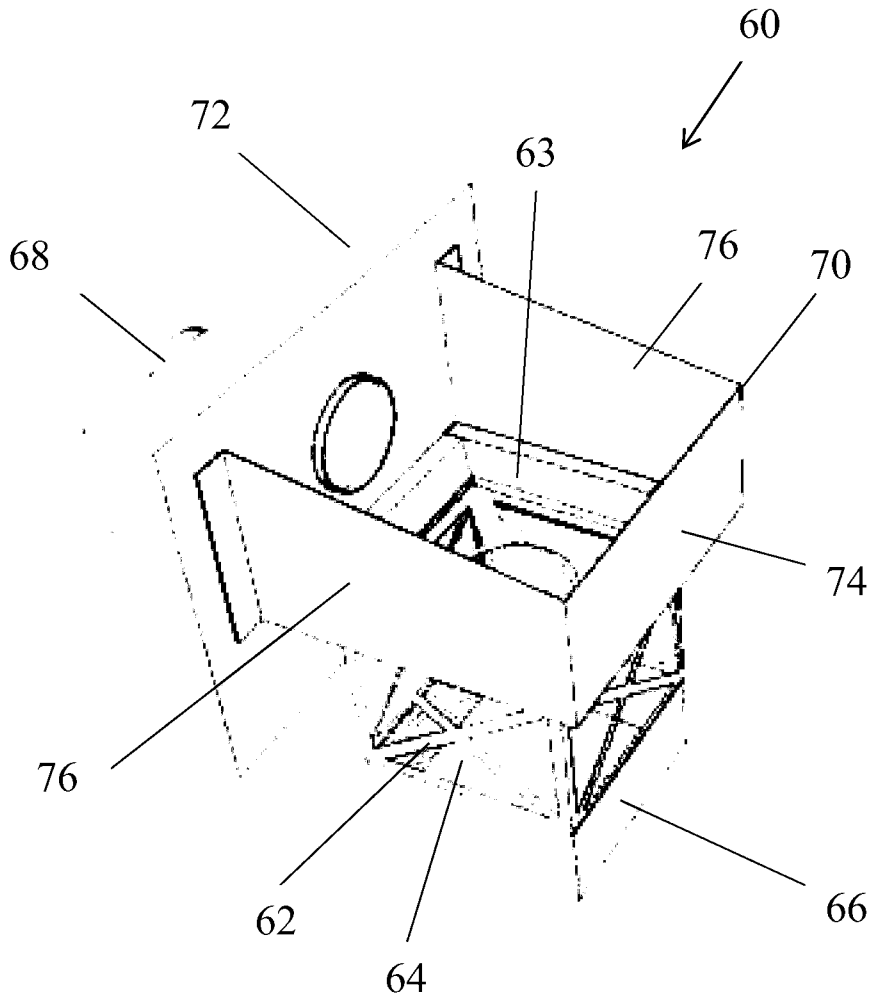

Figure 6

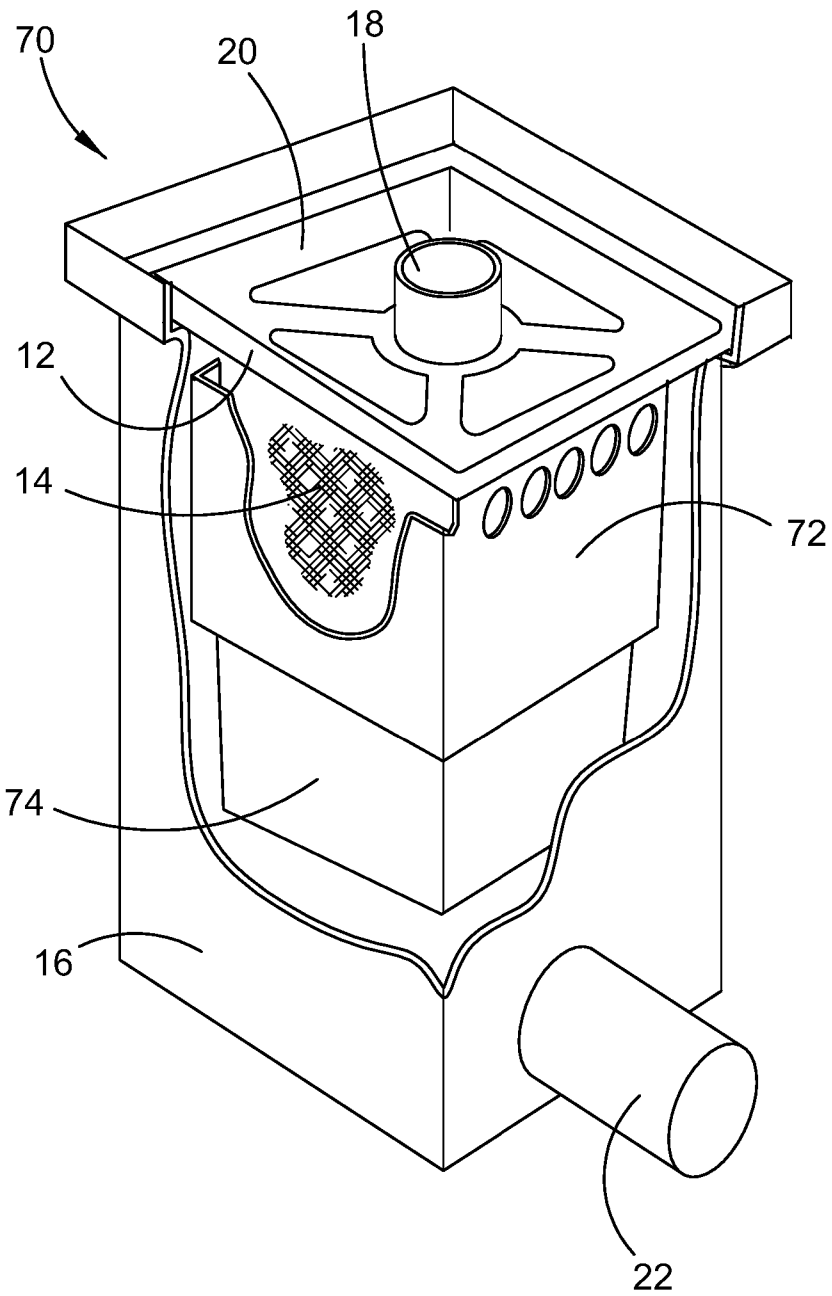

Figure 7

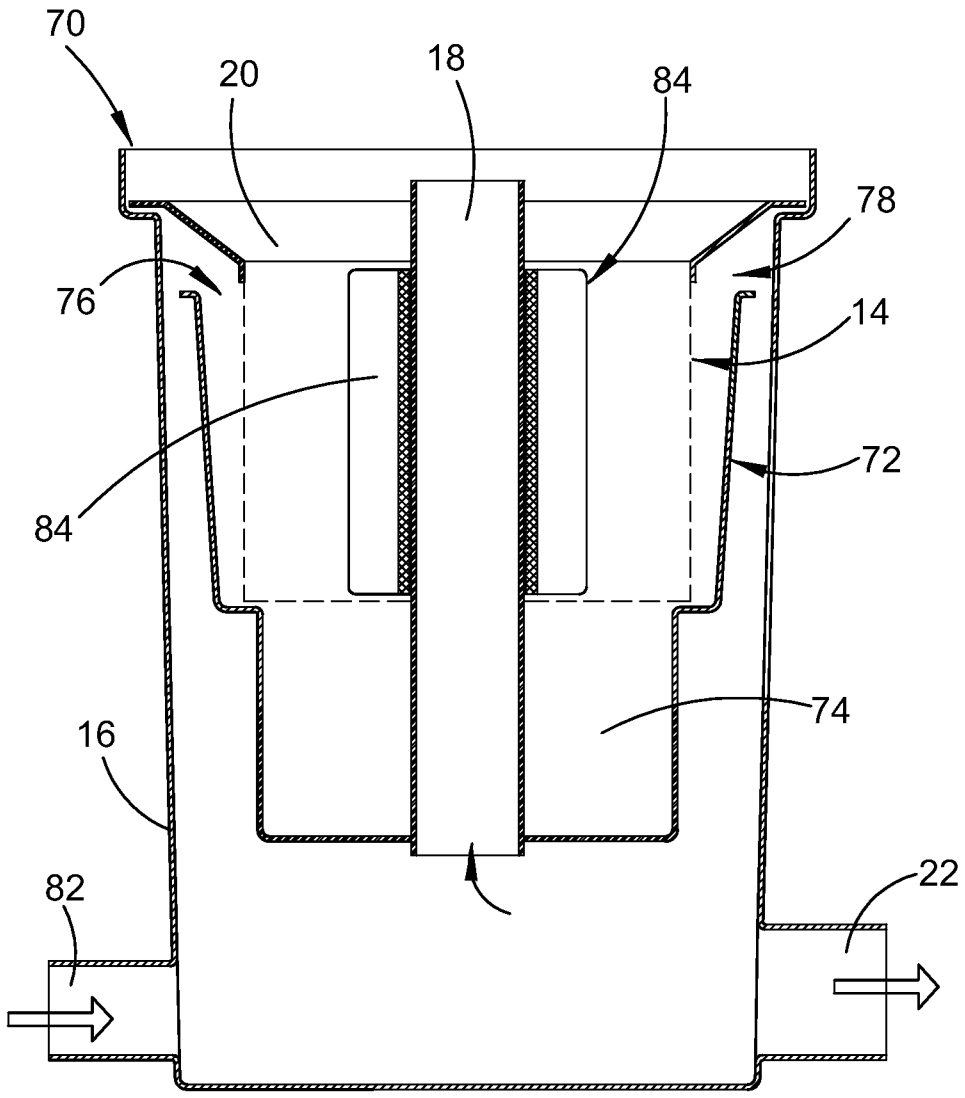

Figure 8

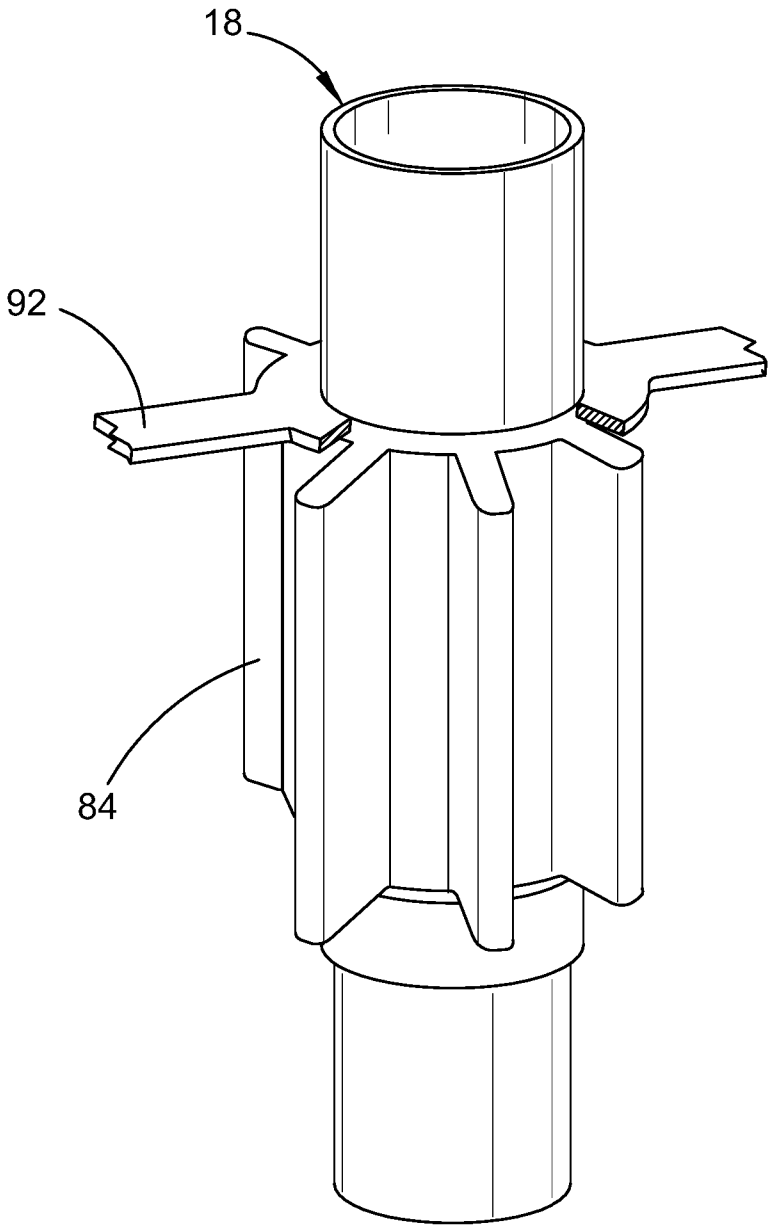

Figure 9

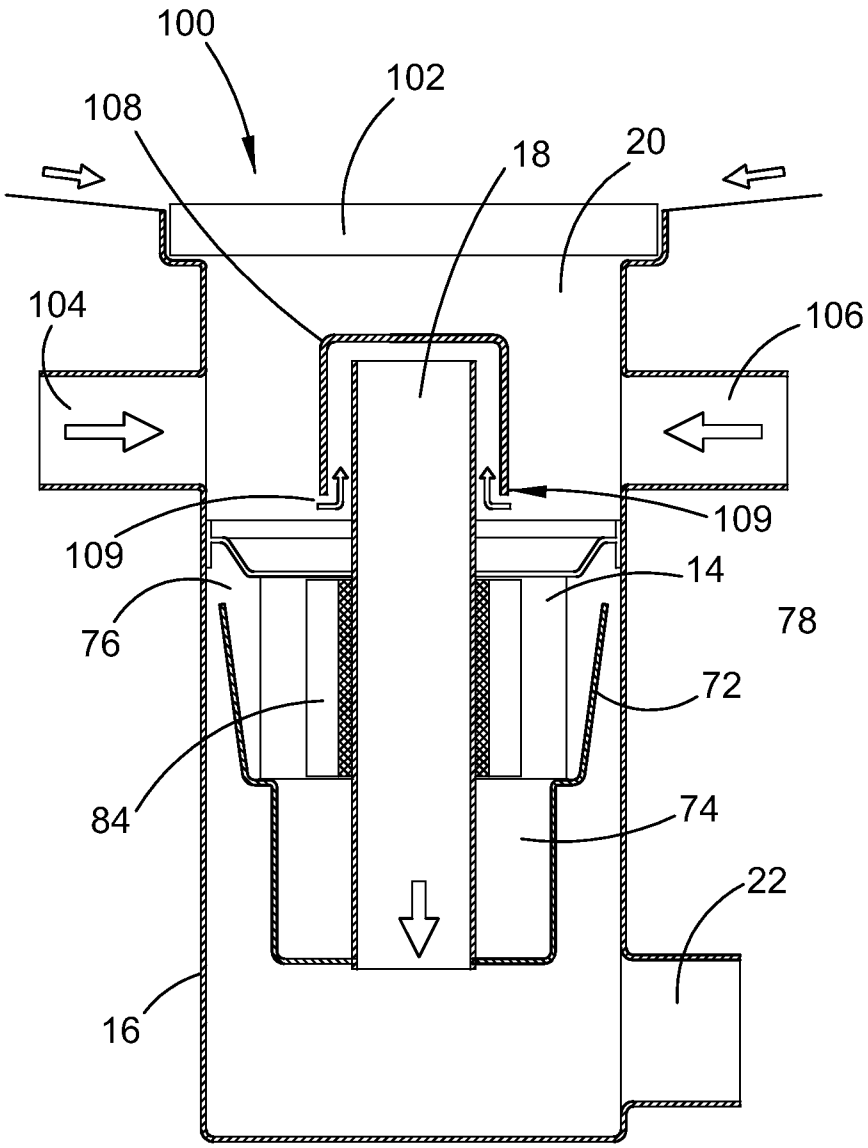

Figure 10

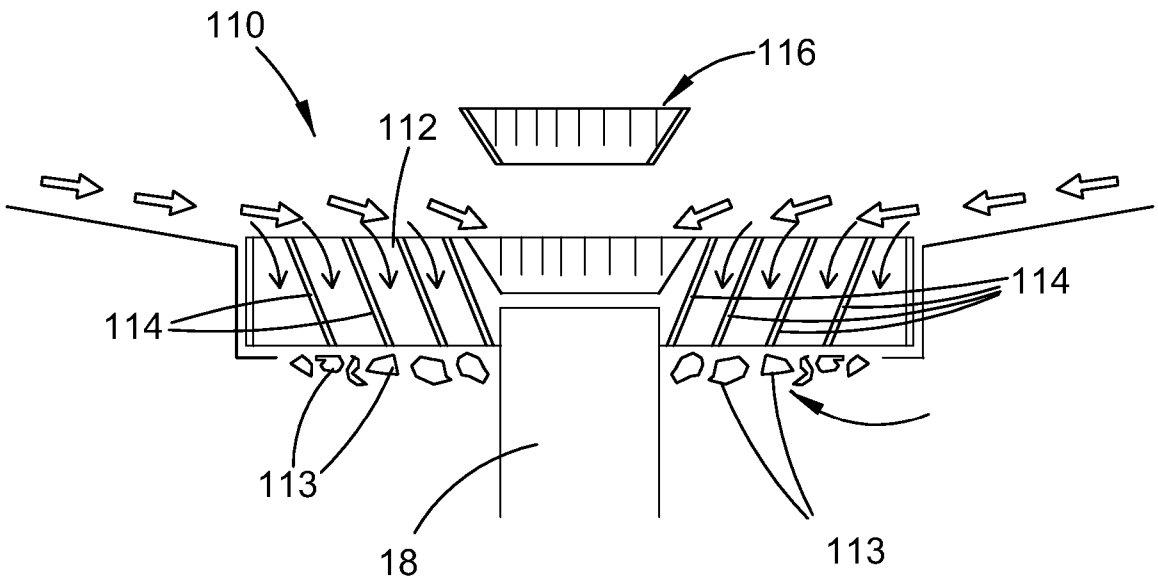

Figure 11

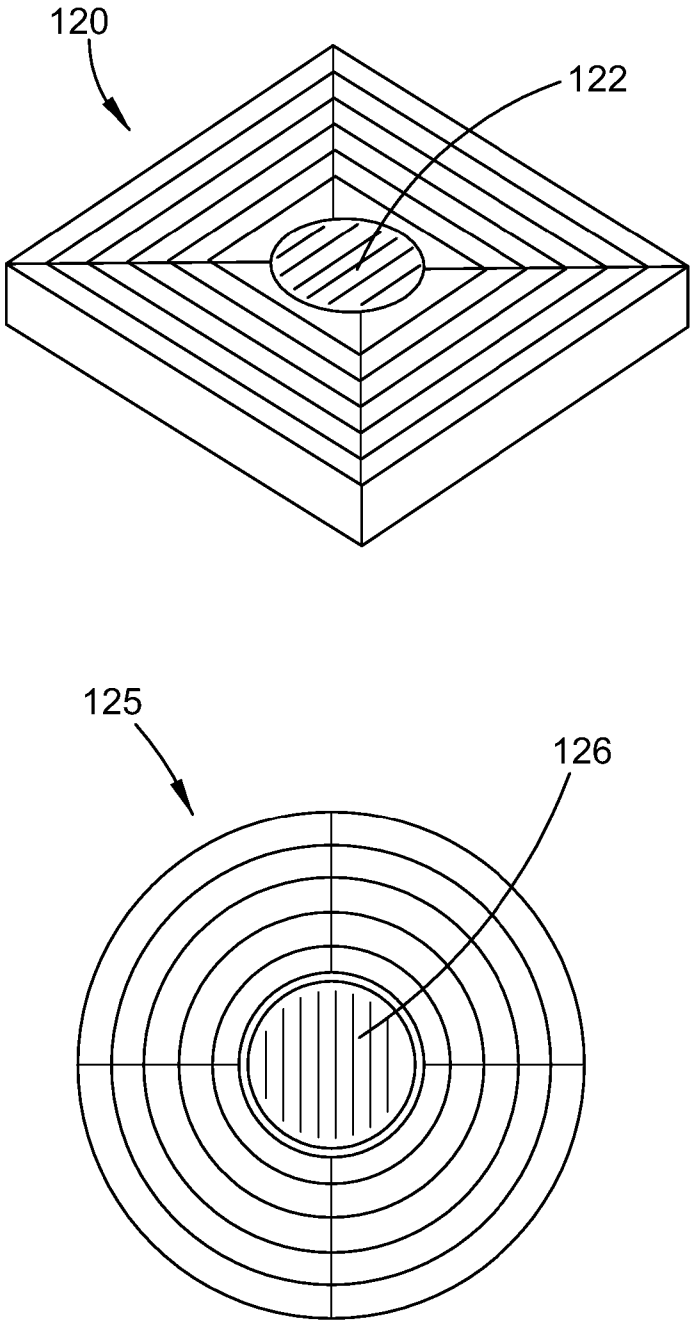

Figure 12

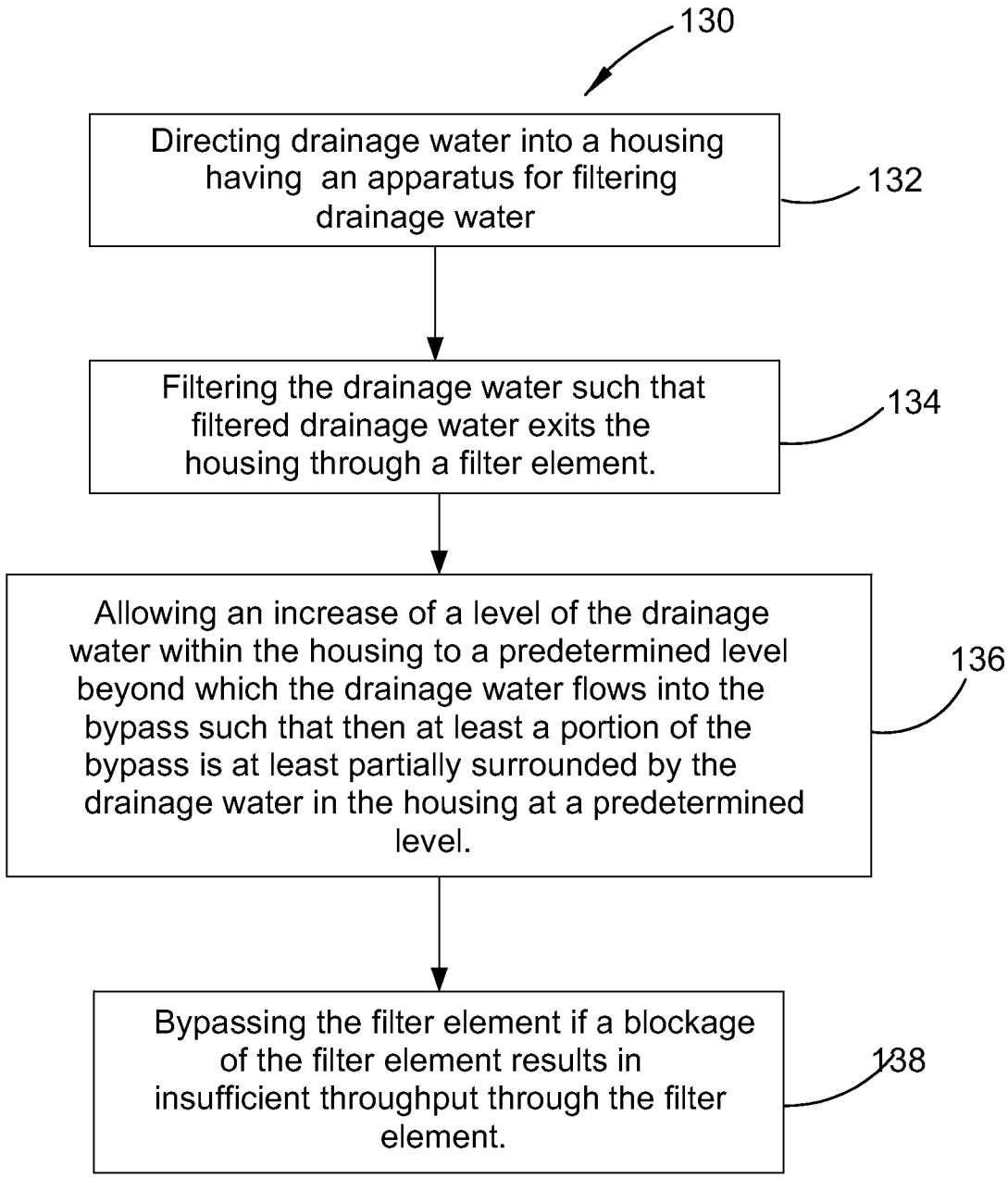
130
Directing drainage water into a housing having an apparatus for filtering drainage water
132
Filtering the drainage water such that filtered drainage water exits the housing through a filter element.
134
Allowing an increase of a level of the drainage water within the housing to a predetermined level beyond which the drainage water flows into the bypass such that then at least a portion of the bypass is at least partially surrounded by the drainage water in the housing at a predetermined level.
136
Bypassing the filter element if a blockage of the filter element results in insufficient throughput through the filter element.
138

Figure 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2015/000391

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Supplemental Box for Details

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2015/000391

A. CLASSIFICATION OF SUBJECT MATTER

E03F 5/06 (2006.01) E03F 5/04 (2006.01) E03F 5/042 (2006.01) B01D 35/147 (2006.01)

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)

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

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

EPODOC & WPI - IPC & CPC: E03F, E03F 5/0404, E03F5/042, E03F 5/14, B01D, B01D35/147 & Keywords (Filter, bypass, overflow, surge, excess, exess water, divert, drain, gulley); Google Patents - keywords: stormwater, filter, bypass, grate, debris, buoyant, and like terms; AUSPAT, IP Australia internal databases and ESPACE - keywords: Crasti, Leo and Aquavest.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 August 2015	31 August 2015
Name and mailing address of the ISA/AU	**Authorised officer**
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au	Rhys Munzel AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +612 6283 2621

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/AU2015/000391**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2013/028475 A1 (WDD ENGINEERING, LLC) 28 February 2013 See Figs. As above	1, 2, 8-11, 13-15, 19-25, 30-35 19-25 (when appended to claim 3)
X Y	US 2006/0207922 A1 (DUSSICH, I) 21 September 2006 See Figs. As above	1, 2, 8, 9, 11-13, 19, 26-31, 33, 36 12, 26, 27 (when appended to claim 3)
X Y	KR 10-2013-0021598 A1 (JUN-DONG KIM) 06 March 2013, English Abstract and translation downloaded from http://kposd.kipo.go.kr:8088/up/kpion/ See Figs. As above	1-6, 8-11, 30 12, 19-27 (when appended to claim 3)
X	WO 2008/104030 A1 (DROOMER) 04 September 2008 See Figs.	28
X	WO 1999/027204 A1 (UNIVERSITY OF SOUTH AUSTRALIA) 03 June 1999 See Figs.	28
X	US 2006/0016767 A1 (OLSON et al.) 26 January 2006 See Figs.	37-39
X	US 2008/0073277 A1 (PAOLUCCIO et al.) 27 March 2008 See Figs.	37, 39

INTERNATIONAL SEARCH REPORT	International application No. PCT/AU2015/000391

Supplemental Box

Continuation of: **Box III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1, 2 and 30-36 (and 8-27 when directed to invention 1) are directed to an apparatus for filtering water comprising a filter and an overflow bypass, the bypass having a particular opening configuration. The feature of water entering the overflow bypass from directions around at least a portion of the opening is specific to this group of claims.

- Claims 3-7 (and 8-27 when directed to invention 2) are are directed to an apparatus for filtering water comprising a grate, a filter and an overflow bypass. The feature of how the grate and the overflow bypass are cooperately configured to prevent a portion of buoyent material found in the water to flow into the bypass is specific to this group of claims.

- Claims 28 and 29 are directed to a method for filtering water comprising a filter and an overflow bypass formed by a container. The feature of a container portion arranged to accumulate water received beyond an upper edge of a filter housing and allowing the water to flow out of the container via a wall edge that is lower than an adjacent wall edge is specific to this group of claims.

- Claims 37-39 are directed to an apparatus for filtering water comprising a filter and an overflow bypass, the bypass having a particular opening configuration. The feature of water flowing into the bypass from directions around at least a portion of the water is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions and which provides a technical relationship among them is an apparatus for filtering water comprising a filter and an overflow bypass

However it is considered that this feature is generic in this particular art. Therefore in this light this common feature cannot be a special technical feature. Hence there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a priori* .

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/AU2015/000391**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		**Patent Family Member/s**	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
WO 2013/028475 A1	28 February 2013	WO 2013028475 A1	28 Feb 2013
		CN 103857856 A	11 Jun 2014
		EP 2744948 A1	25 Jun 2014
		US 2013206661 A1	15 Aug 2013
		US 9068337 B2	30 Jun 2015
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		WO 2006102340 A2	28 Sep 2006
KR 10-2013-0021598 A1	06 March 2013	None	
WO 2008/104030 A1	04 September 2008	WO 2008104030 A1	04 Sep 2008
WO 1999/027204 A1	03 June 1999	WO 9927204 A1	03 Jun 1999
		AU 733772 B2	24 May 2001
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		GB 2346818 A	23 Aug 2000
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		US 7799235 B2	21 Sep 2010
		KR 20070036032 A	02 Apr 2007
		US 2011062088 A1	17 Mar 2011
		US 2012298590 A1	29 Nov 2012
		WO 2006025962 A2	09 Mar 2006
US 2008/0073277 A1	27 March 2008	US 2008073277 A1	27 Mar 2008
		US 7479221 B2	20 Jan 2009
		US 2009095682 A1	16 Apr 2009
		US 7588689 B2	15 Sep 2009

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.