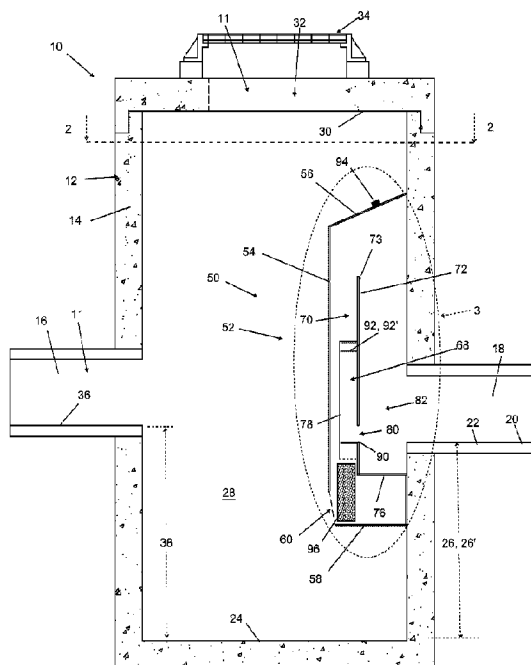




(86) Date de dépôt PCT/PCT Filing Date: 2019/01/22
(87) Date publication PCT/PCT Publication Date: 2019/08/01
(45) Date de délivrance/Issue Date: 2022/07/19
(85) Entrée phase nationale/National Entry: 2020/06/17
(86) N° demande PCT/PCT Application No.: US 2019/014446
(87) N° publication PCT/PCT Publication No.: 2019/147526
(30) Priorités/Priorities: 2018/01/23 (US62/620,643);
2018/08/22 (US62/720,997)

(51) Cl.Int./Int.Cl. *E03F 5/14* (2006.01),
B01D 17/02 (2006.01), *B01D 17/025* (2006.01),
B01D 17/028 (2006.01), *B01D 17/032* (2006.01),
B01D 17/038 (2006.01), *C02F 1/00* (2006.01),
C02F 1/40 (2006.01), *E03F 7/00* (2006.01)
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(54) Titre : ENSEMBLE ET SYSTEME DE RETENUE DE DRAINAGE D'EAUX PLUVIALES
(54) Title: STORM DRAINAGE DETENTION ASSEMBLY AND SYSTEM



(57) Abrégé/Abstract:

A water detention system for detaining storm water having a side wall and a bottom floor; an inlet conduit for ingress of storm water; and a water discharging assembly, which includes a siphon, configured to pass storm water there through; and an outlet conduit for egress of storm water from the water discharging assembly. The inlet and outlet conduits are disposed through the side wall of the water detention system. A water discharging assembly for discharging storm water from a water detention system includes an outer enclosure; a first opening in the outer enclosure for ingress of water; a second opening in the outer enclosure for egress of water; and a siphon disposed within the outer enclosure; where, except of the first opening and the second opening, the outer enclosure is substantially fluid tight.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property

Organization

International Bureau

(43) International Publication Date

01 August 2019 (01.08.2019)



(10) International Publication Number

WO 2019/147526 A1

(51) International Patent Classification:

B01D 17/02 (2006.01) B01D 17/032 (2006.01)

B01D 17/025 (2006.01) B01D 17/038 (2006.01)

B01D 17/028 (2006.01) C02F 1/40 (2006.01)

(21) International Application Number:

PCT/US2019/014446

(22) International Filing Date:

22 January 2019 (22.01.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/620,643 23 January 2018 (23.01.2018) US

62/720,997 22 August 2018 (22.08.2018) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,

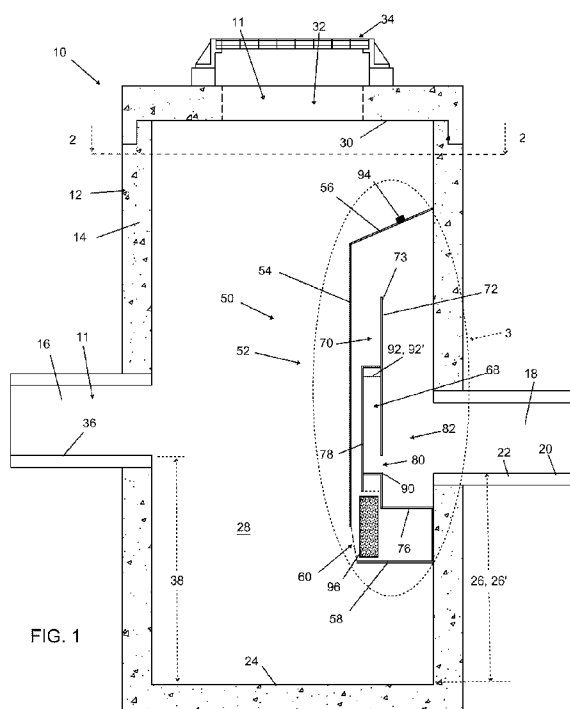
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: STORM DRAINAGE DETENTION ASSEMBLY AND SYSTEM



(57) Abstract: A water detention system for detaining storm water having a side wall and a bottom floor; an inlet conduit for ingress of storm water; and a water discharging assembly, which includes a siphon, configured to pass storm water there through; and an outlet conduit for egress of storm water from the water discharging assembly. The inlet and outlet conduits are disposed through the side wall of the water detention system. A water discharging assembly for discharging storm water from a water detention system includes an outer enclosure; a first opening in the outer enclosure for ingress of water; a second opening in the outer enclosure for egress of water; and a siphon disposed within the outer enclosure; where, except of the first opening and the second opening, the outer enclosure is substantially fluid tight.

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STORM DRAINAGE DETENTION ASSEMBLY AND SYSTEM

5

[0001]

FIELD OF THE INVENTION:

10 [0002] The device, assembly, or system of the present invention is useful to detain storm water, and remove floatables (free oil, trash) and solids prior to discharging downstream to a conveyance or subsequent treatment system. This device, assembly, or system of the present invention is an improvement over current controls since it utilizes the structure's storage to detain water thereby improving removal of floatables and solids. The
15 device may be installed in a standard catch-basin or drainage manhole, thereby utilizing existing drainage structures.

BACKGROUND OF THE INVENTION:

[0003] Existing systems for detaining storm water do not have devices for enhancing
20 water detention and removal of floatables and solids.

SUMMARY OF THE INVENTION:

[0004] The present invention provides devices, assemblies, and/or systems for enhancing water detention and removal of floatables and solids.

[0005] In one aspect or embodiment of the present invention, a water detention
25 system may comprise a side wall, a top ceiling, and a bottom floor, thereby configured to provide a holding area therein; a storm water entry for ingress of storm water into the holding area; a water discharging assembly configured to pass storm water there through, the water discharging assembly comprising a siphon; and an outlet conduit for egress of storm water from the water discharging assembly, the outlet conduit being disposed through the side wall.
30 The water detention structure may be a catch-basin or a drainage manhole. The storm water entry may be an inlet conduit disposed through the side wall, a top opening through the top

ceiling, and/or combinations thereof. During static (non-flowing storm water), a static holding area for storm water is disposed below the outlet conduit, above the bottom floor, and between portions of the side wall. During flow conditions for storm water, the siphon creates or acts as a temporary holding or storage area which is above the outlet conduit.

5 **[0006]** The water discharging assembly may further include an outer enclosure. The outer enclosure may have an opening for ingress of water from the holding area. The outer enclosure may also have an opening for egress of water into the outlet conduit. The water discharging assembly may be configured to substantially prevent water from bypassing the water discharging system and directly entering into the outlet conduit.

10 **[0007]** The outer enclosure may further include back portions. The back portions may be adjacently juxtaposed to portions of the side wall surrounding the outlet conduit. These back portions of the water discharging assembly may be sealed to portions of the side wall surrounding the outlet conduit. Alternatively or in addition to, the back portions may further include a pipe stub, where the pipe stub is configured to be disposed within the outlet
15 conduit. In such as case, the water discharging assembly may be self-contained such that it could be inserted into the outlet conduit without fastening it to the wall, typically concrete, of the water detention structure.

[0008] The siphon may be an automatically acting siphon, such as but not limited to, a bell siphon. The siphon may include at least one internal water-receiving conduit for
20 ingress of water, where the at least one internal water-receiving conduit has an open bottom portion for receiving water and a top portion. The siphon further may include at least one water-discharging conduit for egress of water, where the at least one water-discharging conduit has a top portion in fluid communication with the top portion of the at least one internal water receiving conduit for receiving water therefrom. The at least one water-
25 discharging conduit may further include a discharge opening to define a discharge area for the siphon. Top wall portion of the siphon is enclosingly disposed above the top portion of the at least one internal water-receiving conduit and the top portion of the at least one water-discharging conduit. The top wall of the siphon encloses the top portions of these conduits to prevent air from entering, which may adversely affect the performance of the siphon.

30 **[0009]** While the siphon may include one water-receiving or ingress conduit and one water-discharging or egress conduit, the present invention is not so limited. The siphon may

include multiple ingress conduits, such as at least two internal water-receiving conduits for ingress of water, and/or multiple egress conduits.

5 [0010] The siphon may further include a vertical wall opposed from a vertical wall of the water discharging assembly, thereby defining an internal space within the water discharging assembly. Water disposed within the internal space between the vertical wall of the siphon and the vertical wall of the water discharging assembly may be in fluid communication with the open bottom of the at least one internal water-receiving conduit of the siphon. The internal space between the vertical wall of the siphon and the vertical wall of the water discharging assembly may also be in fluid communication with the discharge area for the siphon. In addition, to the action of the siphon for removing water, an overflow may be provided. In such a case, the siphon may further include an internal wall having a top portion extending above the top wall portion disposed above the top portion of the at least one internal water-receiving conduit and the top portion of the at least one water-discharging conduit of the siphon to provide an overflow area for water to bypass the siphon.

15 [0011] In another aspect or embodiment of the present invention, a water discharging assembly for discharging storm water from a water detention system may include an outer enclosure; a first opening in the outer enclosure for ingress of water; a second opening in the outer enclosure for egress of water; and a siphon disposed within the outer enclosure. Except for the first opening and the second opening, the outer enclosure may be substantially fluid tight.

25 [0012] The siphon may further include at least one internal water-receiving conduit for ingress of water, the at least one internal water-receiving conduit having an open bottom portion for receiving water and a top portion. The siphon may also include at least one water-discharging conduit for egress of water, the at least one water-discharging conduit having a top portion in fluid communication with the top portion of the at least one internal water receiving conduit for receiving water therefrom, the at least one water-discharging conduit having a discharge opening to define a discharge area for the siphon. A top wall portion of the siphon is enclosingly disposed above the top portion of the at least one internal water-receiving conduit and the top portion of the at least one water-discharging conduit to provide an enclosed area, thereby preventing exposure to air which may adversely affect the performance of the siphon.

[0013] The siphon may further include a vertical wall opposed from a vertical wall of the water discharging assembly, thereby defining an internal space within the water discharging assembly. Water disposed within the internal space between the vertical wall of the siphon and the vertical wall of the outer enclosure of the water discharging assembly may be in fluid communication with the open bottom of the at least one internal water-receiving conduit of the siphon. The internal space between the vertical wall of the siphon and the vertical wall of the water discharging assembly may also be in fluid communication with the discharge area for the siphon.

[0014] These and other features and advantages of the present invention will become apparent from the following detailed description of illustrative embodiments thereof, which is to be read in connection with the accompanying drawings. Corresponding reference element numbers or characters indicate corresponding parts throughout the several views of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0015] Figure 1 is a side elevational view of a water detention system having a water discharging assembly for removal of floatables and solids from storm water according to the present invention.

[0016] Figure 2 is a top view of the water detention system of Figure 1 taken along the 2-2 axis with a top opening shown in phantom.

[0017] Figure 3 is an exploded side view of the water discharging assembly of Figure 1 taken within the dashed indication labeled 3 in Figure 1.

[0018] Figure 4 is an exploded cross-sectional view of the water discharging assembly of Figure 1.

[0019] Figure 5 is an exploded top view of the water discharging assembly of Figure 1 taken within the dashed indication labeled 3 in Figure 1.

[0020] Figure 6 is a partial side elevational view of the water discharging assembly of Figure 3 further showing a pipe stub useful for insertion into an outlet conduit of the water detention system.

DETAILED DESCRIPTION OF THE INVENTION:

[0021] Figure 1 is a side elevational view of a water detention system 10 having a water discharging assembly 50 for removal of floatables and solids, such as but not limited to

oils, trash, etc. from water, such as storm water, according to the present invention. The water detention system **10** may also be referred to as a catch-basin, drainage manhole and the like. The water detention system **10** includes a water detention structure **12** having ingress for storm water via an inlet conduit **16** and egress for treated storm water via an outlet conduit **18**. These conduits **16, 18** may be in the form of pipe connectors, such as but not limited to rubber connectors or boots that are connectable or engageable with storm water piping. Storm water may also enter the water detention structure **12** via a top opening **32** of the water detention structure **12**. The top opening **32** of the water detention structure **12** may further include an inlet grate **34** to prevent large floatables and/or solids from entering the water detention structure **12**. Thus, the water detention system **10** includes a storm water entry **11** that may be either or both the inlet conduit **16** and top opening **32**.

[0022] Water (not shown) typically enters the water detention structure **12** horizontally through the inlet conduit **16** and/or vertically from above through an inlet grate **34** of the top opening **32** into the holding area **28** of the water detention structure **12**. While the drawings depict inlet and outlet conduits **16, 18** as round conduits or pipes, the present invention is not so limited. The inlet and outlet conduits **16, 18** may have any suitable configuration or shape to allow water to pass through the water detention structure **12**. Further, while the inlet and outlet conduits **16, 18** are depicted as being horizontally disposed conduits, the present invention is not so limited. The inlet conduit **16** and/or the outlet conduit **18** may have sloped and/or stepped portions as long as their configurations do not substantially interfere with ingress and egress of water, including storm water.

[0023] The inlet conduit **16** and the outlet conduit **18** are typically mortared to the water detention structure **12** in the field. Thus, the inlet conduit **16** and the outlet conduit **18** are typically not integral members with the water detention structure **12**, but rather are part of the overall or pipe system (not shown) for storm water. Alternatively, the inlet conduit **16** and the outlet conduit **18** may be in the form of pipe connectors, such as rubber boots or other short length members, for connecting the pipe system to the water detention structure **12**.

[0024] The water detention structure **12** may include a side wall **14**, a bottom portion or inside floor **24** and a top portion or ceiling **30**, inter-related as shown in Figure 1. The inside floor **24** of the water detention structure **12** will be typically lower than the outlet elevation **22** of the outlet pipe **18** by a distance or amount **26**, thereby creating a sump **26'** of water up to the outlet elevation **22**. This depth **26** or sump **26'** of water is typically 2 to 4 feet

in standard inlet structures. Such a depth is non-limiting, and any suitable depth may be used. Furthermore, as depicted in Figure 1 the elevation **38** of bottom portion **36** of the inlet pipe **16** with respect to the inside floor **24** of the water detention structure **12** is typically greater than the outlet elevation **22** or the depth **26** of the sump **26'**.

5 **[0025]** Water exits the water detention structure **12** via the outlet pipe or conduit **18**. Before exiting the outlet pipe or conduit **18**, the water must pass or navigate through the water discharging assembly **50**. The water discharging assembly **50** has an outer enclosure **52** at the side wall **14** of the water detention structure **12** having the outlet pipe or conduit **18**. The outer enclosure **52** has an opening **60** to permit ingress of water of the water into the
10 discharging assembly **50** from the holding area **28**. This opening **60** may be screened to prevent debris from entering and creating blockages inside the water discharging assembly **50**. The water discharging assembly **50** further includes a discharge area **82** (or opening **82'** through the outer enclosure **52**, preferably through the below described back portion **62** of the outer enclosure **52** as depicted in Figure 3) for egress of water from the water discharging
15 assembly **50** into the outlet pipe or conduit **18**.

[0026] As depicted in Figure 1, the water discharging assembly **50** includes a vertical outer wall **54**, a bottom portion **58**, and a top portion **56** of the outer enclosure **52** of the water discharging assembly **50**. These elements, among others, are further depicted in Figures 2-5. Figure 2 is a top view of the water detention system of Figure 1 taken along the 2-2 axis with
20 a top opening shown in phantom; Figure 3 is an exploded side view of the water discharging assembly of Figure 1 taken within the dashed indication labeled 3 in Figure 1; Figure 4 is a cross-sectional view of the water discharging assembly of Figure 3 taken along the 4-4 axis; and Figure 5 is a top view of the water discharging assembly of Figure 1 within the dashed indication labeled 3 in Figure 1.

25 **[0027]** The outer enclosure **52** of the water discharging assembly **50** may further include some, all, or none of back portions **62**, **64** and **66**. Back portion **62** is useful if it is connected to the outlet conduit **18**. In such a case the back portion **62** may include a connector, such as but not limited to the pipe stub depicted in Figure 6, to fit over or inside of the outlet conduit **18**, and back portions or flanges **64**, **66** may not be required as these back
30 portions or flanges **64**, **66** are useful for, among other things, bolting the water discharging assembly **50** to the water detention structure **12**. If the water discharging assembly **50** is bolted and sealed/caulked to the side walls **14**, which are typically concrete walls, of the

water detention structure **12**, then back portions **64** and **66** are useful or required, but the back portion **62** may not be required.

[0028] When present, these back portions **62**, **64** and **66** of the water discharging assembly **50** are generally disposed, such as adjacently disposed, including adjacently juxtaposed, at or near the side wall **14** of the water detention structure **12**. The back portions **62**, **64** and **66** may be disposed directly at or substantially proximal to the side wall **14**. One consideration for the design, placement, and/or orientation of the back portions **62**, **64** and **66** is that it is desirable that water from the holding area **28** substantially passes through the water discharging assembly **50** and into the outlet pipe or conduit **18** as opposed to bypassing the water discharging assembly **50** and entering the outlet pipe or conduit **18**. The back portions **62**, **64** and **66** need not be absolutely fluid-tight against the side wall **14** to ensure proper or adequate operation of the water detention system **10**. For example, some minor water bypassing can be tolerated, such as being substantially fluid tight. As used herein, substantially fluid tight may refer to as being about 95% fluid tight or greater than 95% fluid tight (or about 5% fluid bypass or less than 5% fluid bypass), more desirably about 99% fluid tight or greater than 99% fluid tight (or about 1% fluid bypass or less than 1% fluid bypass). Desirably, the degree of fluid tightness is sufficient to prevent or substantially prevent any floatables, such as oil, etc. or solids by bypassing through the water detention system **10**. Of course such potential minor water bypassing may be minimized through the use of sealants, gaskets or the like (not shown) at or between the back portions **62**, **64** and **66** and the side wall **14**. The back portions **62**, **64** and **66** may be of unitary construction or may be different portions, or even possibly different materials, joined together or otherwise proximally disposed.

[0029] The water discharging assembly **50** further includes a siphon system **68**. The siphon system **68** is useful for the egress of water from the water detention system **10** or the water discharging assembly **50** into the outlet pipe or conduit **18**. Not wishing to be bound by any particular scientific principle, the siphon system **68** may be described in terms of general siphon terminology. A siphon may be considered as a tube or conduit capable of carrying water from a first container, reservoir, or area at a “high” elevation to a second container, reservoir, or area at a “lower” elevation. The siphon is primed by the water level in the first container reaching an elevation higher than the siphon elevation. Up until the top of the siphon the structure is storing water. The difference in head between the water level in the

first container and water level in the second container makes water begin to flow through the siphon once the water level reaches/is higher than the height of the siphon. The area of the siphon regulates the flow rate through the device such that water is continued to be stored if the flow rate into the structure is greater than the flow rate of the siphon. Since the top of the siphon is closed a vacuum is created such that even when the water level falls below the top of the siphon water continues to flow through the siphon as long as the water level in the first container is higher than water level in the second container. Once the water levels in the containers become equal or air is allowed to reach the top of the siphon, flow through the siphon stops. Such a siphon may be referred to as a loop siphon or U-bend siphon.

10 [0030] One siphon useful with the present invention is a bell siphon or also known as an automatic siphon. Desirably, the bell siphon has a low profile to save space within the water detention structure 12. While not wishing to be bound by any particular theory, a bell may have a center discharge tube or conduit, also known as a standpipe, beside an inlet tube or conduit, typically having a greater length than the center outlet tube or conduit, is
15 disposed. The inlet tube or conduit may include more than one tubes or conduits. As a container, reservoir, or area fills with water, water will rise within the bell siphon until it reaches the top of the standpipe. At that point the water will start flowing over the top of the standpipe and exiting the container, reservoir, or area. If there were no bell siphon this would just continue to overflow continuously and the water would stay at that height in the
20 container, reservoir, or area. This is because the air pressure acting on the water in the container, reservoir, or area is equal across the whole system, i.e., it is the same pressure in the container, reservoir, or area as it is in in the standpipe. Since the inlet and outlet tubes are in fluid communication with each other but sealed from atmospheric air at the top where they communicate, as water reaches the top of the tubes air is pushed down the standpipe by the
25 inflowing water and a vacuum is created, and water will be forced rapidly out of the container, reservoir, or area. This will typically continue until the level of water in the container, reservoir, or area reaches down to gaps at the bottom of the bell siphon and air will once again enter the bell siphon. This will cause the siphon to stop. Once the siphon has stopped then the container, reservoir, or area will simply fill up with water as before, until it
30 reaches the top of the standpipe and the siphons automatically starts again. This process is repeated for as long as the water is entering the container, reservoir, or area. This type of siphon may be referred as an auto-siphon or automatic siphon, because, if properly designed as in the present invention and as long as water is flowing into the container, reservoir, or

area; the siphon will start and finish in an automatic fashion. As used herein the phrase “fluid communication” and its variants refer to one element having a fluid (gas or liquid) pathway, either directly or indirectly, including an unobstructed or an obstructed pathway, to a second element. Such a fluid pathway may include an additional element disposed between the first
 5 and second elements.

[0031] As depicted in Figure 4, the siphon system **68** includes internal passages, conduits, or tubes **84, 86** for the ingress of water into the siphon system **68** and a middle passage(s), conduit(s), or tube(s) **88** for the egress of water from the siphon system **68**. As perhaps best shown in Figures 1 and 3, water may enter the opening **60** of the outer enclosure
 10 **52** and rises upward in the internal space **70** between the vertical outer wall **54** of the outer enclosure **52** and the siphon system wall **78** opposed from the vertical outer wall **54**. Water will then rise upward in the internal passages, conduits, or tubes **84, 86** of water the siphon system **68**. Water cannot yet enter the middle tube the middle passage(s), conduit(s), or tube(s) **88** as the internal passages, conduits, or tubes **84, 86** and **88** are sealed together and
 15 the bottom of the middle passage(s), conduit(s), or tube(s) **88** is closed by the bottom portion **90**, whereas the bottom of the internal passages, conduits, or tubes **84, 86** are open. Once water in the internal passages, conduits, or tubes **84, 86** and the internal space **70** reaches a predefined or predetermined elevation **92'** or the top portion **92** of the internal passages, conduits, or tubes **84, 86**; water spills from the internal passages, conduits, or tubes **84, 86**
 20 into the middle passage(s), conduit(s), or tube(s) **88** and a siphon is created since internal passages, conduits, or tubes **84, 86** and **88** have a top portion **77** of the siphon system **68** and are generally not subject to atmospheric pressure (or generally not open to air). Water then flows through the middle passage(s), conduit(s), or tube(s) **88**; the rate of which is determined by the height of water in internal space **70**, the size of the middle passage(s), conduit(s), or tube(s) **88**; and the size of the discharge opening **80** from the siphon system **68**. Water is
 25 conveyed through the discharge opening **80** into a discharge area **82** of the siphon system **68** and then into the outlet pipe or conduit **18**. The use of the siphon system **68** restricts or prevents the water from directly entering the outlet pipe or conduit **18**, thereby allowing water to build in the internal holding area **28** and the internal space **70**, providing detention,
 30 and increasing removal of floatables and solids.

[0032] To prevent upstream flooding, the internal wall **72** of the siphon system **68** does not extend to the top portion **56** of the outer enclosure **52** of the water discharging

assembly **50**. If water reaches the top portion **73** of the internal wall **72**, water, which may also be referred to as water overflow, may then flow over the internal wall **72** directly to the discharge area **82** and into the outlet pipe or conduit **18**. Accordingly, the top portion **73** of internal wall **72** acts as an emergency spillway regulating the maximum water level height in internal holding area of the water detention structure **12**. Water may continue to be discharged through the siphon system **68** during overflow periods, and the siphon system **68** may continue to operate until the water level in the internal holding area **28** and the internal space **70** is in equilibrium with the water level in the discharge area **82**.

[0033] The water discharging assembly **50** is typically sealed to structure or side wall **14**, thereby preventing air in the water detention structure **12** from reaching the outlet conduit **18**. If there are no or little interactions with the atmosphere downstream of outlet conduit **18**, an airlock may be created in the water discharging assembly **50**, thereby interfering with the operation of the water discharging assembly **50**. An air check valve **94** may be disposed on the top portion **56** of the outer enclosure **52** of the water discharging assembly **50** to prevent this from occurring. If the water level in the internal space **70** reaches the top portion **73** of internal wall **72** and the water level in the discharge area **82** is above the top of the outlet conduit **18**, then air trapped above the water level could impede water flow over the top portion **73** of internal wall **72**. The air check valve **94** allows air to escape from the internal space **70** and/or the discharge area **82** into the internal holding area **28** to prevent the air from restricting flow over the top portion **73** of internal wall **72**.

[0034] As depicted in Figure 1, water discharging assembly **50** may further include an optional filter **96**. The optional filter **96** may be disposed past the opening **60** of the outer enclosure **52** of the water discharging assembly and before siphon system **68**. If present, the filter **96** may filter the water prior to entry into the siphon system **68**. This may prevent undesirable solids from entering the siphon system **68**. Water overflow, i.e., water flowing over the internal wall **72** directly to the discharge area **82** and into the outlet pipe or conduit **18**, is not filtered by the filter **96** as such water overflow bypasses the siphon system **68**. Furthermore, if for some reason the filter **96** becomes inoperable, for example plugged with materials, then the water flow may bypass, either partially or in total, the siphon system **68**.

[0035] Figure 6 is a partial side elevational view of the water discharging assembly **50** of the present invention further showing a pipe stub **63** useful for insertion into the outlet conduit **18** of the water detention system **10**. In such a case the pipe stub **63** may be integral

or connected to the back portion **62** of the water discharging assembly **50**. The pipe stub **63** may fit over, around, or inside of the outlet conduit **18**. The back portions or flanges **64**, **66** may not be required with the use of the pipe stub **63**, but could be included if desired.

[0036] While various embodiments of the present inventive technology are specifically illustrated and/or described herein, it will be appreciated that modifications and variations of the present inventive technology may be effected by those skilled in the art without departing from the spirit and intended scope of the inventive technology. Further, any of the embodiments or aspects of the invention as described in the claims or in the specification may be used with one and another without limitation.

[0037] The following aspects, embodiments, and the like of the invention or inventive technology, which are labelled as clauses below, are part of the detailed description for the present invention and may be combined in any fashion and combination and be within the scope of the present invention, as follows:

[0038] Clause 1. A water detention system (10) for detaining storm water comprising:

a water detention structure (12) comprising a side wall (14), a top ceiling (30), and a bottom floor (24), thereby configured to provide a static holding area (28) therein;

a storm water entry (11) for ingress of storm water into the holding area (28);

a water discharging assembly (50) configured to pass storm water there through, the water discharging assembly (50) comprising a siphon (68); and

an outlet conduit (18) for egress of storm water from the water discharging assembly (50), the outlet conduit (18) being disposed through the side wall (14).

[0039] Clause 2. The water detention system (10) of any previous clause, preferably clause 1, wherein the water detention structure (12) is a catch-basin or a drainage manhole.

[0040] Clause 3. The water detention system (10) of any previous clause, preferably clause 1, wherein the storm water entry (11) is selected from the group consisting of an inlet conduit (16) disposed through the side wall (14), a top opening (32) through the top ceiling (30), and combinations thereof.

[0041] Clause 4. The water detention system (10) of any previous clause, preferably clause 1, wherein the static holding area (28) for storm water is disposed below the outlet conduit (18), above the bottom floor (24), and between portions of the side wall (14).

5 [0042] Clause 5. The water detention system (10) of any previous clause, preferably clause 1, wherein the siphon (68) is an automatically acting siphon.

[0043] Clause 6. The water detention system (10) of any previous clause, preferably clause 1, wherein the siphon is a bell siphon.

10

[0044] Clause 7. The water detention system (10) of any previous clause, preferably clause 1,

wherein the water discharging assembly (50) further comprises an outer enclosure (52);

15 wherein the outer enclosure (52) has an opening (60) for ingress of water from the holding area (28);

wherein the outer enclosure (52) has an opening (82') for egress of water into the outlet conduit (18); and

20 wherein the water discharging assembly (50) is configured to substantially prevent water from bypassing the water discharging system (50) and directly entering into the outlet conduit (18).

[0045] Clause 8. The water detention system (10) of clause 7, wherein the outer enclosure (52) further comprises back portions (62, 64, 66); and wherein the back portions (62, 64, 66) are adjacently juxtaposed to portions of the side wall (14) surrounding the outlet conduit (18).

[0046] Clause 9. The water detention system (10) of clause 8, wherein the back portions (62, 64, 66) of the water discharging assembly are sealed to portions of the side wall (14) surrounding the outlet conduit (18).

[0047] Clause 10. The water detention system (10) of clause 8, wherein the back portions (62, 64, 66) further comprise a pipe stub (63); and wherein the pipe stub (63) is configured to be disposed within, or around, the outlet conduit (18).

[0048] Clause 11. The water detention system (10) of any previous clause, preferably clause 1,

wherein the siphon (68) comprises at least one internal water-receiving conduit (84, 86) for ingress of water, the at least one internal water-receiving conduit (84, 86) having an open bottom portion (84'', 86'') for receiving water and a top portion (84', 86');
5

wherein the siphon (68) comprises at least one water-discharging conduit (88) for egress of water, the at least one water-discharging conduit (88) having a top portion (88') in fluid communication with the top portion (84', 86') of the at least one internal water receiving conduit (84, 86) for receiving water therefrom, the at least one water-discharging conduit (88) having a discharge opening (80) to define a discharge area (82) for the siphon (68); and
10

wherein a top wall portion (77) of the siphon (68) is enclosingly disposed above the top portion (84', 86') of the at least one internal water-receiving conduit (84, 86) and the top portion (88') of the at least one water-discharging conduit (88).
15

[0049] Clause 12. The water detention system (10) of any previous clause, preferably clause 11,

wherein the siphon (68) comprises at least two internal water-receiving conduits (84, 86) for ingress of water.
20

[0050] Clause 13. The water detention system (10) of any previous clause, preferably clause 11,

wherein the siphon (68) further comprises a vertical wall (78) opposed from a vertical wall (54) of the water discharging assembly (50), thereby defining an internal space (70) within the water discharging assembly (50); and
25

wherein water disposed within the internal space (70) between the vertical wall (78) of the siphon (68) and the vertical wall (54) of the water discharging assembly (50) is in fluid communication with the open bottom of the at least one internal water-receiving conduit (84, 86) of the siphon (68).
30

[0051] Clause 14. The water detention system of clause 13,
wherein the internal space (70) between the vertical wall (78) of the siphon (68) and
the vertical wall (54) of the water discharging assembly (50) is in fluid communication with
the discharge area (82) for the siphon (68).

5

[0052] Clause 15. The water detention system of clause 13 or 14, wherein the siphon
(68) further comprises an internal wall (72) having a top portion (73) extending above the top
wall portion (77) disposed above the top portion (84', 86') of the at least one internal water-
receiving conduit (84, 86) and the top portion (88') of the at least one water-discharging
10 conduit (88) of the siphon (68) to provide an overflow area for water to bypass the siphon
(68).

[0053] Clause 16. A water discharging assembly (50) for discharging storm water
from a water detention system, comprising:
15 an outer enclosure (52);
a first opening (60) in the outer enclosure (52) for ingress of water;
a second opening (82') in the outer enclosure (52) for egress of water; and
a siphon (68) disposed within the outer enclosure (52);
wherein, except for the first opening (60) and the second opening (82'), the outer
20 enclosure (52) is substantially fluid tight.

[0054] Clause 17. The water discharging assembly (50) of clause 16,
wherein the siphon (68) comprises at least one internal water-receiving conduit (84,
86) for ingress of water, the at least one internal water-receiving conduit (84, 86) having an
25 open bottom portion (84'', 86'') for receiving water and a top portion (84', 86');

wherein the siphon (68) comprises at least one water-discharging conduit (88) for
egress of water, the at least one water-discharging conduit (88) having a top portion (88') in
fluid communication with the top portion (84', 86') of the at least one internal water
receiving conduit (84, 86) for receiving water therefrom, the at least one water-discharging
30 conduit (88) having a discharge opening (80) to define a discharge area (82) for the siphon
(68); and

wherein a top wall portion (77) of the siphon (68) is enclosingly disposed above the
top portion (84', 86') of the at least one internal water-receiving conduit (84, 86) and the top
portion (88') of the at least one water-discharging conduit (88).

[0055] Clause 18. The water discharging assembly (50) of clauses 16-17, wherein the siphon (68) comprises at least two internal water-receiving conduits (84, 86) for ingress of water.

5

[0056] Clause 19. The water discharging assembly (50) of clauses 16-18, wherein the siphon (68) further comprises a vertical wall (78) opposed from a vertical wall (54) of the outer enclosure (52) of the water discharging assembly (50), thereby defining an internal space (70) within the water discharging assembly (50); and

10 wherein water disposed within the internal space (70) between the vertical wall (78) of the siphon (68) and the vertical wall (54) of the water dispensing assembly (50) is in fluid communication with the open bottom of the at least one internal water-receiving conduit (84, 86) of the siphon (68).

15 **[0057]** Clause 20. The water discharging assembly (50) of clause 19, wherein the internal space (70) between the vertical wall (78) of the siphon (68) and the vertical wall (54) of the water discharging assembly (50) is in fluid communication with the discharge area (82) for the siphon (68).

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. A water detention system for detaining storm water comprising:
 - 5 a water detention structure comprising a side wall, a top ceiling, and a bottom floor, thereby configured to provide a static holding area therein;
 - a storm water entry for ingress of storm water into the holding area;
 - a water discharging assembly configured to pass storm water there through, the water discharging assembly comprising a siphon; and
 - 10 an outlet conduit for egress of storm water from the water discharging assembly, the outlet conduit being disposed through the side wall;
 - wherein the siphon comprises at least one internal water-receiving conduit for ingress of water, the at least one internal water-receiving conduit having an open bottom portion for receiving water and an open top portion;
 - 15 wherein the siphon comprises at least one water-discharging conduit for egress of water, the at least one water-discharging conduit having an open top portion in fluid communication with the open top portion of the at least one internal water receiving conduit for receiving water therefrom, the at least one water-discharging conduit having a discharge opening at a bottom portion to define a discharge area for the siphon; and
 - 20 wherein a top wall portion of the siphon is enclosingly disposed above the top open portion of the at least one internal water-receiving conduit and the top open portion of the at least one water-discharging conduit to seal the top open portions against atmospheric pressure or air within the holding area.
- 25 2. The water detention system of claim 1, wherein the water detention structure is a catch-basin or a drainage manhole.
3. The water detention system of claim 1, wherein the storm water entry is selected from the group consisting of an inlet conduit disposed through the side wall, a
30 top opening through the top ceiling, and combinations thereof.
4. The water detention system of claim 1, wherein the static holding area for storm water is disposed below the outlet conduit, above the bottom floor, and between portions of the side wall.

35

5. The water detention system of claim 1, wherein the siphon is an automatically acting siphon.
6. The water detention system of claim 1, wherein the siphon is a bell siphon.
7. The water detention system of claim 1, wherein the water discharging assembly further comprises an outer enclosure;
wherein the outer enclosure has an opening for ingress of water from the holding area;
wherein the outer enclosure has an opening for egress of water into the outlet conduit; and
wherein the water discharging assembly is configured to substantially prevent water from bypassing the water discharging system and directly entering into the outlet conduit.
8. The water detention system of claim 7, wherein the outer enclosure further comprises back portions; and wherein the back portions are adjacently juxtaposed to portions of the side wall surrounding the outlet conduit.
9. The water detention system of claim 8, wherein back portions of the water discharging assembly are sealed to portions of the side wall surrounding the outlet conduit.
10. The water detention system of claim 8, wherein the back portions further comprise a pipe stub; and wherein the pipe stub is configured to be disposed within, or around, the outlet conduit.
11. The water detention system of claim 1, wherein the siphon comprises at least two internal water-receiving conduits for ingress of water.
12. The water detention system of claim 1, wherein the siphon further comprises a vertical wall opposed from a vertical wall of the water discharging assembly, thereby defining an internal space within the water discharging assembly; and

wherein water disposed within the internal space between the vertical wall of the siphon and the vertical wall of the water discharging assembly is in fluid communication with the open bottom of the at least one internal water-receiving conduit of the siphon.

5

13. The water detention system of claim 12, wherein the internal space between the vertical wall of the siphon and the vertical wall of the water discharging assembly is in fluid communication with the discharge area for the siphon.

10

14. The water detention system of claim 12, wherein the siphon further comprises an internal wall having a top portion extending above the top wall portion disposed above the top portion of the at least one internal water-receiving conduit and the top portion of the at least one water-discharging conduit of the siphon to provide an overflow area for water to bypass the siphon.

15

15. A water discharging assembly for discharging storm water from a water detention system, comprising:

an outer enclosure;

a first opening in the outer enclosure for ingress of water;

20

a second opening in the outer enclosure for egress of water; and

a siphon disposed within the outer enclosure;

wherein, except for the first opening and the second opening, the outer enclosure is substantially fluid tight;

25

wherein the siphon comprises at least one internal water-receiving conduit for ingress of water, the at least one internal water-receiving conduit having an open bottom portion for receiving water and an open top portion;

30

wherein the siphon comprises at least one water-discharging conduit for egress of water, the at least one water-discharging conduit having an open top portion in fluid communication with the open top portion of the at least one internal water receiving conduit for receiving water therefrom, the at least one water-discharging conduit having a discharge opening at a bottom portion to define a discharge area for the siphon; and

wherein a top wall portion of the siphon is enclosingly disposed above the top open portion of the at least one internal water-receiving conduit and the top open

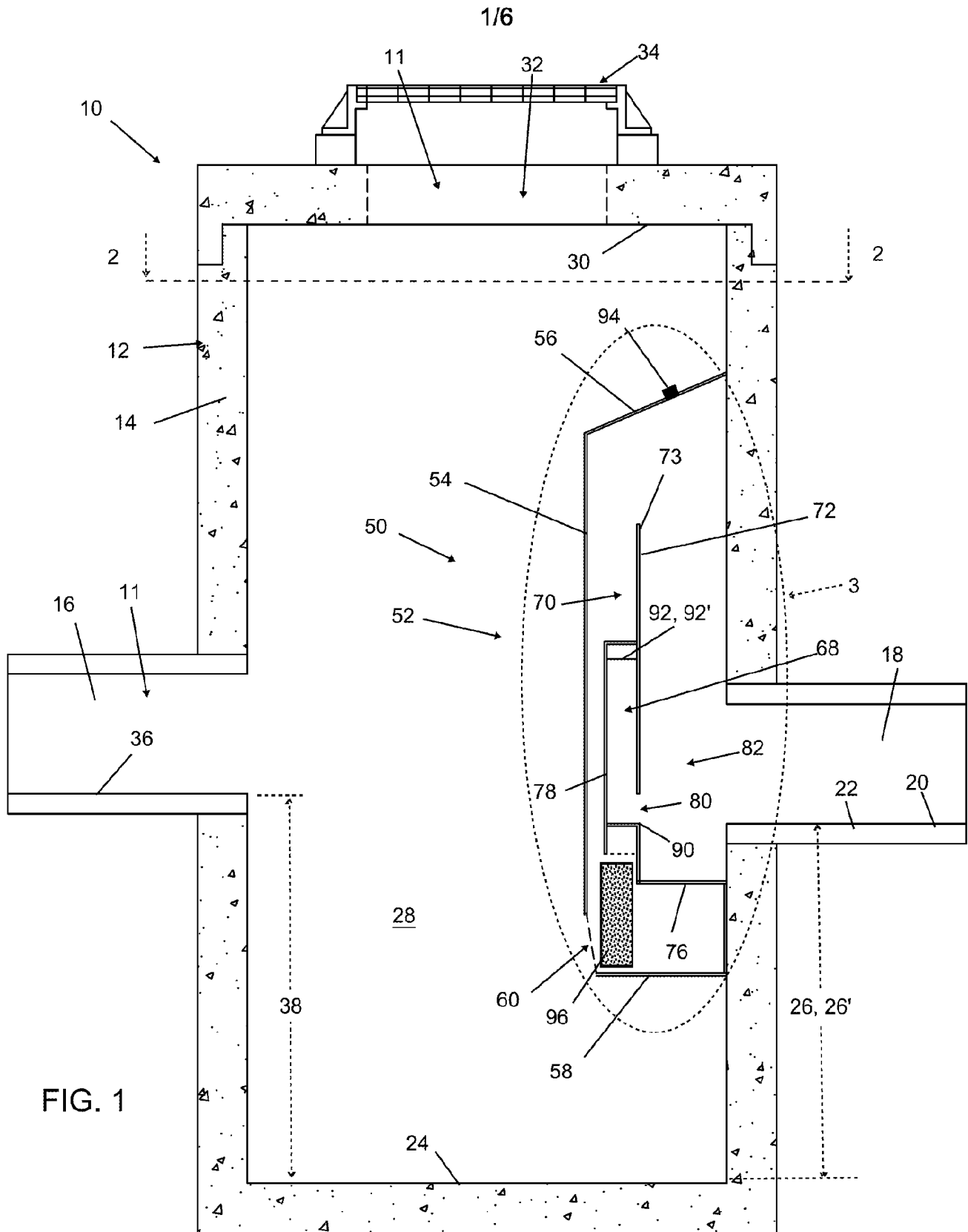
portion of the at least one water-discharging conduit to seal the top open portions against atmospheric pressure or air within the holding area.

16. The water discharging assembly of claim 15,
5 wherein the siphon comprises at least two internal water-receiving conduits for ingress of water.

17. The water discharging assembly of claim 15, wherein the siphon further comprises a vertical wall opposed from a vertical wall of the water discharging
10 assembly, thereby defining an internal space within the water discharging assembly; and

wherein water disposed within the internal space between the vertical wall of the siphon and the vertical wall of the outer enclosure of the water discharging assembly is in fluid communication with the open bottom portion of the at least one
15 internal water-receiving conduit of the siphon.

18. The water discharging assembly of claim 17, wherein the internal space between the vertical wall of the siphon and the vertical wall of the water discharging assembly is in fluid communication with a discharge area for the siphon.



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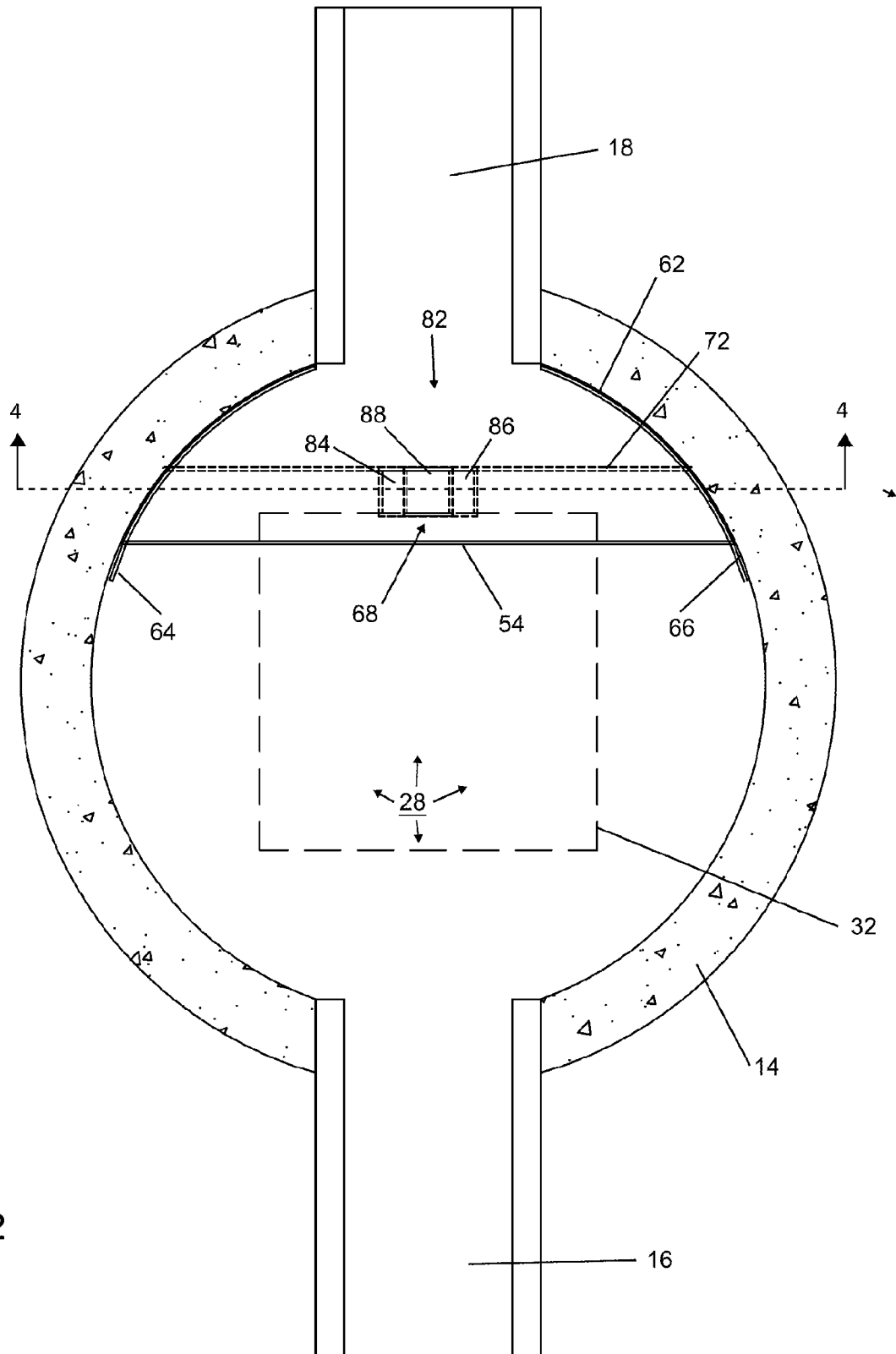


FIG. 2

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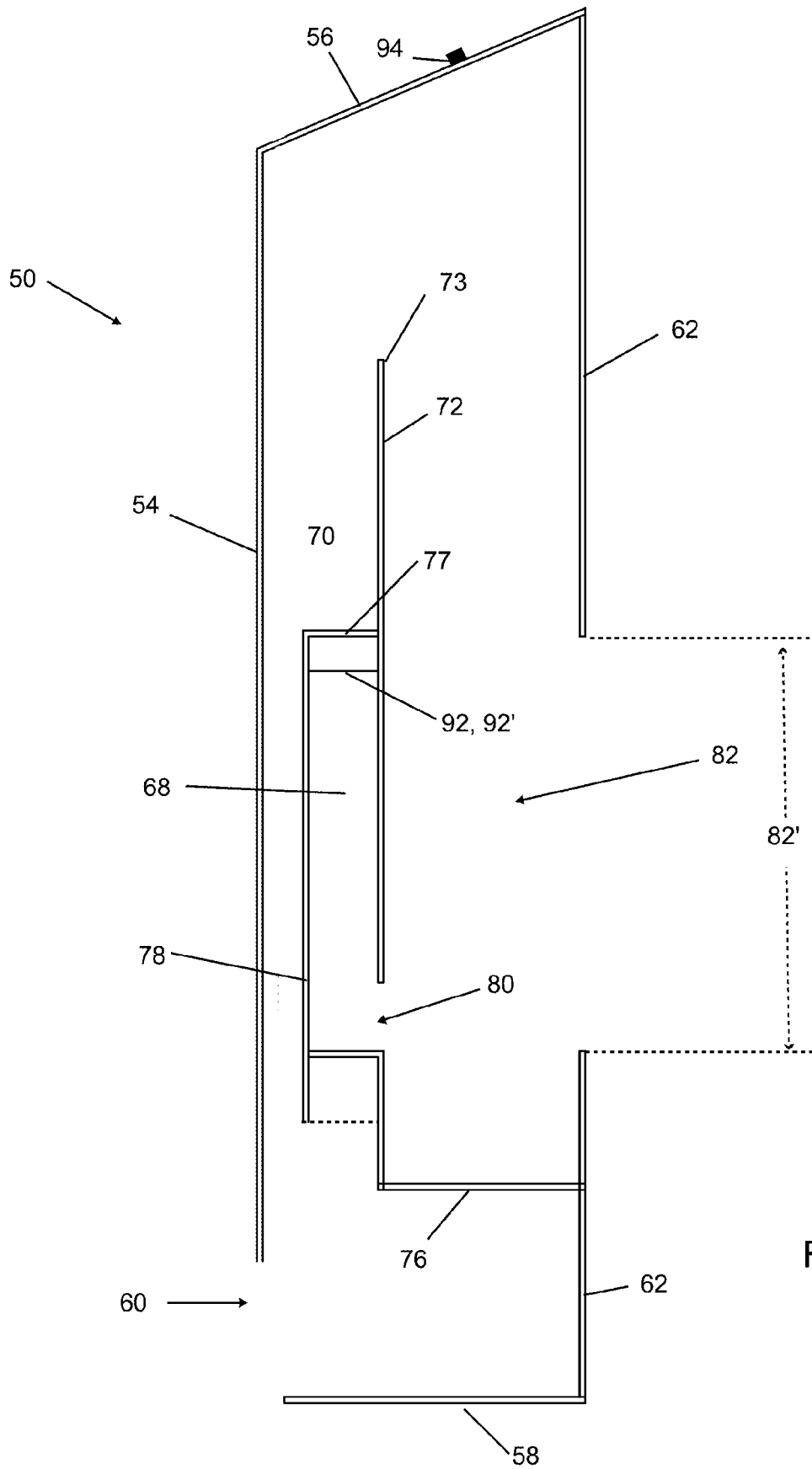


FIG. 3

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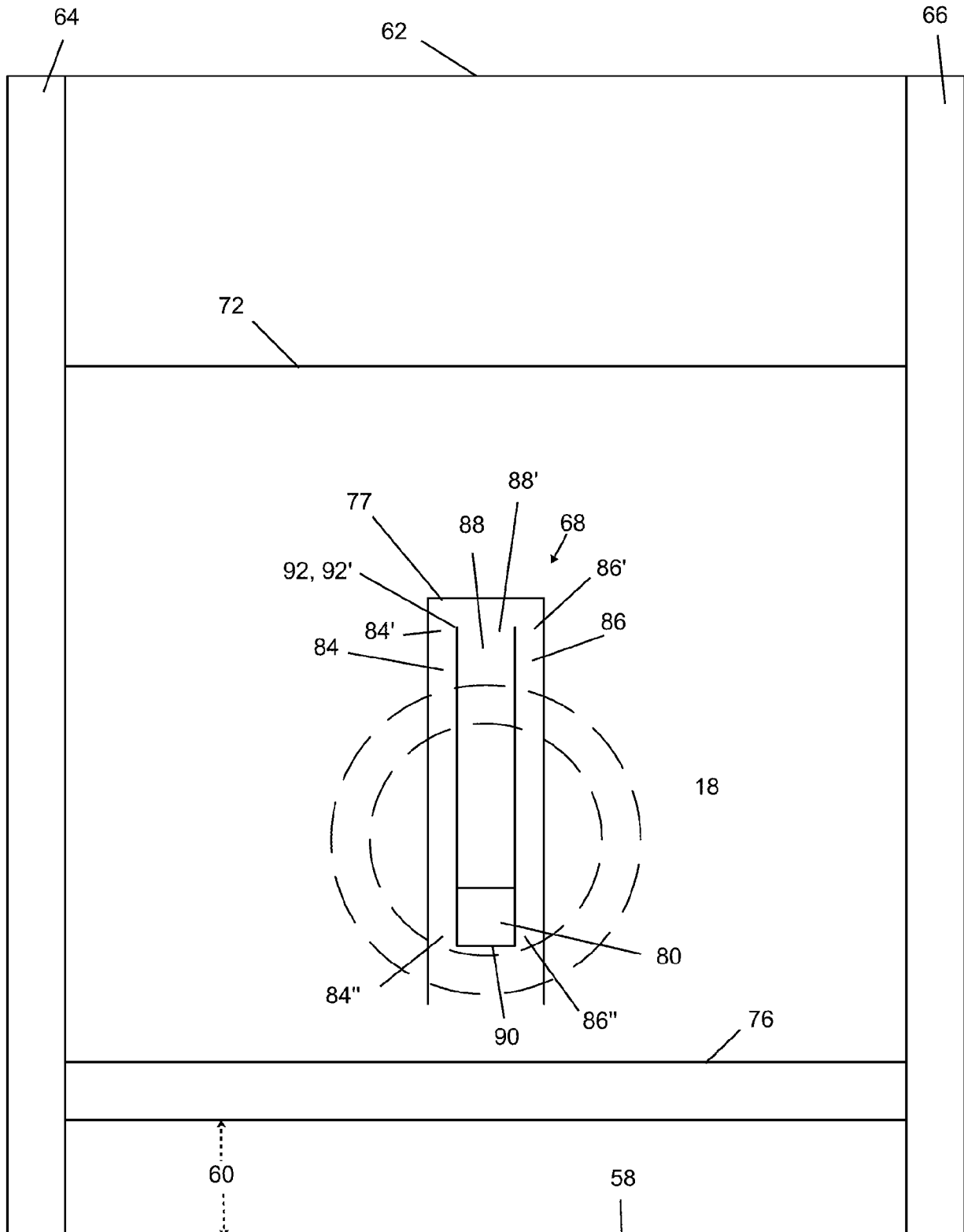


FIG. 4

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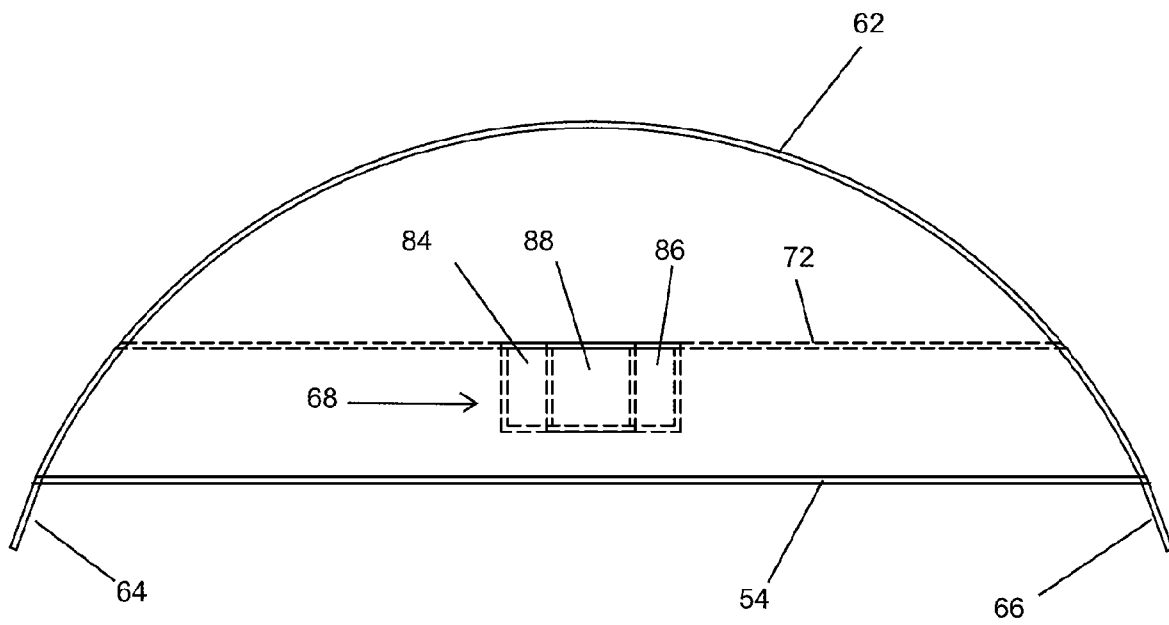


FIG. 5

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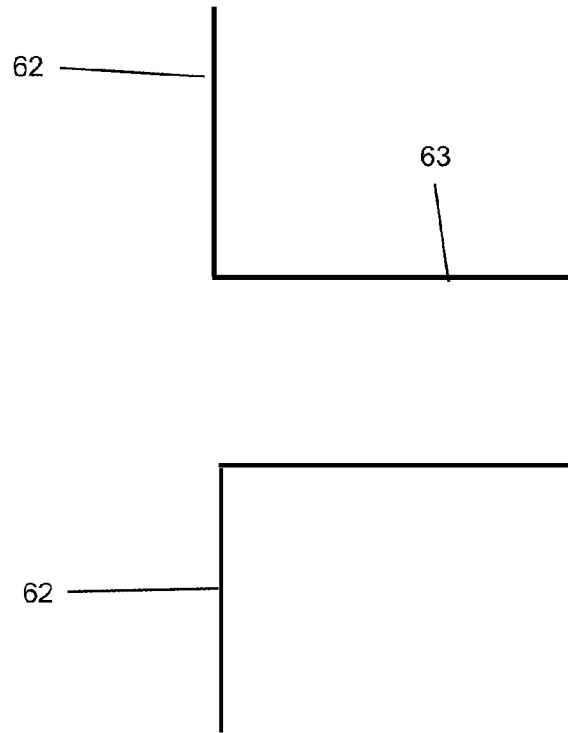


FIG. 6

