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(54) **RAINWATER TREATMENT DEVICE**

(57) The disclosure relates to a rainwater treatment device comprising a fluid inlet (11), a fluid outlet (12), a cartridge accommodation space (20) for removably receiving a cartridge including a substrate for treating rainwater, a fluid receiving space (50) for receiving fluid flowing out of the accommodation space (20), the fluid receiving space (50) being fluidly connected to the fluid outlet (12) by a drainage flow path, and an overflow damming element (40) provided in the drainage flow path and/or the fluid receiving space (50) for damming up fluid in the fluid receiving space (50) and the accommodation space (20) and for reducing a fluid throughput in the drainage flow path towards the fluid outlet (12) for as long as the overflow damming element (40) does not overflow.

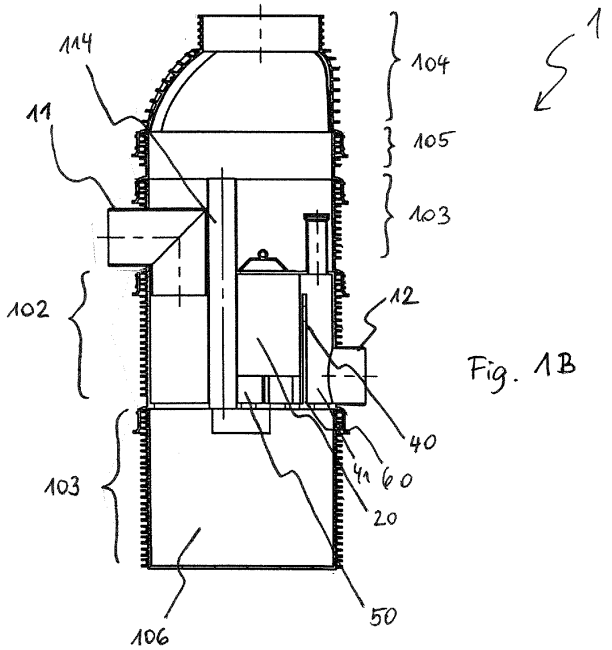

Fig. 1B

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Description

[0001] This disclosure relates to a rainwater treatment device configured to removably receive a cartridge with a substrate for treating a fluid such as rainwater. It further relates to the use of such a device for treating rainwater and to a method of producing such a device.

[0002] There are rainwater treatment devices which are designed to be mounted and used underground. Such a rainwater treatment device receives a filter cartridge including a filter substrate in a cartridge accommodation space. The substrate is configured to treat rainwater, e.g., for filtering substances such as metallic particles out of the rainwater.

[0003] This device is particularly useful near roads, where metal contaminations occur, e.g., due to vehicle breaking and/or drainage of building roofs containing metal. The filtered water is fed back into the environment, for example, into the groundwater, or into a river or a lake.

[0004] Rainwater should not remain stagnant in the cartridge for too long. If the filter substrate stays wet for excessive periods of time, its lifespan decreases. Known rainwater treatment devices are therefore constructed such that the cartridge runs dry when there is no further rainwater throughput.

[0005] To enable a high rainwater throughput, the cartridge may be provided with a plurality of sidewall openings through which rainwater can enter. The cartridge accommodation space of the device is designed such that, upon receiving a cartridge, a space remains between the cartridge side wall and the accommodation space side wall. Rainwater thus enters said space and flows into the cartridge through the sidewall openings. This enables a large rainwater throughput. During periods of heavy rain (high rainwater throughput), the space between a cartridge and the accommodation space side wall constantly fills up with new rainwater. Consequently, rainwater enters the cartridge through all of the cartridge sidewall openings.

[0006] However, when the rainwater throughput is low, e.g., during periods of light rainfall, the space between the cartridge sidewall and the accommodation space does not fill up. As a consequence, there is no even distribution of rainwater entering the cartridge over the openings in the cartridge sidewall. For example, there may be a tendency of rainwater primarily entering through lower openings. The lower parts of the substrate(s) in the cartridge are thus wet more frequently and are worn more quickly than the upper parts. Substrate cartridges thus need to be exchanged before the upper parts of the substrate(s) reach the end of their lifespan.

[0007] There is a need for a rainwater treatment device that addresses at least one of the abovementioned shortcomings.

[0008] Embodiments of a rainwater treatment device in accordance with the present disclosure are defined by the claims below.

GENERAL DESCRIPTION

[0009] One aspect of this disclosure relates to rainwater treatment device comprising a fluid inlet, a fluid outlet, a cartridge accommodation space for removably receiving a cartridge including a substrate for treating rainwater, a fluid receiving space for receiving fluid flowing out of the accommodation space, the fluid receiving space being fluidly connected to the fluid outlet by a drainage fluid path, and an overflow damming element provided in the drainage flow path and/or the fluid receiving space for damming up fluid in the fluid receiving space and the accommodation space and for reducing fluid throughput in the drainage flow path towards the fluid outlet for as long as the overflow damming element does not overflow. Preferably, the overflow damming element is provided in the drainage flow path.

[0010] The device may comprise one or several overflow damming elements.

[0011] When a cartridge is received in the accommodation space, a fluid (e.g., rainwater) entering the device through the fluid inlet is (possibly, after having passed one or several other treatment stages) led into a cartridge received in the accommodation space. The rainwater is treated (e.g., filtered in the cartridge) and then flows out of the cartridge (out of the accommodation space). The rainwater then flows into the fluid receiving space.

[0012] At least the part of the fluid receiving space may be provided below the cartridge accommodation space. The term "below" makes reference to the direction of gravity when the rainwater treatment device is positioned/oriented so as to be in use. Fluid flows from the fluid receiving space through the drainage flow path to the fluid outlet.

[0013] The overflow damming element dams up fluid in (at least a part of) the fluid receiving space and/or in the accommodation space. Preferably, fluid first dams up in the fluid receiving space and then additionally also in the accommodation space. When a cartridge is received in the accommodation space, fluid is, hence, dammed up in the cartridge. The cartridge is therefore wet more homogenously. In other words, different parts of the substrate(s) are wet for similar periods of time. This is true both when the fluid throughput is high (e.g., during periods of heavy rainfall) and when the fluid throughput is low (e.g., during periods of low rainfall). As rainwater is dammed up in the accommodation space, water may fill a space between a received cartridge and the accommodation space, also when the water throughput is low. Consequently, rainwater enters through a large number of or all of a plurality of openings in the sidewall of the cartridge, also when the rainwater throughput is low.

[0014] The overflow damming element is configured to reduce the fluid throughput in the drainage flow path towards the fluid outlet for as long as the overflow damming element does not overflow. When it overflows, the throughput is no longer (or at least to a lesser degree) reduced so that the damming up of fluid is not excessive.

The reduction of the fluid throughput in the drainage flow path is defined as a reduction relative to the fluid throughput in the drainage flow path towards the fluid outlet when the damming element overflows.

[0015] The reduction of fluid throughput for as long as the damming element does not overflow may be a reduction to zero. However, preferably, the reduction is not absolute also when there is no overflow. In other words, preferably, the damming element allows some fluid throughput also before overflowing. Thus, the accommodation space (and thus also a received cartridge) run(s) dry.

[0016] The device according to the present invention promotes a more homogeneous use of cartridges (and of the substrates therein, in particular) irrespective of the level of fluid throughput. Costs are therefore saved as cartridges need to exchanged less frequently. The life span of cartridges is maximized as the device may ensure that the accommodation space and received cartridges run dry irrespective of the level of fluid throughput.

[0017] According to some preferred embodiments, the overflow damming element comprises a wall of another type of baffle. That said, that damming element may also consist of one or more walls and/or one or several other types of baffles.

[0018] For example, when the damming element is a wall, it may reduce fluid throughput in the drainage flow path towards the fluid outlet for as long as the water level does not exceed the height of the wall (i.e., before the wall overflows). When the wall overflows with fluid, the fluid throughput is no longer "reduced".

[0019] The implementation of the damming element with a wall is especially advantageous due to the simplicity of the construction. The provision of a wall in the drainage flow path may be effected cost-efficiently. For example, the wall may be welded to the drainage flow path. This is simpler than, e.g., a complex construction of drainage system using different pipes etc. Moreover, the damming element in the form of a wall also requires less space. Thus, the overflow damming wall is particularly useful for a rainwater treatment device of compact build.

[0020] According to some preferred embodiments, the overflow damming element consists of a curved or straight wall portion. For example, when the wall portion is curved, the shape may conform to the shape of an adjacent wall part of the cartridge accommodation space and/or another constituent of the rainwater treatment device. This is especially advantageous when the accommodation space has an at least partially cylindrical shape. The latter is, e.g., the case when cylindrical cartridges are used.

[0021] The wall portion preferably has a height which lies in a range of 50% to 100% of the height of the type of cartridge which the accommodation space is configured to receive. Preferably, the height of the wall portion lies in a range of 50 to 100% of the height of a side wall of the cartridge accommodation space. The mentioned heights may aid in ensuring an adequate amount of reduction of fluid throughput in the drainage flow path.

[0022] According to the some preferred embodiments, the overflow damming element comprises at least one opening and/or leak allowing fluid to pass the overflowing damming element in the direction of the fluid outlet also when the fluid damming element does not overflow. This way, it is ensured that the fluid throughput is not zero also when the damming element does not overflow. Thus, it is a cartridge is not hindered from running dry.

[0023] The opening and/or leak may be formed in a lower portion of the damming element, preferably at the bottom thereof ("bottom" referring to the direction of gravity when the device is oriented in the position for use). Preferably, the opening and/or leak is arranged at or adjacent to the bottom of the fluid receiving space. The amount of fluid remaining in the fluid receiving space and/or the accommodation space when there is there is no more fluid throughput is reduced to zero or at least minimized. Moisture problems are, hence, avoided or minimized.

[0024] Preferably, the overflow damming element is welded to the fluid receiving space and/or the drainage flow path, and the weld is leaky. For example, the damming element may be a curved or straight wall (or partially curved and partially straight). The wall may be welded to the bottom of the fluid receiving space and/or the drainage flow path. Making the weld "incomplete" such that the weld is leaky is an especially efficient way of ensuring that some fluid may always pass the damming element. The leaky weld thus promotes that the accommodation space and, hence, a received cartridge runs dry when no new fluid enters the device. The combination of the leaky weld with a wall as a fluid damming element is particularly advantageous.

[0025] According to some preferred embodiments, the rainwater treatment device comprises a substrate cartridge including a substrate for treating rainwater. Preferably, the cartridge is removably mountable in the accommodation space. Moreover, the cartridge preferably comprises openings for letting fluid enter the cartridge in a side wall. Preferably, the cartridge does not comprise any openings for letting fluid enter in a top wall. Therefore, fluid preferably enters the cartridge from the plurality of openings in the side wall.

[0026] Preferably, the cartridge is received in the accommodation space and a fluid inflow space is formed between a side wall of the accommodation space and the cartridge for letting a fluid flow from the fluid inflow space into the cartridge laterally.

[0027] The rainwater treatment device preferably comprises a sediment settling space which is separate from the cartridge accommodation space and the fluid receiving space. In other words, the sedimentation treatment preferably does not (or at least primarily does not) occur in the accommodation space and/or the fluid receiving space and/or the drainage flow path.

[0028] The rainwater treatment device may have a

modular construction comprising separable modules. This increases the versatility of the device and allows changing the relative orientation of components. This simplifies connection with other elements, etc.

[0029] According to some preferred embodiments, the device comprises an inflow module. The inflow module is provided with the inlet of the device and is axially rotatable with respect to at least one other module. Thus, the relative orientation of the inlet can be changed. The inlet is preferably oriented in a lateral direction with respect to a central axis of at least one (preferably at least partially cylindrically shaped) further module. The inflow module may be axially rotated so as to orient the inlet so as to conform to the surrounding (e.g., the orientation of a part to be connected to the inlet) in which the assembly is used/installed.

[0030] According to some preferred embodiments, the device comprises a treatment module including the accommodation space, the fluid receiving space, and at least a part of the drainage flow path (preferably the entire drainage flow path). Preferably, the treatment module also comprises the fluid outlet of the device.

[0031] According to some preferred embodiments, the rainwater treatment device comprises a settling module including a sediment settling space (preferably, a settling space as described above). The sediment settling space may be provided at the floor of a shaft/manhole part of the device.

[0032] According to some preferred embodiments, the substrate cartridge is at least partially cylindrically shaped and comprises a centrally located hollow space connected to the bottom of the substrate cartridge. The space being "hollow" in this context means that no substrate is provided in said space. Fluid can be drained out of the cartridge through the hollow space.

[0033] Preferably, the bottom of the substrate cartridge comprises perforations. These perforations are preferably located around the central hollow space.

[0034] According to some preferred embodiments, the at least one substrate comprises a filter material, preferably selected from the group consisting of iron oxide hydrate, active carbon and/or zeolite, or any combination thereof. When a fluid such as rainwater flows through the device, a chemical reaction takes place in the substrate. The fluid is cleansed from metallic particles as the latter get bound to the substrate.

[0035] It is preferable for the cartridge to be separately exchangeable/replaceable. In other words, it is preferable if an old cartridge is removable from the device and replaceable with a new one. A worn cartridge may, hence, be removed from the accommodation space and replaced with a new one.

[0036] According to some preferred embodiments, the device comprises a cartridge, and the cartridge comprises at least one opening in a side surface through which fluid can enter from the accommodation space when the cartridge is received in the accommodation space.

[0037] The disclosure also relates to the use of a rainwater treatment device according to any one of the described embodiments for treating rainwater. The use may take place above ground and/or underground.

[0038] The disclosure also relates to a method of producing a rainwater treatment assembly according to any of the embodiments described above and to a cartridge for a rainwater treatment assembly according to any one of the embodiments described above. Preferably, the method comprises the step of welding the overflow damming element to another part of the assembly, wherein the weld is made such that it comprises at least one leaky spot.

[0039] The cartridge may contain a single substrate but preferably it comprises two or more substrates. The substrate (s) is/are configured to filter filterable substances in the fluid such as mineral hydrocarbons, and/or dissolved metallic particles, especially dissolved heavy metals.

[0040] Preferably, an exit is located in a lower part of the cartridge. More preferably, the exit is located at a lower end of the cartridge. The exit may be provided in a bottom surface of the cartridge.

[0041] The terms "upper" and "lower" used when referring to the upper and lower parts/ends of the cartridge and the term "top" (e.g., in "top entrance") pertain to the cartridge's orientation when the rainwater treatment device is brought into its operating position. Put differently, the terms pertain to the orientation when gravity pulls (substantially) in the direction from the upper part / top towards the lower part / bottom of the device. The device is, hence, configured so as to be oriented such that a fluid flows into the cartridge at an upper position and flows out of the cartridge at a lower position under the influence of gravity.

[0042] According to an embodiment, the accommodation space and the cartridge are both at least partially cylindrically shaped. Preferably, the inflow space between the cylindrically shaped circumferential inner sidewall of the accommodation space and the cylindrically shaped outer circumferential wall of the cartridge has a width of 20-30mm, and more preferably of 24-26mm.

[0043] Additional advantages and features of the present disclosure, that can be realized on their own or in combination with one or several features discussed above, insofar as the features do not contradict each other, will become apparent from the following description of preferred embodiments.

[0044] The description is given with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] In the following description accompanying the various figures, like parts are denoted with like reference signs.

Fig. 1A depicts a perspective view of an embodiment of a rainwater treatment device according to

the present disclosure;

Fig. 1B depicts a sectional view of an embodiment of a rainwater treatment device according to the present disclosure;

Fig. 2 depicts a side view of a cartridge and an inflow module and a treatment module in accordance with an embodiment of a rainwater treatment device according to the present disclosure;

Fig. 3A depicts a top view of an inflow module and a treatment module of an embodiment of a rainwater treatment device according to the present disclosure;

Fig. 3B depicts a sectional view of an inflow module and a treatment module with a cartridge accommodation space of an embodiment of a rainwater treatment device according to the present disclosure;

Fig. 4A depicts a sectional view of an embodiment of a fluid treatment device in accordance with the present disclosure comprising two substrate cartridges; and

Fig. 4B is a cut-open perspective view of an embodiment of a fluid treatment device in accordance with the present disclosure comprising two substrate cartridges.

[0046] Fig. 1A depicts a perspective view of an embodiment of a rainwater treatment device 1 according to the present disclosure. The rainwater treatment device 1 is configured to treat, and especially to filter, a fluid such as rainwater. The device 1 comprises a fluid inlet 11 through which rainwater can enter as well as an outlet 12 through which treated (filtered) rainwater can exit.

[0047] The embodiment of a rainwater treatment device 1 of Fig. 1A is configured to be installed as underground. It can be used for filtering contaminating substances such as metallic particles out of rainwater and/or (e.g.) to filter sand and one or several types of oils.

[0048] The rainwater treatment device 1 has a modular construction comprising separable modules. This embodiment has five separable modules. However, the disclosure also relates to embodiments comprising between one and four, six, or more modules. The modules are removably attachable to the respective adjacent module(s), as illustrated in Fig. 1A.

[0049] The device 1 comprises, from top to bottom, a top module 104, an intermediate module 105, an inflow module 101, a treatment module 102, and a settling module 103. The inflow module 101 is provided with the fluid inlet 11. The treatment module 102 comprises a cartridge accommodation space (not shown in Fig. 1A) for removably receiving a substrate cartridge. The treatment module 102 also comprises the fluid outlet 12. The settling module 103 comprises a sediment settling space 106 at the bottom. In the sediment settling space 106 (see Fig. 1B), sediments, ascending substances, and/or liquids can settle.

[0050] The modules 101, 102, 103, 104, and 105 are separable units. The inflow module 101 may be an integral part (i.e., made of one piece) or it may be made of separate parts, e.g., an inlet pipe and a cone. The modules 101, 102, 103, 104, and 105 are axially rotatable with respect to one another around a central longitudinal axis of the device 1. By rotating the inflow module 101, for example, the inlet 11 can be oriented differently in order to adapt the device 1 for a particular use according to the given surrounding.

[0051] Likewise, also the orientation of the fluid outlet 12 can be conveniently oriented by rotating the treatment module 102 accordingly (see Fig. 1B).

[0052] As illustrated in Fig. 1B, the fluid flow path starts from the fluid inlet 11. A fluid, such as rainwater, which has enters through the inlet 11, is led into the sediment settling space 106. After sedimentation treatment, a fluid is led on and, eventually, reaches the cartridge accommodation space 20 from above.

[0053] The device 1 also comprises a pipe 114 which may serve as a form of cleaning opening. The pipe 114 provides accessibility to lower parts of the device (e.g., to the sediment settling space 106).

[0054] At least one substrate cartridge 30 (not shown in Fig. 1B) is removably receivable in the accommodation space 20. A fluid receiving space 50 for receiving fluid flowing out of the accommodation space 20 (and out of the cartridge when received in the accommodation space 20) is provided below the accommodation space 20. When fluid such as rain water has been filtered in the cartridge, it automatically flows into the fluid receiving space 50 under the influence of gravity.

[0055] The fluid receiving space 50 is fluidly connected to the fluid outlet 12 by a fluid drainage path 60. In the fluid drainage path 60, an overflow damming element 40 in the form of a wall is provided. However, the disclosure also encompasses other embodiments wherein the overflow damming member is not realized as a wall but differently.

[0056] The wall 40 dams up water in the fluid receiving space 50 and also in the accommodation space 20, an, hence, in a cartridge received in the accommodation space 60. This promotes that cartridge being wet more homogeneously also upon low fluid throughput (e.g., when there is only light rainfall).

[0057] As long as the fluid level does not rise enough for the wall to overflow at the top (see Fig. 1B), the fluid throughput is reduced as compared to when the wall overflows.

[0058] The fluid throughput is, however, not reduced to zero in the drainage flow path 60 as the wall 40 comprises a little opening in the form of the leaky weld 41

enabling some fluid to pass the wall at the bottom also when the wall does not (yet) overflow. In other words, the wall 40 is welded to the bottom wall of the drainage flow path 60. The drainage flow path 60 is provided, as shown Fig. 1B, to the right of fluid receiving space 50 and fluidly connected thereto.

[0059] The fact that rainwater in the fluid receiving space 50 can pass the damming member wall 40 though the opening 41 at the bottom means that a cartridge in the accommodation space 20 can run dry. This promotes longevity of cartridges used with the device 1.

[0060] The embodiment of Fig. 1B comprises a straight wall 40 as a fluid damming element. However, the disclosure is not limited to this type of overflow damming element. For example, the damming element may also comprise or consist of one or several curved and/or straight wall (portions) and/or any other type of baffle(s).

[0061] As schematically depicted in Fig. 1B, the height of the wall 40 is slightly higher than the height dimension of the accommodation space 20. Preferably, the height of a wall-typed damming element lies in the range of 50% to 140% of the height of the accommodation space, or of the height of a cartridge to be used with the device 1. More preferably, the height of the wall portion 40 lies in a range of 50% to 100% of the height of a cartridge to be received, and more preferably in the range of 50% to 100% of the sum of the height of the accommodation space (or of a cartridge to be received) and the height of the fluid receiving space 50.

[0062] Fig. 2 depicts a side view of an inflow module 101 and of a treatment module 102 of an embodiment of a device 1. Also illustrated is a substrate cartridge 30 with a plurality of axially extending sidewall openings 34 for letting fluid enter the cartridge 30. Besides, Fig. 2 also shows the fluid inlet 11 as a part of the inflow module 101, and a fluid outlet 12 as a part of the treatment module 102. The treatment module 102 further comprises the pipe 114 providing access to lower parts of the device 1. In addition, the treatment module 102 comprises another access pipe 115 which is, during use of the device 1, closed with a screw cup 116.

[0063] Fig. 3A depicts a side view of a treatment module 103 and of an inflow module 101, stacked on top of each other. On the left-hand side, there is shown the fluid inlet 11. On the right-hand side, the fluid outlet 12 is shown. The embodiment of Fig. 3A comprises two cartridge accommodation spaces 20. It is schematically depicted that a cartridge 30 is fitted to the lower one of the two accommodation spaces 20. The upper accommodation space 20 in Fig. 3A is empty.

[0064] Fig. 3B is a section across line A-A of Fig. 3A of the inflow module 101 and the treatment module 102, stacked on top of each other. Also shown are the pipes 114, 115, a space between the cartridge accommodation spaces, a wall as a fluid damming element 40 with a leaky weld 41 where it is welded to the drainage flow path 60 and the fluid receiving space 50.

[0065] Figs. 4A and 4B are a sectional view and a cut-open perspective view of an embodiment of a rainwater treatment device 1, respectively. The device 1 has two cartridge accommodation spaces 20 and is, hence, configured to receive two substrate cartridges 30. However, the present disclosure is not limited to devices with two accommodation spaces 20. Other embodiments may merely comprise a single accommodation space 20 or several accommodation spaces 20.

[0066] The perspective view of the rainwater treatment device 1 of Fig. 4B is cut open along a plane extending in the top-bottom direction (such that gravity points in the vertical direction in the image plane) so that the inside of the device 1 is revealed. Fig. 4B shows a cartridge 30 beings accommodated in each of the cartridge accommodation spaces 20.

[0067] As shown in Fig. 4B, the accommodation spaces 20 of this embodiment are cylindrically shaped. Also the substrate cartridges 30 are substantially cylindrically shaped (see Fig. 1C) and they comprise a centrally located hollow space 31 that is connected to a bottom 32 of the respective substrate cartridge 30.

[0068] Fig. 4B also shows a fluid damming element 40 in the form of a curved wall. The wall in fact comprises a shape which conforms to both of the adjacent accommodation spaces 20 (shown in the left and the right parts of Fig. 4B, respectively). The curved wall 40 also comprises small openings formed as bores (not shown in Fig. 4B) for letting a fluid pass the wall 40 also when it does not (yet) overflow.

[0069] The accommodation space 20 comprises an inner circumferential sidewall 21 (see Fig. 4A) having a slightly larger diameter than the diameter of the inserted cartridge 30. The space in-between is an inflow space 70 (see Fig. 4A) which can fill up with a fluid such as rainwater and via which the rainwater can enter the cartridge 30 from the side. As the water throughput becomes higher, the inflow space 70 increasingly fills up so that rainwater enters the cartridge 30 from increasingly higher positions.

[0070] Many additional variations and modifications are possible and are understood to fall within the framework of the invention.

[0071] Further disclosure of embodiments is provided in the form of the following numbered items:

1. A rainwater treatment device comprising:

   a fluid inlet,
   a fluid outlet,
   a cartridge accommodation space for removably receiving a cartridge including a substrate for treating rainwater,
   a fluid receiving space for receiving fluid flowing out of the accommodation space, the fluid receiving space being fluidly connected to the fluid outlet by a drainage flow path, and
   an overflow damming element provided in the drainage flow path and/or the fluid receiving

space for damming up fluid in the fluid receiving space and the accommodation space and for reducing a fluid throughput in the drainage flow path towards the fluid outlet for as long as the overflow damming element does not overflow.

2. The rainwater treatment device according to item 1,
wherein the overflow damming element is for reducing the fluid throughput in the drainage flow path towards the fluid outlet for as long as the damming element does not overflow relative to the fluid throughput in the drainage flow path towards the fluid outlet when the damming element overflows.

3. The rainwater treatment device according to item 1 or 2, wherein the overflow damming element comprises a wall and/or any other type of baffle.

4. The rainwater treatment device according to any one of the previous items, wherein the overflow damming element comprises a straight and/or curved wall portion.

5. The rainwater treatment device according to item 4,
wherein the wall portion has a height which lies in a range of 50% to 140% of the height of the cartridge accommodation space and/or a cartridge which the cartridge accommodation space if configured to receive.

6. The rainwater treatment device according to any one of the previous items, wherein the overflow damming element comprises at least one opening and/or leak through which fluid is able to pass the overflowing damming element in the direction of the fluid outlet when the damming element does not overflow.

7. The rainwater treatment device according to any one of the previous items, wherein the overflow damming element is welded to the fluid receiving space and/or the drainage flow path by at least one weld, and wherein the weld is leaky.

8. The rainwater treatment device according to any one of the previous items, comprising a substrate cartridge including a substrate for treating rainwater.

9. The rainwater treatment device according item 8, wherein the cartridge is received in the accommodation space and a fluid inflow space is formed between a side wall of the accommodation space and the cartridge for letting fluid flow from the fluid inflow space into the cartridge laterally.

10. The rainwater treatment device according to any one of the previous items, further comprising a sediment settling space, the sediment settling space provided separately from the cartridge accommodation space and the fluid receiving space.

11. The rainwater treatment device according to any one of the previous items, the device having a modular construction comprising separable modules.

12. The rainwater treatment device according to item 11, comprising an inflow module, wherein the inflow module is provided with the inlet, and the inflow module is axially rotatable with respect to at least one other module so as to change the orientation of the inlet.

13. The rainwater treatment device according to item 11 or 12, comprising a treatment module including the accommodation space, the fluid receiving space, and at least a part of the drainage flow path.

14. The rainwater treatment device according to any one of items 11 to 13, comprising a settling module including a sediment settling space.

15. The rainwater treatment device according to item 8 or 9, wherein the cartridge is at least partially cylindrically shaped and comprises a centrally located hollow space connected to a bottom of the cartridge.

16. The rainwater treatment device according to item 15,
wherein the bottom of the cartridge comprises perforations.

17. The rainwater treatment device according to any one of items 8, 9, 15 and 16, wherein the at least one substrate comprises a filter material, preferably selected from the group consisting of iron oxide hydrate, active carbon and/or zeolite.

18. The rainwater treatment device according to any one of items 8, 9, and 15 to 17, wherein the cartridge comprises at least one opening in a side surface through which fluid can enter from the accommodation space when the cartridge is received in the accommodation space.

19. Use of a rainwater treatment device according to any one of the previous items for treating rainwater.

20. Method of producing a rainwater treatment device according to any one of items 1 to 18.

21. Method of item 20, comprising the step of welding the overflow damming element to another part of the assembly, wherein the weld is made such that it comprises at least one leaky spot.

22. Cartridge for a rainwater treatment device according to any one of items 1 to 18.

Claims

1. A rainwater treatment device comprising:

   a fluid inlet,
   a fluid outlet,
   a cartridge accommodation space for removably receiving a cartridge including a substrate for treating rainwater,
   a fluid receiving space for receiving fluid flowing out of the accommodation space, the fluid receiving space being fluidly connected to the fluid outlet by a drainage flow path, and
   an overflow damming element provided in the drainage flow path and/or the fluid receiving space for damming up fluid in the fluid receiving space and the accommodation space and for reducing a fluid throughput in the drainage flow path towards the fluid outlet for as long as the overflow damming element does not overflow.

2. The rainwater treatment device according to claim 1, wherein the overflow damming element is for reducing the fluid throughput in the drainage flow path towards the fluid outlet for as long as the damming element does not overflow relative to the fluid throughput in the drainage flow path towards the fluid outlet when the damming element overflows.

3. The rainwater treatment device according to claim 1 or 2, wherein the overflow damming element comprises a wall and/or any other type of baffle, and/or wherein the overflow damming element comprises a straight and/or curved wall portion.

4. The rainwater treatment device according to claim 3, wherein the wall portion has a height which lies in a range of 50% to 140% of the height of the cartridge accommodation space and/or a cartridge which the cartridge accommodation space if configured to receive.

5. The rainwater treatment device according to any one of the previous claims, wherein the overflow damming element comprises at least one opening and/or leak through which fluid is able to pass the overflowing damming element in the direction of the fluid outlet when the damming element does not overflow.

6. The rainwater treatment device according to any one of the previous claims, wherein the overflow damming element is welded to the fluid receiving space and/or the drainage flow path by at least one weld, and wherein the weld is leaky.

7. The rainwater treatment device according to any one of the previous claims, comprising a substrate cartridge including a substrate for treating rainwater, wherein the cartridge is preferably received in the accommodation space and a fluid inflow space is formed between a side wall of the accommodation space and the cartridge for letting fluid flow from the fluid inflow space into the cartridge laterally.

8. The rainwater treatment device according to any one of the previous claims, further comprising a sediment settling space, the sediment settling space provided separately from the cartridge accommodation space and the fluid receiving space.

9. The rainwater treatment device according to any one of the previous claims, the device having a modular construction comprising separable modules, preferably comprising an inflow module, wherein the inflow module is provided with the inlet, and the inflow module is axially rotatable with respect to at least one other module so as to change the orientation of the inlet, and/or
   preferably comprising a treatment module including the accommodation space, the fluid receiving space, and at least a part of the drainage flow path.

10. The rainwater treatment device according to claim 9, comprising a settling module including a sediment settling space.

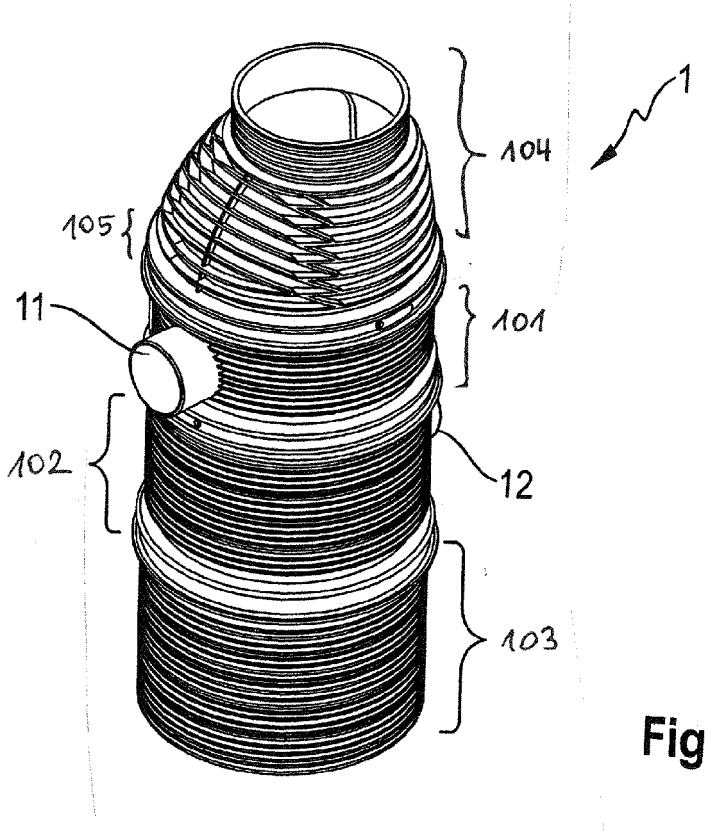
11. The rainwater treatment device according to claim 7, wherein the cartridge is at least partially cylindrically shaped and comprises a centrally located hollow space connected to a bottom of the cartridge, wherein the bottom of the cartridge preferably comprises perforations.

12. The rainwater treatment device according to claim 7 or 11, wherein the at least one substrate comprises a filter material, preferably selected from the group consisting of iron oxide hydrate, active carbon and/or zeolite.

13. The rainwater treatment device according to any one of claims 7, 11 and 12, wherein the cartridge comprises at least one opening in a side surface through which fluid can enter from the accommodation space when the cartridge is received in the accommodation space.

14. Method of producing a rainwater treatment device according to any one of claims 1 to 13, preferably comprising the step of welding the overflow damming element to another part of the assembly, wherein the weld is made such that it comprises at least one leaky spot.

15. Cartridge for a rainwater treatment device according to any one of claims 1 to 13.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105
11
101
102
12
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Fig. 1A

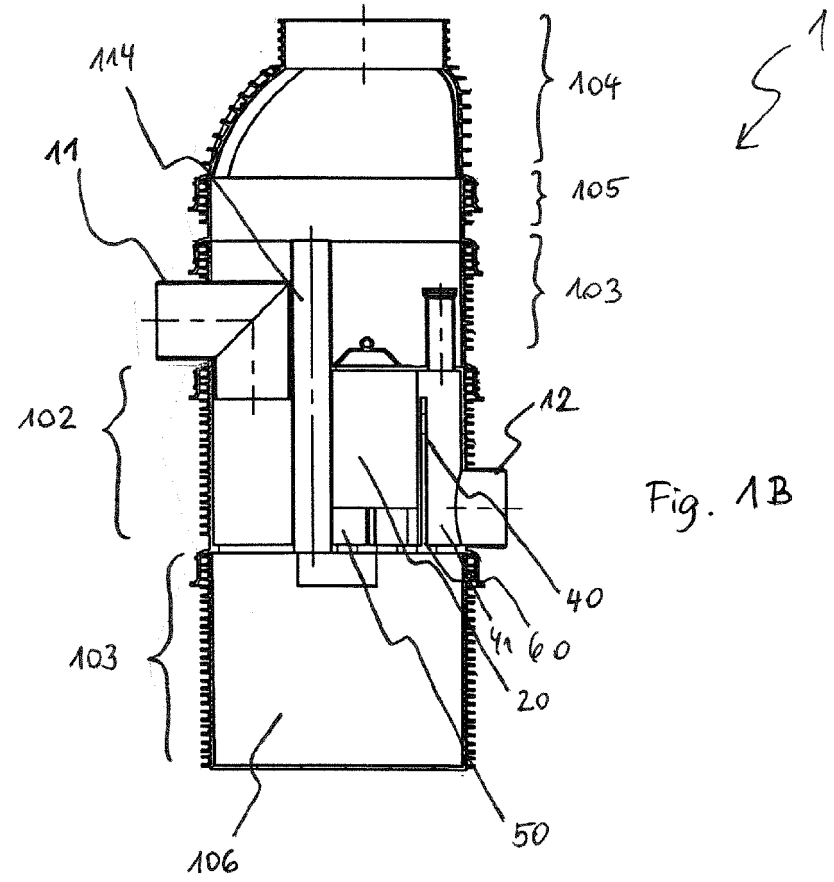
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Fig. 1B

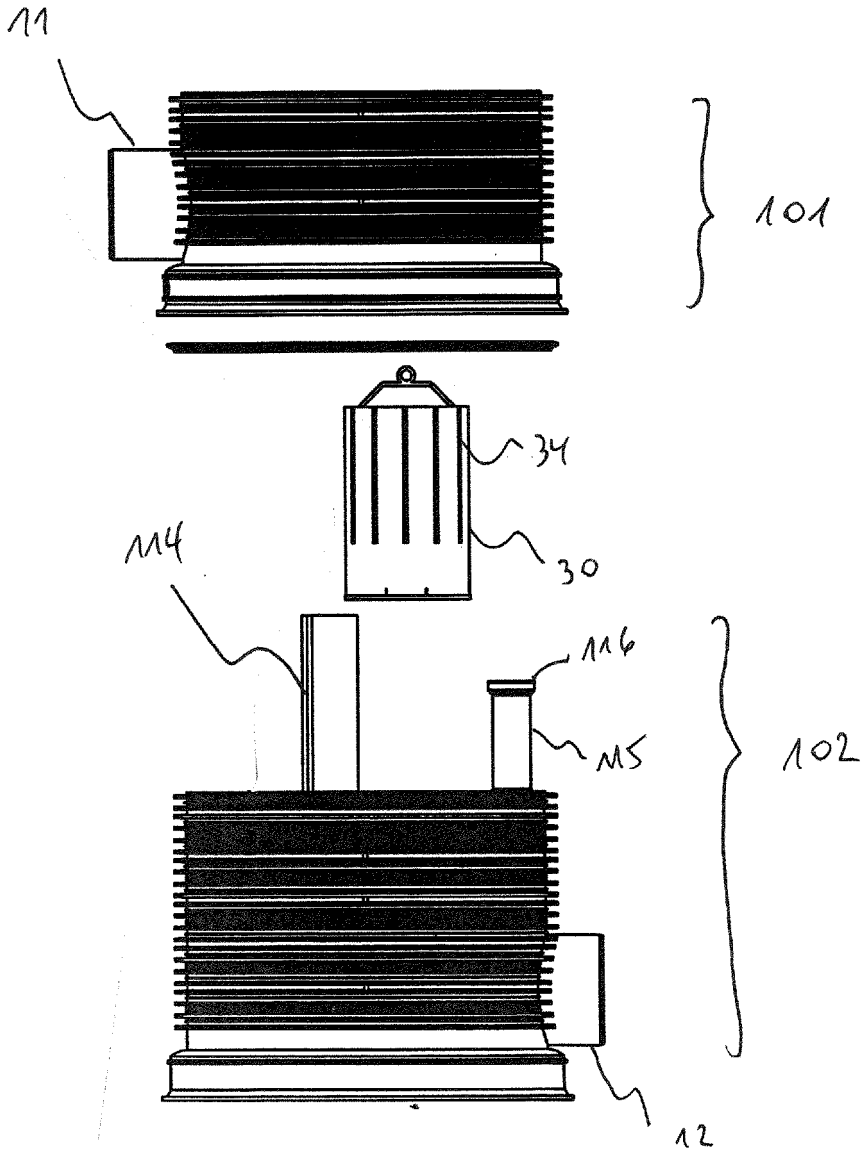

Fig. 2

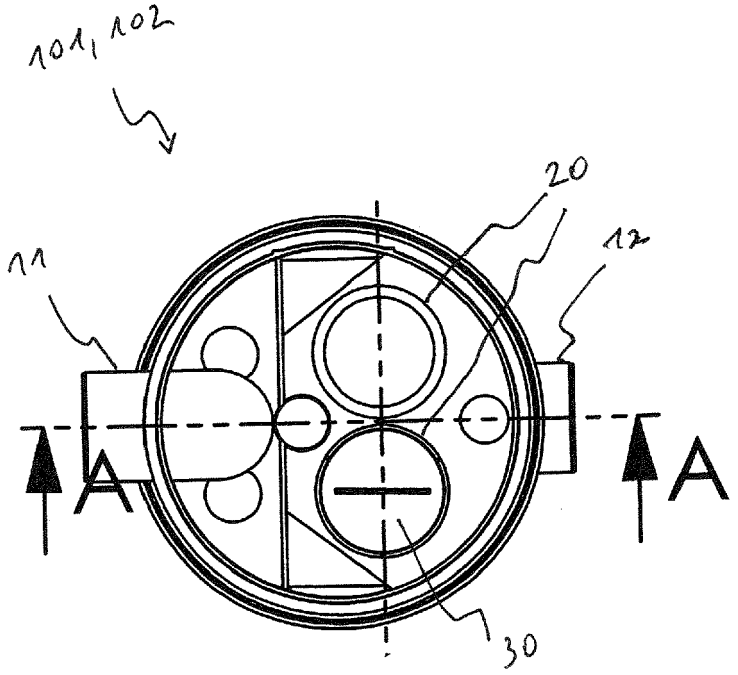

Fig. 3A

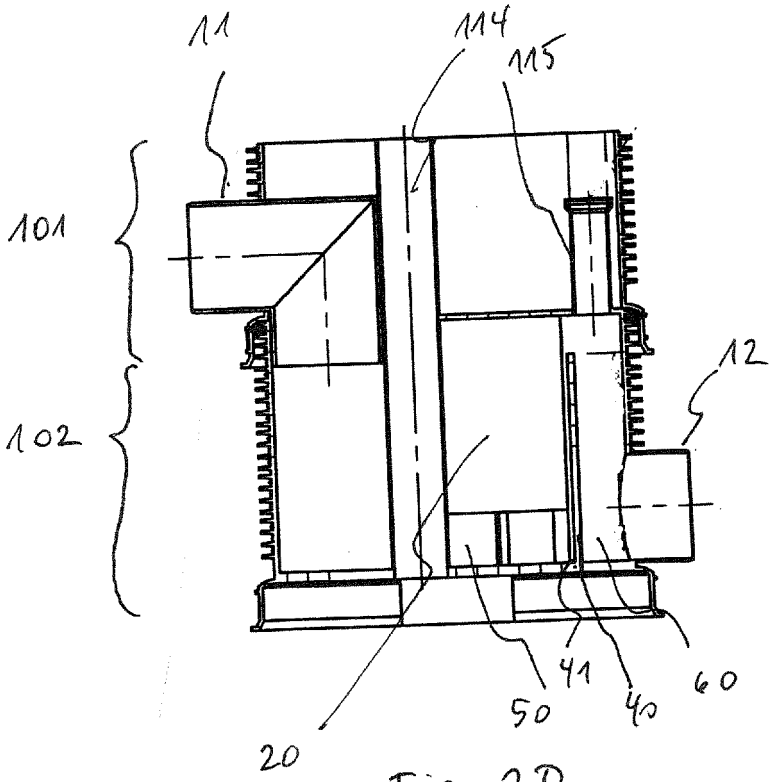

Fig. 3B

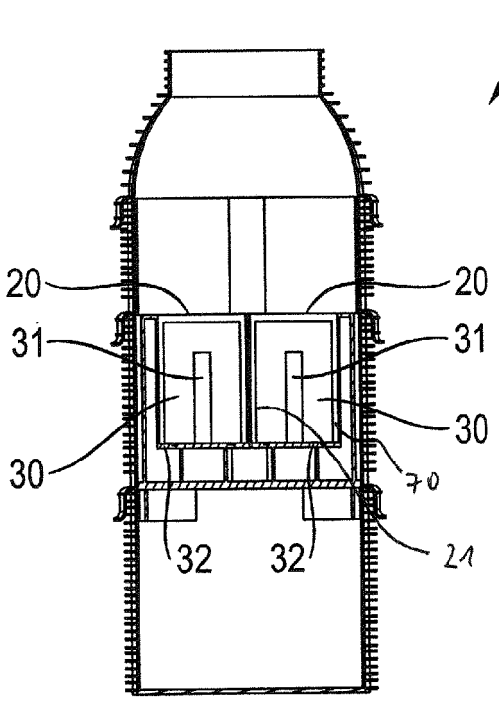

Fig. 4A

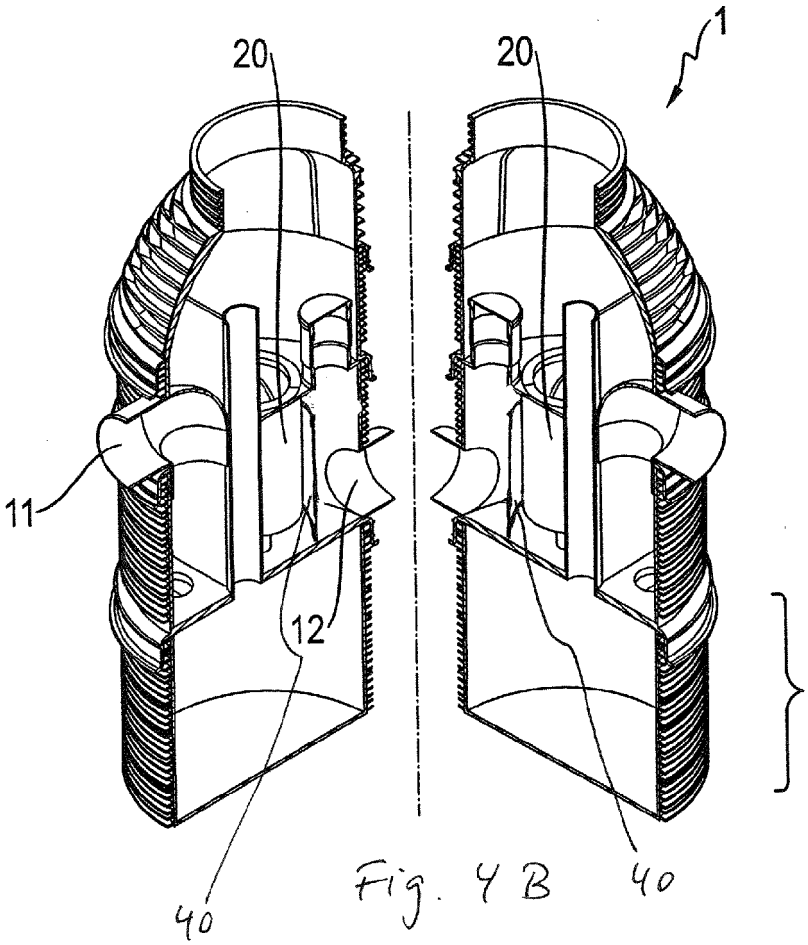

Fig. 4B