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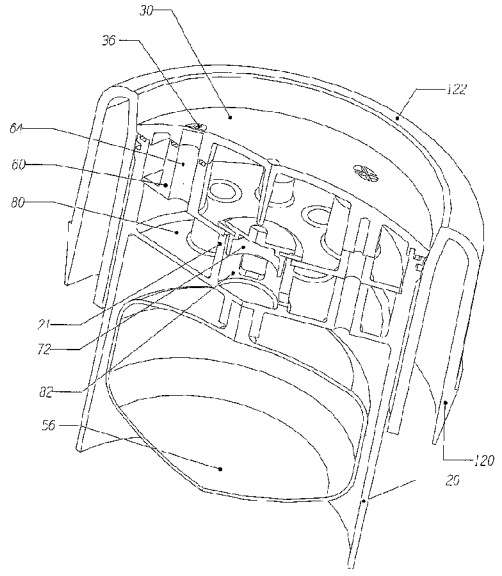

FIGURE 5
SECTION A-A

(57) **Abstract:** A sewer overflow relief device for mounting at a top end of a sewer overflow relief pipe, the device including: a top cover (30) having at least one outside air intake (36); air flow control means (72) for controlling the flow of outside air into the sewer overflow relief pipe; wherein, in use, the device prevents outside water from entering the sewer and the device may be ejected from the sewer overflow relief pipe by sewage pressure pushing against the device, thereby allowing the sewer overflow relief pipe to overflow.

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SEWER OVERFLOW RELIEF DEVICE

FIELD OF THE INVENTION

The present invention relates to a device for providing sewer overflow relief arrangements and to venting of sewers. The invention is described herein in relation to domestic plumbing but is not limited to that application only.

BACKGROUND OF THE INVENTION

Waste water is carried away from buildings and roads via two different systems. The first is via storm water drains and channels, which typically discharge directly to a natural body of water such as a river, estuary or sea. While some rubbish carried from stormwater may be filtered from the flow by appropriate screens or grates, the water itself is not treated before discharge, as it is generally freshwater run-off from rainfall or storms. The second system is the sewage system, and water or sewage discharged to the sewage system must be carefully treated by appropriate processes before the treated water can be discharged into the environment. Such treatment is expensive.

The connection of a house or building to the general sewage system includes provision for dealing with local sewage blockages or pressure problems. Rather than having a situation where sewage backs up through an outlet in the home (for example, the toilet), an overflow relief gully is provided outside, adjacent the home. This ensures that in the event of a sewage overflow, the overflow does not incur inside the home. Typically the overflow relief gully is a grate over a pit, connected to the building's sewage system by a sewer overflow relief pipe having a water seal created by a 'water trap' or 'U-bend' which prevents egress of sewer gas. This pipe is run as an extension from the sewage pipes under the house and typically the sink waste water is run to the overflow relief gully in order to maintain the water seal. A bib tap is also provided to help maintain the water seal.

It has become a common practice for builders and landscapers to channel stormwater run-offs into the overflow relief gully, instead of to the storm water system. This is because the overflow relief gully is typically conveniently located near the home (in order to minimise the length of the extension and distance to run the sink waste water), and hence is located near surfaces such as concreted

driveways and the like, from which water runs off. The driveways and the like are deliberately built with a gradient directing the run-off water to the overflow relief gully. Also, guttering down pipes can also be run to the overflow relief gully. This practice is very undesirable, as it increases significantly the volume of sewage that needs to be treated, and hence the costs associated with carrying the volume of sewage to a treatment plant, the number of treatment plants required, and the cost of actually treating the sewage.

It is therefore desirable to reduce the volume of sewage requiring treatment.

SUMMARY OF THE INVENTION

A first aspect of the present invention provides a sewer overflow relief device for mounting at a top end of a sewer overflow relief pipe, the device including:

- a top cover having at least one outside air intake;
- air flow control means for controlling the flow of outside air into the sewer overflow relief pipe;

wherein, in use, the device prevents outside water from entering the sewer and the device may be ejected from the sewer overflow relief pipe by sewage pressure pushing against the device, thereby allowing the sewer overflow relief pipe to overflow.

Preferably, the air flow control means include:

- a one-way air valve having an upstream side in fluid connection with the at least one outside air intake, and having a downstream side in fluid connection with the sewer overflow relief pipe;

the valve oriented, in use, with the upstream side at a lower level than the downstream side; the valve operable to allow passage of air when pressure on the downstream side is lower than on the upstream side, whereby outside air is admitted into the sewer overflow relief pipe.

Advantageously, this prevents egress of sewer gas, as sewer gas tends to rise and therefore is less likely to escape in a downward direction when the valve is in an open position.

Preferably, the at least one outside air intake is, in use, located on a raised portion of the device.

Preferably, the top cover has a polyhedral upper surface which has the outside air intake.

In a preferred embodiment, the sewer overflow relief device further includes:

- a body of circular cross section for insertion into the top end of the sewer overflow relief pipe, the side walls of the body in a close fitting arrangement with the internal wall of the top end of the sewer overflow relief pipe thereby preventing egress of sewer gas;

the top cover being fixed to the body and having the same diameter as the outer diameter of the top end of the sewer overflow relief pipe, whereby the device is difficult to manually remove from the sewer overflow relief pipe.

If desired, the body and the 'pipe' into which the body is inserted could have any cross-sectional shape, such as a square or other polygon, provided a close fit is obtained. Optionally, a pipe end extension or receiving housing can be fitted to extend the pipe and to receive the device. The end extension or receiving housing may be of different cross-sectional area or shape to the rest of the pipe.

In another preferred embodiment, the sewer overflow relief device further includes:

a float for engaging against the device;

wherein, in use, the device may be ejected from the sewer overflow relief pipe by sewage pressure pushing against the float. This provides for an even force to be applied to the device, ensuring that it does not jam or wedge within the pipe. The size (volume) of the float can also be selected such that the device is ejected from the pipe earlier than would otherwise occur.

Advantageously, a device according to the first aspect of the present invention will prevent most storm water from entering the sewer via the sewer overflow relief pipe, even where run-off water has been channelled to the pit or pipe. Even where the level of water builds up above the outside air intake, water may not pass the one-way valve except when the downstream (or sewer-side) pressure is lower than the upstream (or outside-air-side) pressure. Should this occur, only small amounts of water can enter the sewer system, and at a low rate.

Another advantage of a device according to the first aspect of the present invention is that local venting of the sewer may be achieved, reducing the need for alternative venting arrangements. When waste water is flushed down the

drains, ventilation must be provided to allow the flowing waste water to displace the sewer gas in the drain and then the vacuum which would otherwise form as the waste water flows down the drain. "Neutral" air pressure is required in drains, in order to ensure that the gravity operated system functions correctly. As the waste water passes the sewer overflow relief pipe junction with the sewer drain, air may be replenished into the sewer via the one-way valve, which is operated to automatically open when a low pressure or partial vacuum is present in the sewer overflow relief pipe, drawing air in through the outside air intake.

Yet another advantage of a device according to the first aspect of the present invention is that it avoids the need to provide a separate water trap or U-bend to prevent egress of sewer gas, which is both unpleasant to smell and hazardous. The sewer overflow relief pipe may be installed as a simple vertical section of pipe, and its end simply fitted with a device according to the invention. This reduces both materials and labour involved in construction. It is not necessary to provide an extension from the pipes running under the house to adjacent the external wall, as the overflow relief pipe may be located near the property boundary, and simply be a vertical extension running from the pipe connecting the house to the public sewer. Nor is it necessary to run the sink waste water or provide a bib tap to the overflow relief gully. Furthermore, by locating the overflow relief pipe remote from the external wall of the house, the temptation for builders or landscapers to deliberately channel storm water or other run-offs to the overflow relief gully is much reduced. As mentioned above, a pipe extension or receiving housing can be fitted to extend the overflow relief pipe, or the pipe may simply end without an extension or other fitting.

As storm water will not drain effectively via the sewer when the sewer overflow relief pipe is fitted with the device, and as the device is tamper resistant (and also necessary to prevent sewer gas egress and smells), builders, landscapers and the like will be motivated to ensure stormwater run-off is appropriately directed to stormwater drainage points (typically near the boundary of a property). Hence, the volume of sewage requiring treatment is dramatically reduced.

A second aspect of the present invention provides a sewer overflow relief device for mounting at a top end of a sewer overflow relief pipe, the device including:

a top cover; and

wherein, in use, the device prevents outside water from entering the sewer and the device may be ejected from the sewer overflow relief pipe by sewage pressure pushing against the device, thereby allowing the sewer overflow relief pipe to overflow.

A device according to the second embodiment of the invention is useful for retro-fitting situations, where venting of the sewer is provided by existing arrangements, and sewer gas egress is prevented by existing water traps or U-bends.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of one or more preferred embodiments of the present invention will be readily apparent to one of ordinary skill in the art from the following written description with reference to and, used in conjunction with, the accompanying drawings, in which:

Figure 1 shows a top view of a device according to a preferred embodiment of the present invention;

Figure 2 shows a cross-sectional side view of a device according to the embodiment of Figure 1, along the line A-A;

Figure 3 shows another top view of a device according to the embodiment of Figure 1 positioned in a pipe;

Figure 4 shows a cross-sectional side view of a device according to the embodiment of Figure 3, along the line B-B;

Figure 5 shows a sectioned top perspective view of a device according to another embodiment of the invention, along the line A-A;

Figure 6 shows a schematic plan view of a house having a sewage system incorporating a device according to an embodiment of the invention; and

Figure 7 shows a schematic plan view of a house having a traditional overflow relief gully.

DESCRIPTION OF PREFERRED EMBODIMENT

Figure 1 is a top view of a device according to a preferred embodiment of the present invention together with a pipe end extension or receiving housing. It shows a top cover 30 having an outer diameter 34. The top cover 30 has four outside air intakes 36. As may be seen in Figure 2, (which is a cross-sectional view of the embodiment taken along the section line A-A as shown in Figure 1) the top cover 30 has an upper surface which is a dome 32. The device further includes a body or housing 20, an insert 60 and air flow control means, being a one way valve 72 having an outer ring 73. A float 56 also resides within the housing 20.

The housing 20, insert 60 and top cover 30 are assembled together in order to form an air path through which outside air is drawn through outside air intake 36, through conduit 64 of insert 60 into lower chamber 80 and then to sub-chamber 82. Lower chamber 80 is formed by housing 20 and insert 60. The path taken by air is shown by the heavy black arrows. When one-way valve 72 is in a raised position (not shown), air passes from lower chamber 80 through valve 72 into upper chamber 90. As shown in Figure 2, the housing 20 includes support members 21 which support the insert 60. These support members 21 define a sub-chamber 82 of lower chamber 80.

The valve 72 is only raised when the air pressure in upper chamber 90 is lower than the pressure in lower chamber 80. As may be seen in Figure 4, (which is a cross-sectional view of the embodiment taken along the section line B-B as shown in Figure 3), the device 10 is installed at the end of pipe 50. The device may be installed directly in the pipe (not shown) or be received by a pipe end extension 120. Air passes from upper chamber 90 through housing conduit 16 to the sewer pipe 50 - chamber 90 is in fluid communication with the sewer. This arrangement allows for the venting of the sewer overflow relief pipe 50 but prevents egress of sewer gas from the sewer through the end of the pipe 50, which is wholly blocked by the sewer overflow relief device 10. It is therefore not necessary to provide a separate water seal such as a 'water trap' or 'U-bend'.

Air can only pass in one direction through the sewer overflow relief device 10 – that is outside air may pass into the sewer. Water cannot pass into the sewer overflow relief device except in the relatively rare circumstances that one-

way valve 72 is in a raised position (i.e. under the same circumstances in which air may be passed into the sewer overflow relief pipe). Hence, stormwater and the like does not pass into the sewerage system and hence the volume of sewerage required to be treated is reduced.

The lower chamber 80, which is on the upstream side of one-way valve 72, is in fluid communication with outside air, via outside air intake 36 and conduit 64. By relying upon negative sewer pressure to raise one-way valve 72 in order to admit air into upper chamber 90 and, where neutral pressure is obtained, relying upon gravity to close one-way valve 72, the admittance of any water that may be present into the sewer is severely restricted. One-way valve 72 is desirably manufactured from a material heavier than water. Therefore, if chamber 80 is filled with water, the valve 72 is not raised by normal water pressure – only by negative pressure in chamber 90. As the operation of the venting valve is infrequent, a very low volume of water may be admitted.

Storm water and other water is further deterred from entering the device 10 as the outside air intake holes 36 are raised by being situated part way up dome 32. Where water does enter through these holes, it may pool in lower chamber 80 and on relatively rare occasions be passed through to chamber 90 (as described above). However, this is a very small volume of water when compared to the volume of water typically passed into the sewer system from stormwater run off.

An optional pipe end extension or receiving housing 120 may be provided at the end of pipe 50. The device 10 is received by or fits inside extension/housing 120 (or optionally may be integrally formed) and the raised dome section 122 of the housing 120, which extends above the local ground level (or bottom of a pit) further prevents storm water from pooling near or entering intake holes 36.

The extension/housing 120 may also serve as an 'adaptor' for the device 10, allowing retrofitting of the device 10 into finishing collars (also known as mound collars) (not shown) installed at pipe ends (usually for supporting grates). It can be used with terracotta, PVC and iron finishing collars.

The extension/housing 120 has the 'same' internal diameter as pipe 50 and is positioned to rest upon the end of the pipe 50. Preferably, the

extension/housing 120 has a resilient structure or is of resilient material, such that it may be readily installed in a retrofit situation and allows for ease of insertion of the device.

The extension/housing 120 shown in Figure 4 includes an angled outer rim 124 (forming an 'arrow' in cross-section) which may be useful in a retrofit situation as it assists in guiding for installation and increases the resilient flexibility in this area. An O-ring may be provided to rest on the base of the 'arrow' to seal to a finishing collar.

In the event that the sewer pressure builds such that the sewer overflow relief device is required to operate by overflowing, in order to prevent overflow at a location inside the house, the float 56 pushes against housing 20 thereby causing the entire sewer overflow relief device 10 to pop out or eject from the sewer overflow relief pipe 50 (or from extension/housing 120). This allows the sewer to overflow as necessary from the overflow relief pipe 50. Once the situation has been corrected or resolved, the overflow relief device 10 may be simply re-installed into the pipe 50.

As the top cover 30 has an outer diameter 34 which is the same or lesser diameter than the outer diameter of pipe 50 (the embodiment of Figure 4 has outer diameter 34 the 'same' as the inner diameter of pipe end extension 120 of pipe 50), it is very difficult for the general public or indeed a workman to tamper with the sewer overflow relief device 10. A special tool may be required to remove the device – potentially being inserted through an outside air intake hole 36. A further motivation for avoidance of tampering is the fact that the sewer overflow relief pipe 50 does not need to have been provided with a water seal and hence removal of the overflow relief device 10 will result in egress of sewer gas – which both smells and is hazardous. Therefore, attempts to alter the device or force it into a permanently 'open' valve position, to allow storm water to drain to the sewer, are unlikely.

As may be seen in Figures 2, 4 and 5, the various parts of the sewer overflow relief device 10 according to embodiments of the invention may be fixed and sealed together by provision of sealing O-rings 38 and 42, which seal the top cover 30 to the insert 60 and housing 20. The device 10 is closely fitted inside extension/housing 120 or pipe 50, (once installed). The outer diameter of

housing or body 20 is closely matched to the inner diameter of the receiving housing 120 or pipe 50. Optional holes (not shown) in the wall 22 may enable both a saving of material and a degree of resilient movement in the housing 20, to enable ease of installation. Depending on the characteristics of the material selected, the holes may, or not, be appropriate in some embodiments. Preferably the device is manufactured from PVC. O-ring 28 seals the sewer overflow relief device 10 to the receiving housing 120 or to the sewer overflow relief pipe 50. The insert 60 may be affixed to top cover 30 via screws engaged through screw holes 46, 66, 26. The distance through which one-way valve 72 may travel is regulated by valve stop 44 provided on top cover 30. One-way valve 72 rests in its closed or lowered position upon insert 60, however, the precise arrangement may be varied and it could also rest upon the housing. In a less preferred embodiment (not shown) the device is fitted outside the pipe 50 rather than inside and alternative tamper proof features may be provided.

As is shown in Figure 6 which is a schematic plan view, the present invention allows for an arrangement in which (when compared to Figure 7, a schematic plan view of prior art arrangements) an extension pipe 112 and overflow relief gully 110 may be omitted. Sewer main 100 is connected at sewer connection point 104 to a private property 102 having a building 106. A venting arrangement 108 is provided at the remote end of the building 106 (the additional venting provided by the present invention provides localised venting). The overflow relief pipe may be provided as a vertical pipe at the sewer connection point 104, thereby further removing the temptation for stormwater to be drained towards it as it is remote from the house and from concreted driveways, paths, guttering down pipes and the like.

As the present invention may be embodied in several forms without departing from the spirit of the essential characteristics of the invention, it should be understood that the above described embodiments are not to limit the present invention unless otherwise specified, but rather should be construed broadly within the spirit and scope of the present invention as defined in the appended claims. Various modifications and equivalent arrangements are intended to be included within the spirit and scope of the present invention and appended claims.

CLAIMS:

1. A sewer overflow relief device for mounting at a top end of a sewer overflow relief pipe, the device including:

- a top cover having an upper surface, the upper surface having at least one outside air intake;
- air flow control means for controlling the flow of outside air into the sewer overflow relief pipe;

wherein, in use, the device prevents outside water from entering the sewer and the device may be ejected from the sewer overflow relief pipe by sewage pressure pushing against the device, thereby allowing the sewer overflow relief pipe to overflow.

2. A sewer overflow relief device according to claim 1 wherein the upper surface is a dome.

3. A sewer overflow relief device according to claim 1 or 2 wherein the air flow control means include:

- a one-way air valve having an upstream side in fluid connection with the at least one outside air intake, and having a downstream side in fluid connection with the sewer overflow relief pipe;

the valve oriented, when the device is oriented in an in-use orientation, with the upstream side at a lower level than the downstream side; the valve operable to allow passage of air when pressure on the downstream side is lower than on the upstream side, whereby outside air is admitted into the sewer overflow relief pipe.

4. A sewer overflow relief device according to any one of the preceding claims wherein the at least one outside air intake is, when the device is oriented in an in-use orientation, located at a level higher than the level of the top end of the sewer overflow relief pipe.

5. A sewer overflow relief device according to any one of the preceding claims further including:

- a body of circular cross section for insertion into the top end of the sewer overflow relief pipe, the side walls of the body in a close fitting arrangement with the internal wall of the top end of the sewer overflow relief pipe thereby preventing egress of sewer gas;

the top cover being fixed to the body and having the same diameter as the outer diameter of the top end of the sewer overflow relief pipe, whereby the device is difficult to manually remove from the sewer overflow relief pipe.

6. A sewer overflow relief device according to any one of the preceding claims further including:

- a float for engaging against the device;

wherein, in use, the device may be ejected from the sewer overflow relief pipe by sewage pressure pushing against the float.

7. A sewer overflow relief device according to claim 1 wherein the upper surface is polyhedral.

8. A sewer overflow relief device according to claim 1 wherein, when the device is oriented in an in-use orientation, the at least one outside air intake is located in a raised position higher than the outer perimeter of the top cover.

9. A sewer overflow relief device substantially as hereinbefore described, with reference to any one of the embodiments shown in the accompanying Figures 1 to 6.

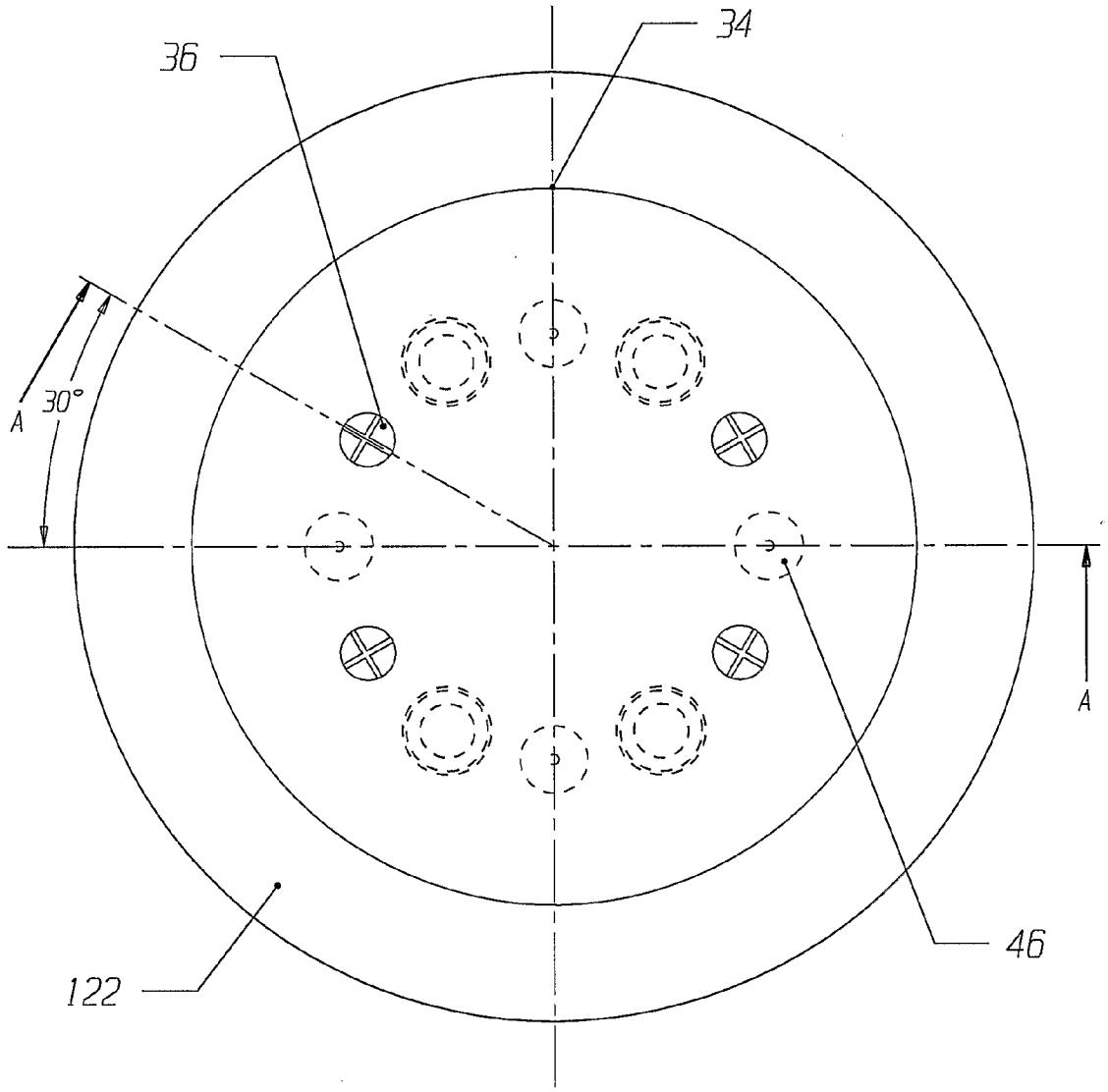

FIGURE 1

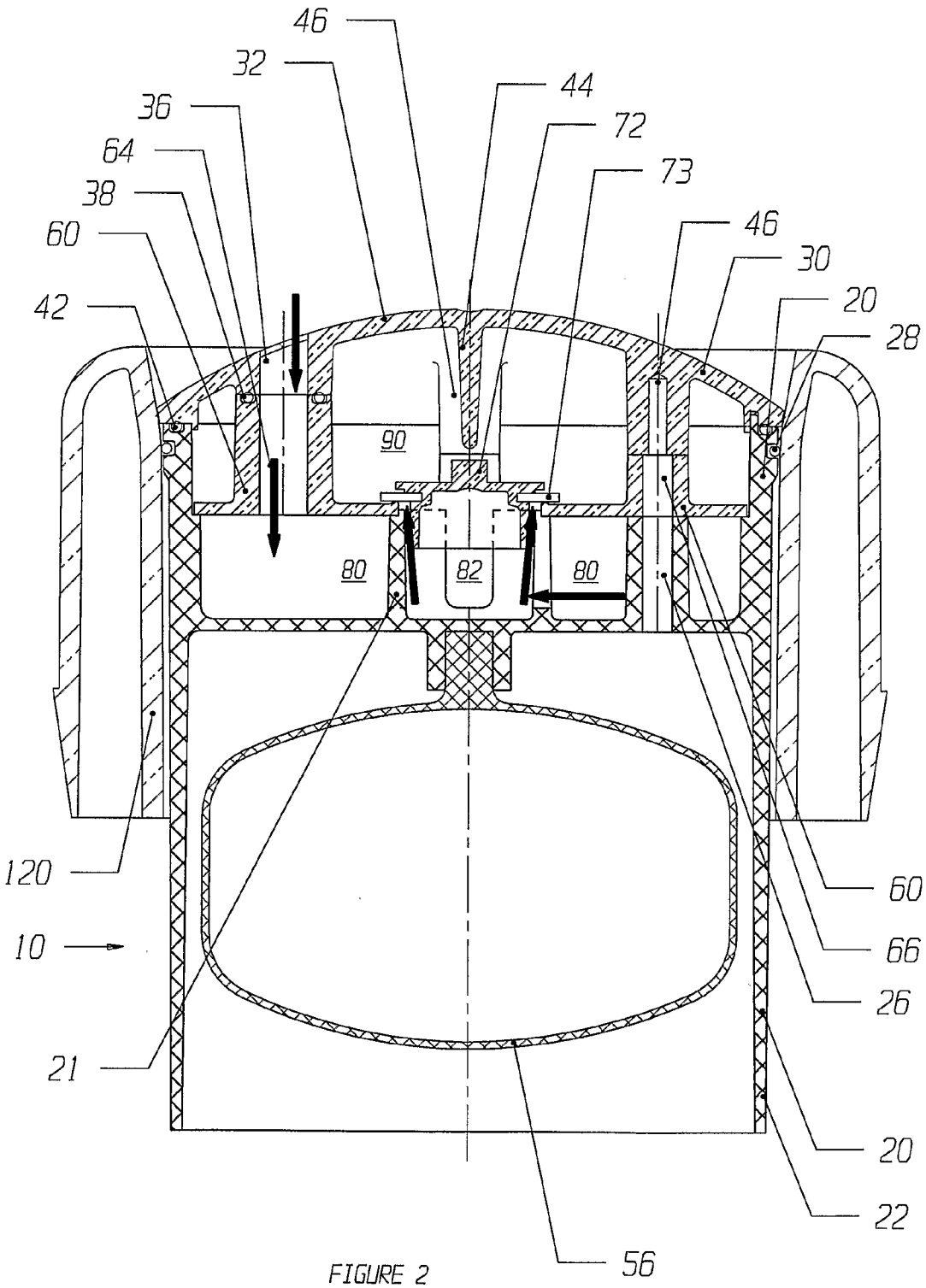

FIGURE 2
SECTION A-A

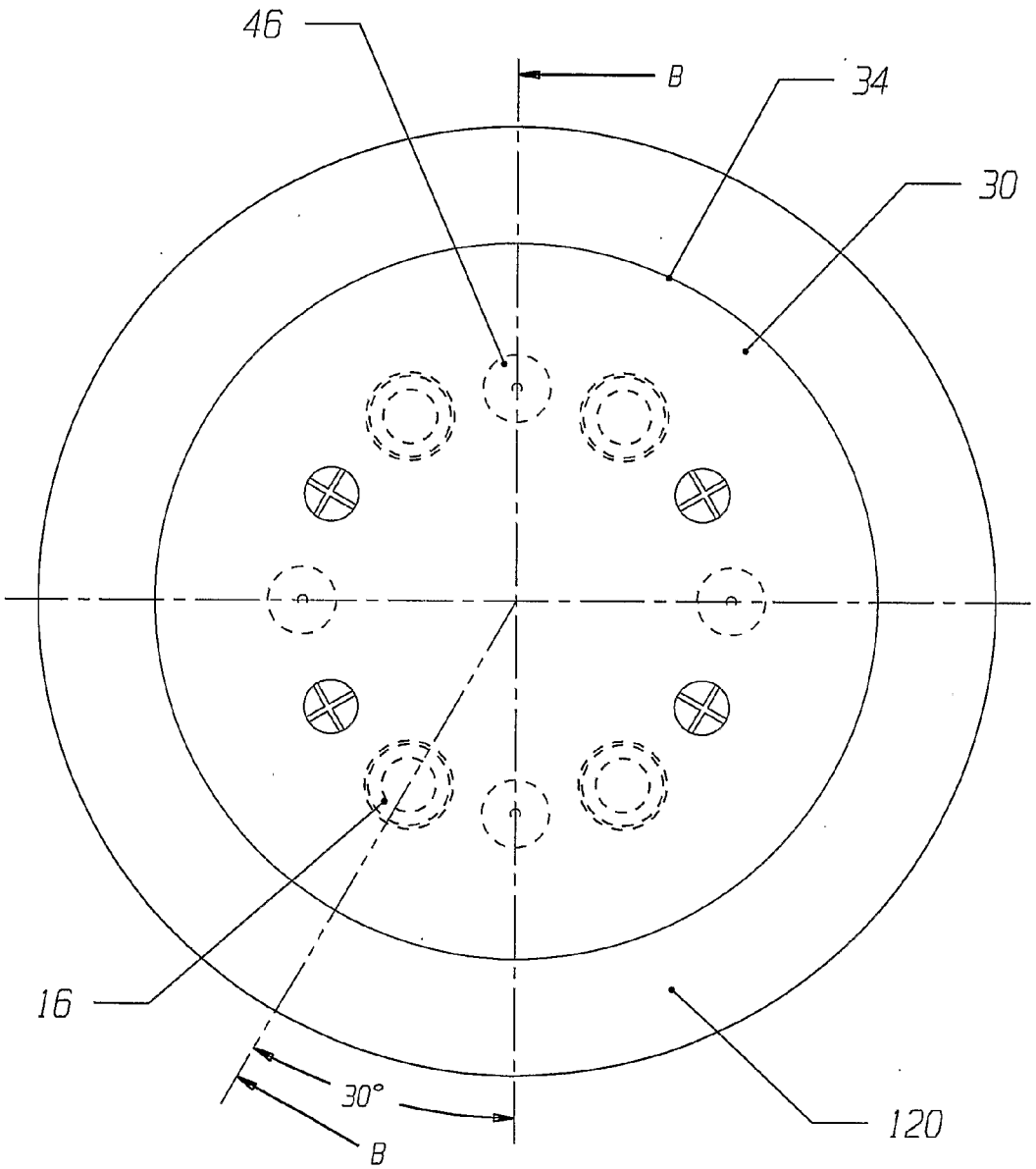

FIGURE 3

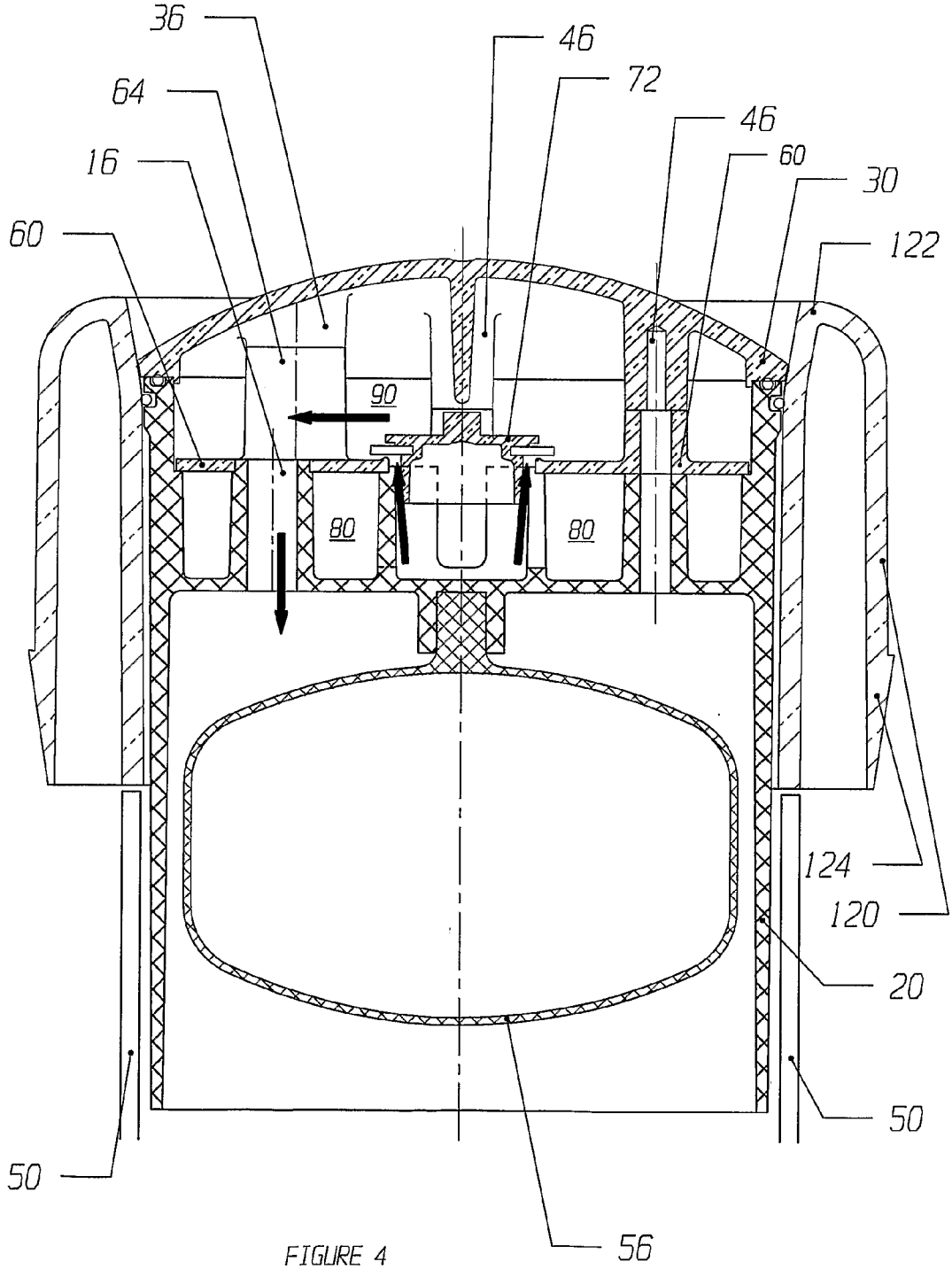

FIGURE 4
SECTION B-B

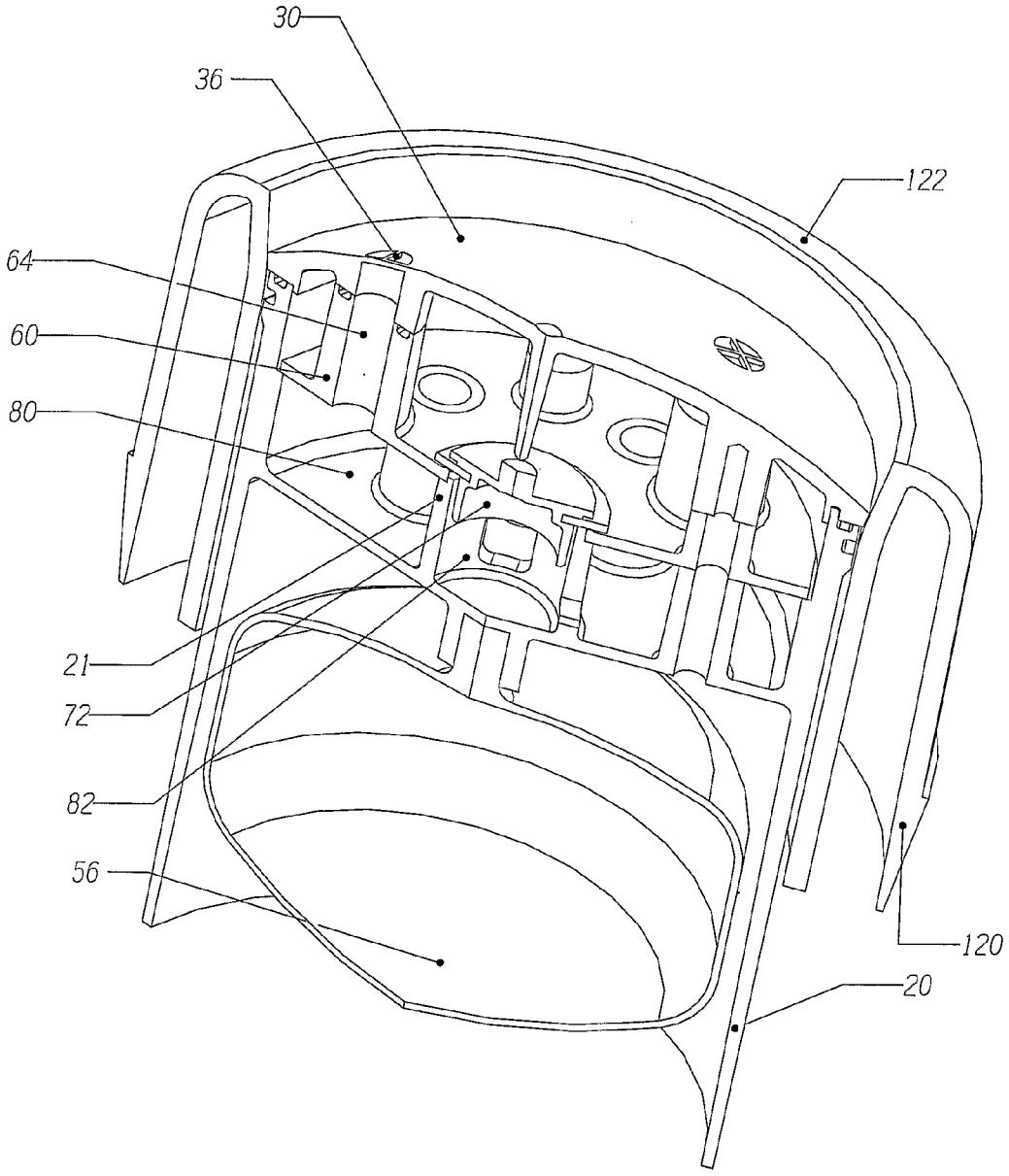

FIGURE 5
SECTION A-A

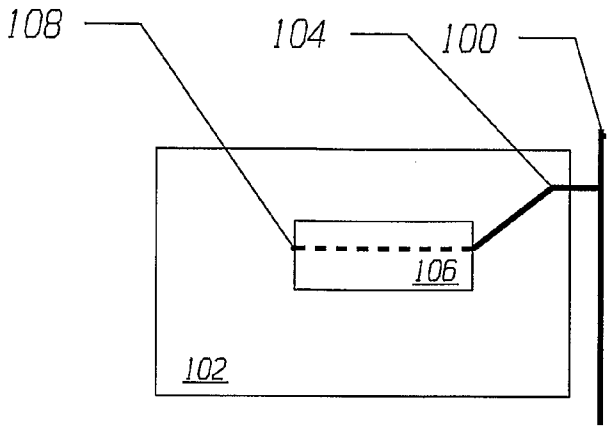

FIGURE 6

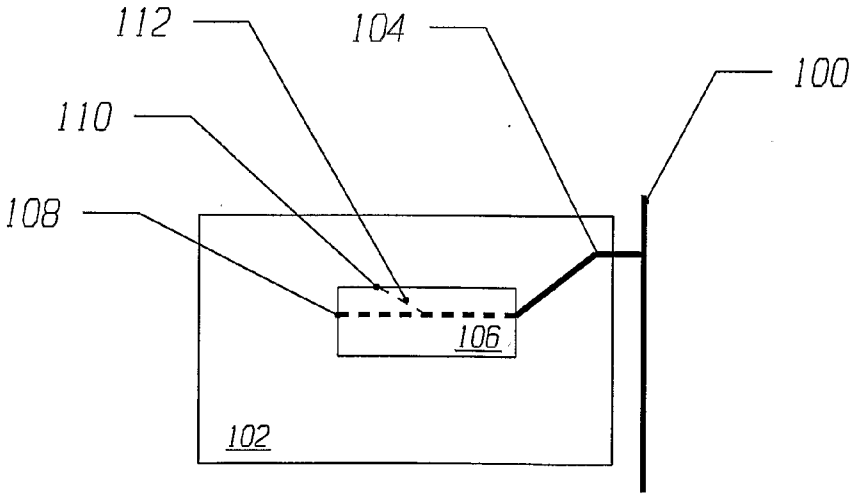

FIGURE 7