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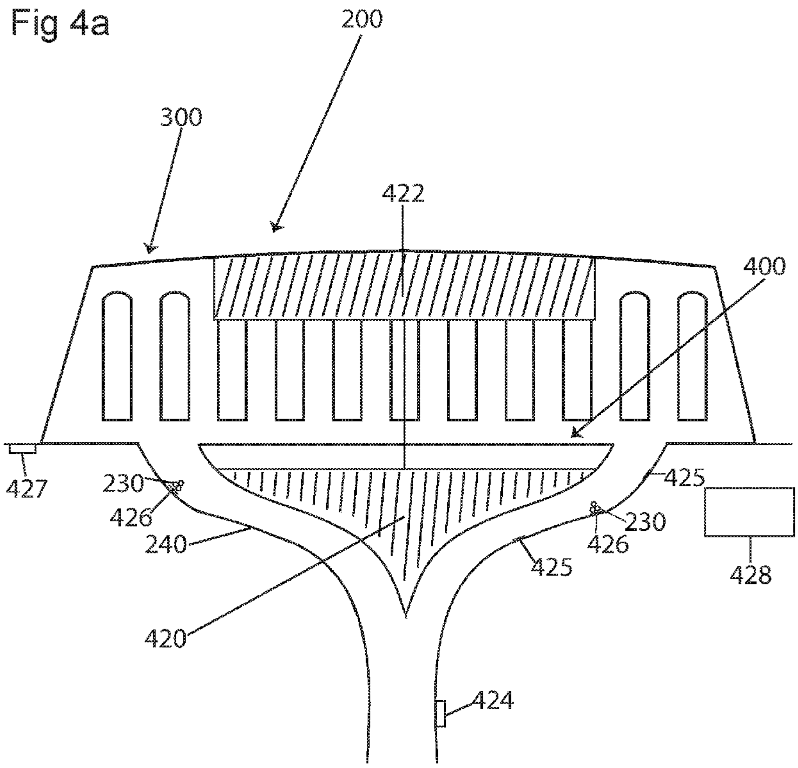
Fig 4a



(57) Abstract: An object of the present invention is to provide a system and a method for effectively preventing that gases/heat from an outlet are ascending from a gully and form ice, in addition to effectively drain liquids through a gully. The present invention is obtained by arranging a float so that said float and a portion of the gully define a closable opening for through flow, further arranged such that the float is preventing gases/heat from the outlet to ascend up from the gully and form ice and/or so that the float prevents that gas is drawn into the gully.

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DRAIN

Technical field

The invention relates to drains and gullies in general and in particular a system and a method for effectively draining liquids through a gully.

Background art

From prior art it is referred to general open gullies known from gullies on roofs or in roads as well as wash and laundry drains and sinks. The basic principle is that liquid flows due to its own weight “gravity flow” and the gullies can be co named self draining. These gullies are open and allow air to enter the outlet or drainage system, thereby limiting the amount of liquid to be drained. In addition the employment of a manifold will represent a risk for liquid flowing from a gully at a higher level through a lower gully.

Figure 1 of the drawings shows a system of the gravity flow gully type where due to the above mentioned reason is chosen to avoid a manifold and letting its gully have its own outlet so that these are gathered in bottom pipes and are fed to a basin or direct to the drainage or sewer pipeline network.

From prior art it is referred to NO 17591 of same inventor, regarding a gully having elongated channel parts extending radially from a central part.

It is also referred to vacuum gullies, also called total flow gullies, where gases like air are excluded from the flow. The technical effect of this is that it is stablished a liquid column from the gully to the outlet, the complete weight of said column generating a heavy suction to handle lager amounts of water than open gullies. In addition this enables the use of manifolds so as to save pipes and simplify portions of the structure. Such systems are often called “full-bore flow” or “syphonic”. There is however a number of problems connected to such gullies, such as:

- The gully head is more complex, as the head comprises a housing part having a roof and forms an air lock, as the roof is defining the maximum height for the opening into said housing part
- The gully may comprise a throttle or choke disk, often in the form of a ring or plate having a hole, arranged upon the gully bottom and limiting/throttling the outlet dimension
- Several throttle disks of various dimensions have to be produced
- The gully head is easily blocked by extraneous matters like leaves, dirt and smaller particles gathering in a kind of clay

- The system is complicated to calculate and dimension
- The system is when installed sensitive for even minor changes like new superstructures or the adjustments of outlet pipes or constructional alterations leading to changes in the amount of water between the gullies. Then new calculations and adjustments for new throttle disks or gully dimensions have to be made
- Gullies have mainly to be arranged in the same heights, and if gullies in different floors of a building are to be connected together, the dimensioning has to be calculated and the connection has to be carried out further down to the outlet
- The gullies can be adapted to different amounts of water by use of throttle disks, but only down to a limit
- If the amounts of water are too small the outlet pipes will not longer be self-cleaning so that the outlets over the time may be fouled/clogged
- Unless not regularly flushed

Figure 2 shows a system with a vacuum gully. It should be mentioned that the outlet system for such gullies comprises pipes arranged horizontally, that is without any inclination. Because the outlet pipes in this case can be arranged horizontally (without inclination), these pipes are accommodated just under the ceiling and are assembled to turn down at one place. Due to this, the pipe arrangement in the ground will be at a minimum, which is being particularly favourable when the building is on a rock fundament.

In a first period a vacuum gully will operate like when of gravity flow, and only when the water level rises over the roof height of the inlet gas will be excluded so the gully starts operating as a vacuum gully. The draining ability increases dramatically and is maintained until the water level has been reduced so far that also air is drawn in, whereby the gully again changes to operate as a gravity flow gully. A vacuum gully having 75 mm diameter can as an example handle 10 litres per second at a water level of 35 mm and 19 litres per second at a water level of 55 mm.

When several vacuum gullies are connected together, the air intake from one gully will be sufficient for that the liquid column no longer will be unbroken any longer so that all the gullies are starting to operate as gravity flow gullies. This can be remedied by using throttle disks so that the gullies during operation will be drained approximately at the same time, so that the complete system may operate as a vacuum gully for as long as possible.

Of suppliers Blücher should be mentioned, supplying vacuum gullies having an opening of 11 mm between surface and roof, but without throttle disk. Also the supplier Joli should be mentioned, using vacuum gullies with an opening of 19 mm and having throttle disks. A lower opening means that the gully operates as a vacuum gully even by a lower water level, but having the drawback that the resistance against flowing through also becomes higher

Common for gullies of the gravity flow and vacuum gullies is that warm air rising from the outlet causes ice build-up on the roof surface. This happens because the gully remains at temperatures above the freezing point while the snow on the roof is holding temperatures below freezing. Ice will then build up in the area around zero temperature (^{o}C). The building-up of ice will normally become greater for gravity-flow gullies due to the employment of greater outlet pipes that normally dissipate more heat and therefore melts more slow, which leads to the building-up of larger ice build-up.

The heat is generated by that at least portions of the outlet pipes are in frost-free ground and is brought up through building constructions having higher temperature. Warm air therefore ascends from the outlets and heats up the gullies in varying degree, but common for all the gullies is that they receive a surplus heat keeping them free from frost so that they are not frozen completely. This is a great benefit for the gullies themselves, as the entire outlet would have become blocked if the gullies had frozen. The drawback is that the surplus heat also melts the snow around the gully so that the melted water can build up ice blocks around the gully on the roof surface.

Brief summary of the invention

Problems that had to be solved by the invention

For this reason it is a main object for the present invention to provide a system and a method for effectively hindering that gases/heat from the outlet ascends from the gully and generates ice, in edition to the draining of liquids through a gully where the above mentioned problems are overcome.

Means needed for solving the problems

The present invention achieves the object given above by

a gully system (gully device) as defined in the preamble of claim 1, having the features of the characterizing clause of claim 1,

a gully system as defined in the preamble of claim 2, having the features of the characterizing clause of claim 2,

a method for controlling gullies, as defined in the preamble of claim 7, having the features of the characterizing clause of claim 7, a method for flushing gullies and as defined in the preamble of claim 10, having the features of the characterizing clause of claim 10, and

a gully grid as defined in the preamble of claim 12, having the features of the characterizing clause of claim 12.

The present invention achieves the goal stated above by arranging an adjustable float in a gully.

In a first aspect of the invention the float is adjusted to prevent gases/heat from the outlet from rising from the gully and forming ice.

In a second aspect of the invention the float is adjusted to prevent gas, typically air, from becoming sucked into the gully and stop the vacuum gully effect.

Both can be combined, but the first aspect is only relevant where building-up of ice is a problem. Common for both is that it is desired to prevent gas/air to pass into or out from the gully, said goal being obtained by an adjustable float that can be adjusted to block the down pipe from the gully. The combination can be made by using a float adapted for performing both tasks, as well as to floats in tandem can be used in the same gully, as a first float prevents gas from being sucked into the gully, while a second float prevents gas from ascending from the gully and forming ice.

In the first aspect the adjustment is sufficiently taken care of by using a float having low specific weight so that it floats up when liquid enter the gully. Such a system does not need further operating or control systems.

In the second aspect it is desired to have sensors for initially adjustment of the float and adjustment during operation. This can be done by providing gullies with local pressure gauges, by providing the outlet system with a central pressure gauge and a central control unit or in other ways to measure operating parameters.

The invention is a novel gully arranged locally or centrally and having sensors measuring i.e. pressure, temperature, water level, and a float acting both as an automatic adjustable air lock and an adjustable throttle or choke disk. The float is preferably controlled/regulated by an automatic unit.

As the float according to the present invention provides several technical effects connected to the building-up of ice and draining, where these are related to draining for surfaces, these are comprised by same inventive concept.

Effects of the invention

The technical difference from traditional gullies or drains is in the first aspect that the float reduces the heat supply from the outlet pipe and out from the gully. This involves that the zero point is moved from the roof surface and down into the gully, preferably just above the float, so that it is not freezing in position.

In a favourable embodiment the gully is provided with a heating element so that the zero point can be adjusted upwards.

The technical difference from a vacuum gully is that the roof in the housing part is replaced by a float defining an adjustable opening for the liquid flowing into the gully and down in the outlet.

These effects provide in turn further favourable affects:

- the use of throttle disks are avoided, as the adjustable float replaces these and the effective throttle disk is defined by the adjustable float
- the problem with blocking is overcome as possible extraneous elements or matter are/is removed by raising the gully head and the float sufficiently, so that when said extraneous elements are removed, the gully head and the float can be lowered back to the original position
- calculations are greatly simplified as the float is adjustable and controlled by local conditions
- by alterations the working situation will be adjusted for compensation by adjustment of the float
- gullies or drains in several heights can be connected together to a common draining or outlet system as the roof surface is separately adjusted by lowering and raising the floats, under the condition that the connecting to the main outlet is made correctly by giving each roof its own gravity fall height before the connection
- due to that the float is held in a closed position until there is a demand for draining, enables the avoiding of a warm air flow ascending from the outlet and facilitating the building-up of ice, as well as the amount of air carried external matter such as sand and dust are reduced for the entering into the outlet system
- the roof can be simply pressure tested with a grater water level before the delivery to the builder, and the height of the water level can be logged at each gully as well as the time the roof has had this water level. This again may be used as documentation for the owner as a confirmation on that the test is carried out with noted time, date and clock hour. A pressure test can be repeated just ahead of the expiry of the warranty in order to check if the roof still is tight.

Calculations are made for giving approximately the same under pressure in all the gullies.

The control unit measures the pressure in all the gullies and adjust its separate floats so that the same under pressure is obtained for the complete plant.

The described solution can be employed for all types of outlet and draining systems, but for systems of the gravity flow gullies a simpler solution can be used.

Brief description of the drawings

The invention will be further described below and refer to the drawings presenting several exemplary embodiments, wherein:

fig. 1 shows state of the art of an open gully

fig. 2 shows schematically a vacuum gully of prior art

fig. 3 shows schematically an outlet system for vacuum gullies

fig. 4a shows schematically a section of a gully according to the invention

fig. 4b shows schematically a section of a gully according to the invention, in details

fig. 5a shows schematically an outlet system for a gully according to the invention and having a vacuum gully

fig. 5b shows schematically an outlet system for a gully according to the invention and having a gravity fall gully

fig. 6 shows schematically an outlet gully having a float, only for a gravity fall gully

fig. 7a shows schematically a float system for a full flow gully suitable for post-mounting in an existing gully system

fig. 7b shows the outlet and annulus of fig. 7a, seen from above

fig. 7c shows the float system of fig. 7a in an open position

fig. 7d shows an alternative to fig. 7a, using a goose neck

fig. 8a shows schematically a gully grid

fig. 8b shows schematically a section of a gully grid

The reference numbers used in the drawings

100	Drain or gully system
120	Central control unit
200	Gully
210	Liquid
212	Liquid level of gully
220	Gas bubble
230	Ice
240	Gully bottom
300	Housing part
302	Roof of housing part

400	Gully head
401	Throttle or choke disk
410	Prior art roof
420	Float
422	Actuator for float
424	Pressure sensor
425	Temperature sensor
426	Heating element
427	Pressure gauge (under pressure)
428	Control unit
440	Insert
442	Goose neck
450	Float
460	Float control
462	Dowel (guide) pin
464	Guide cylinder
500	Outlet or drainage system
510	Drain pipe from gully
512	Annulus
520	Manifold
525	Main down pipe
530	Outlet
540	Basin
600	Building
610	Roof
620	Terrace
630	Ground level
640	External drainage or outlet system
700	Gully grid
702	Roof of gully grid
704	Arms for gully grid

Detailed description of invention

The invention will in the following be described in more details with references to the drawings showing several embodiments, in that fig. 1 schematically shows a open gully 200 of prior art and arranged on a roof 610 of a building 600, shown in fig.

3 and fig. 5b. The gully leads a liquid 210, typically water, to a drainage (outlet) system 500 through a drain pipe 510 from the gully. The drainage system comprises an outlet to an external draining or outlet system 640, such as a municipal draining system beneath ground level 630.

During operation water will enter the gully and bring gas, typically air with it, in the form of bubbles 220. This results in that the water is not in the form of a single column of water. A major part of the fluid flow cross section is of air, and the capacity thereby is correspondingly reduced.

If an additional gully is arranged on a terrace 620at a level beneath the roof and is connected to a common outlet system, the risk is that during heavy precipitations water from the roof will flow up through the outlet system and out through the gully on the terrace.

Fig. 2 shows schematically a vacuum gully according to prior art and comprises in addition to the solution mentioned above also a housing part 300 having a roof 302 and a grid to avoid the entering of extraneous matter and to protect components in the housing part, also comprising a gully head 400. The gully head comprises a roof 410 that together with the bottom 240 of the gully defines an opening for through flow. The diameter and height of the opening as well as the complete outlet system and its diameter have to be calculated before installation.

During operation at a low water flow the vacuum gully will act approximately as an open gully, but when the inflow exceeds a certain level so that the roof is submerged in water, air will not any longer, but just water enter into the outlet system, so there will exist an unbroken column of water from the gully to the outlet. The weight of the column establishes a strong suction that effectively drains large amounts of water from the roof, and at the same time the complete column cross section is water, even if there is used a manifold 520 to connect several gullies together to a common outlet. Fig. 3 and fig. 5a show schematically such an outlet system for vacuum gullies.

The connection to open gullies or gullies at several levels will allow for gas in the column and then destroy the effect.

The roof, in case a separate throttle disk 401 is adapted for allowing large water through-put without also letting air enter. Throttle disks are typically provided in several sizes, and the choice of a throttle or choke disk will be a result from the calculations made when the complete plant is projected.

Principles forming the basis of the invention

Figs. 4a and 4b show schematically a section of a gully according to the invention and comprise a float 420 that together with the gully bottom defines an opening for a through flow. The height is adjustable by the actuator 422 for the float, where the actuator is controlled by a control unit 428 receiving signals from a pressure sensor 424 arranged in the gully downstream from the float.

In a first aspect where the float 420 prevents heat from the outlet from rising up from the gully and forming ice, the float is in a closed position when there is no need for draining. When liquid 210 is building-up, it flows into the gully and the float is lifted to allow the liquid in the gully to flow further down into an outlet pipe connected to the gully. In a simple embodiment the float is a ball 450, see fig. 6, said ball is floating on the water due to its buoyancy. The ball is preferably arranged movable in a perforated tube or in a guide cylinder 464 having ribbed walls so that the ball is lifted up by the water, but without swaying sideways. The ball is preferably of an elastic material inflated by gas under pressure, so that if said ball should be damaged it will collapse like a punctured balloon and flushed down the outlet without getting stuck.

In a second aspect of the invention where the float is regulated for preventing gas, typically air, from being sucked into the gully and deteriorates the effect of the vacuum gully, the float is in a closed position when there is no need for draining.

In a first embodiment the float is arranged for adjusting the through-put flow, about in the same way as throttling disks, while the gully head is provided with a roof of which the height establishes a vacuum gully effect. In this embodiment the roof height of the gully head is adjusted for each gully on the same surface, so that all the gullies are operating so long as possible as vacuum gullies, or for a given under pressure, before air is sucked into one of the gullies connected together. The float then is used for throttling gullies starting to take in air, so that gullies becoming dry will not block other gullies from the loss of suction from an unbroken liquid column. By using a central control unit the performance of the gullies can be monitored, for possibly adjusting the roof height of the gully head in order to bring the draining capacity to a maximum.

In another embodiment the float is arranged for both to define the ceiling or roof height of the gully head and for controlling through flow, about in the same way as throttling disks. In this embodiment the float is adjusted so that the gully keeps as great opening as possible without taking in air, for in this way to drain as fast as possible. As the water level 212 is reduced, the float is adjusted downwards to a minimum height. Then the water amounts are so small that the pipes are not filled any longer, so that the outlet system can handle these small amounts of water as in a gravity flow system. In the case where the float is a ball, this will prevent air/gas in entering during the progress when gullies become empty of liquid.

The operation of gullies is following several phases, and an optimal control/adjusting of gullies involves a surveillance of changes or transfers.

In a first phase there is nothing to drain, and gullies are preferably closed, both in the first and the second embodiment. In addition to protecting against ice building-up, such a method will also prevent dust and particles from entering the outlet system, even at warmer seasons or global regions.

In a second phase the outlet system works as a gravity flow system until the amounts of water are so great that they can fill the outlet pipes, in that the water level then will build up around the gullies. This transition can be registered by a sensor connected to a central unit or by measuring the building-up of water around the float. In this phase it can be decided if a flushing operation should be carried out. This performed by letting the water level build up to a defined height before the opening of the gullies. When the gullies are opened the floats can be activated or controlled to a maximum opening before air is sucked into the gullies. This can be performed separately for each gully or in parallel, or in combination of such.

In a third phase the water level is reduced so that air can enter into at least one gully. This can be registered by measuring the water level above the float or above the effective roof of the gully, or by registering the pressure reduction in the outlet pipe connected to the gully when an air bubble is taken in, or by registering an increasing number of air bubbles in an acoustic way, optically or by other means. The gullies are controlled either by choking or throttling by the float or by lowering the effective gully roof by use of the float, for maintaining an unbroken liquid column longest possible. Ultimately the gully can be completely closed.

Typically the amount of water may rise, whereby gullies again open for taking down the entering water. This can be registered in the same way as described for the first phase. In such consecutive opening phases it is probably not necessary to carry out flushings.

In a fourth phase all the gullies have become dry and the water column is broken. This can happen due to that a lack of water supply causes air to enter the gullies from the outlet system, and it is then to be registered that the pressure reduction in the outlet system vanishes. In this phase it may be an advantage that all the gullies are to be opened so that in this way they can take the last remains of water, then being operated as gravity fall gullies. Such a phase can be timed controlled so that the gullies are closing and again are ready for starting the process once more, when it is estimated that all the water has dried away. Alternatively the rest amount of water can be registered by a separate sensor.

During an operation at a small water flow into the vacuum gully, it will behave approximately like an open gully, but when the water supply exceeds a certain level, corresponding to the height of the gully head/air lock, so that the gully head will be beneath the water, air will not any longer penetrate into the outlet system, only water, so there will be an unbroken column of water from the gully to the outlet. Then it is a desire of an adjustment process for control of the float. The pressure sensor detects that a suction is established, and the control unit send control signals to the actuator so that the float is raised and the openings or the through flow is increased. After a certain point air will enter the gully and an air bubble is taken in. This is registered by the pressure gauge, that sends a signal to the control unit which in its turn send control signals to the actuator so that the float is lowered and the opening for through flow becomes reduced, until air is no longer drawn into the gully. When a proper adjustment is carried out the position of the gully head and the float is locked. The plant or system is first regulated again for through flushing or pressure testing of the roof, possibly also other conditions calling for a new adjustment of that system.

When several gullies are connected together in manifold, the floats are controlled so that each gully on the same roof surface has the same under pressure, to ensure an optimal draining.

This ensures an optimal opening into the gully and reduces the demand for a housing part for avoiding that smaller extraneous elements are taken in, as such elements effectively will be sucked down and the control provides that such elements will not function as embankments around the gully.

As the conditions changes over time, such as if further extraneous matter enters and changes the conditions for the gully, it is desirable to repeat the process so that the amount of such matter will not build up over time and that the conditions are optimally maintained.

The control and adjustment process takes in air over a period during the adjustment, which is not favourable for an effective draining over this period. It is therefore a wish that not many gullies are adjusted at the same time. This can be done either by having the control unit centrally positioned and common for many or all gullies, in order to adjust one or a reduced number of gullies at the time. If each gully has its local control unit the amount of simultaneous adjustment can be reduced by having the adjustment process carried out with uneven intervals.

However it is still an advantage to provide the gullies with a leaf grid to prevent grater objects like twigs to block the float, while smaller particles can be handled by the system itself.

There are also other situations calling for adjustment of the float.

On delivering a system or plant it is often favourable to bring a roof under pressure to see that the surfaces are fully tight, often a requirement when taking over. This can be done simply by using the present invention and adjust all the floats to a closed position, for then to fill the roof surface with water, possibly to a water level of 100 – 150 mm over the roof surface and during 24 hours. This can be done during a rain period or by filling the roof up with water.

When a pressure test is carried out and the roof is maintained under 100 – 150 mm water, this is a good start for an initial adjusting or setting so that the greatest possible number of, preferably all the gullies are emptied for water at about the same time, and then lock the position for gully head and float to said position.

A such pressure setting can verify not only that the roof is tight, but also that it has a sufficient carrying capacity and that the outlet system has a capacity to handle a maximal load and that outlet pipes are not cracking or in other ways cannot withstand the load.

It is also advisable to flush the gullies and the draining or outlet pipes for thereby to remove undesired elements, sand and other material which can accumulate over time in gullies and outlet pipes. Especially where concrete tiles are used, smaller concrete particles can detach and build up a deposit. This can be remedied by holding the floats in a closed position until approx. 60 mm water level is built-up and thereafter open the floats and in this way rapidly fill up the outlet system and in this way flush it clean. This avoids the necessity for an internal flushing and manual work, a great benefit.

Common for these methods for initial adjusting is that they are not in need of a manual calculation for each gully.

Best modes of carrying out the invention

An embodiment of the invention and shown in fig. 4a and fig. 4b comprises a gully 200 or drain having a gully bottom 240 and over it a housing part 300 comprising a gully head 400 in its turn comprising a float 420 controlled or activated by an actuator 422. The actuator adjusts the height of the float over the gully bottom. The actuator is itself controlled i.e. based upon registered values from a pressure sensor 424.

The gully is preferably equipped with a heating element 426 to ensure that the float is not freezing to the gully bottom when it is in a locked position. The float will be closed when the air temperature is below the freezing point for preventing the gully to radiate heat, and in that way to prevent ice in building-up on the roof surface.

The zero point will vary with the external temperature. At very low temperatures like -30°C the zero point will be close to the float if a heating element is not used. Correspondingly zero point will be positioned further away at -1°C. By using a heating element the zero point will be moved upwards and the float remaining in a region above the freezing point, which also prevents the flow from freezing to immobility (congelation). The heating element, if used, can be controlled either locally by use of a thermostat or use of a central control unit 428.

In another advantages embodiment a new or existing full flow system can be provided with a float, typical by retrofitting. Then the float takes care of hindering that warm air ascends into the gully and creates ice build-ups. When the gully is filled with water, the float is lifted and lets the water pass. In this embodiment the full flow function is separated from the prevention of ice build-up.

In such an embodiment the float will often remain so deep under the gully head that it is maintained in a frost free region. The float does not necessarily need to be controlled by an electric actuator instead it may be sufficient that the buoyancy of the float is sufficient for lifting it when water is flowing in.

In those cases where there is no need for the extended draining capacity in a full flow system, it is a possibility to provide a gravity fall gully with such a float in the purpose to ensure that warm air is not entering up in the gully and makes possible the growth of ice blocks. When the gully is filled with water the float is raised and let the water pass.

In systems having such passive float it is advantage to use a ball. A further advantageous embodiment the float is inflated and set under pressure. If the ball should be damaged it will burst and be flushed out through the outlet and then prevent that it is blocking the gully or outlet pipes.

For gullies, and in particularly full flow systems, it is an advantage that the water flow from the gully is meeting the ball at mainly the same side as the outlet to the draining pipe, so that the water flow from the gully presses the ball away from the opening to the outlet or drainage pipe. In particular by large flows the force from the water may exceed the buoyancy of the ball and therefore lock it, if not the force from the water acts in a direction mainly being the same as the buoyancy. This can be arranged in several different ways. A first embodiment is shown in fig. 7a where the water is fed from the gully into an annulus up against the ball, while the outlet is surrounded by the annulus. Fig. 7b shows the outlet and annulus from above, where it is clearly presented that a liquid flow in the annulus will lift the float so that the liquid flow continues down into the outlet. While fig. 7a illustrates the ball in a lower position where it closes the outlet, fig. 7c shows the gully where water is flowing in and the ball is lifted up to an open position.

A second embodiment is shown in fig. 7d where the water is led through a goose neck 442 inclined upwards against the ball, while the outlet is positioned adjacent the goose neck. In both situations the ball is freely movable and positioned in a guide cylinder 464 preferably with a device for an upper limitation in the longitudinal direction, so that the ball is not lost. These embodiments can be provided as in search for post mounting in already existing gullies or as an independent insert to be mounted into the outlet system some distance further down, which is within the building. Typically will then be that the one side of the insert is to be disassembled for simple inspection and maintenance.

It is advisable to use a float control 460 holding the float within a defined region so that it will not come out of position or be lost. In many cases a dowel acting as a guide pin 462 can be used for letting the float slide along or off. In cases where a ball is used, preferably an inflated ball, it is practical to avoid puncturing, and then a guide cylinder 464 shows to be a suitable means for holding the ball within a defined area.

It is an advantage that the gullies are arranged at the lowest parts of the surface to be drained. Possible separate sensors for detecting liquid height over the surface should also be arranged at the lowest parts on the surface.

It is advantages to have a central unit for synchronized start adjustment of all the gullies and for the control of the heating elements. By a central unit the gullies may be synchronized so that the adjustment of them can be done individually. In addition a registration of starting of intake of air in one gully, be used for adjusting also other gullies.

Additional embodiments

It is foreseen a number of variation over the above. As an example the pressure gauge can be replaced by other means for registration that air is sucked into the gully, such as acoustical and optical measure devices and meters for through flow velocity. It is also possible that the control unit, the pressure gauge and the actuator are combined mechanically for the steering or control of the float.

Alternatively the float can be controlled to a constant water level over each float, preferred under 100 mm, more preferred 10 – 60 mm and most preferred around 25 mm water. It is advisable not to build up a too great water pressure on roof surfaces to avoid water penetration through the roof construction and into the underlying building structure and for avoiding overloading in extreme conditions.

It is an advantage if the control system of the gully is communicating wirelessly with the central control unit, so that the installation can be simplified. This however calls for an electric power source in the gully head. This can be accomplished by using a battery or preferably a rechargeable battery to be charged by a solar panel arranged on the roof of the gully head.

A local power supply can also be provided by extracting energy from the liquid flowing through the gully.

The energy can be taken out from a separate turbine or propeller, alternatively the float can be provided with blades so that it rotates about the dowel pin 462. In both cases the power typically can be fetched as a rotating movement of a rotor.

In a first embodiment the energy can be purely mechanical, as the rotational speed of the rotor corresponds to the speed of the flow and then may give an indication of the liquid level 212 of the gully. A centrifugal regulator can be used for raising and lowering the float. If air should be drawn into the gully, this will reduce the rotational speed so that the gully is lowered. A mechanical pressure transmitter can also be used for the regulating.

I another embodiment the mechanical energy can be used for driving a simple generator for providing electric power to drive an electric actuator as well as electric pressure meters and control/steering units.

Gullies at several heights can be connected together to a common outlet system, as each roof surface then gets individual adjusting by lowering and raising the floats. The connection to a main down pipe 525 should however be made correctly by letting each roof having its own gravity fall height before the connection. This is illustrated in fig. 5a in that the outlet from a lower roof is taken down along the outlet from an upper roof before the connection. This is made so as to let the lower roof establish certain under pressure to avoid water from the upper roof pressing up into the gullies of the lower roof and thereby making a fountain. If the system is used in a road system each road level, if there are several, will operate in the same way as each individually roof level.

In that case where the float should freeze and become immovable it is an advantage if it is made by a material having a thermal expansion coefficient together with its form making that itself will become detached from the ice. An example is that an expansion with the increasing number of degrees below zero and combined with a concave form in a bowl enable that the float is pressed up and out from the ice and thereby is detached.

A float in the form of a ball will in a conical gully become pressed up when the float expands. It is therefore an advantage if the control cylinder surrounding the ball has a conical form or part enabling that the ball is detached from ice at a temperature change.

A float designed for disintegrating and flushed out on damage can be provided with a transmitter for warning the system when the float remains are flushed out. The sensor can be arranged at the outlet or a manifold to limit the number of possible gullies the float has arrived from.

The transmitter is in a simple embodiment a magnet, and the sensor can then be a magnetic sensor. In a system having a large number of gullies it is an advantage to provide the floats with an identification, such as a RFID-tag which when its passes a RFID-reader arranged at the outlet, will identify the identity of the float remains being flushed out, so that it is possible to find exactly which gully is now missing a float.

For gullies provided with a pressure sensor it is easy to find which gully or gullies that is/are missing a functioning float, as it/they then will not change the pressure during draining.

In an embodiment having a ball, a somewhat greater ball can be used for in that way to block the gullies by a manual pressure testing of roofs.

In an alternative embodiment using a ball, said ball can be equipped with a mechanism releasing it at a higher water level than the when necessary for lifting the ball alone under its own buoyancy. For example the ball can be equipped with a magnet holding it back in a closed position until the force of the buoyancy becomes so strong that the ball is released. In another example the ball can be equipped with a locking mechanism detaching the ball first at a minimum height of the water.

It is an advantage to keep foreign elements in a sufficient distance from the gully in order to maintain a good and most possibly unhindered flow into the gully. Particularly advantage is to avoid that such unwanted elements are acting in a way that the liquid level 212 of the gully is reduced too much.

It is found that a gully grid having arms like in a star is effective in this way.

Fig. 8a shows such a gully grid 200 comprising a roof 702 in the gully grid, typically arranged above the gully. From the roof 702 arms 704 for the gully grid are extending. In a typical embodiment four arms are used, but even more or fewer arms can be used. The arms are provided with a grid at least at one of its roof, side or sides of the arm, where liquid is flowing into the arms in the gully grid and further to the proper gully.

Fig. 8b illustrates the gully grid 700 from its side, in a section. The arms are shown extending from the roof 700 and in an angle downwards and outwards against the roof 610, possibly the terrace 620. The illustration shows that the arms are connected near the middle of the roof 702, but it will also be natural to imagine that the arms are extending outwards like an extension of the roof.

In an advantage embodiment the arms are pointing downwards for being aligned or flush with the roof 610. This causes foreign bodies or particles meet minimal resistance and will more easily slide upwards along the arms.

Larger foreign elements like for example twigs, will be captured on the arms, and if these elements are pressed inwards towards the gully itself, they will be lifted up and let liquid pass at the underside. Another problematic type of foreign element is leaves, as when single leaf may pack around a traditional gully head and obstruct the openings into it. With a gully grid according to the invention, leaves will be guided along the arms and in towards the centre, then into the corners between the arms. This means that the outer portions of the arms are extending outside the amount of leaves and still may have a good capacity to handle the liquid.

The gully grid therefore is particularly suitable for a gully system according to the present invention.

If the roof is inclined it may be sufficient with one arm, then arranged at the upstream for the gully. On a flat roof it is an advantage to have two arms, but considerably more effective is to have three arms.

In a further favourable embodiment the arms and roof 702 are arranged for avoiding that foreign elements are catching, such as by using smooth surfaces and avoid projections. This makes maintenance easier, and in particular on inclined roofs the foreign elements will then gather at the lowest parts and not be stuck in a number of gullies.

During operation a system according to the present invention will provide unbroken water columns during great parts of the time, as the floats can be continuously adjusted to keep a water height at for example 5 cm longest possible. This makes the system particularly well suited for leading into turbines. For smaller and lower buildings the outlet pipe is lead directly to the turbine that normally is positioned near the outlet or the transfer to the drainage network. For large and in particular tall buildings having vacuum gullies it is common to operate with fall heights up to typically 15 metre before the vacuum system is interrupted for avoiding noise, vibration etc. If one wishes to drive a turbine, the roof water can be lead to one or several basins some floors under the roof surface. From these basins the water throughput can be regulated further down in a way suitable for turbine operation. Use of a turbine has the advantage that much mechanical energy can be extracted from the water fall so that the forces of the water coming out from the turbines in the bottom of the building become less.

In a further embodiment gullies are provided with a motor valve.

During operation the water level and temperature on the roof surface are measured.

When the temperature is below the water freezing point the valve is approximately closed and will thereby nearly hinder air/heat to arise into the gully, but should there arrive some water drops, these will pass through. This hinders that water can build up from the valve arranged internal in the building and up into the gully for there blocking the outlet with ice.

When the temperature on the roof surface is above the freezing point the valve is opened and the gully is ready to take water. When the water sensor registers water higher than the air lock, approx. 25 mm, the valve is adjusted so that the water level can be kept between for example 25 – 30 mm of each gully.

Industrial applicability

The invention finds its use by being employed in an effective draining of surfaces like roofs, parking areas etc. More generally it is found useful in two phase systems where a liquid component is to be removed without also taking a gas component. So even if the examples above are examples with air and water, these are just examples for an invention generally covering liquids and gases.

The invention is particularly useful where one desires an effective draining and where installed parts have to be as small as possible, such as on runways and roads. The system is very suitable for upgrading older municipal surface water pipes by entering new pipes, having less pipe dimensions into older pipes, replace old basins with new ones, having special gullies as described and control these also as described, so that the complete renovated outlet network will work as a UV system. Even if the new pipe dimensions are less, these pipes will in this way be handling much more water.

Claims

1. A gully system (100) comprising a gully (200) for draining a liquid (210) to a drainage system (500), characterized in further comprising:

a float (420, 450) arranged so that the float and a portion of the gully (200) define a closable opening for through flow, and

arranged so that the float (420, 450) prevents gas/heat from outlet rising up from the gully (200) and forming ice (230).

2. A gully system (100) comprising a gully (200) for draining of a liquid (210) to a drainage system (500), characterized in further comprising:

a float (420, 450) arranged so that said float and a portion of the gully (200) define a closable opening for the through flow, and

arranged so that the float (420, 450) prevents gas (220) from being drawn into the gully (200).

3. Gully system according to claim 1 or 2, wherein the means for controlling the float so that gas is not passing the float comprise:

an actuator (422),

means for detecting that gas is drawn into the gully (200), and

a control unit (428),

wherein said means for controlling the float are arranged for the steps

to control the actuator (422) for opening by means of the float until gas is drawn into the gully (200), and

to control the actuator (422) for closing by using the float until gas not any longer is drawn into the gully (200).

4. Gully system according to claim 3, wherein means for detecting that gas is drawn into the gully (200) is a pressure sensor situated downstream from the float.

5. Gully system according to claim 1 or 2, wherein means for controlling the float are arranged near the gully (200).

6. Gully system according to claim 3, wherein means for controlling the float are arranged for controlling more than one float.

7. Method for controlling a gully system (100) according to claim 1 or 2, further comprising an actuator (422) characterized by the following steps for adjustment:

controlling the actuator (422) for lifting the float until gas is drawn into the gully (200), and

control the actuator (422) to lower the float until gas not any longer is drawn into the gully (200).

8. Method according to claim 7, further comprising the repetition of the steps for adjustment.

9. Method according to claim 7, further comprising repetition of the steps for adjustment, at unequal intervals.

10. Method for controlling a gully system (100) according to claim 1, further comprising an actuator (422) for flushing, characterized in the steps for adjustment:

controlling the actuator (422) to close by using the float until the liquid level above the gully (200) has reached a critical height, and

adjusting the actuator (422) for opening by using the float so that the draining system is filled with liquid.

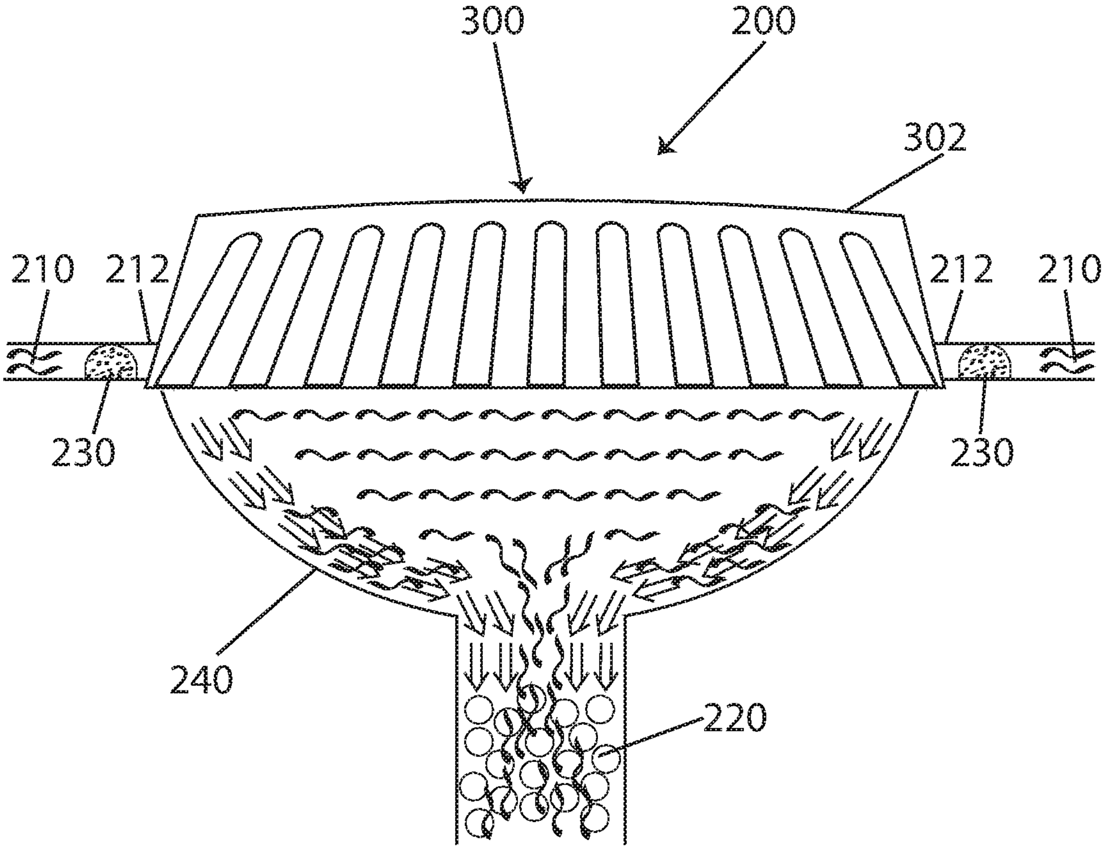
11. Method according to claim 10, wherein the critical height is 60 mm.

12. A gully grid (700) for gullies according to claim 1 or 2, comprising a roof (702) in the gully grid,

characterized by further to comprise at least one arm (704) extending outwards and down from the roof (702).

13. A gully grid (700) for gullies according to claim 12, wherein the at least one arm (704) is extending downwards until alignment with the roof (610).

Fig 1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230
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220

Fig 2

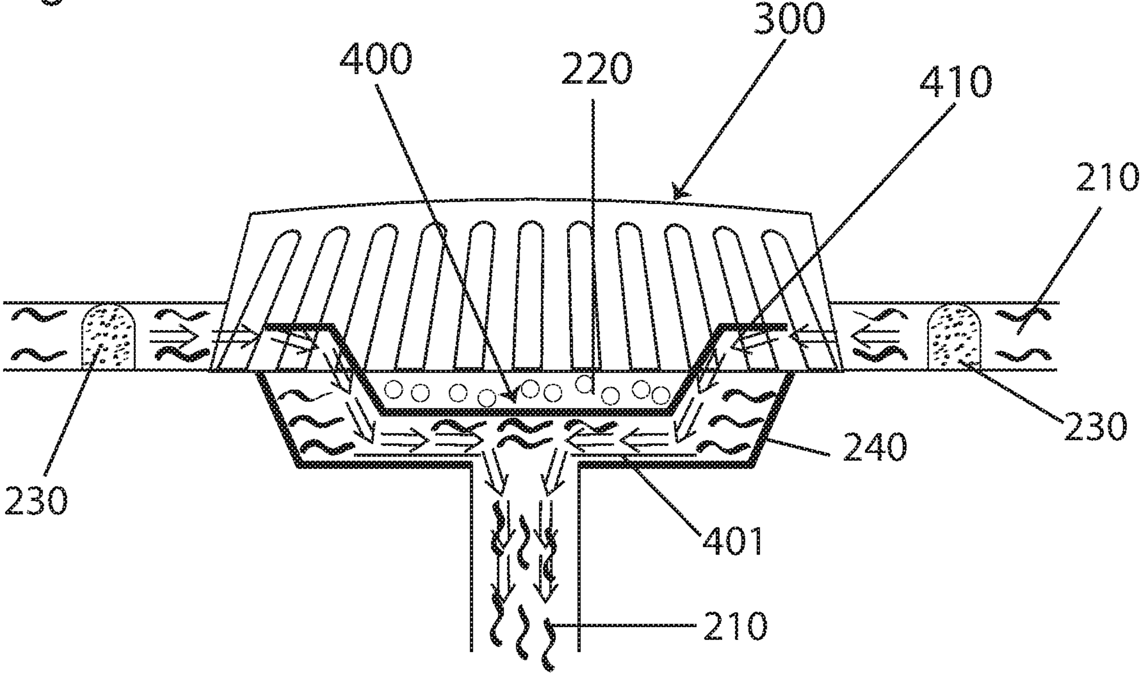
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Fig 3

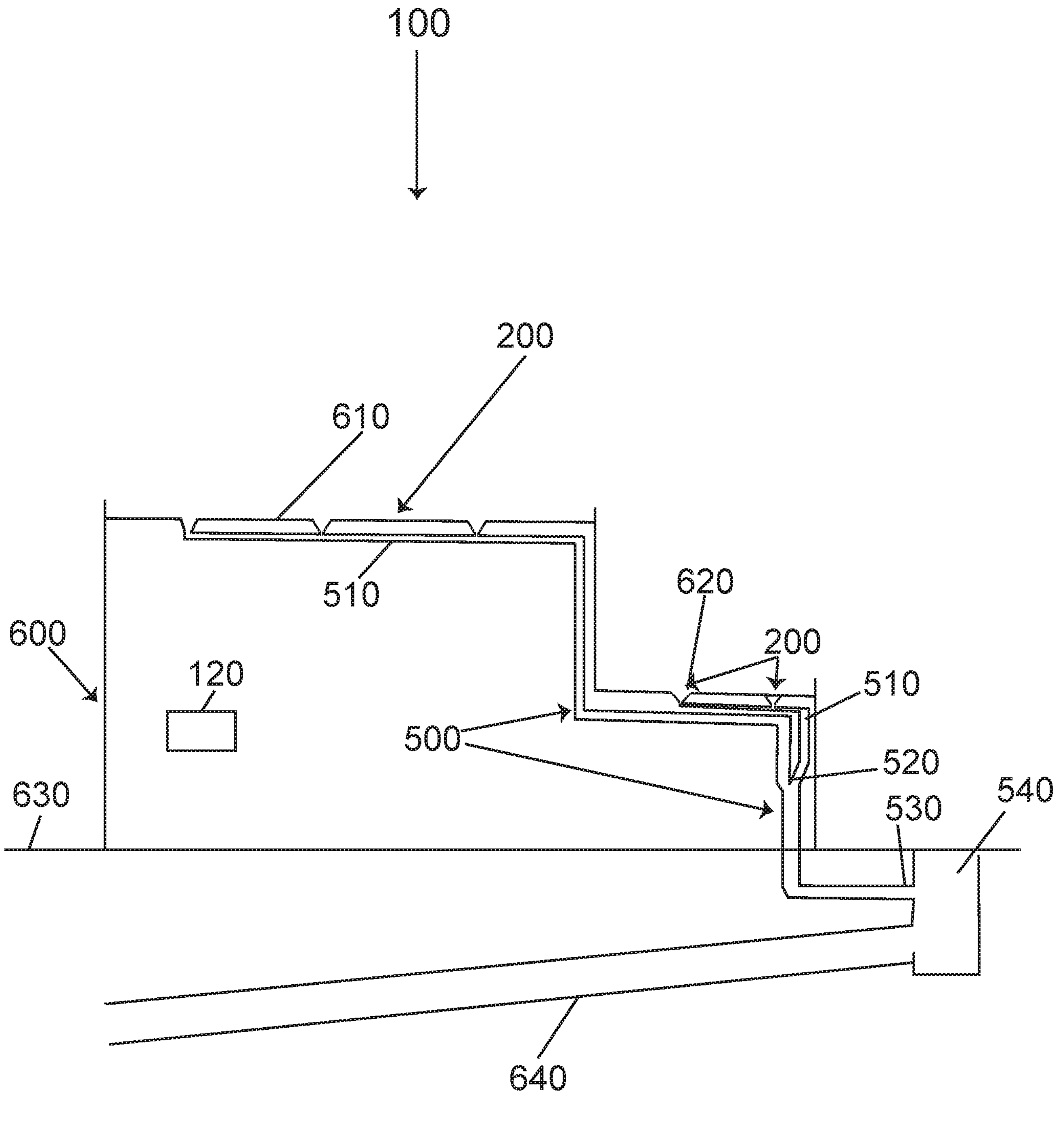
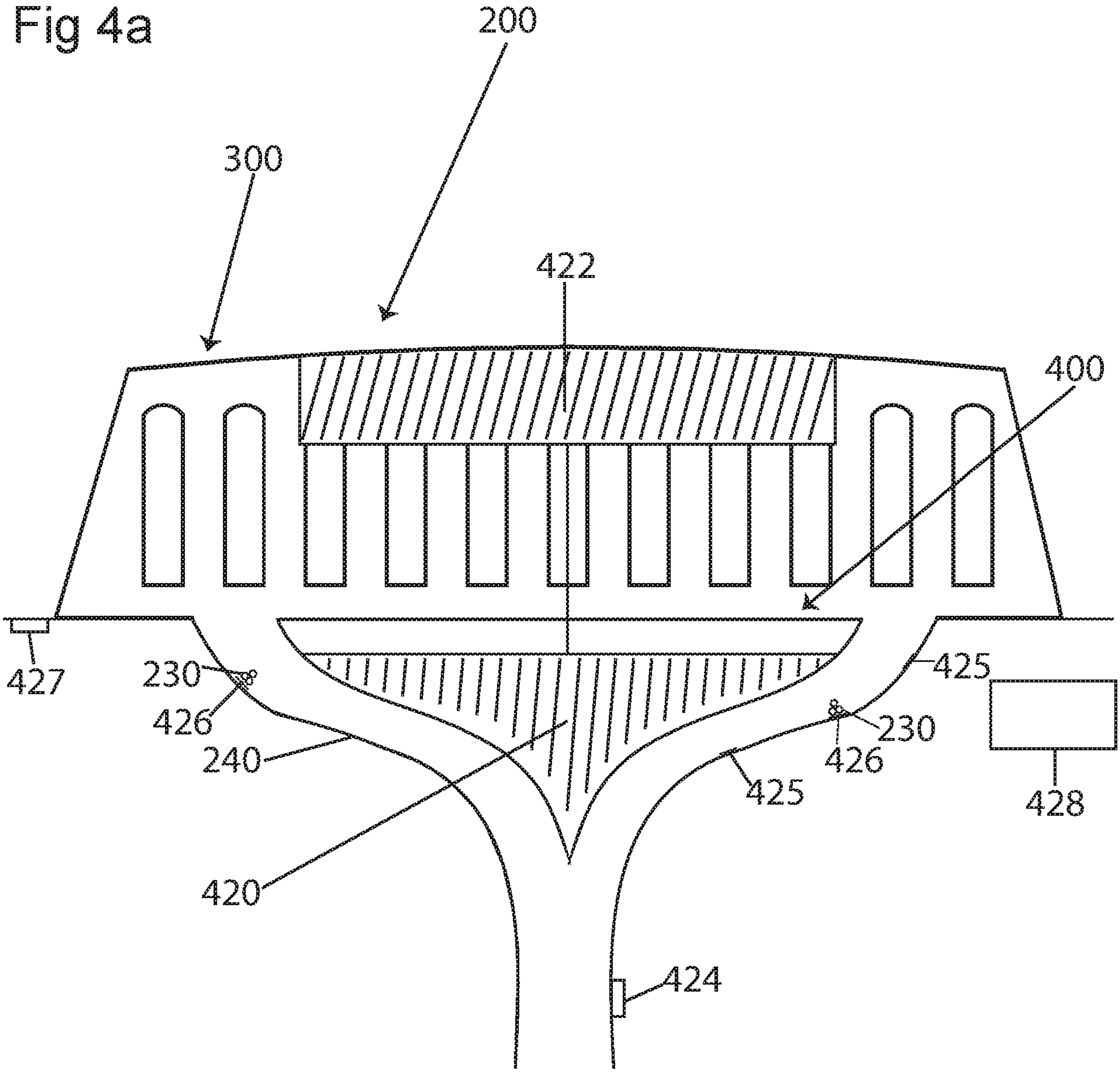


Fig 4a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426
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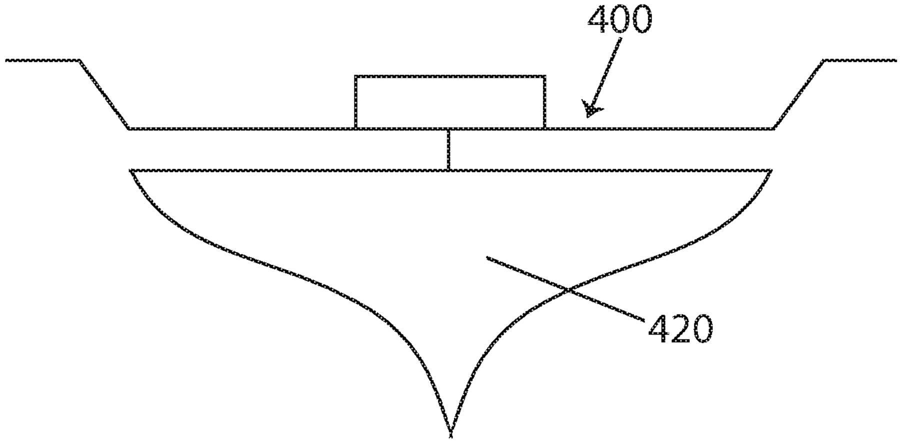
428
420
424

Fig 4b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420

Fig 5a

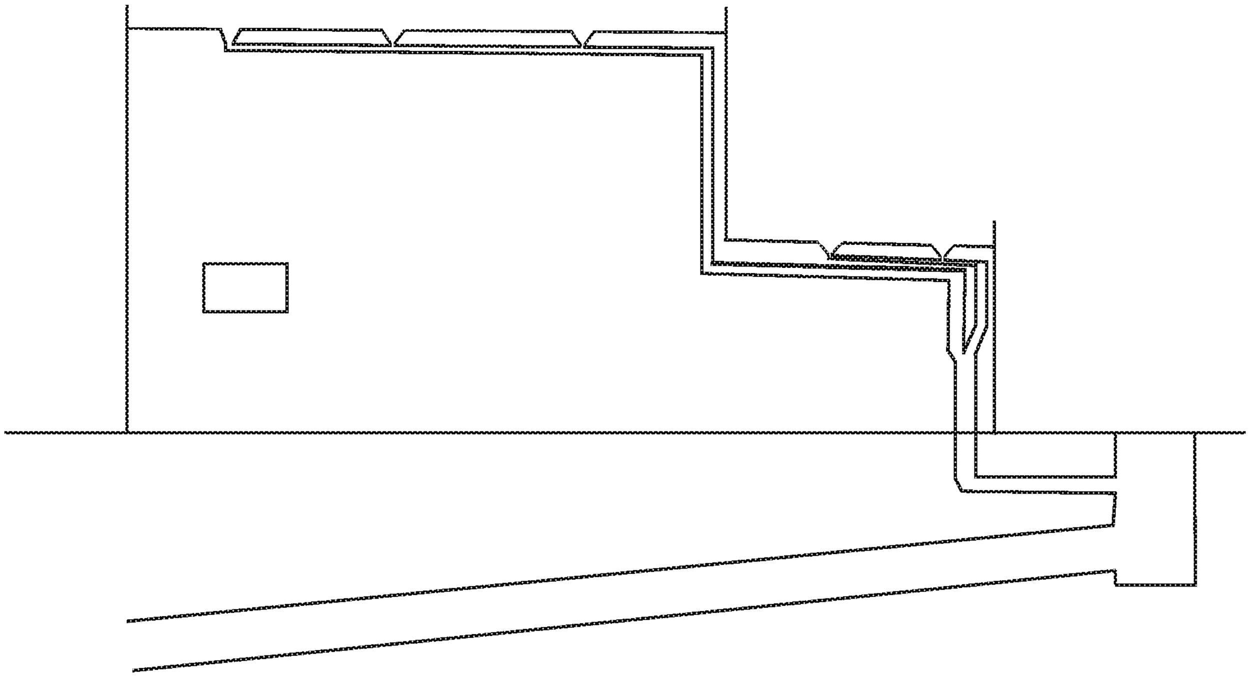


Fig 5b

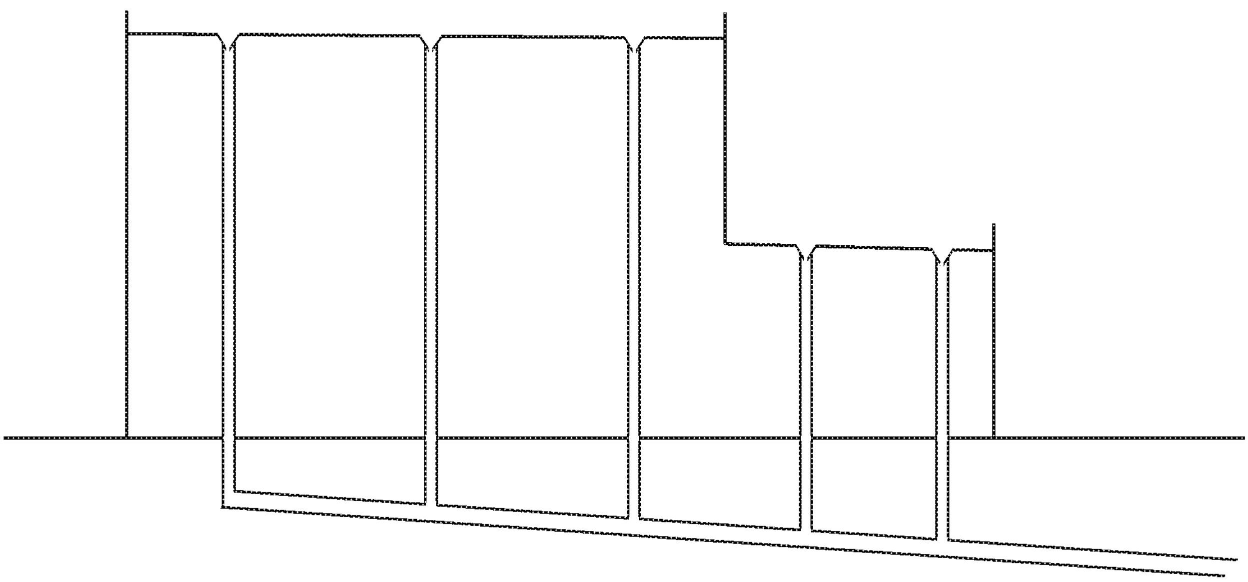
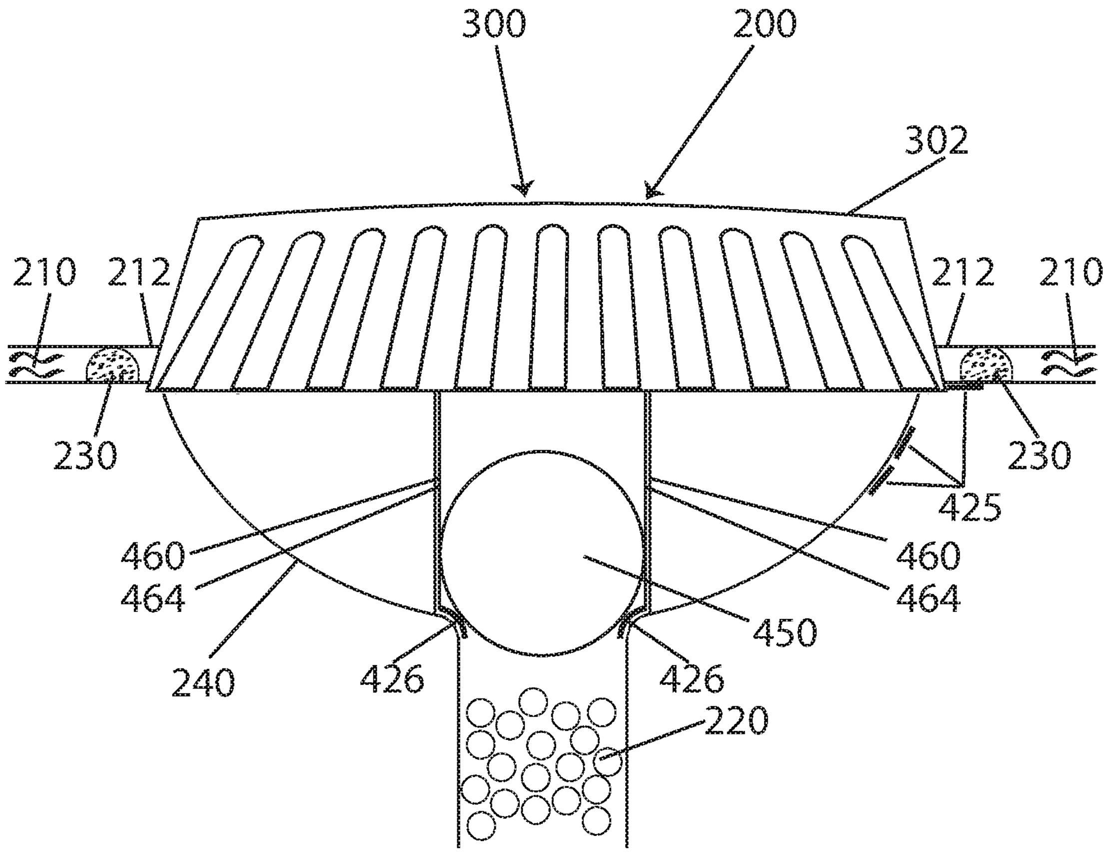


Fig 6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220

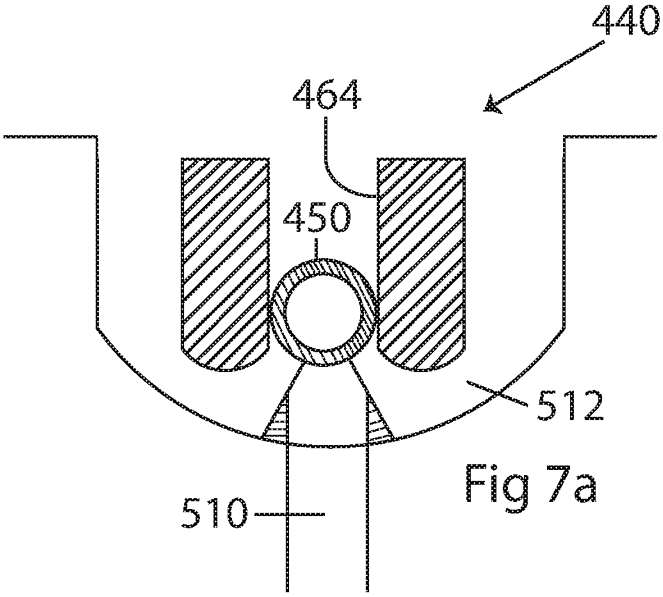

Fig 7a

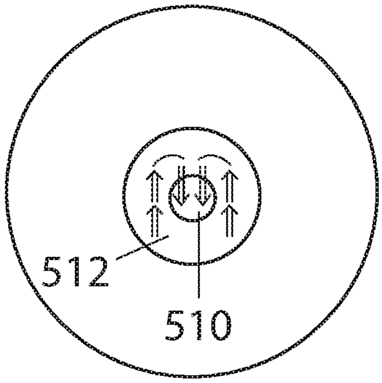

Fig 7c

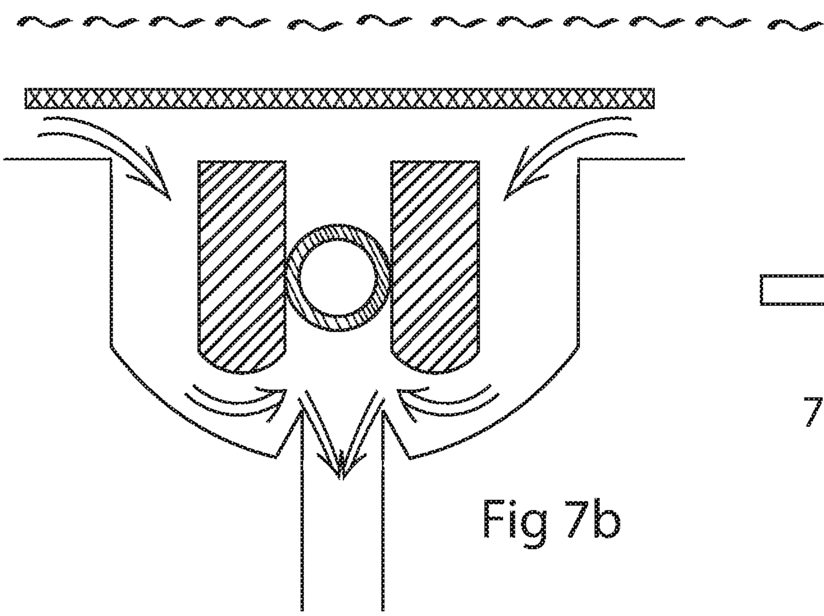

Fig 7b

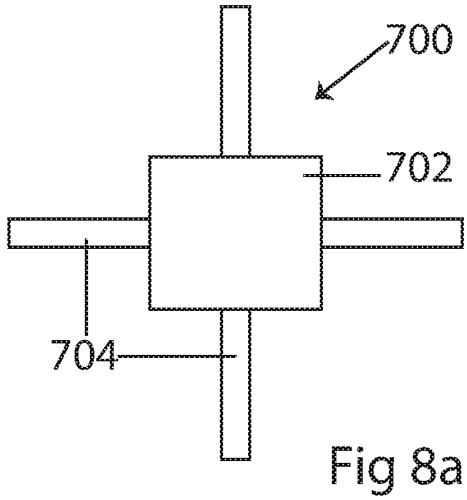

Fig 8a

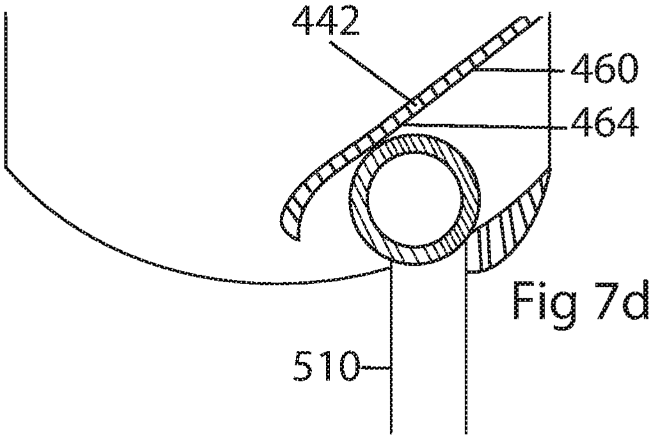

Fig 7d

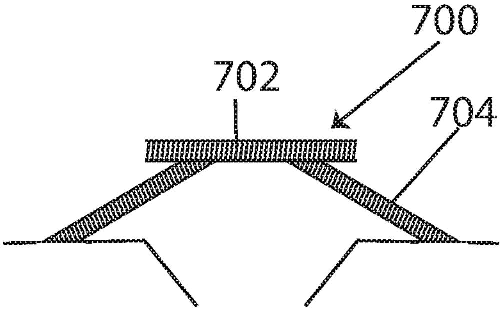

Fig 8b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2014/050118

A. CLASSIFICATION OF SUBJECT MATTER
IPC: E04D 13/04 (2006.01), E03F 5/04 (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC: E04D, E03F

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

DK, NO, SE, FI: Classes as above.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC, WPI, FULL-TEXT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	EP 1607542 A1 (GEBERIT TECHNIK AG) 2005.12.21 abstract and figures 1-2.	1-2, 5
X	RU 2458219 C1 (GRIGOR, EV V. S.) 2012.08.10 abstract and figure	1-2, 5
X	US 6318397 B1 (HUBER, D. G. et al.) 2001.11.20 abstract; figures 4-5	1-2, 5
X	DE 3737767 A1 (ABFLUSSROHRKONTOR GMBH & CO KG) 1989.05.24 figures 1-2; column 3, lines 59-67	1-2, 5
X	DE 20115386 U1 (BIOTEG GMBH BIOTECHNOLOGISCHE) 2001.12.06 abstract and figure	1-2, 5

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24/09/2014	25/09/2014
Name and mailing address of the ISA Nordic Patent Institute Helgeshøj Allé 81 DK - 2630 Taastrup, Denmark. Facsimile No. + 45 43 50 80 08	Authorized officer Øystein Skalland Telephone No. +47 22 38 75 25

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO2014/050118

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1203851 A1 (GEBERIT TECHNIK AG) 2002.05.08 abstract and figure	1-13
Y	WO 1983/03114 A1 (KONTEKLA OY) 1983.09.15 figure 5; page 6, lines 22-26.	12-13

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/NO2014/050064

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