United States Patent [19]

Johannessen

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[54] **UNIVERSAL BASIN FOR USE IN A SEWER SYSTEM**

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[73] Assignee: **Per Pontoppidan Sorensen,** Solrod Strand, Denmark; a part interest

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[30] **Foreign Application Priority Data**

Sept. 28, 1971 Denmark 4705/71

[52] **U.S. Cl.** **210/163,** 210/512, 404/4.5

[51] **Int. Cl.** **B01d 21/26**

[58] **Field of Search** 210/163, 512; 52/12; 404/4, 5

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Assistant Examiner—F. F. Calvetti
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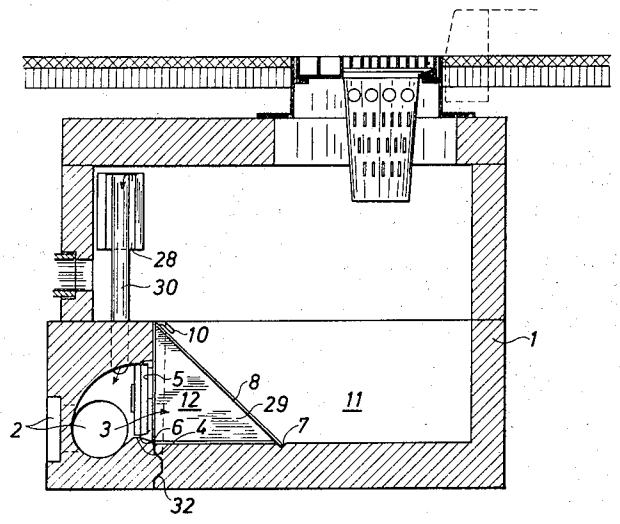
[57] **ABSTRACT**

A basin for use in a sewer system and having a draining device designed as a cover consisting of a housing with a submerged inlet opening and a centrally located outlet opening, the said housing containing an outlet chamber with a circular or helical sidewall along which an inlet tube opens tangentially into the outlet chamber. When the water level in the basin raises, the water flowing into the outlet chamber is caused to circulate in such a manner that it works as a centrifugal brake retarding the water flow.

10 Claims, 13 Drawing Figures



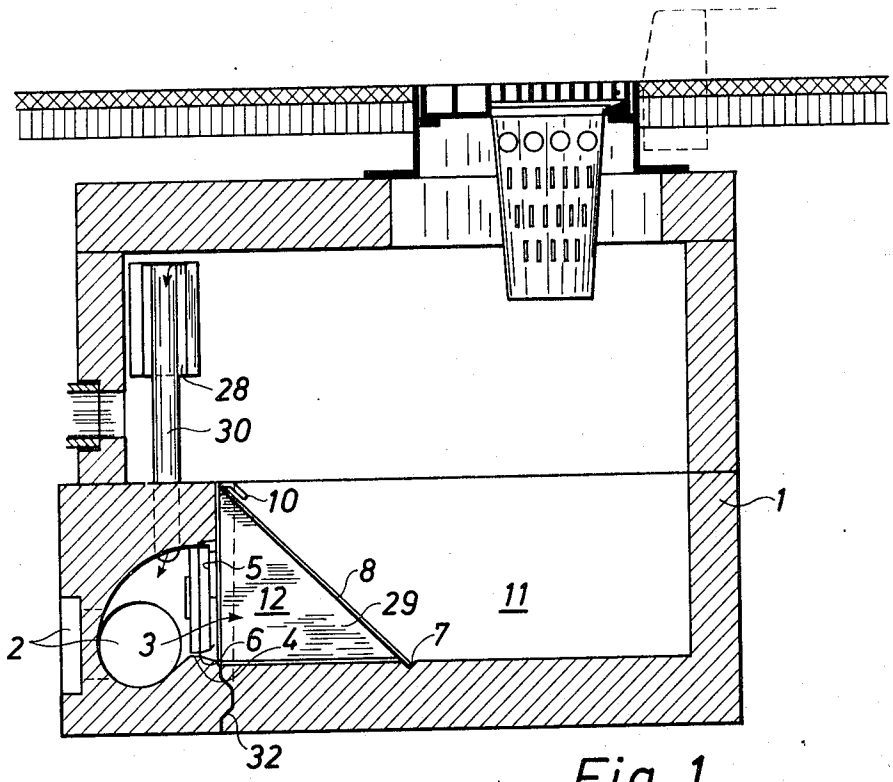


Fig. 1

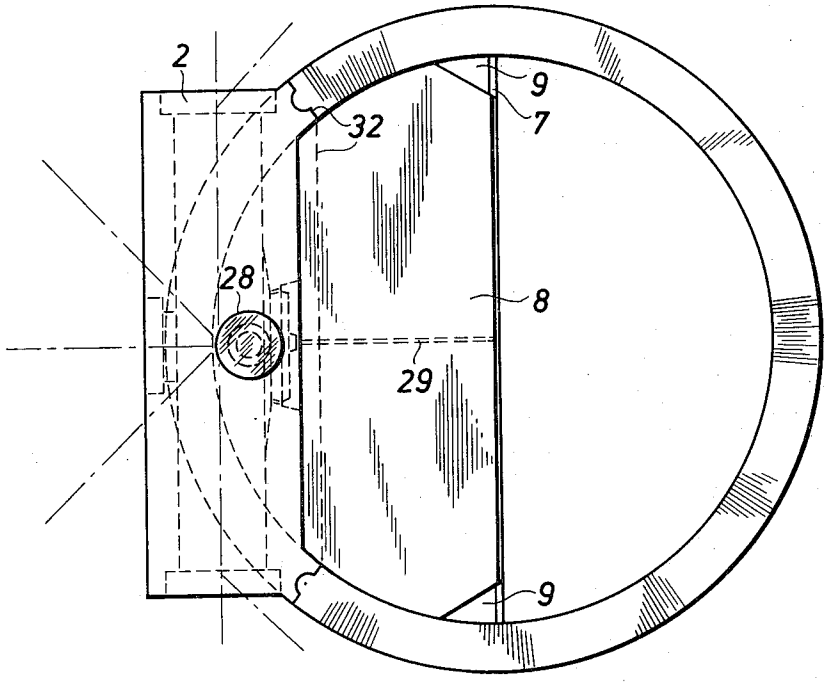


Fig. 2

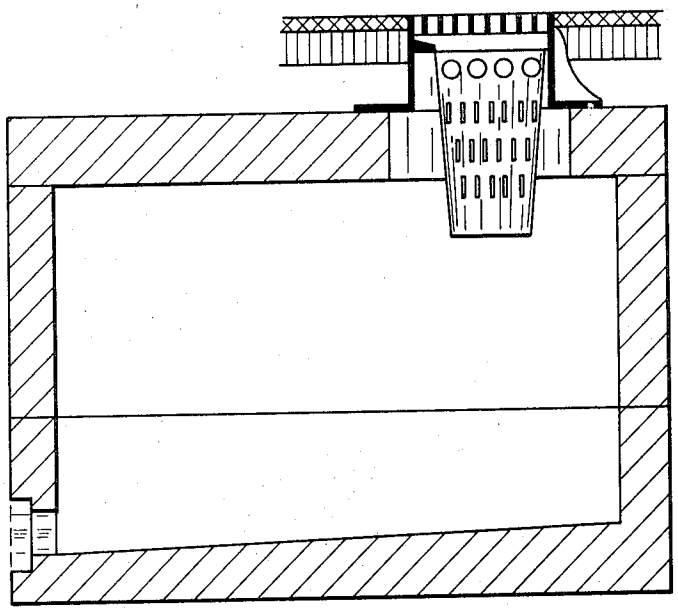


Fig. 3

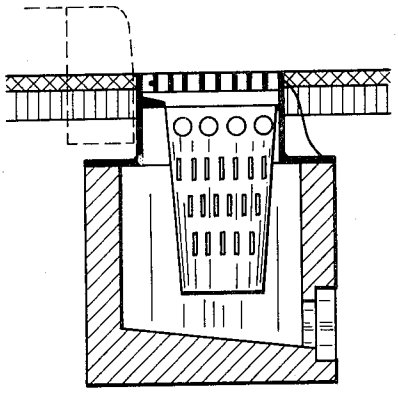


Fig. 4

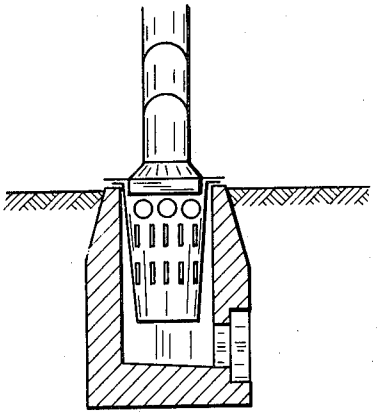


Fig. 5

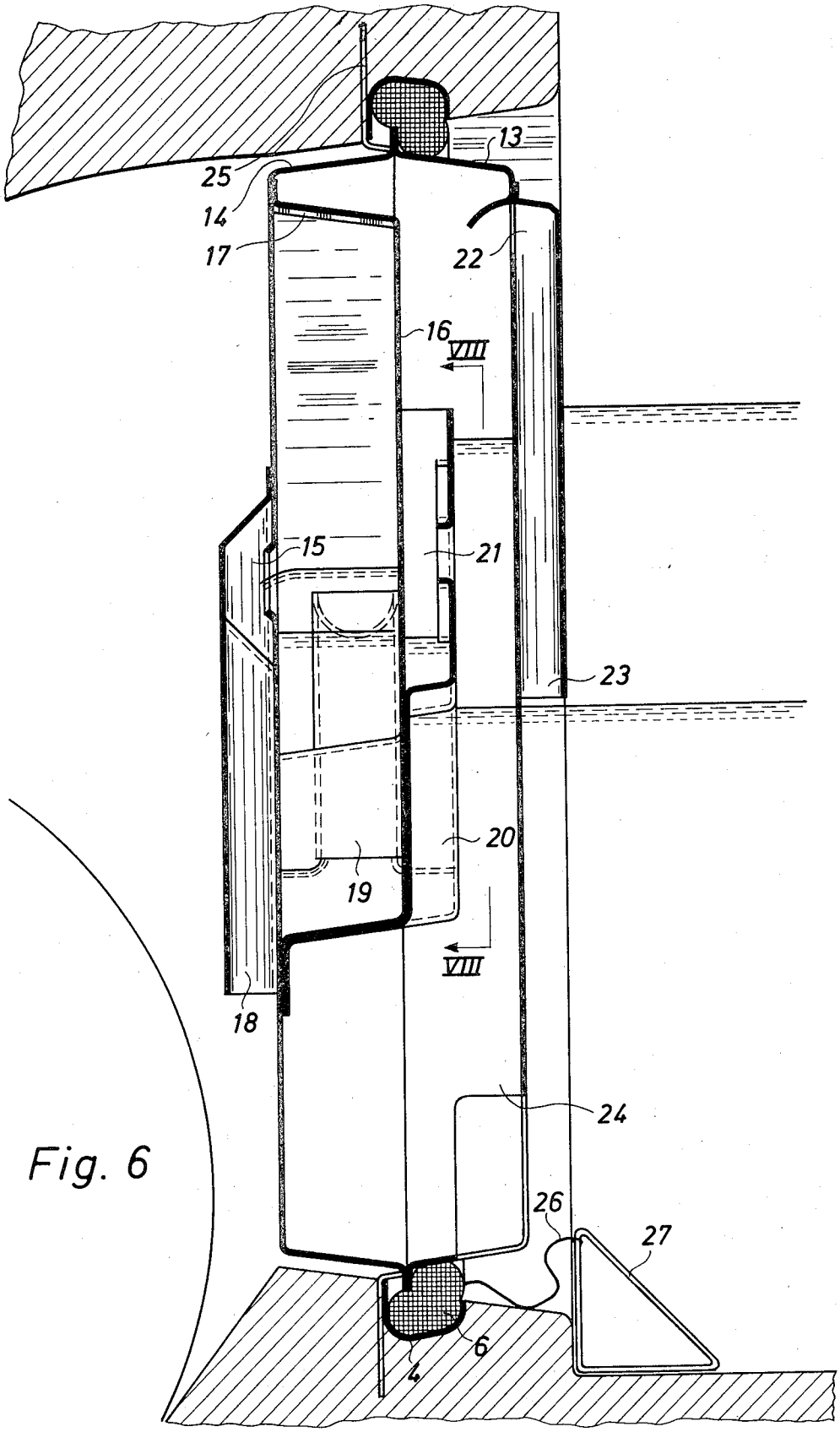


Fig. 6

Fig. 7

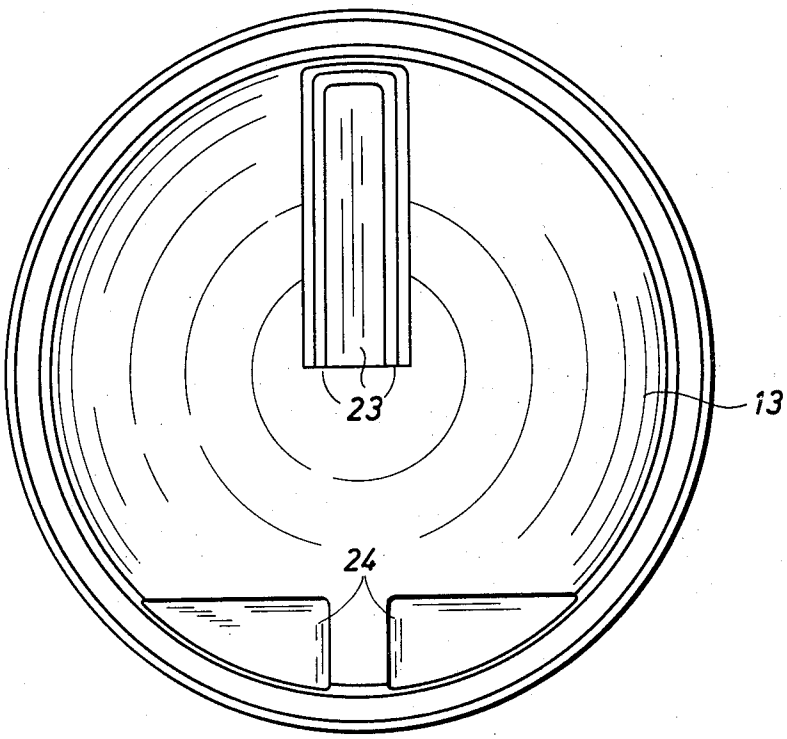
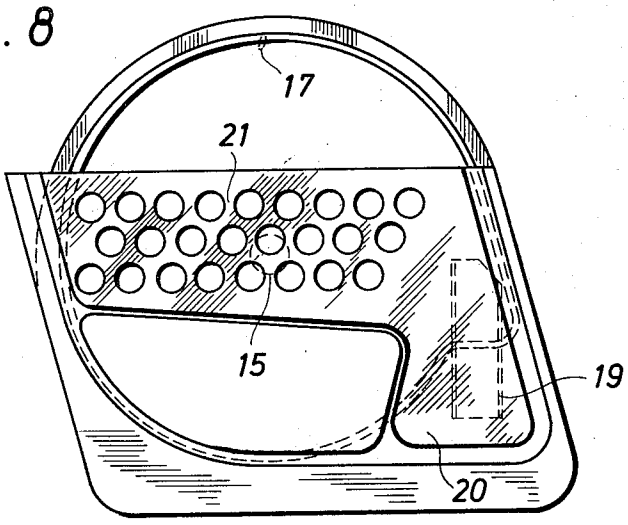


Fig. 8



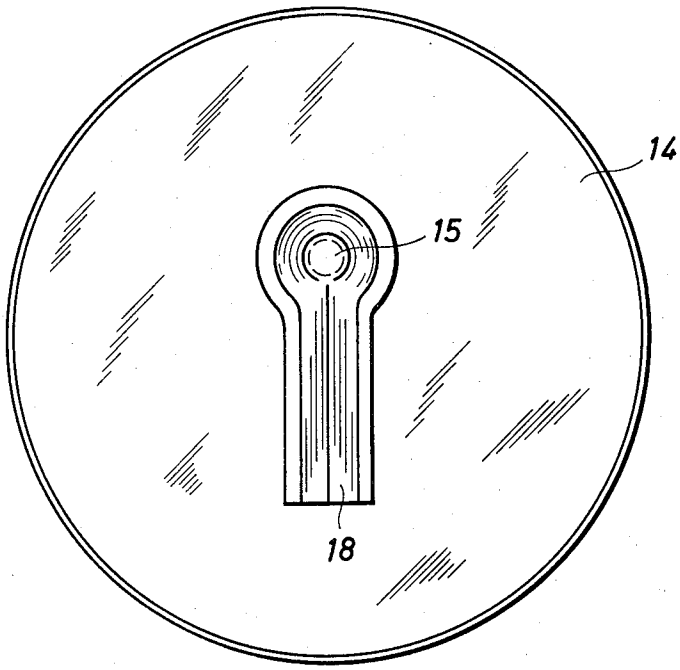


Fig. 9

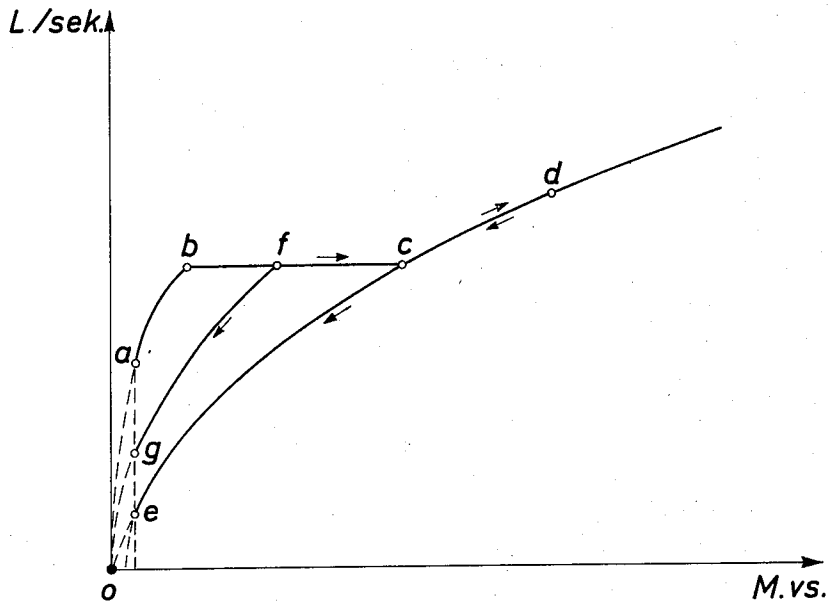


Fig. 10

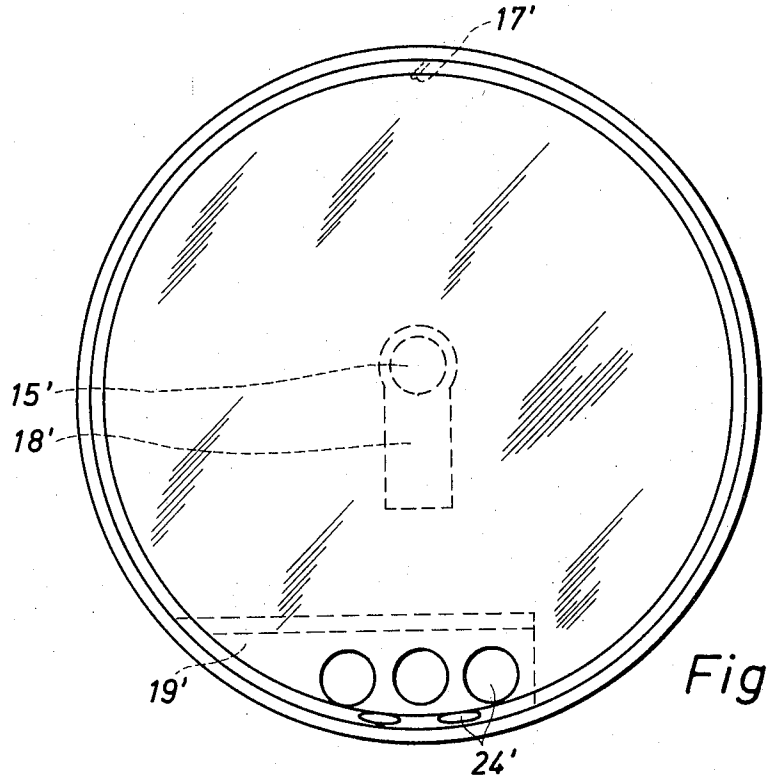


Fig. 11

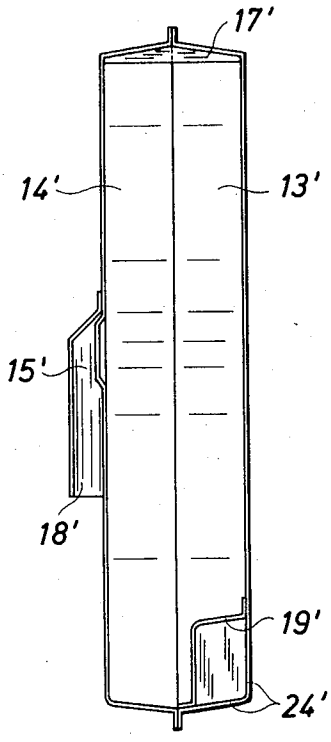


Fig. 12

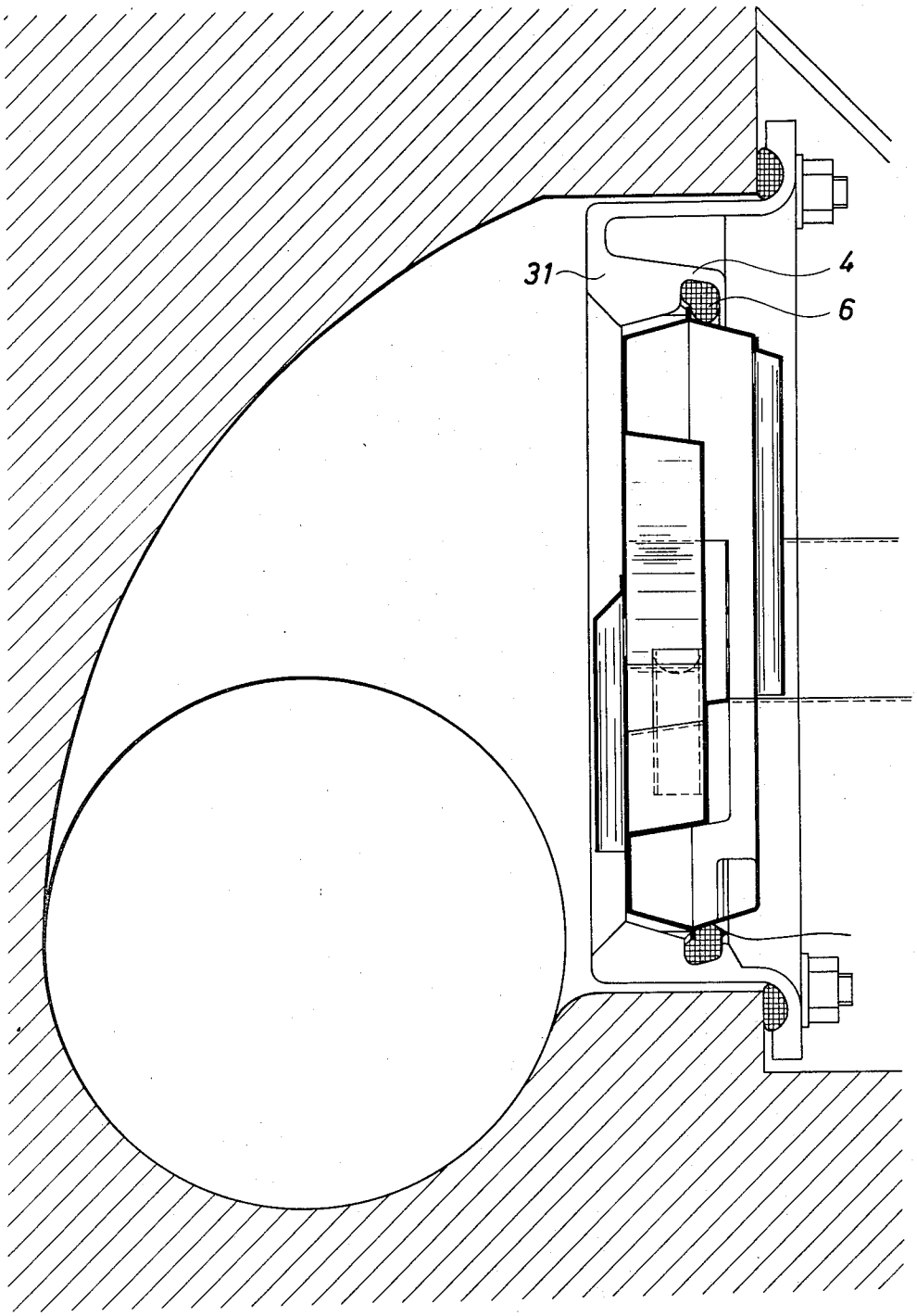


Fig. 13

UNIVERSAL BASIN FOR USE IN A SEWER SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a universal basin for use in a sewer system such as manhole, gully, sedimentation basin, equalizing basin and oil and petrol interceptor. The said basin is designed as a container cast in one piece or constructed of a number of rings and a bottom part cast in one or more pieces with an inlet and an outlet and means for draining off an approximately constant amount of water through the outlet per time unit. The basin further comprises a top plate or cone on which different types of grates and covers or combinations thereof can be mounted.

2. Description of Prior Art

It has been proposed to use such universal basins as equalizing basins in sewer systems in which sanitary and storm sewage normally flow in one common pipe, thus avoiding a pipe system specifically dimensioned for rain water peak loads, as the rain water during heavy rainfalls will be dammed up in the equalizing basins, and be discharged from these as a substantially constant flow distributed over a longer period. However, it may also be desirable to use similar basins in other types of sewer systems, such as in pipe systems leading rain water into actual storm sewers, and on the whole into sewer systems at locations where manholes, gullies and catch basins are usually located, so that these are replaced by the universal basin. It is a problem in such basins to avoid clogging of the devices for draining off the water from the basin, since these devices must have a relatively small outlet dimension so as to produce a retarding effect on the outflow as the water rises in the basin, and they should preferably not be any obstruction to inspection and/or cleaning of the pipe system from the basin in case of emergency.

SUMMARY OF THE INVENTION

It is the object of the invention to devise a universal basin of the aforesaid kind, which can replace or combine separate basins hitherto used in sewer systems, so as to make substantial savings on the piping system possible, and at the same time to achieve a number of sewerage advantages. More specifically it is an object of the invention to devise a self-cleaning draining device of a simple design which is capable of effectively braking the outflow of water from the basin, when the water level in the basin rises.

Furthermore it is the object of the invention to provide a basin with a drainage device so adapted and located in an outlet opening of the basin that it may readily be opened for inspection and/or cleaning.

The basin according to the invention is characteristic thereby that the draining device is designed as a cover, consisting of a housing with end walls, of which the wall facing the basin has a submerged inlet opening, and that the wall facing the piping system is provided with a centrally located outlet opening, the said housing containing an outlet chamber, with a circular or helical side wall, along which an inlet tube opens tangentially into the outlet chamber, fastening means being furthermore formed along the periphery of the housing for securing the cover to the outlet opening of the basin.

The combined cover and draining device is of a robust and reliable design, without moving parts, and water flowing into the outlet chamber when the water level in the basin rises, is caused to circulate in the chamber in such a manner that it works as a centrifugal brake on the water flow. The draining device ensures for the surface water (rain water) the necessary time of retardation in the universal basin for effectively removing impurities by straining, sedimentation and seperation simultaneously providing the necessary minimum velocity of flow through the outlet to keep this self cleaning.

In an appropriate embodiment of the draining device according to the invention, the outlet chamber is separated from an inlet chamber by a partition, and the chambers are in connection with each other through an inlet strainer (grate) and a bottom chamber which forms a trap, and which is in connection with the outlet chamber through a delivery tube the discharge end of which forms the inlet opening to the outlet chamber.

Straining and sedimentation is necessary to avoid clogging up of the small outlet and accumulation of sand and smaller particles in the piping system. To prevent pollution and damage to the biological filters in sewage treatment plants, it is important that any occurring oil and petrol are separated off in the universal basin. To protect the draining device against floating and precipitable substances it is appropriate according to the invention that the bottom of the universal basin is provided with a groove or a hinge parallel to the plane of the draining device, in which a protective cover with submerged openings is mounted so that it can be opened and so as to cover the draining device, simultaneously forming a sedimentation- and clarification chamber in front of the draining device. The protective cover, which, for example, may be provided with a vertical partition located on its underside to prevent rotation of the liquid beneath the cover, may easily be swung aside when access to the sewer pipe is desired. The draining device itself may easily be removed when, as is the case in one embodiment of the invention, it is mounted in a groove by means of a sealing and locking ring, which at its lower end on the side facing the basin has a bow attached by means of a strap. By means of a tool or, for example, a boat-hook, the said bow may easily be grasped and the sealing ring pulled off, by which the draining device may be removed.

If desired the draining device according to the invention may be mounted on spacers cast in the basin in such manner that, when the sealing ring is torn off, a ring-shaped opening is formed along the periphery of the draining device, whereupon the outlet area is immediately substantially increased.

More particularly, the universal basin may be provided with an emergency overflow which will function during very heavy rain falls and thereby reduce the quantity of water dammed up and the duration of damming up. This overflow may consist of a vertical pipe with a combined basket and ball float attached to the top end of the pipe.

A preferred embodiment of the draining device according to the invention is characteristic thereby that such wall of the draining device housing as is facing the basin forms a protective cover with an inlet opening at its bottom edge that is submerged at lowest water level and with a vertical venting tube, the lower end of which opens into the upper part of the basin at a point close

to the center of the end wall, whereas its upper end opens at the top of the inlet chamber. Further the end wall facing the piping system is provided with a central outlet opening, communicating with a downwardly directed outlet tube where the outlet chamber forms a centrifugal brake with a circular or helical side wall and is in connection with the inlet chamber through a bottom chamber and an inlet tube, which together form a trap. Furthermore the outlet tube forms together with the inlet tube to the centrifugal brake a syphon system, in which the lower end of the inlet tube that projects into the bottom chamber is located at a level above the lower end of the outlet tube.

In view of the risk of clogging up and the outflowing water quantity, the draining device is provided with an outlet opening of maximum size and the protective cover on the inlet side forms at lowest occouring water level a sufficiently submerged inlet, so that a certain amount of oil or petrol can be separated off in the universal basin above the inlet. The bottom chamber, which is filled with water before its installation, functions as a trap at low water level in the basin. When the water in the basin at rising water level is blocking the bottom opening of the air venting tube, air will be trapped and pressurized in the upper part of the inlet chamber. This pressure acts on the water level in the bottom chamber and forces the water up through the inlet tube until the water level in the bottom chamber has reached a level below the bottom edge of the inlet tube, whereupon the air will suddenly penetrate below the water column in the inlet tube and into the centrifugal brake formed by the outlet chamber. The pressure drop in the inlet chamber causes a heavy water flow from the basin into this chamber and further into the bottom chamber and the outlet chamber where the water quickly rises to above the outlet opening so that air is trapped and pressurized in the upper part of the outlet chamber. The outlet tube now functions as the outlet of a syphon. By a further rise of the water level in the basin the water level in the centrifugal brake rises above the inlet tube, and at last the water rotates along the periphery of the centrifugal brake and the trapped air is hurled out as small bubbles through the outlet opening while the centrifugal braking effect on the rotating water will commence to operate. To avoid premature braking effect an inwardly directed projection may according to the invention be provided on the side wall of the centrifugal brake, behind which the air may at the beginning be partly sheltered until the rotational velocity of the water is sufficient to hurl out the remaining air, whereby the full braking effect is established.

Between the inlet chamber and the bottom chamber may be inserted a strainer at such a distance from the wall of the draining device, that larger typical longitudinal solids are not able to turn and pass through the strainer.

According to the invention the universal basin can be provided with an emergency overflow which, when the basin is almost filled, constitutes a bypass bypassing the draining device.

A simple embodiment of the draining device may be used in cases where the outlet opening has to be of a size sufficient to eliminate any major risk of clogging. The said draining device consists of an undivided double conical housing with a number of submerged inlets provided in the bottom part of one wall of the housing and opening into an internal inlet tube extending tangentially to the housing, and with an external outlet tube directed downwardly from the outlet which is centrally provided in the other wall of the housing.

BRIEF DESCRIPTION OF THE DRAWING

In the following the invention will be described in more detail in connection with some embodiments and with reference to the drawing in which

FIGS. **1** and **2** show vertical and horizontal sections of a universal basin with a draining device,

FIG. **3** shows a vertical section of a gully and supplementing basin,

FIG. **4** shows a vertical section of a gully for street and space drainage,

FIG. **5** shows a vertical section of a gully for roof drainage,

FIGS. **6–9** show on different scales a vertical section and plan the draining device shown in FIGS. **1** and **2**,

FIG. **10** shows the outlet flow characteristic of the draining device according to the invention,

FIGS. **11** and **12** show in front elevation and vertical section a draining device of simple embodiment, and

FIG. **13** shows a draining device mounted in a larger cover.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The universal basin **1** shown in vertical and horizontal section in FIGS. **1** and **2** replaces a gully and/or a manhole, and is provided at places, where these are normally located. In the side of the basin the desired forms of pipe lead-ins and connections (**2**) may be provided, as shown in principle by the dotted lines. The pipe lead-in or connection (**2**) is through a cleaning and inspection opening (**3**) in connection with the inside of the universal basin. In the cleaning opening a groove (**4**) of reverse conical shape in relation to the direction of mounting may be cast or formed (for details see FIG. **6**), in which the draining device (**5**) can be mounted by means of a sealing and locking ring (**6**). To protect the draining device against floating and precipitable solids, a groove (**7**) in the bottom of the universal basin is provided with a protective cover (**8**) that can be opened. The said cover has at either end an inlet opening (**9**), which is submerged at lowest water level, and a handle (**10**). The protective cover divides the bottom of the universal basin into a sedimentation chamber (**11**) and a clarification chamber (**12**).

If desired the basin may be provided with an emergency overflow in the form of a pipe (**30**) which at its upper end carries a combined basket and ball float (**28**) and at its lower end opens at the outside of the draining device (**5**).

FIG. **3** is a vertical section of a gully and supplementing basin used as a supplement to the volume of the universal basin in case the latter together with the outlet is insufficient to drain the desired area. The outlet leads to the universal basin.

FIGS. **4** and **5** show in vertical section a gully for street and space drainage and a gully for roof drainage respectively. The outlets from these also lead to a universal basin.

The draining device (**5**) according to FIG. **6** is in the embodiment shown constructed as a double conical housing consisting af two bowls (**13** and **14**) facing each other and joined by means of a flange joint. The

bowl (14) forms in combination with an internal bowl (16) an outlet chamber, which constitutes a centrifugal brake provided with an outlet opening (15) which together with the centrifugal brake (16), an air stabilizer (17), an outlet tube (18) and the pressure head occurring in the universal basin at any time determines the flow velocity through the outlet as the basin is filled and drained. The centrifugal brake (16) is in addition to the air stabilizer (17) provided with an inlet tube (19) which together with the outlet tube (18) constitutes a syphon. The lower end of the inlet tube (19) opens into a bottom chamber (20) forming a trap with same. FIG. 8 shows the bottom chamber (20) as viewed from line VIII—VIII in FIG. 6. The top of the bottom chamber wall, is designed as an inlet strainer (21) which is located at such a distance from the wall of the centrifugal brake that larger typically longitudinal solids are unable to turn and pass through the inlet strainer whose inlet openings have a slightly smaller cross-section than the inlet tube (19), the outlet opening (15) and the outlet tube (18). The bowl (13) which forms an inlet chamber is at its upper end provided with a venting opening (22), a venting tube (23) and two submerged inlet openings (24).

In the embodiment disclosed the draining device (5) is secured in an integrally cast reverse conical groove (4) by a sealing and locking ring (6). The said conical groove is at the side facing the pipe system provided with combined anchors and spacers (25), which when the sealing and locking ring (6) is removed ensure an outlet slit along the periphery of the draining device housing. The sealing and locking ring (6) has at its lower end a removing ring (27) provided with a strap (26). When this ring is pulled upwards the sealing and locking ring (6) and thereupon the draining device (5) may be removed.

The universal basin and the draining device, in which the bottom chamber (20) is filled with water prior to its installation operates as follows: When the rain water is flowing into the universal basin (1) it has normally, after passing a downpipe or a grate passed a strainer, in which the larger impurities are caught. The water then flows into the sedimentation chamber (11) in which entrained sand and smaller impurities settle before the water flows through the submerged inlet openings (9) into the clarification chamber (12). In the clarification chamber (12) the remaining suspension of particles in the water are precipitated before they reach the inlet strainer (21) owing to the very quiet and slow water flow below the protective cover (8). The slow water flow below the protective cover, ensures together with the submerged inlet openings (24) and the small outlet that oil and petrol washed down by the rain water, have time to be separated from the water before the water reaches the piping system.

When the water in the universal basin owing to the inflow into it, has reached a level at which the lower opening of the venting tube (23) is blocked, the air trapped between the two bowls (13 and 14) will be pressurized. This pressure spreads to the water surface in the bottom chamber (20) so as to force the water in same through the inlet tube (19). When the water in the universal basin has risen to a certain level the water surface in the bottom chamber has sunk to a level slightly below the lower edge of the inlet tube (19) and forms a concave. Now a state of balance is reached, in which an additional slight decline of the water level in the bottom chamber causes the air to penetrate below the water column in the inlet tube (19), blowing it into the centrifugal brake in a split second, thereby opening a narrow passage between the water surface in the bottom chamber and the lower edge of the inlet tube (19). Owing to the pressure a large amount of the trapped air quickly disappears through this passage. The subsequent pressure drop between the bowls causes a sudden rise of the water level in front of the inlet strainer (21), and the flow through the outlet starts, because the bottom chamber is quickly filled, whereupon the centrifugal brake is filled to a level where the water closes the outlet opening (15). The air thereby trapped in the upper part of the centrifugal brake, will now be pressurized and thereby prevent any further rise of the water level in the centrifugal brake for the time being. The flow through the outlet opening (15) thereupon fills the outlet tube (18) so that this starts to function as the outlet tube of a syphon. The outflow from the universal basin has now obtained the minimum velocity which is conditioned by the head between the lower edge of the venting tube (23) and the lower edge of the outlet tube (18) and the intermediate pressure losses. If the water continues to rise in the universal basin the inlet velocity through the inlet tube (19) will increase, causing the water level in the centrifugal brake to rise in the side at which the inlet is located, by which the water surface will adopt a position inclining towards the outlet opening. Conversely the water level at the other side of the chamber will fall slightly, so that a small portion of the trapped air may escape through the outlet opening. By continued increase in pressure the inlet velocity increases so that the water is caused to rotate along the periphery of the centrifugal brake, and the trapped air is hurled out as small bubbles, while the water starts rotating in front of the outlet opening and the centrifugal braking effect begins to operate. To avoid a premature braking effect a projection (17) is provided in the upper part of the centrifugal brake (16). This projection (17) serves as an air stabilizer as the air may be partly sheltered behind it until the pressure and consequently the rotational velocity of the water, increases so much that the remaining air is at last hurled out, thereby establishing full braking effect.

When later the water level in the universal basin (1) has dropped to a level below the bottom edge of the venting tube (23), the air will enter the said tube, and the water level in front of the inlet strainer will drop to the same level as the water level in the basin. Owing to the syphon action in the outlet tube (18) water is then sucked from the bottom chamber (20) until the water level in this has dropped sufficiently to allow air to be sucked in through the inlet tube (19) whereupon the outlet chamber which forms a centrifugal brake will be filled with air, until the water level in the said chamber has dropped to the outlet opening (15). The air thereupon will be sucked into the outlet tube (18) and interrupt the syphon action. The surplus water quantity in the centrifugal brake (16) which is located above the bottom edge of the top part of the inlet tube (18), subsequently flows back through this tube and down into the bottom chamber, so that a trap is established, and the draining device is ready for the next time water flows into the universal basin.

FIG. 10 shows the outlet flow characteristic for the draining device according to the invention, the outflowing water quantity in litres per second being indi-

cated as a function of the pressure head in water column metres. The quantity of outflowing water at a certain pressure head is indicated at point *a*, and the quantity will increase to point *b* at increasing pressure head, whereupon the centrifugal braking effect is established as the water in front of the outlet opening starts to rotate. By a continued increase in pressure head the rotational velocity of the water will increase and thereby cause an increased braking effect, so that the quantity outflowing per second in spite of increasing pressure head remains substantially constant until point *c* is reached. When point *c* is reached, all air in the centrifugal brake (**16**) will be displaced, and full braking effect is established. By a continued increase in pressure head the outflow increases in normal manner parabolically to point *d*. When the pressure head again drops, the outflow decreases according to the same parabola to point *e*, whereupon the syphon action in the draining device is interrupted by the intake of air, and a minor backflow of water to the bottom chamber (**20**) forms a trap which provides the counterpressure and the pressure equalization that reactivates the syphon action, so that the minimum velocity necessary for the self-cleaning is obtained.

If the flow of water to the universal basin (**1**) is no more than corresponds to the pressure head at point *f*, the outflow quantity drops with the braking effect obtained to point *g*, whereupon air intake and backflow as described above are repeated.

FIGS. **11** and **12** show a more simple embodiment of a draining device which may replace that shown in FIGS. **6–9** in cases where the outlet and consequently the outlet opening have to be of such size that it involves no appreciable risk of clogging under available conditions. The said draining device is installed and dismantled in the same way as that shown in FIGS. **6–9.** However, there is no trap to be filled with water before installation.

In the embodiment disclosed in FIGS. **11** and **12** the draining device shown is constructed as a double conical housing, consisting of two bowls (**13'** and **14'**) facing each other and joined by means of a flange joint, and with their total volume functioning as a centrifugal brake. The bowl (**13'**) is at its bottom provided with a number of inlet openings (**24'**) and an inlet tube (**19'**). The bowl (**14'**) is provided with an outlet opening (**15'**) and an outlet tube (**18'**) which together with the bowl (**13'**) at top is provided with a projection (**17'**).

The draining device shown in FIGS. **11** and **12** and installed in a universal basin operates as follows: When the water level in the universal basin rises owing to inflowing water, the water flows through the inlet openings (**24'**) into the inlet tube (**19'**) which directs the water into the draining device along its internal periphery. When the water has reached the outlet opening (**15'**) it flows into the pipe system through the outlet tube (**18'**) which is filled by and by and will function as the outlet of a syphon. Accordingly, the trapped air above the outlet opening will be subjected to pressure and thereby prevent further rising of the water level between the bowls (**13'** and **14'**). By continued rising of water level in the universal basin the inflow velocity through the inlet tube (**19'**) increases so that the water is hurled along the internal periphery, causing the trapped air to escape as small bubbles, while the water starts rotating in front of the outlet opening (**15'**) and the centrifugal braking effect begins to operate. To prevent premature braking effect a projection (**17'**) is provided in the upper part of the centrifugal brake (**16'**). This projection (**17'**) functions as an air stabilizer as the air may be partly sheltered behind the edge until the pressure and consequently the rotational velocity of the water increase to a point at which the remaining air is hurled out, establishing full braking effect. When later the water level in the universal basin (**1'**) has again dropped to a level equal to the bottom end of the outlet tube (**18'**), the syphon action in this is interrupted causing a backflow through the inlet tube (**19'**), by which any impurities at the inlet openings are washed back and precipitated.

The outlet flow characteristic is equal to that shown in FIG. **10,** except starting at zero.

It will be appreciated that the draining device may be installed in many ways differing from that shown in FIG. **6.** For instance it may, as shown in FIG. **13,** be mounted in a groove (**4**) surrounding an opening in a larger cover (**31**) covering a large inspection opening in the basin.

With the use of universal basins according to the design disclosed, a tight and closed sewer piping system is provided, which for instance, in addition to water draining may be used to carry off smoke or fumes, for instance, through the pipe (**2**) in FIG. **2,** connected to flues from boilers such as central heating boilers in residential buildings.

What I claim is:

1. Universal basin for use in a sewer system, such as a manhole, gully, sedimentation basin, equalizing basin, and oil and petrol interceptor; comprising a container having an inlet gate, an inlet pipe and a discharge opening; and a draining device mounted in said discharge opening for draining off an approximately constant amount of water through the discharge opening per unit of time, said draining device comprising a cover having spaced end walls and an annular well connecting said end walls defining a hollow housing, a first one of said end walls facing toward said basin having a submerged inlet opening formed therein, the other of said end walls having a centrally located outlet opening communicating with an outlet piping system, an outlet chamber being provided in said housing having a curved side wall portion, an inlet tube extending along said side wall portion and opening tangentially into said outlet chamber; and fastening means being formed along the periphery of said housing for securing said cover to the discharge opening of said basin.

2. Universal basin as claimed in claim **1,** said housing having an inlet chamber, a partition separating said inlet chamber and said outlet chamber, an inlet strainer interconnecting said chambers, a bottom chamber forming a trap, and said inlet tube connecting said bottom chamber and said outlet chamber, said inlet tube having a discharge end forming the inlet opening to said outlet chamber.

3. Universal basin as claimed in claim **1,** including a groove in the bottom of said basin in parallel with the plane of the draining device, a protective cover having submerged openings being mounted in said groove so as to cover the draining device while simultaneously forming a sedimentation- and clarification chamber between said device and the protective cover.

4. Universal basin as claimed in claim 3, said groove including hinge means for hinged connection of said protective cover to said basin.

5. Universal basin as claimed in claim 1, comprising a conical annular groove encompassing said discharge opening and tapering in relative to the direction of installation of said draining device in said openings, a sealing and locking ring engaged in a recess in said groove retaining said draining device in said opening; and a removal ring fastened to the lower end of said sealing and locking ring facing said basin adapted to facilitate removal of the latter from said groove.

6. Universal basin as claimed in claim 2, said end wall facing the basin forming a protective cover, said inlet opening in said end wall being at its bottom edge that is submerged at lowest water level, a vertical venting tube at the basin side of said end wall, having bottom end thereof open to the basin at a point proximate the center of said end wall and the top end of said venting tube opening into the upper end of said inlet chamber, a downwardly directed outlet tube communicating with the centrally located outlet opening in said other end wall, said outlet chamber having a helical side wall and forming a centrifugal brake, said inlet chamber, bottom chamber and inlet tube together forming a trap, and said outlet tube and the inlet tube of the centrifugal brake forming a syphon system in which the lower end of the inlet tube projecting into the bottom chamber is located at a level above the bottom end of the outlet tube.

7. Universal basin as claimed in claim 6, comprising an air stabilizer in said outlet chamber forming said centrifugal brake, said air stabilizer being in the shape of a projection directed radially inwardly from the helical side wall.

8. Universal basin as claimed in claim 6, comprising an inlet strainer located between said inlet chamber and said bottom chamber.

9. Universal basin as claimed in claim 1, comprising an emergency overflow including a substantially vertical pipe in said basin, the upper end of said pipe opening proximate the top of the basin, and a combined basket and ball float supported on the upper end of, and said pipe, the lower end of the pipe opening on the side of the draining device remote from the basin.

10. Universal basin as claimed in claim 1, said housing being an undivided double conical housing, a plurality of submerged inlet openings being provided in the bottom part of one housing end wall, an internal inlet tube extending tangentially to the housing communicating with said inlet openings, and an outlet tube directed downwardly from the discharge opening being centrally located in the other end wall of said housing.

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