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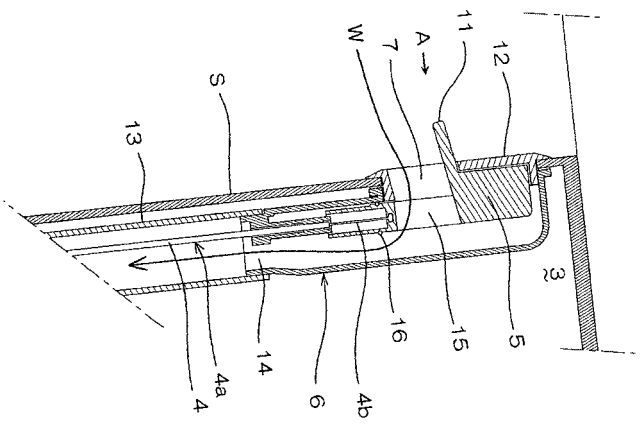
(54) Waste plug apparatus

(57) A remote-operated, drain plug apparatus having an operating portion provided in a vertical wall is provided which prevents the buckling and action deterioration of release wire and has good exterior appearance.

The remote-operated drain plug apparatus includes a drain port (1) provided in a tub; a valve member (2) opening and closing the drain port (1); an operating portion (3) disposed in a substantially vertical wall; a release wire (4) transferring operation performed on the operating portion (3) to the valve member (2). The operating portion (3) includes an action body (5) connected to the inner wire (4b) of release wire (4), an operating portion body (6) formed of a box-shaped member connected to the outer tube (4a) and provided with a side-surface opening (7), the operation portion body (6) accommodating the action body (5) slidably upward and downward, and a knob (11) attached to the operating portion body (5) in such a way that the knob (11) protrudes through the opening (7).

Fig 2



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Description

[Technical Field]

[0001] The present invention relates to a remote-operated drain plug apparatus attached to a washstand, a bathtub, or any other similar tub, and particularly to a front-switch, remote-operated drain plug apparatus having an operating portion provided in a substantially vertical wall of a drain apparatus or a tub.

[Background Art]

[0002] There has been a remote-operated drain plug apparatus used with a washstand, a bathtub, or any other similar tub and including a drain port that a user can open and close by operating an operating portion without having to directly touch by a hand and operate a water-shutoff valve member provided at the drain port.

A conventional example of the remote-operated drain plug apparatus used with a washstand including a tub will be described below with reference to the drawings.

The conventional remote-operated drain plug apparatus shown in Figure 14 includes a valve member, a drain plug body, a drain connecting tube, an overflow pipe, an operating portion, a release wire, a driver, and other members. The structure of each of the members is described below.

The valve member includes a substantially disc-shaped valve body and a valve shaft extending immediately downward from the center of the valve body.

The drain plug body is a tubular member having a drain port provided in an upper portion thereof, a flange provided around the circumferential edge of the upper end thereof, and a drain flow passage provided therein. The drain plug body further has a fixing potion provided in a lower portion of the tubular member and fixing the driver, which will be described later. The drain plug body is connected to the drain connecting tube, which will be described later, disposed on the downstream side.

The drain connecting tube includes a laterally oriented branch tube for connecting an overflow tube, which will be described later, to a tubular body of the drain connecting tube somewhere in the middle thereof.

The overflow pipe includes: an overflow drain plug attached to the inner side of the tub and including an overflow drain port; an overflow body having an L-like cross-sectional shape, connected to the overflow drain plug, and inserted into an overflow attachment hole; and the overflow tube, which is connected to a downstream portion of the overflow body and through which drain having passed through the overflow drain port is discharged.

The operating portion is a member disposed in the overflow drain port and connected to the release wire and includes: a rod-shaped action body connected to an inner wire and including a button having an end pressed by the user; and a tubular operating portion body which is connected to an outer tube and through which an operating shaft movable forward and backward is inserted. The action body is urged by a return spring in the release wire and hence protrudes toward a knob when no particular operational load or any other load is applied.

The release wire is a member that transfers the action of the operating portion to the driver. The release wire includes the outer tube having a cylindrical shape and showing sideways flexibility and axial rigidity and the inner wire slidably disposed in the outer tube and showing sideways flexibility and axial rigidity. One end of the inner wire in the release wire is connected to the lower end of the operating shaft, and the other end of the inner wire abuts the rear end of a support shaft to push the support shaft upward whenever the operating portion is pressed. The release wire further accommodates the return spring (not shown), which always urges the inner wire relative to the outer tube toward the operating portion.

The driver includes a mechanism called a thrust lock mechanism, which is employed, for example, in a push-action ball-point pen. The thrust lock mechanism accommodates the support shaft liftable and lowerable in the up-down direction and repeats maintaining the support shaft lifted/releasing the lifted support shaft and moving the support shaft downward whenever the lower end of the support shaft is pushed upward.

In addition to the above members, a trap pipe connected to a discharge port of the drain connecting tube is provided.

A washbowl of the washstand in which the remote-operated drain plug apparatus is installed is a tub with an upper opening and includes an attachment hole for attaching the drain plug to a lower portion of the tub and an overflow attachment hole for attaching the overflow drain plug to the tub but the vicinity of the upper edge of the tub.

[0003] To install the remote-operated drain plug apparatus formed of the members described above in the washbowl, the circumferential edge of the overflow attachment hole is first sandwiched between and fixed by the overflow drain plug and the overflow body. The release wire is then inserted into the overflow drain port, the overflow body, the overflow tube, the branch tube, and the drain connecting tube, and the operating portion is fixed into the overflow drain port. The drain plug body is then attached into the attachment hole, and an end of the release wire is connected to the driver attached to the drain plug body. Thereafter, the lower end of the drain plug body is connected to the upper end of the drain connecting tube, and the lower end of the drain connecting tube is connected to an underfloor pipe on the sewage side via the trap pipe.

Further, the valve member is inserted through the drain port and disposed in the drain plug body so that the valve shaft is disposed above the support shaft. The installation of the remote-operated drain plug apparatus is thus completed.

[0004] To use the thus installed remote-operated drain plug apparatus, a state in which the drain port is closed,

that is, a state in which the support shaft is lowered, is first established. In this state, when the user presses the button of the operating portion to move the inner wire in the release wire forward toward the driver via the operating shaft, the tip of the inner wire pushes the support shaft of the driver upward, and the thrust lock mechanism maintains a state in which the support shaft pushes the valve shaft upward, that is, a state in which the entire valve member is lifted and the valve body moves away from the drain port so that the drain port is opened. At this point, the return spring causes the inner wire to protrude toward the operating portion (toward the interior of the tub).

In this state, when the user presses the button of the operating portion again to move the inner wire in the release wire forward via the operating shaft, the following actions occur: The tip of the inner wire pushes the support shaft of the driver upward; the support shaft fixed in the thrust lock mechanism is unlocked; the valve shaft and the support shaft are lowered; and the valve body blocks the drain port.

The drain port can then be arbitrarily opened and closed remotely by repeating the same operation described above.

[0005] In addition to the conventional example described above, the remote-operated drain plug apparatus may be installed in some cases by providing the operating portion in a vertical wall of the washstand, instead of providing it in the overflow drain port, so that the release wire is not disposed in the overflow pipe.

[0006] In the remote-operated drain plug apparatus shown in Fig. 14, providing the operating portion in a vertical wall of a drain apparatus, such as a tub and a washstand, allows any drain droplet that adheres to the operating portion to readily fall downward and the operating portion to be maintained in sanitary conditions.

Further, when the operating portion is disposed in the overflow drain plug, it is unnecessary to provide an opening in the washstand (or washbowl) through which the release wire is inserted, whereby not only can part of work necessary to manufacture the drain apparatus be omitted, but also the drain apparatus can be formed of the same members as those of a drain apparatus without a remote-operated drain plug apparatus and hence member management can be made more easily.

[Citation list]

[patent Literature]

[0007]

[Patent Literature 1] Japanese Patent Laid-Open No. 2004-183225

[Summary of Invention]

[Technical Problem]

[0008] The example described above, however, has the following problems:

1. In the conventional remote-operated drain plug apparatus described above, the release wire is configured to move forward and backward in the operating portion. However, there is typically not enough clearance space between a vertical wall of a tub to which an operating portion for a drain apparatus is attached or a vertical wall of a drain apparatus and the wall of the room. As a result, the release wire horizontally extending from the operating portion is sharply bent downward in the narrow clearance space between the drain apparatus and the wall of the room and then connected to the driver. Since the inner wire in the release wire is formed, for example, of metal twisted wires, the inner wire could be broken if bent to a very small curvature and hence cannot slide in the outer tube, which is called a buckling phenomenon. Even when the inner wire is not bent to the point of breakage, the pressure at which the bent inner wire abuts the inner surface of the outer tube and the magnitude of associated frictional force increase, preventing a smooth action of the remote-operated drain plug apparatus.
2. Since the interior of the overflow drain port is dark and water stain and other dirt adhere thereto, a cover member is often provided in consideration of exterior appearance so that the user of the drain apparatus cannot directly look into the overflow drain port. When the operating portion is disposed in the overflow drain port, however, no cover member can be provided because the cover member could obstruct operation of the button, the operating shaft, and other components of the operating portion. In this case, the user of the drain apparatus can directly look into the overflow drain port, disadvantageously resulting in degraded exterior appearance.

The present invention has been made to solve the above problems and relates to a remote-operated drain plug apparatus used with a bathtub, a sink, a washstand, and other tubs and having an operating portion provided in a vertical wall thereof. Specifically, in the remote-operated drain plug apparatus, a release wire will not buckle or malfunction, and the user of the drain apparatus cannot directly look into an overflow drain port when the operating portion is disposed in the overflow drain port so that the remote-operated drain plug apparatus has good exterior appearance.

[Solution to Problem]

[0009] The present invention according to claim 1 is a

remote-operated drain plug apparatus including: a drain port 1 provided in a tub; a valve member 2 disposed in the drain port 1 and opening and closing the drain port 1 when moved upward and downward; an operating portion 3 disposed in a substantially vertical wall and opening and closing the valve member 2; a release wire 4 including a tubular outer tube 4a and an inner wire 4b disposed in the outer tube 4a movably in forward and backward directions, the release wire 4 transferring operation performed on the operating portion 3 to the valve member 2. The drain port 1 is opened and closed by moving the inner wire 4b forward and backward in the axial direction of the outer tube 4a. The operating portion 3 includes

an action body 5 connected to the inner wire 4b,

an operating portion body 6 formed of a box-shaped member connected to the outer tube 4a and provided with a side-surface opening 7, the operating portion body 6 accommodating the action body 5 slidably upward and downward, and

a knob 11 attached to the operating portion body 6 in such a way that the knob 11 protrudes through the opening 7 and is movable forward and backward or upward and downward.

The knob 11 protruding through the opening 7 lowers the action body 5 when the knob 11 is moved in one of the forward and backward directions or one of the upward and downward directions, whereas the knob 11 protruding through the opening 7 lifts the action body 5 in the operating portion body 6 when the knob 11 is moved in the other one of the forward and backward directions or the other one of the upward and downward directions.

The opening 7 in the operating portion 3 is located in the tub.

Overflow drainage in which drain in the tub is discharged toward sewage is carried out when the water level in the tub reaches or goes beyond a fixed level in the opening 7. When the drain port 1 is open, movement of the knob 11 in one of the movable directions or associated downward movement of the action body 5 causes at least part of the opening 7 to be blocked.

[0010] In the present invention according to claim 2, which is a variation of the remote-operated drain plug apparatus according to claim 1, the knob 11 is provided on a side surface of the action body 5, and the operating portion body 6 accommodates the action body 5 with the knob 11 protruding through the side-surface opening 7. The structure described above is that shown in a first embodiment, which will be described later.

[0011] In the present invention according to claim 3, which is a variation of the remote-operated drain plug apparatus according to claim 1, the action body 5 is provided with an inclined surface 5a in an upper portion so that a front-rear dimension increases in the downward direction. The knob 11 is attached to the operating portion body 6 movably forward and backward in the front-rear direction. When the knob 11 abuts the inclined surface 5a through the opening 7 and is pushed deeper, the inclined surface 5a allows the action body 5 to lower. The structure described above is that shown in a second embodiment, which will be described later.

[0012] In the present invention according to claim 4, which is a variation of the remote-operated drain plug apparatus according to claim 3, the action body 5 has a plane symmetric shape. When an installation of the apparatus is completed, the drain port 1 is opened and closed by moving the action body along the direction parallel to the symmetric plane thereof. The center of gravity of the knob 11 and the portion where the action body 5 is connected to the inner wire 4b in the release wire 4 are located in the symmetric plane of the action body 5. An overflow discharge port 14 through which drain in the operating portion body 6 is discharged is provided in a position outside the symmetric plane of the action body 5 when the installation is completed.

[0013] The present invention according to claim 5 is any one of the remote-operated drain plug apparatus described in Sections [0009] to [0012]. The remote-operated drain plug apparatus according to claim 5 forms a one-way remote-operated drain plug apparatus in a sense that a driver 8 is further provided in the path between the operating portion 3 and a valve shaft 2b of the remote-operated drain plug apparatus, the driver 8 including a support shaft 8a movable forward and backward in the axial direction and repeating maintaining the valve member 2 lifted/releasing the lifted valve member 2 and lowering the valve member 2 whenever the operating portion 3 is pressed, and that the drain port 1 is opened or closed whenever the operating portion 3 is pressed.

[Advantageous effects of Invention]

[0014] The remote-operated drain plug apparatus of the present invention provide the following advantages:

1. In the remote-operated drain plug apparatus according to claim 1, when the release wire is connected to the operating portion, the connected release wire is oriented only in the up-down direction but is not oriented in the front-rear direction (horizontal direction). As a result, a disadvantageous situation in which the release wire is bent downward sharply in a narrow clearance space between, the tub and the wall and then connected to the driver will not occur. The configuration described above will solve the buckling problem, in which the release wire bent to a small curvature may be broken. Further, the other problem, in which the pressure at which the bent inner wire abuts the inner surface of the outer tube and the magnitude of associated frictional force increase, preventing a smooth action of the remote-operated drain plug apparatus, will not occur.

The remote-operated drain plug apparatus includes a mechanism for lowering the action body 5 when the knob 11 is moved in any one of the movable directions described above. The action body 5 is lowered specifically due to physical contact with the

knob 11 or a component interposed between the action body 5 and the knob 11 or due to an integrated structure of the action body 5 and the knob 11. The drain port 1 can therefore be reliably opened and closed without having to provide a large space but by moving the knob to cause the action body 5 to slide.

Further, in the remote-operated drain plug apparatus configured to allow overflow drainage through the opening in the operating portion, the knob or the action body blocks at least part of the opening from being viewed by the user when the drain port is open and hence no overflow drainage is required. As a result, the user of the drain apparatus can view none of the interior of the operating portion through the opening, and the look and feel can be enhanced. At the same time, blocking part of the opening allows the amount of overflow to be adjusted.

2. In the release-wire-based remote-operated drain plug apparatus having the operating portion provided in a vertical wall according to claims 2 and 3 of the present invention, the action body 5 can be reliably lifted and lowered when the knob is operated so that the drain port is reliably opened and closed even when an overflow structure is incorporated, which is specifically achieved by integrating the knob with the action body in the configuration according to claim 2 or by allowing the knob to slide along the inclined surface of the action body in the configuration according to claim 3. Further, the knob protruding forward through the opening 7 according to claim 2 or 3 or the shape of the action body whose width increases in the downward direction according to claim 3 readily blocks at least part of the opening 7 from being viewed by the user. At the same time, blocking part of the opening 7 allows the amount of overflow to be readily adjusted.

3. Since the invention described in claim 4 is characterized in that the action body has a plane symmetric shape; when an installation of the apparatus is completed, the drain port is opened and closed by moving the action body along the direction parallel to the symmetric plane thereof; and the center of gravity of the knob 11 and the portion where the action body is connected to the inner wire in the release wire are located in the symmetric plane of the action body, the force applied to the action body via the knob and the force acting on the inner wire through the action body are well balanced, allowing a stable action. On the other hand, since the overflow discharge port, through which drain in the operating portion body is discharged, is provided in a position outside the symmetric plane of the action body when the installation is completed, the release wire hardly obstructs the drain flowing from the operating portion body, allowing drainage performance to be maintained in a satisfactory manner.

4. The remote-operated drain plug apparatus according to claim 5 can provide a clear configuration for opening and closing operation in the remote-operated drain plug apparatus.

[Brief Description of Drawings]

[0015]

[Figure 1] Figure 1 is a cross-sectional view in a first embodiment with a drain port closed.

[Figure 2] Figure 2 is an enlarged view of an operating portion and the vicinity thereof shown in Figure 1.

[Figure 3] Figure 3 shows the operating portion and the vicinity thereof shown in Figure 2 but viewed in the direction of the arrow A with a washbowl omitted.

[Figure 4] Figure 4 is a cross-sectional view in the first embodiment with the drain port open.

[Figure 5] Figure 5 is an enlarged view of the operating portion and the vicinity thereof shown in Figure 4.

[Figure 6] Figure 6 shows the operating portion and the vicinity thereof shown in Figure 5 but viewed in the direction of the arrow B with the washbowl omitted.

[Figure 7] Figure 7 is a cross-sectional view in a second embodiment with a drain port closed.

[Figure 8] Figure 8 is an enlarged view of an operating portion and the vicinity thereof shown in Figure 7.

[Figure 9] Figure 9 is a reference view showing a state in which a knob is pushed in the operating portion shown in Figure 8.

[Figure 10] Figure 10 is a cross-sectional view in the second embodiment with the drain port open.

[Figure 11] Figure 11 is an enlarged view of the operating portion and the vicinity thereof shown in Figure 10.

[Figure 12] Figure 12 is a front view showing an operating portion of a third embodiment with a washbowl omitted.

[Figure 13] Figure 13 is a cross-sectional view in the third embodiment.

[Figure 14] Figure 14 is a cross-sectional view of a washbowl in which a conventional remote-operated drain plug apparatus is incorporated.

[Embodiments]

[0016] Each embodiment of the present invention will be described below with reference to the drawings. In each embodiment, a remote-operated drain plug apparatus of the present invention includes a drain port 1 provided in a tub, a valve member 2 that is disposed in the drain port 1 and moves upward and downward to open and close the drain port 1, an operating portion 3 that is disposed in a substantially vertical wall and opens and closes the valve member 2, and a release wire 4 that transfers operation performed on the operating portion 3 to the valve member 2 and includes a tubular outer tube

4a and an inner wire 4b disposed in the outer tube 4a and movable forward and backward therein. The drain port 1 is opened and closed by moving the inner wire 4b forward and backward in the axial direction of the outer tube 4a.

As a feature of the present invention, the operating portion 3 is formed of an action body 5 connected to the inner wire 4b; an operating portion body 6 that is a box-shaped member connected to the outer tube 4a and has an opening 7 in a side surface, the operating portion body 6 accommodating the action body 5 slidably upward and downward; and a knob 11 protruding through the opening 7 and attached to the operating portion body 6 movably forward and backward or upward and downward.

The knob 11 protruding through the opening 7 lowers the action body 5 when the knob 11 is moved in one of the forward and backward directions or one of the upward and downward directions, whereas the knob 11 protruding through the opening 7 lifts the action body 5 in the operating portion body 6 when the knob 11 is moved in the other one of the forward and backward directions or the other one of the upward and downward directions.

The opening 7, which is provided in the operating portion 3, is disposed in the tub and allows overflow drainage in which the drain in the tub is discharged toward the sewage when the water level in the tub reaches or goes beyond a certain level in the opening 7.

When the drain port 1 is open, moving the knob 11 in one of the movable directions described above or the resulting downward movement of the action body 5 advantageously causes at least part of the opening 7 to be closed or blocked and prevents the interior of the opening for the overflow drainage from being fully exposed to the user who looks into the opening obliquely downward.

The remote-operated drain plug apparatus according to a first embodiment of the present invention shown in Figures 1 to 6 includes the valve member 2, a drain plug body 9, a drain connecting tube 10, the operating portion 3, the release wire 4, and other members. In the first embodiment, in particular, the knob 11 is fixed to the side surface of the action body 5 that faces the opening 7, and the knob 11 integrated with the action body 5 protrudes sideways therefrom. The knob 11, along with the action body 5, is therefore movable upward and downward along the shape of the opening 7.

When the knob 11 protruding through the opening 7 is moved downward, which is one of the upward and downward directions, the action body 5 is lowered in the operating portion body 6. As a result, the knob 11 makes part or all of the interior of the opening 7 including an upper portion thereof invisible to the user and moves the inner wire 4b downward to close the drain port.

On the other hand, when the knob 11 protruding through the opening 7 is moved upward, which is the other one of the upward and downward directions, the action body 5 is lifted in the operating portion body 6. As a result, part or all of the opening 7 including a lower portion thereof is exposed, and the inner wire 4b is moved upward. In this case, the drain port is opened. The structure of each of the members in the first embodiment will be described below.

The valve member 2 includes a substantially disc-shaped valve body 2a and a valve shaft 2b extending immediately downward from the center of the valve body 2a.

The drain plug body 9 is a tubular member having the drain port 1 provided in an upper portion thereof, a flange 9a provided around the circumferential edge of the upper end thereof, and a drain flow passage provided therein. The lower end of the drain plug body 9 is connectable to the drain connecting tube 10, which will be described later.

The drain connecting tube 10 is a member formed of a substantially tubular body and has a branch tube 10a into which the release wire 4 is inserted and through which overflow drain from the operating portion 3 flows. The branch tube 10a is provided on the side surface of the tubular body somewhere in the middle thereof. A fixing portion for fixing an end of the outer tube 4a of the release wire 4, which will be described later, is provided in a position substantially immediately under the valve shaft 2b in the drain connecting tube 10.

The operating portion 3 is a member that remotely operates the action of the valve member 2, which is provided in the drain port 1, and allows overflow drainage in which the drain in the tub is discharged toward the sewage when the water level in the tub reaches or goes beyond a certain level. The operating portion 3 is formed of a cover member 12, the operating portion body 6, the action body 5, and an overflow tube 13, which will be described below.

The cover member 12 is a substantially rectangular member when viewed from the front and has the opening 7 in a lower central portion thereof.

The operating portion body 6 is a box-shaped member connected to the cover member 12. An opening for connecting the cover member 12 is provided in a front portion of the operating portion body 6, and an overflow discharge port 14 to which the overflow tube 13 is connected is provided in a lower portion of the operating portion body 6. The operating portion body 6 accommodates the action body 5, which will be described later, movably upward and downward. The operating portion body 6, in which the action body 5 is accommodated, still has a drain space behind the action body 5 through which drain can pass. When an installation of the apparatus is completed, overflow drain can be discharged through the opening 7, a water flow port 15, the drain space in the operating portion body 6, and the overflow drain discharge port 14 and out of the overflow tube 13, as will be described later.

The action body 5 is a flat-plate member the lower end of which is connected to the inner wire 4b and includes the knob 11 and the water flow port 15. The knob 11 is disposed in a substantially central portion of the action body 5 and slightly inclined downward toward the front side, and the water flow port 15 is disposed in a portion below the knob 11 and allows drain to pass therethrough.

An o ring 16 for fixing the position of the action body 5 relative to the operating portion body 6 is provided around the action body 5. The action body 5 as a whole has a bilaterally plane symmetric shape, and the center of gravity of the knob 11 and the portion where the action body 5 is connected to the inner wire 4b in the release wire 4, which will be described later, are disposed in the symmetric plane of the action body 5 (since the knob 11 is also bilaterally symmetric, the center of gravity thereof is, of course, located in the symmetric plane of the action body 5).

The overflow tube 13 is a member formed of a flexible tube body connecting the overflow discharge port 14 to the branch tube 10a and allows drain having passed through the overflow discharge port 14 to be discharged into the branch tube 10a.

The release wire 4 is a member that transfers operation performed on the operating portion 3 to the valve member 2 and includes the outer tube 4a having a cylindrical shape and showing sideways flexibility and axial rigidity, the inner wire 4b slidably disposed in the outer tube 4a and showing sideways flexible and axial rigidity, and a rod portion 4c provided at the end of the inner wire 4b that faces the drain plug body 9. The inner wire 4b in the release wire 4 has one end disposed immediately under the lower end of the valve shaft 2b of the valve member 2 and the other end connected to the action body 5 in the operating portion 3.

In addition to the above members, a trap pipe 17 connected to a discharge port of the drain connecting tube 10 is provided.

A washbowl S of a washstand, which is the tub in which the remote-operated drain plug apparatus is installed, is a tub with an upper opening and includes an attachment hole for attaching the drain plug to a lower portion of the tub and an operating portion attachment hole for attaching the operating portion 3 to the tub but to the vicinity of the upper edge of the tub.

[0017] To install the remote-operated drain plug apparatus formed of the members described above in the washbowl S, the overflow discharge port 14 of the operating portion body 6 is first connected to the branch tube 10a of the drain connecting tube 10 via the overflow tube 13. Thereafter, one end of the inner wire 4b in the release wire 4 is connected to the lower end of the action body 5, and the other end of the inner wire 4b that will face the drain plug body 9 (the end provided with the rod portion 4c) is inserted into the operating portion body 6, the overflow tube 13, the branch tube 10a, and the drain connecting tube 10 in this order. The release wire 4 is inserted into the overflow tube 13, and the action body 5 is accommodated in the operating portion body 6. Thereafter, one end of the outer tube 4a of the release wire 4 is connected and fixed to the fixing portion.

Further, the circumferential edge of the operating portion attachment hole in the washbowl S, which is the tub, is sandwiched between the cover member 12 and the circumferential edge of the front-side opening in the operating portion body 6 so that the cover member 12 and the operating portion body 6 are fixed to the washbowl S. At this point, the following state is established: The knob 11 of the action body 5 protrudes through the opening 7 in the cover member 12 toward the front side, and the action body 5 can slide upward and downward in the operating portion body 6 when the knob 11 is operated (since the action body 5 is bilaterally plane symmetric, moving the action body 5 upward or downward means that the action body 5 is moved along the direction parallel to the symmetric plane thereof). In the present embodiment, the overflow discharge port 14 is immediately under the operating portion body 6 in a position in the symmetric plane of the action body when the installation is completed.

In this state, the release wire 4 on the side where the operating portion 3 is present is oriented in the up-down direction in accordance with the action body 5 moving upward and downward, unlike in the conventional example, in which the release wire 4 extends in the front-rear direction (horizontal direction) and is then sharply bent downward.

The drain plug body 9 is then attached and fixed into the attachment hole in the washbowl S so that the lower surface of the flange 9a abuts the upper surface of the circumferential edge of the attachment hole. The lower end of the drain plug body 9 is connected to the upper end of the drain connecting tube 10, and the lower end of the drain connecting tube 10 is further connected to an underfloor pipe on the sewage side via the trap pipe 17. Moreover, the valve member 2 is inserted through the drain port 1 and disposed in the drain plug body 9 so that the valve shaft 2b is disposed above a support shaft 8a. The installation of the remote-operated drain plug apparatus is thus completed. It is noted at this point that the rod portion 4c at the corresponding end of the inner wire 4b is disposed immediately under the valve shaft 2b.

[0018] To use the thus installed remote-operated drain plug apparatus, the following state is first established: The drain port 1 is closed, that is, the inner wire 4b is retracted relative to the outer tube 4a toward the operating portion 3 and the action body 5 is lifted so that the rod portion 4c at the opposite end of the inner wire 4b is lowered, as shown in Figure 1. At this point, the valve member 2 is not supported by the rod portion 4c and hence is lowered, and the valve body 2a blocks the drain port 1. The opening 7 in the cover member 12 and the water flow port 15 in the action body 5 are positioned at this point in such a way that the water flow port 15 and the opening 7 coincide with each other in a front view (when viewed in the direction of the arrow A in Figure 3), as shown in Figures 2 and 3.

In the state shown in Figure 1, since the drain port 1 is blocked, the drain resulting from use of the washstand, which is a drain apparatus, accumulates in the washbowl S, which is the tub. When the accumulated drain reaches the lower end of the opening 7 in the cover member 12, the drain in the washbowl S flows along the lower end of

the opening 7 into the operating portion 3, passes through the opening 7 in the cover member 12, the water flow port 15, the water passage space in the operating portion body 6, and the overflow discharge port 14, and is discharged through the overflow tube 13, the branch tube 10a, the drain connecting tube 10, and finally the trap pipe 17 toward the sewage, as indicated by the arrow W shown in Figure 2. Even when the drain keeps being produced in the washbowl S, the drain level in the washbowl S does not go up but stays at a constant level, and the drain will not flow over the upper edge of the washbowl S.

In this state, when the user operates the knob 11 in the operating portion 3 to lower the action body 5, the inner wire 4b disposed in the release wire 4 and connected to the action body 5 moves forward toward the drain plug. As a result, the tip of the rod portion 4c pushes the lower end of the valve shaft 2b of the valve member 2 upward to lift the entire valve member 2, and the valve body 2a moves away from the drain port 1. The drain port 1 is thus opened, as shown in Figures 4, 5, and 6. In this state, the portion of the action body 5 that is above the knob 11 works as a wall that blocks the opening 7.

In the state shown in Figure 4, since the drain port 1 is open, the drain resulting from use of the washstand, which is a drain apparatus, is discharged directly through the drain port 1, the drain plug body 9, the drain connecting tube 10, and finally the trap pipe 17 toward the sewage. Even when the drain keeps being produced in the washbowl S, the drain will not accumulate in the washbowl S, which means that blocking the opening 7 does not cause the drain to overflow from the washbowl.

In this state, when the user operates the knob 11 in the operating portion 3 to lift the action body 5, the inner wire 4b is retracted toward the operating portion 3 to lower the valve member 2 along with the rod portion 4c, and the drain port 1 is blocked. The state thus returns to the state shown in Figure 1.

The drain port 1 can then be arbitrarily opened and closed remotely by using the operating portion 3 and repeating the same operation described above.

[0019] In the first embodiment described above, when the release wire 4 is connected to the operating portion 3, the connected release wire 4 is oriented only in the up-down direction but is not oriented in the front-rear direction (horizontal direction). As a result, a disadvantageous situation in which the release wire 4 is bent downward sharply in a narrow clearance space between the drain apparatus and the wall and then connected to a driver 8 will not occur. The configuration described above will solve the buckling problem, in which the release wire 4 bent to a small curvature may be broken. Further, the other problem, in which the pressure at which the bent inner wire 4b abuts the inner surface of the outer tube 4a and the magnitude of associated frictional force increase, preventing a smooth action of the remote-operated drain plug apparatus, will not occur.

Further, in the first embodiment described above, when the drain port 1 is closed as shown in Figures 1, 2, and 3, the interior of the operating portion body 6, which allows overflow drainage through the opening 7 and the water flow port 15, is visible when the user's line of sight is at the level of the operating portion 3. The user of the tub, however, usually views the interior of the tub obliquely downward, and the knob 11 protruding from the operating portion 3 prevents the user of the drain apparatus who views the interior of the tub obliquely downward from viewing the interior of the operating portion body 6 in the embodiment described above.

On the other hand, when the drain port 1 is open as shown in Figures 4, 5, and 6, since the lowered action body 5 blocks the opening 7, the interior of the operating portion body 6 will not be viewed through the opening 7 in the cover member 12. Further, at this point, since the opening 7 in the operating portion 3 is closed but the drain port 1 is open, the drain resulting from use of the drain apparatus does not accumulate in the tub but is discharged through the drain port 1. Therefore, blocking the opening 7, through which overflow drain is discharged, will not cause any problem in the use of the drain apparatus.

[0020] A second embodiment of the present invention will next be described with reference to the drawings.

A remote-operated drain plug apparatus according to the second embodiment of the present invention shown in Figures 7 to 11 includes a valve member 2, a drain plug body 9, a drain connecting tube 10, an operating portion 3, a release wire 4, a driver 8, and other members. In the second embodiment, a knob 11, in particular, is provided rotatably around a hinge at the upper end thereof through an opening 7 in an operating portion body 6 in a direction including the front-rear direction so that the knob 11 can protrude and extract through the opening 7. The portion of the knob 11 that is in the rear operating portion body 6 has an arcuate shape, and the knob 11 slidably comes into contact with an action body 5 via the backside arcuate inclined surface.

Further, in the second embodiment, the action body 5 is accommodated in the operating portion body 6 and movable upward and downward in the space in the operating portion body 6. In particular, the action body 5 has an upper-front-side inclined surface 5a inclined in the direction along which the action body 5 abuts the inclined surface of the backside arcuate portion of the knob 11, and the inclined surface 5a moves upward and downward within the range of the opening 7 in the operating portion body 6 as the action body 5 moves upward and downward.

When the knob 11 is moved backward, which is one of the forward and backward directions, the knob 11 abuts the action body 5 in the opening 7, and the action body 5 is lowered in the operating portion body 6 in accordance with the relative sliding motion between the inclined surface of the arcuate portion of the knob 11 and the inclined surface of the action body 5, whereby the knob 11 and the action body 5 make part or all of the opening 7 including an upper portion thereof invisible to the user. At

the same time, an inner wire 4b is lowered and a drain port is closed. The structure of each of the members in the second embodiment will be described below.

The valve member 2 includes a substantially disc-shaped valve body 2a and a valve shaft 2b extending immediately downward from the center of the valve body 2a.

The drain plug body 9 is a tubular member having a drain port 1 provided in an upper portion thereof, a flange 9a provided around the circumferential edge of the upper end thereof, and a drain flow passage provided therein. The lower end of the drain plug body 9 is connectable to the drain connecting tube 10, which will be described later.

The drain connecting tube 10 is a member formed of a substantially tubular body and has a branch tube 10a into which the release wire 4 is inserted and through which overflow drain from the operating portion 3 flows. The branch tube 10a is provided on the side surface of the tubular body somewhere in the middle thereof. A fixing portion for fixing the driver 8, which will be described later, is provided in a position substantially immediately under the valve shaft 2b in the drain connecting tube 10.

The driver 8 is a member located in the path between the operating portion 3 and the valve shaft 2b and connected and fixed to the fixing portion of the drain connecting tube 10 and includes a thrust lock mechanism with a support shaft 8a movable forward and backward in the up-down direction. The thrust lock mechanism is used, for example, in a push-action ball-point pen and repeats maintaining the support shaft 8a lifted/releasing the lifted support shaft 8a and moving the support shaft 8a downward whenever the lower end of the support shaft 8a is pushed.

The operating portion 3 is a member that remotely operates the action of the valve member 2 provided in the drain port 1 and allows overflow drainage in which the drain in a tub is discharged toward the sewage when the water level in the tub reaches or goes beyond a certain level. The operating portion 3 is formed of a cover member 12, the operating portion body 6, the action body 5, and an overflow tube 13, which will be described below.

The cover member 12 is a substantially rectangular member when viewed from the front and has the opening 7 formed therein.

The operating portion body 6 is a box-shaped member connected to the cover member 12. An opening for connecting the cover member 12 is provided in a front portion of the operating portion body 6, and an overflow discharge port 14 to which the overflow tube 13 is connected is provided in a lower portion of the operating portion body 6. The operating portion body 6 accommodates the action body 5, which will be described later, movably upward and downward. The operating portion body 6, in which the action body 5 is accommodated, still has a drain space behind the action body 5 through which drain can pass. When the installation is completed, overflow drain can be discharged through the opening 7, a water flow port 15, the drain space in the operating portion body 6, and the overflow discharge port 14, and out of the overflow tube 13, as will be described later.

The action body 5 is a member having the following characteristics: The action body 5 as a whole has a bilaterally plane symmetric shape; the lower end of the action body 5 is connected to the inner wire 4b; and the action body 5 is provided with an inclined surface 5a in an upper portion so that a front-rear dimension increases in the downward direction. Further, the water flow port 15, through which drain passes, is provided in a lower portion of the inclined surface 5a.

The knob 11 is a bilaterally symmetric member pivotal around the upper edge of the opening 7 in the cover member 12 and includes a backside arcuate portion when viewed from a side. When the knob 11 pivots around the upper edge of the opening 7, the knob 11 protrudes from and retracts in the operating portion body 6 through the opening 7. When the knob 11 protrudes and retracts, the arcuate portion abuts the inclined surface 5a of the action body 5. When the knob 11 is pushed deeper at the time of abutment, the inclined surface 5a causes the action body 5 to lower. The knob 11 is configured in general to protrude into the tub because a spring member (not shown) urges the knob 11. Further, when the installation is completed and the action body 5 is lowered downward as will be described below, the lower end of the knob 11 is lower than the upper end of the action body 5. In this state in which the action body 5 is lowered, the user of a washstand, which is a drain apparatus, cannot view the interior of the operating portion body 6 (since the user cannot see a portion above the action body 5 hidden behind the knob 11 unless the user's eyes are in a washbowl S, which is the tub, and the user looks upward at the operating portion 3).

It is noted that the symmetric plane of the action body 5 and the symmetric plane of the knob 11 coincide with each other when the installation is completed (since the knob 11 is bilaterally symmetric, the center of gravity of the knob 11 is located in the symmetric plane thereof. As a result, the center of gravity of the knob 11 is in the symmetric plane of the action body).

The overflow tube 13 is a member formed of a flexible tube body connecting the overflow discharge port 14 to the branch tube 10a and allows drain having passed through the overflow discharge port 14 to be discharged into the branch tube 10a.

The release wire 4 is a member that transfers operation performed on the operating portion 3 to the valve member 2 and includes a cylindrical outer tube 4a showing sideways flexibility and axial rigidity and the inner wire 4b slidably disposed in the outer tube 4a and showing sideways flexibility and axial rigidity. The inner wire 4b in the release wire 4 has one end disposed immediately under the support shaft 8a of the driver 8 and the other end connected to the action body 5 in the operating portion 3.

In addition to the above members, a trap pipe 17 connected to a discharge port of the drain connecting tube 10 is provided.

The washbowl S of the washstand, which is the tub in which the remote-operated drain plug apparatus is installed, is a tub with an upper opening and includes an attachment hole for attaching a drain plug to a lower portion of the tub and an operating portion attachment hole for attaching the operating portion 3 to the tub but to the vicinity of the upper edge of the tub.

It is noted in the second embodiment that the total weight of the valve member 2 and the support shaft 8a is greater than the total weight of the action body 5 and the inner wire 4b resulting from the difference in elevation.

[0021] To install the remote-operated drain plug apparatus formed of the members described above in the washbowl S, the overflow discharge port 14 of the operating portion body 6 is first connected to the branch tube 10a of the drain connecting tube 10 via the overflow tube 13. Thereafter, one end of the inner wire 4b in the release wire 4 is connected to the lower end of the action body 5, and the other end of the inner wire 4b that will face the drain plug body 9 is inserted into the operating portion body 6, the overflow tube 13, the branch tube 10a, and the drain connecting tube 10 in this order. One end of the release wire 4 is finally connected and fixed to the driver 8.

Thereafter, the action body 5 is accommodated in the operating portion body 6, and the driver 8 is connected and fixed to the fixing portion.

Further, the circumferential edge of the operating portion attachment hole in the washbowl S, which is the tub, is sandwiched between the cover member 12 and the circumferential edge of the front-side opening in the operating portion body 6 so that the cover member 12 and the operating portion body 6 are fixed to the washbowl S. At this point, the following state is established: The knob 11 in the operating portion body 6 pivots around the upper edge of the opening 7 and protrudes through the opening 7 in the cover member 12 toward the front side. In this configuration, when the knob 11 is pushed, the knob 11 pivots around the upper edge of the opening 7 and moves forward or backward, and the arcuate portion provided on the back side of the knob 11 abuts or moves away from the inclined surface 5a. In this way, the action body 5 can slide upward or downward in the operating portion body 6 (since the action body 5 is bilaterally plane symmetric, moving the action body 5 upward or downward means that the action body 5 is moved along the direction parallel to the symmetric plane thereof). In the present embodiment, the overflow discharge port 14 is immediately under the operating portion body 6 in a position in the symmetric plane of the action body when the installation is completed.

In this state, the release wire 4 on the side where the operating portion 3 is present is oriented in the up-down direction in accordance with the action body 5 moving upward and downward, unlike in the conventional example, in which the release wire 4 extends in the front-rear direction (horizontal direction) and is then sharply bent downward.

The drain plug body 9 is then attached and fixed into the attachment hole in the washbowl S so that the lower surface of the flange 9a abuts the upper surface of the circumferential edge of the attachment hole. The lower end of the drain plug body 9 is connected to the upper end of the drain connecting tube 10, and the lower end of the drain connecting tube 10 is further connected to an underfloor pipe on the sewage side via the trap pipe 17. Moreover, the valve member 2 is inserted through the drain port 1 and disposed in the drain plug body 9 so that the valve shaft 2b is disposed above the support shaft 8a. The installation of the remote-operated drain plug apparatus is thus completed. It is noted at this point that the support shaft 8a of the driver 8 is disposed immediately under the valve shaft 2b.

[0022] To use the thus installed remote-operated drain plug apparatus, the following state is first established: The drain port 1 is closed, that is, the support shaft 8a of the driver 8 is lowered and the inner wire 4b is retracted toward the operating portion 3 so that the action body 5 is lifted, as shown in Figure 7. At this point, the valve member 2 is not supported by the support shaft 8a and hence is lowered due to the self-weight of the valve member 2 and the support shaft, and the valve body 2a blocks the drain port 1. The water flow port 15 in the action body 5 and the opening 7 are positioned at this point in such a way that the water flow port 15 and the opening 7 coincide with each other in a side view, as shown in Figure 8. In this state, since the drain port 1 is blocked, the drain resulting from use of the drain apparatus accumulates in the tub. When the accumulated drain reaches the lower end of the opening 7 in the cover member 12, the drain in the tub flows along the lower end of the opening 7 into the operating portion 3, passes through the opening 7 in the cover member 12, the water flow port 15, the operating portion body 6, and the overflow discharge port 14, and is discharged through the overflow tube 13, the branch tube 10a, the drain connecting tube 10, and finally the trap pipe 17 toward the sewage, as indicated by the arrow W shown in Figure 8.

In this state, when the knob 11 in the operating portion 3 is pushed in the horizontal direction, the backside arcuate portion of the knob 11 abuts the inclined surface 5a as shown in Figure 9, and the inclined surface 5a converts the backward pressing force applied by the arcuate portion of the knob 11 into a force that pushes the action body 5 downward. The action body 5 is therefore lowered, and the inner wire 4b disposed in the release wire 4 and connected to the action body 5 moves forward toward the drain plug. The end of the inner wire 4b in the release wire 4 pushes the lower end of the support shaft 8a upward, and the thrust lock mechanism maintains the lifted support shaft 8a. As a result, the tip of the support shaft 8a pushes the lower end of the valve shaft 2b of the valve member 2 upward to lift the entire valve member 2, and the valve body 2a moves away from the drain port 1. The drain port 1 is thus opened, as shown in Figure 10. In this state, since the support shaft 8a is lifted, the

inner wire 4b in the release wire 4 moves forward due to the weight of the action body 5 and the self-weight of the inner wire 4b to the position where the tip of the inner wire 4b abuts the lower end of the support shaft 8a. As a result, in the operating portion 3, the action body 5 is lowered and moved to a position where the user cannot view the water flow port 15 through the opening 7, as shown in Figure 11. The spring member causes the knob 11 to protrude into the washbowl S, and the knob 11 stops there.

In the state shown in Figure 10, since the drain port 1 is open, the drain resulting from use of the washstand, which is the drain apparatus, is discharged directly through the drain port 1, the drain plug body 9, the drain connecting tube 10, and finally the trap pipe 17 toward the sewage. Even when the drain keeps being produced in the washbowl S, the drain will not accumulate in the washbowl S.

In this state, when the knob 11 in the operating portion 3 is pushed again in the horizontal direction, the inclined surface 5a converts again the backward pressing force applied by the arcuate portion of the knob 11 into a force that pushes the action body 5 downward. The action body 5 is therefore lowered, and the inner wire 4b disposed in the release wire 4 and connected to the action body 5 moves forward toward the drain plug. As a result, the end of the inner wire 4b in the release wire 4 pushes again the lower end of the support shaft 8a upward, and the fixed support shaft 8a is released. In this case, in the present embodiment, since the total weight of the valve member 2 and the support shaft 8a is greater than the total weight of the action body 5 and the inner wire 4b resulting from the difference in elevation as described above, the entire valve member 2 including the support shaft 8a is lowered, and the action body 5 and the inner wire 4b are retracted (moved toward the operating portion 3). The valve body 2a blocks again the drain port 1, as shown in Figure 8.

The drain port 1 can then be arbitrarily opened and closed remotely by repeating the same operation described above. The remote-operated drain plug apparatus according to the second embodiment of the invention, in which the drain port 1 can be remotely opened and closed by pushing the knob 11 only in one direction as described above, is literally called "one-way remote-operated drain plug apparatus."

[0023] In the second embodiment described above, the release wire 4 is oriented only in the up-down direction in the operating portion 3 but is not oriented in the front-rear direction (horizontal direction). As a result, a disadvantageous situation in which the release wire 4 is bent downward sharply in a narrow clearance space between the drain apparatus and the wall of the room and then connected to the driver 8 will not occur. The configuration described above will therefore solve the buckling problem, in which the release wire 4 bent to a small curvature may be broken. Further, the other problem, in which the pressure at which the bent inner wire 4b abuts the inner surface of the outer tube 4a and hence the magnitude of associated frictional force increase, preventing a smooth action of the remote-operated drain plug apparatus, will not occur.

Further, in the second embodiment described above, when the drain port 1 is closed as shown in Figures 7 and 8, the interior of the operating portion body 6, which allows overflow drainage through the opening 7 and the water flow port 15, is visible when the user's line of sight is at the level of the operating portion 3. The user of the tub, however, usually views the interior of the tub obliquely downward, and the knob 11 protruding from the operating portion 3 and the inclined surface 5a protruding forward from the action body 5 prevent the user of the drain apparatus who views the interior of the tub obliquely downward from viewing the interior of the operating portion body 6 in the embodiment described above.

On the other hand, when the drain port 1 is open as shown in Figures 10 and 11, since the lowered action body 5 blocks the opening 7, the interior of the operating portion body 6 will not be viewed through the opening 7 in the cover member 12. Further, at this point, the portion of the opening 7 that is above the action body 5 in the operating portion 3 is open, but the knob 11 occupies that portion. The knob 11 therefore prevents the user of the drain apparatus who views the interior of the tub obliquely downward from viewing the interior of the operating portion body 6.

[0024] A third embodiment of the present invention will next be described with reference to the drawings.

A remote-operated drain plug apparatus according to the third embodiment of the present invention shown in Figures 12 and 13 includes a valve member 2, a drain plug body 9, a drain connecting tube 10, an operating portion 3, a release wire 4, a driver 8, and other members. The structure of each of the members will be described below. Figure 12 is a front view of the operating portion 3 and the vicinity thereof of the remote-operated drain plug apparatus. Figured 13 is a cross-sectional view of the remote-operated drain plug apparatus, and the operating portion 3 and the vicinity thereof in Figure 13 shows the cross section taken along the line C-C in Figure 12.

The valve member 2 includes a substantially disc-shaped valve body 2a and a valve shaft 2b extending immediately downward from the center of the valve body 2a.

The drain plug body 9 is a tubular member having a drain port 1 provided in an upper portion thereof, a flange 9a provided around the circumferential edge of the upper end thereof, and a drain flow passage provided therein. The lower end of the drain plug body 9 is connectable to the drain connecting tube 10, which will be described later.

The drain connecting tube 10 is a member formed of a substantially tubular body bent into an L-like shape. The drain connecting tube 10 includes a branch tube 10a which is provided on the side surface of the tubular body somewhere in the middle thereof and through which overflow drain from the operating portion 3 flows. A wire con-

necting tube 19 into which the release wire 4 is inserted is further provided at the bottom of a vertical portion of the tubular body. A fixing portion for fixing the driver 8, which will be described later, is provided in a position substantially immediately under the valve shaft 2b in the drain connecting tube 10.

The driver 8 is a member located in the path between the operating portion 3 and the valve shaft 2b and connected and fixed to the fixing portion of the drain connecting tube 10 and includes a thrust lock mechanism with a support shaft 8a movable forward and backward in the up-down direction. The thrust lock mechanism is used, for example, in a push-action ball-point pen and repeats maintaining the support shaft 8a lifted/releasing the lifted support shaft 8a and moving the support shaft 8a downward whenever the lower end of the support shaft 8a is pushed.

The operating portion 3 is a member that remotely operates the action of the valve member 2 provided in the drain port 1 and allows overflow drainage in which the drain in a tub is discharged toward the sewage when the water level in the tub reaches or goes beyond a certain level. The operating portion 3 is formed of a cover member 12, an operating portion body 6, an action body 5, and an overflow tube 13, which will be described below.

The cover member 12 is a substantially rectangular member when viewed from the front and has an opening 7 formed therein.

The operating portion body 6 is a box-shaped member connected to the cover member 12. The operating portion body 6 includes a front-side opening for connecting the cover member 12, a wire insertion tube 18 into which the release wire 4, which will be described later, is inserted in a watertight manner in the direction oriented straight downward from a horizontally central portion of the opening, and an overflow discharge port 14 to which the overflow tube 13 is connected, the overflow discharge port 14 disposed also in a lower portion of the operating portion body 6 in a position on the right or left to the wire insertion tube 18 when the operating portion body 6 is viewed from the front.

The operating portion body 6 also accommodates the action body 5, which will be described later, movably upward and downward.

Further, since the overflow discharge port 14 and the wire insertion tube 18 are disposed side by side when the operating portion body 6 is viewed from the front, the operating portion body 6, in which the action body 5 is accommodated, still has a drain space laterally next to the action body 5 through which drain can pass. When the installation is completed, overflow drain can be discharged through the opening 7, a water flow port 15, the drain space in the operating portion body 6, and the overflow discharge port 14, and out of the overflow tube 13, as will be described later. Further, the operating portion body 6 has a portion located on the side opposite to the wire insertion tube 18 and protruding sideways at least by the width of the wire insertion tube 18. As a result, decrease in area through which drain can pass due to the provision of the wire insertion tube 18 can be suppressed, whereby loss in performance is minimized.

The action body 5 is a member having the following characteristics: The action body 5 as a whole has a bilaterally plane symmetric shape; the lower end of the action body 5 is connected to an inner wire 4b; and the action body 5 is provided with an inclined surface 5a in an upper portion so that a front-rear dimension increases in the downward direction. Further, the water flow port 15, through which drain passes, is provided in a lower portion of the inclined surface 5a.

The knob 11 is a bilaterally symmetric member pivotal around the upper edge of the opening 7 in the cover member 12 and includes a backside arcuate portion when viewed from a side. When the knob 11 pivots around the upper edge of the opening 7, the knob 11 protrudes from and retracts in the operating portion body 6 through the opening 7. When the knob 11 protrudes and retracts, the arcuate portion abuts the inclined surface 5a of the action body 5. When the knob 11 is pushed deeper at the time of abutment, the inclined surface 5a causes the action body 5 to lower. The knob 11 is configured in general to protrude into the tub because a spring member (not shown) urges the knob 11. Further, when the installation is completed and the action body 5 is lowered downward as will be described below, the lower end of the knob 11 is lower than the upper end of the
action body 5. In this state in which the action body 5 is lowered, the user of a washstand, which is a drain apparatus, cannot view the interior of the operating portion body 6 (since the user cannot see a portion above the action body 5 hidden behind the knob 11 unless the user's eyes are in a washbowl s, which is the tub, and the user looks upward at the operating portion 3).

It is noted that the symmetric plane of the action body 5 and the symmetric plane of the knob 11 coincide with each other when the installation is completed (since the knob 11 is bilaterally symmetric, the center of gravity of the knob 11 is located in the symmetric plane thereof. As a result, the center of gravity of the knob 11 is in the symmetric plane of the action body).

The overflow tube 13 is a member formed of a flexible tube body connecting the overflow discharge port 14 to the branch tube 10a and allows drain having passed through the overflow discharge port 14 to be discharged into the branch tube 10a.

The release wire 4 is a member that transfers operation performed on the operating portion 3 to the valve member 2 and includes a cylindrical outer tube 4a showing sideways flexibility and axial rigidity and the inner wire 4b slidably disposed in the outer tube 4a and showing sideways flexibility and axial rigidity. The inner wire 4b in the release wire 4 has one end disposed immediately under the support shaft 8a of the driver 8 and the other end connected to the action body 5 in the operating portion 3. The release wire 4 is disposed in the overflow tube 13 in the first and second embodiments, whereas the release

wire 4 is disposed outside the main pipe system but in the wire insertion tube 18 and then connected to the driver 8 via the wire connecting tube 19 at the bottom of the drain connecting tube 10.

In addition to the above members, a trap pipe 17 connected to a discharge port of the drain connecting tube 10 is provided.

The washbowl S of the washstand, which is the tub in which the remote-operated drain plug apparatus is installed, is a tub with an upper opening and includes an attachment hole for attaching a drain plug to a lower portion of the tub and an operating portion attachment hole for attaching the operating portion 3 to the tub but to the vicinity of the upper edge of the tub.

It is noted in the third embodiment that the total weight of the valve member 2 and the support shaft 8a is greater than the total weight of the action body 5 and the inner wire 4b resulting from the difference in elevation.

Further, the circumferential edge of the operating portion attachment hole in the washbowl S, which is the tub, is sandwiched between the cover member 12 and the circumferential edge of the front-side opening in the operating portion body 6 so that the cover member 12 and the operating portion body 6 are fixed to the washbowl S. At this point, the following state is established: The knob 11 in the operating portion body 6 pivots around the upper edge of the opening 7 and protrudes through the opening 7 in the cover member 12 toward the front side. In this configuration, when the knob 11 is pushed, the knob 11 pivots around the upper edge of the opening 7 and moves forward or backward, and the arcuate portion provided on the back side of the knob 11 abuts or moves away from the inclined surface 5a. In this way, the action body 5 can slide upward or downward in the operating portion body 6 (Since the action body 5 is bilaterally plane symmetric, moving the action body 5 upward or downward means that the action body 5 is moved along the direction parallel to the symmetric plane thereof).

In the third embodiment, since the overflow discharge port 14 and the wire insertion tube 18 are disposed side by side when the operating portion body 6 is viewed from the front, and the bilaterally symmetric action body 5 is disposed above the wire insertion tube 18 when the installation is completed, as described in the description of the operating portion body 6 and shown in Figure 12, the overflow discharge port 14 is located in a position outside the symmetric plane of the action body 5 when the installation is completed.

[0025] To install the remote-operated drain plug apparatus formed of the members described above in the washbowl S, the overflow discharge port 14 of the operating portion body 6 is first connected to the branch tube 10a of the drain connecting tube 10 via the overflow tube 13. Thereafter, one end of the inner wire 4b in the release wire 4 is connected to the lower end of the action body 5, and the other end of the inner wire 4b that will face the drain plug body 9 is extracted from the operating portion body 6 through the wire insertion tube 18 out of the drain flow path and inserted again into the drain connecting tube 10 via the wire connecting tube 19. One end of the release wire 4 is finally connected and fixed to the driver 8. The portions of the wire insertion tube 18 and the wire connecting tube 19 through which the release wire 4 is inserted are made watertight by using packing or any other suitable component so that drain will not leak out of the drain flow path.

Thereafter, the action body 5 is accommodated in the operating portion body 6, and the driver 8 is connected and fixed to the fixing portion.

Further, the circumferential edge of the operating portion attachment hole in the washbowl S, which is the tub, is sandwiched between the cover member 12 and the circumferential edge of the front-side opening in the operating portion body 6 so that the cover member 12 and the operating portion body 6 are fixed to the washbowl S. At this point, the following state is established: The knob 11 in the operating portion body 6 pivots around the upper edge of the opening 7 and protrudes through the opening 7 in the cover member 12 toward the front side. In this configuration, when the knob 11 is pushed, the knob 11 pivots around the upper edge of the opening 7 and moves forward or backward, and the arcuate portion provided on the back side of the knob 11 abuts or moves away from the inclined surface 5a. In this way, the action body 5 can slide upward and downward in the operating portion body 6.

In this state, the release wire 4 on the side where the operating portion 3 is present is oriented in the up-down direction in accordance with the action body 5 moving upward and downward, unlike in the conventional example, in which the release wire 4 extends in the front-rear direction (horizontal direction) and is then sharply bent downward.

The drain plug body 9 is then attached and fixed into the attachment hole in the washbowl S so that the lower surface of the flange 9a abuts the upper surface of the circumferential edge of the attachment hole. The lower end of the drain plug body 9 is connected to the upper end of the drain connecting tube 10, and the lower end of the drain connecting tube 10 is further connected to an underfloor pipe on the sewage side via the trap pipe 17. Moreover, the valve member 2 is inserted through the drain port 1 and disposed in the drain plug body 9 so that the valve shaft 2b is disposed above the support shaft 8a. The installation of the remote-operated drain plug apparatus is thus completed. It is noted at this point that the support shaft 8a of the driver 8 is disposed immediately under the valve shaft 2b.

[0026] To use the thus installed remote-operated drain plug apparatus, a state in which the drain port 1 is closed is first established. At this point, the valve member 2 is not supported by the support shaft 8a and hence is lowered due to the self-weight of the valve member 2 and the support shaft, and the valve body 2a blocks the drain port 1. The water flow port 15 in the action body 5 and

the opening 7 are positioned at this point in such a way that the water flow port 15 and the opening 7 coincide with each other in a side view, as shown in Figure 8. In this state, since the drain port 1 is blocked, the drain resulting from use of the drain apparatus accumulates in the tub. When the accumulated drain reaches the lower end of the opening 7 in the cover member 12, the drain in the tub flows along the lower end of the opening 7 into the operating portion 3, passes through the opening 7 in the cover member 12, the operating portion body 6, and the overflow discharge port 14, and is discharged through the overflow tube 13, the branch tube 10a, the drain connecting tube 10, and finally the trap pipe 17 toward the sewage.

In this state, when the knob 11 in the operating portion 3 is pushed in the horizontal direction, the backside arcuate portion of the knob 11 abuts the inclined surface 5a, and the inclined surface 5a converts the backward pressing force applied by the arcuate portion of the knob 11 into a force that pushes the action body 5 downward. The action body 5 is therefore lowered, and the inner wire 4b disposed in the release wire 4 and connected to the action body 5 moves forward toward the drain plug. The end of the inner wire 4b in the release wire 4 pushes the lower end of the support shaft 8a upward, and the thrust lock mechanism maintains the lifted support shaft 8a. As a result, the tip of the support shaft 8a pushes the lower end of the valve shaft 2b of the valve member 2 upward to lift the entire valve member 2, and the valve body 2a moves away from the drain port 1. The drain port 1 is thus opened, as shown in Figure 13. In this state, since the support shaft 8a is lifted, the inner wire 4b in the release wire 4 moves forward due to the weight of the action body 5 and the self-weight of the inner wire 4b to the position where the tip of the inner wire 4b abuts the lower end of the support shaft 8a. At this point, the spring member causes the knob 11 to protrude into the washbowl S, and the knob 11 stops there.

In the state shown in Figure 13, since the drain port 1 is open, the drain resulting from use of the washstand, which is the drain apparatus, is discharged directly through the drain port 1, the drain plug body 9, the drain connecting tube 10, and finally the trap pipe 17 toward the sewage. Even when the drain keeps being produced in the washbowl S, the drain will not accumulate in the washbowl s.

In this state, when the knob 11 in the operating portion 3 is pushed again in the horizontal direction, the inclined surface 5a converts again the backward pressing force applied by the arcuate portion of the knob 11 into a force that pushes the action body 5 downward. The action body 5 is therefore lowered, and the inner wire 4b disposed in the release wire 4 and connected to the action body 5 moves forward toward the drain plug. As a result, the end of the inner wire 4b in the release wire 4 pushes the lower end of the support shaft 8a upward again, and the fixed support shaft 8a is released. In this case, in the present embodiment, since the total weight of the valve member 2 and the support shaft 8a is greater than the total weight of the action body 5 and the inner wire 4b resulting from the difference in elevation as described above, the entire valve member 2 including the support shaft 8a is lowered, and the action body 5 and the inner wire 4b are retracted (moved toward the operating portion 3). The valve body 2a blocks again the drain port 1.

The drain port 1 can then be arbitrarily opened and closed remotely by repeating the same operation described above.

[0027] In the third embodiment described above, the release wire 4 is oriented only in the up-down direction in the operating portion 3 but is not oriented in the front-rear direction (horizontal direction). As a result, a disadvantageous situation in which the release wire 4 is bent downward sharply in a narrow clearance space between the drain apparatus and the wall of the room and then connected to the driver 8 will not occur. The configuration described above will therefore solve the buckling problem, in which the release wire 4 bent to a small curvature may be broken. Further, the other problem, in which the pressure at which the bent inner wire 4b abuts the inner surface of the outer tube 4a and hence the magnitude of associated frictional force increase, preventing a smooth action of the remote-operated drain plug apparatus, will not occur.

Further, in the third embodiment described above, since the knob 11 is disposed in a position where the knob 11 masks the opening 7 in an obliquely downward direction, it is nearly impossible for the user of the drain apparatus who views the interior of the tub obliquely downward to view the interior of the operating portion body 6 as long as the user uses the drain apparatus in a usual manner, although there is a slim chance of doing so, for example, if the user's eyes are intentionally lowered.

[0028] Embodiments of the present invention have been described above, but the present invention is not limited thereto and any changes can be made thereto to the extent that they do not change the substance of the invention. For example, the first and second embodiments have been described with reference to the case where the action body 5 is provided with the water flow port 15 through which overflow drain passes, but the present invention is not limited thereto. For example, the valve body 2a may be configured to lower when the inner wire 4b moves forward toward the drain plug. In this case, the accumulated drain in the tub is discharged through the opening 7 above the lowered action body 5.

[0029] Further, the water flow port 15 is provided only in a lower portion of the action body 5 in the first embodiment, but the invention is not necessarily limited thereto. The water flow port 15 may be provided in upper and lower portions of the action body 5. In this case, overflow drain is discharged through the opening 7 irrespective of whether the drain port 1 is open or closed. In this configuration, the user can view the interior of the operating portion body 6 when the drain port 1 is open as well, and the exterior appearance deteriorates accordingly. In this

case, however, the drain in the tub can be discharged through the opening 7 if the drain port 1 is clogged, for example, with a large amount of dirt.

[0030] The second embodiment has been described with reference to the case where the action body 5 is lowered when the drain port 1 is open, whereas the action body 5 is lifted when the drain port 1 is closed, but the present invention is not necessarily limited thereto. For example, a return spring that urges the inner wire 4b in the release wire 4 toward the operating portion 3 may be provided. In this case, the action body 5 is lifted, as shown in Figure 8, except when the knob 11 is pushed (the state shown in Figure 9). In this case, although the exterior appearance deteriorates as in the case of Section [0029], the drain in the tub can be discharged through the opening 7 if the drain port 1 is clogged, for example, with a large amount of dirt.

The second embodiment has been described with reference to the case where the action body 5 is provided with the water flow port 15 through which overflow drain passes, but the present invention is not limited thereto. For example, the valve body 2a may be configured to lower when the inner wire 4b moves forward toward the drain plug. In this case, the accumulated drain in the tub is discharged through the opening 7 above the lowered action body 5.

[0031] In each of the embodiments described above, the present invention is applied to the washbowl s of the washstand. The present invention is also applicable to a variety of tubs with the drain port 1, such as a washstand, a bathtub, and a sink.

[Reference Signs List]

[0032]

1 drain port
2 valve member
2a valve body
2b valve shaft
3 operating portion
4 release wire
4a outer tube
4b inner wire
4c rod portion
5 action body
5a inclined surface
6 operating portion body
7 opening
8 driver
8a support shaft
9 drain plug body
9a flange
10 drain connecting tube
10a branch tube
11 knob
12 cover member
13 overflow tube
14 overflow discharge port
15 water flow port
16 0 ring
17 trap pipe
18 wire insertion tube
19 wire connecting tube
S washbowl

Claims

1. A remote-operated drain plug apparatus comprising:

a drain port (1) provided in a tub;
a valve member (2) disposed in the drain port (1) and opening and closing the drain port (1) when moved upward and downward;
an operating portion (3) disposed in a substantially vertical wall and opening and closing the valve member (2);
a release wire (4) including a tubular outer tube (4a) and an inner wire (4b) disposed in the outer tube (4a) movably in forward and backward directions, the release wire (4) transferring operation performed on the operating portion (3) to the valve member (2),
wherein the drain port (1) is opened and closed by moving the inner wire (4b) forward and backward in the axial direction of the outer tube (4a),
the operating portion (3) includes
an action body (5) connected to the inner wire (4b),
an operating portion body (6) formed of a box-shaped member connected to the outer tube (4a) and provided with a side-surface opening (7), the operating portion body (6) accommodating the action body (5) slidably upward and downward, and
a knob (11) attached to the operating portion body (6) in such a way that the knob (11) protrudes through the opening (7) and is movable forward and backward or upward and downward,
the knob (11) protruding through the opening (7) lowers the action body (5), when the knob (11) is moved in one of the forward and backward directions or one of the upward and downward directions, whereas the knob (11) protruding through the opening (7) lifts the action body (5) in the operating portion body (6) when the knob (11) is moved in the other one of the forward and backward directions or the other one of the upward and downward directions,
the opening (7) in the operating portion (3) is located in the tub,
overflow drainage in which drain in the tub is discharged toward sewage is carried out when the water level in the tub reaches or goes beyond

a fixed level in the opening (7), and
when the drain port (1) is open, movement of the knob (11) in one of the movable directions or associated downward movement of the action body (5) causes at least part of the opening (7) to be blocked.

2. The remote-operated drain plug apparatus according to claim 1,
wherein the knob (11) is provided on a side surface of the action body (5), and
the operating portion body (6) accommodates the action body (5) with the knob (11) protruding through the opening (7) in the side surface.

3. The remote-operated drain plug apparatus according to claim 1,
wherein the action body (5) is provided with an inclined surface (5a) so that a front-rear dimension increases in the downward direction,
the knob (11) is attached to the operating portion body (6) movably forward and backward in the front-rear direction, and
when the knob (11) abuts the inclined surface (5a) through the opening (7) and is pushed deeper, the inclined surface (5a) allows the action body (5) to lower.

4. The remote-operated drain plug apparatus according to claim 3,
wherein the action body (5) has a plane symmetric shape,
when the installation is completed,
the drain port (1) is opened and closed by moving the action body along then direction parallel to the symmetric plane thereof,
the center of gravity of the knob (11) and the portion where the action body (5) is connected to the inner wire (4b) in the release wires (4) are located in the symmetric plane of the action body (5), and
an overflow discharge port (14) through which drain in the operating portion body (6) is discharged is provided in a position outside the symmetric plane of the action body (5) when the installation is completed.

5. The remote-operated drain plug apparatus according to any one of claims 1, 2, 3, and 4,
the remote-operated drain plug apparatus forms a one-way remote-operated drain plug apparatus in a sense that
a driver (8) is further provided in the path between the operating portion (3) and a valve shaft (2b) of the remote-operated drain plug apparatus, the driver (8) including a support shaft (8a) movable forward and backward in the axial direction and repeating maintaining the valve member (2) lifted/releasing the lifted valve member (2) and lowering the valve member (2) whenever the operating portion (3) is pressed, and
the drain port (1) is opened or closed whenever the operating portion (3) is pressed.

Fig 1

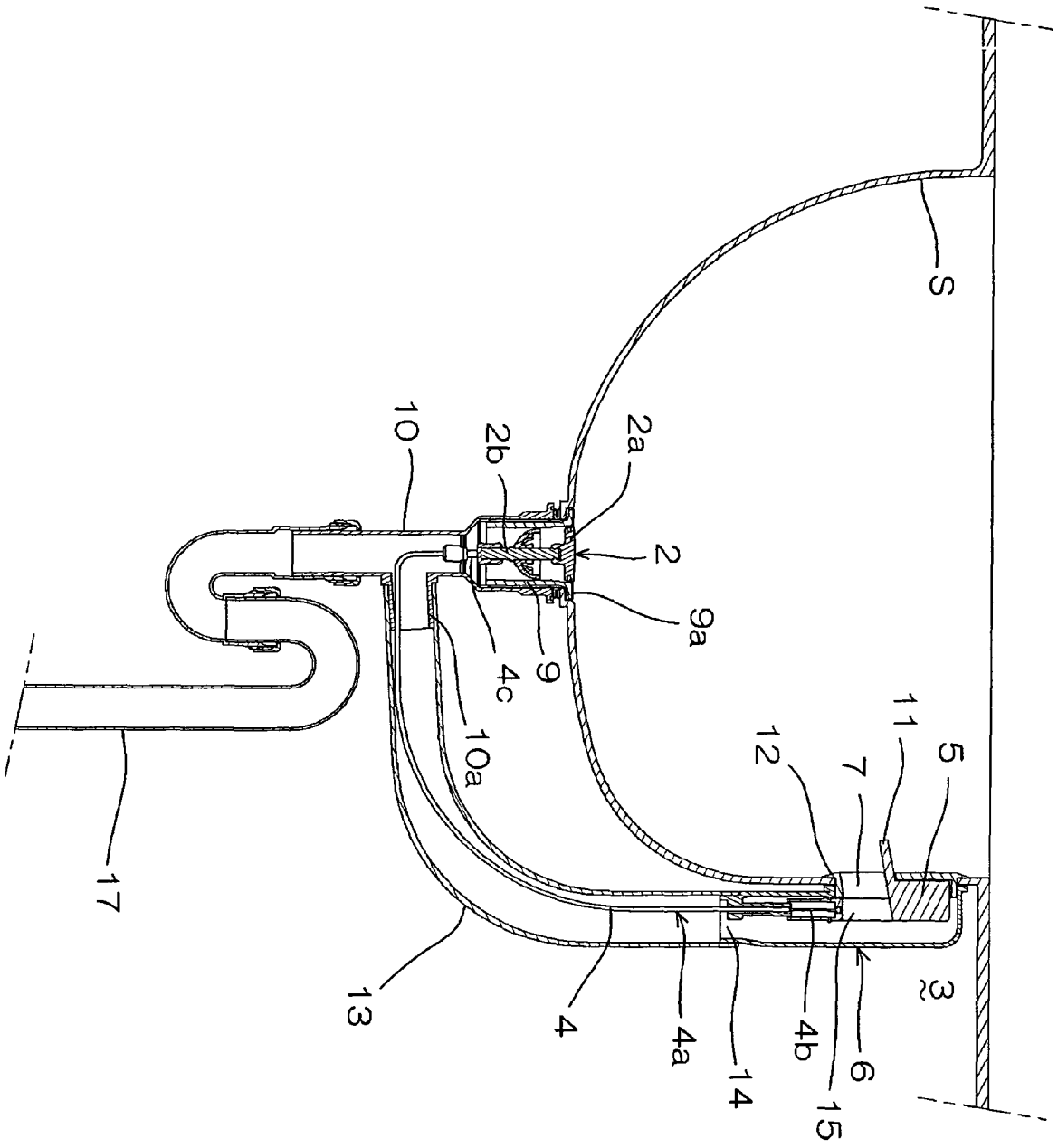


Fig 2

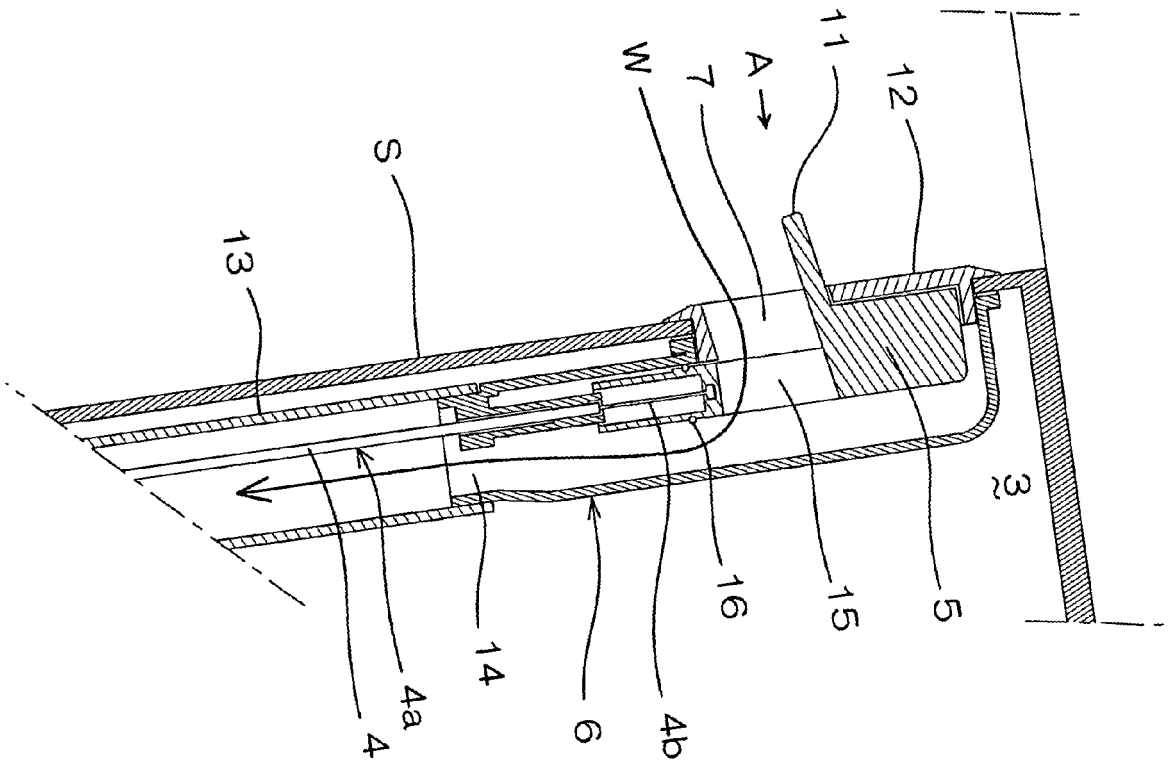


Fig 3

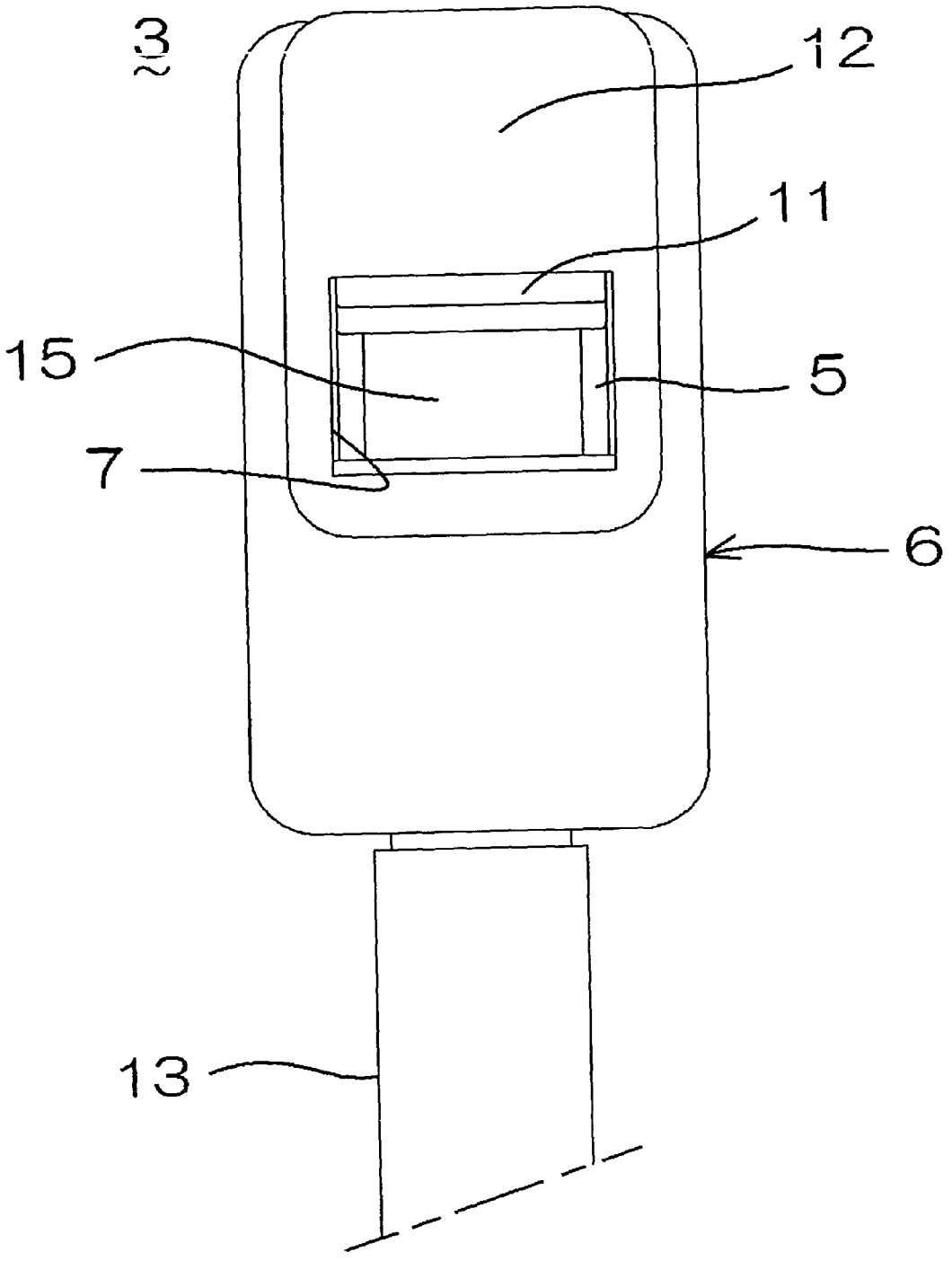


Fig 4

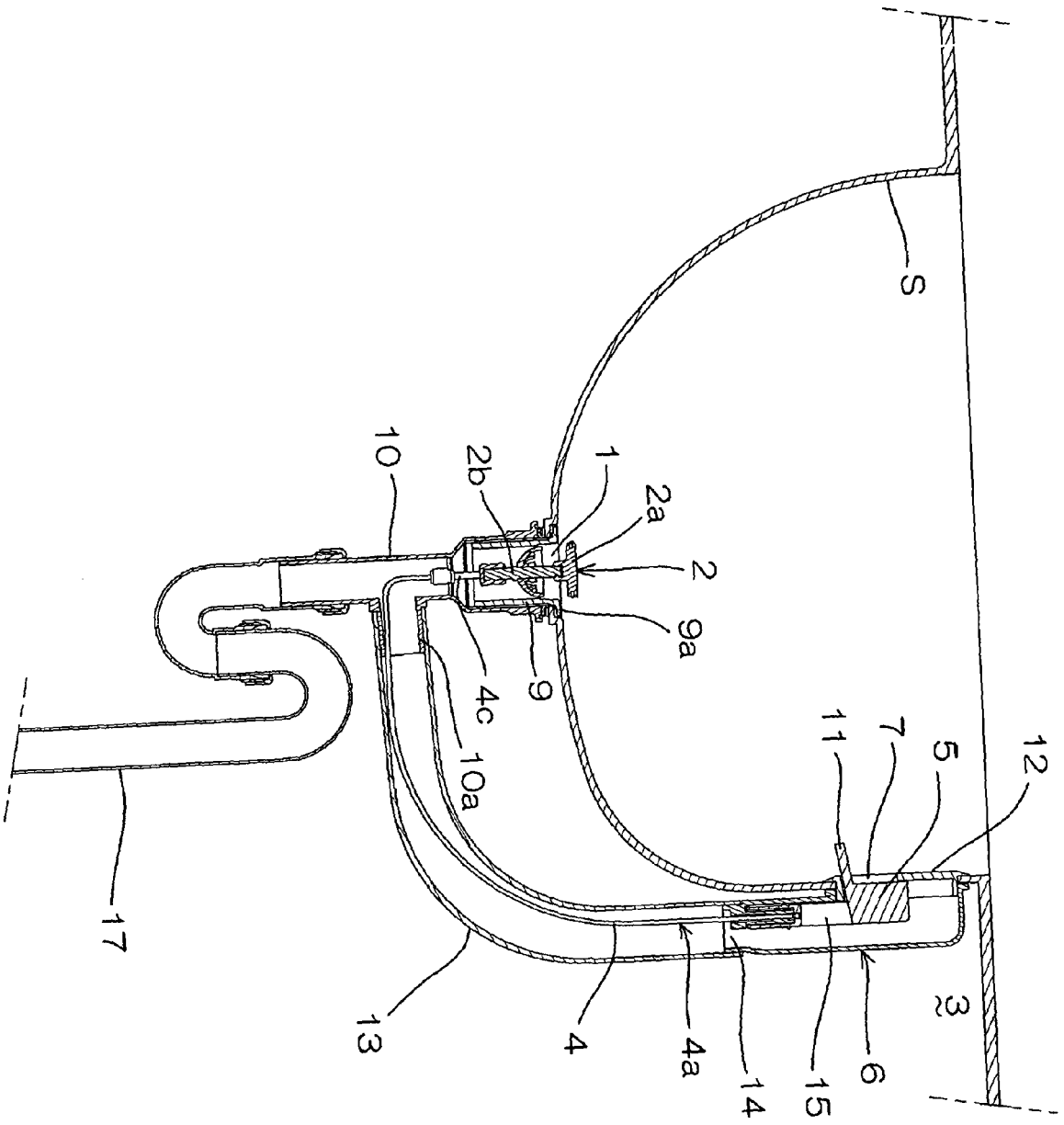


Fig 5

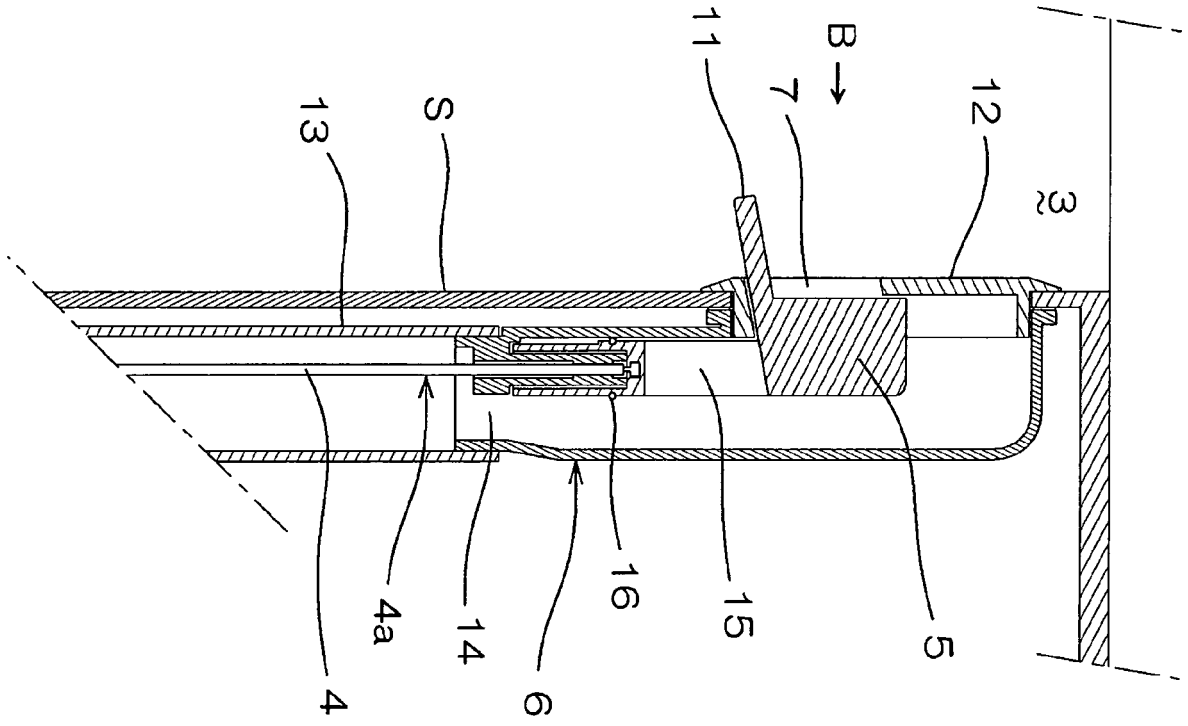


Fig 6

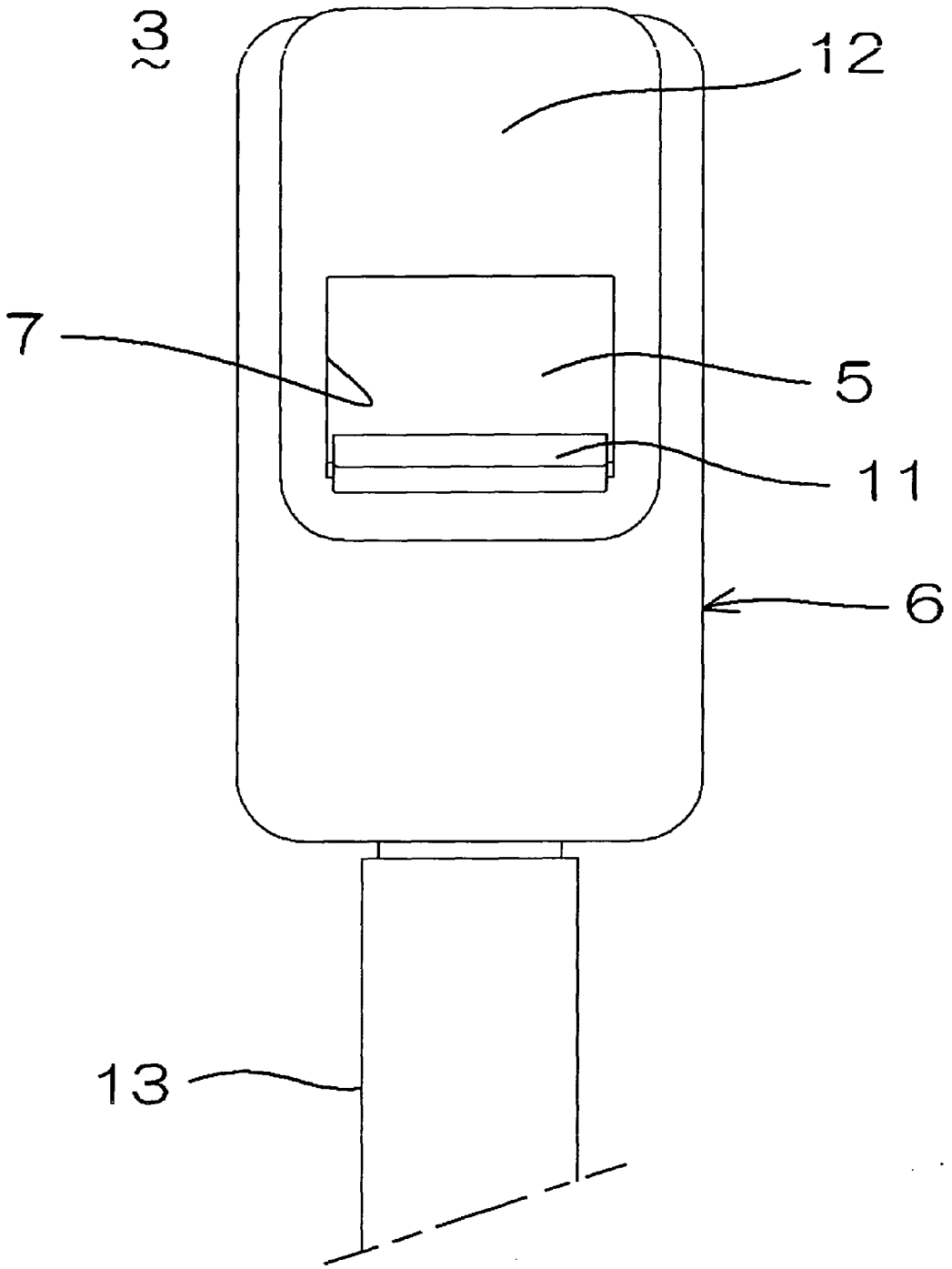


Fig 7

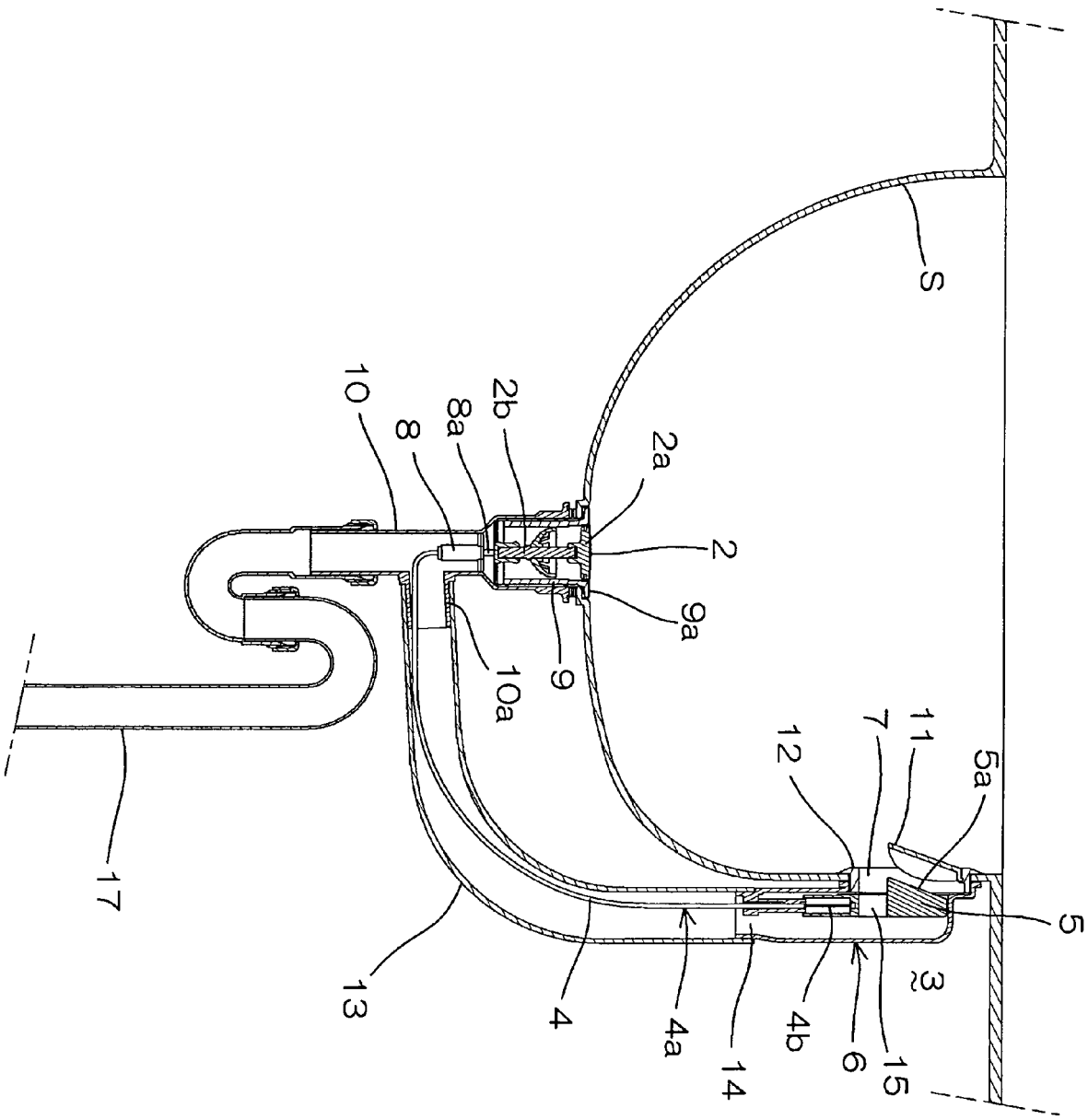


Fig 8

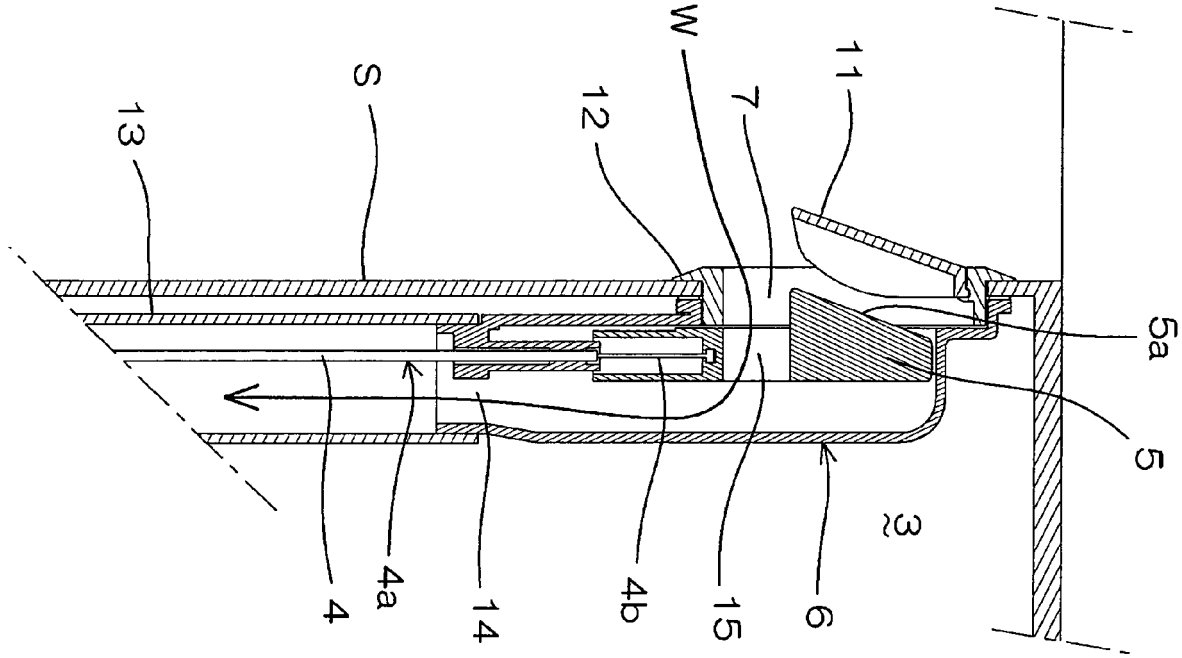


Fig 9

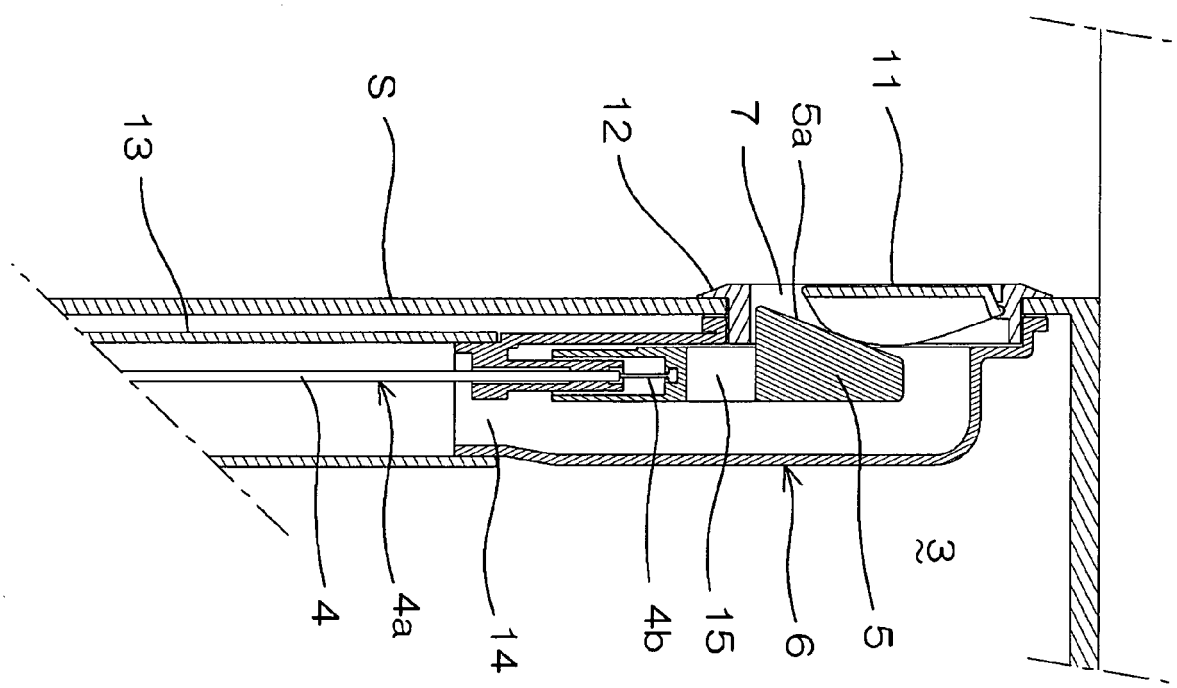


Fig 10

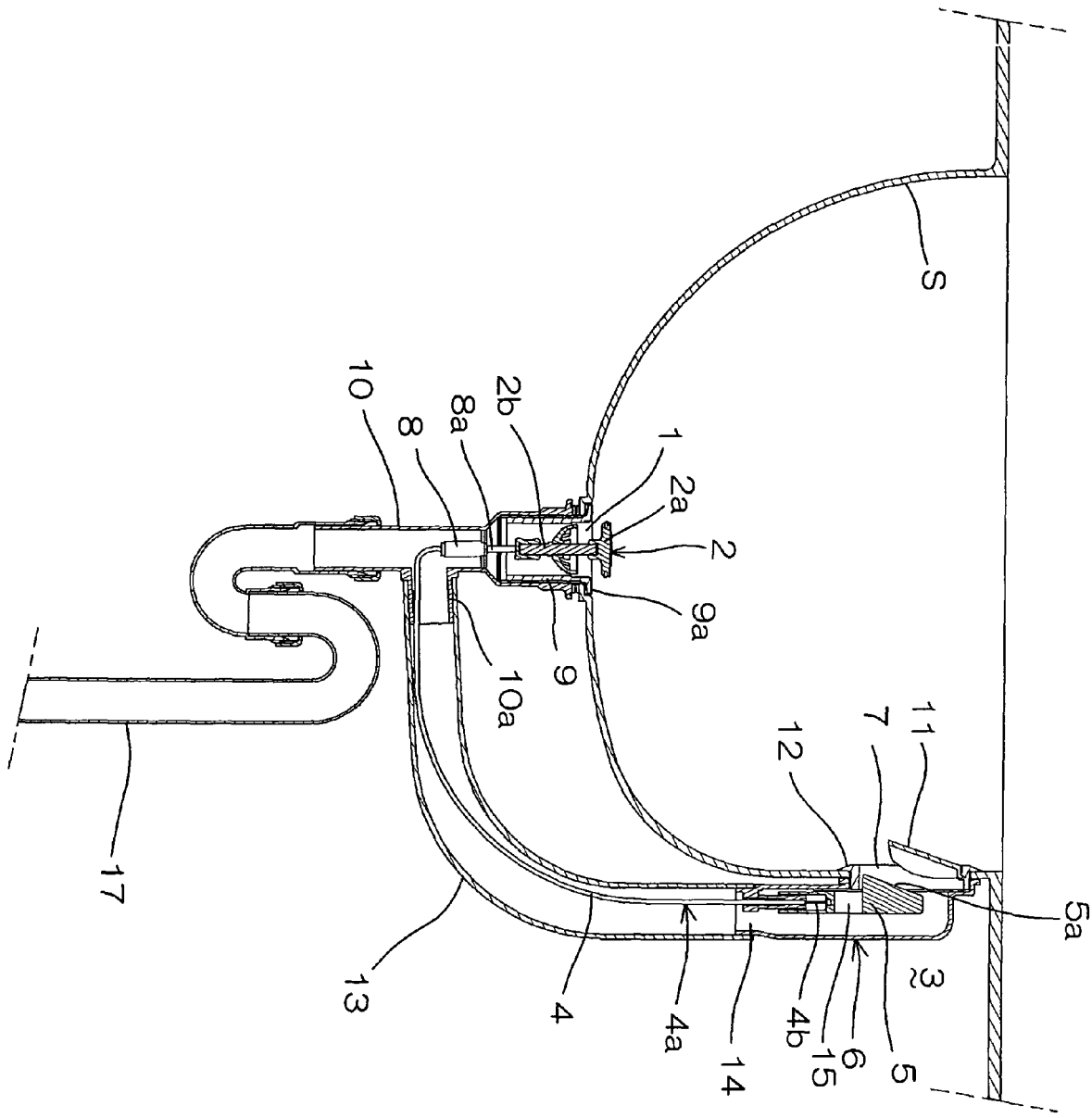
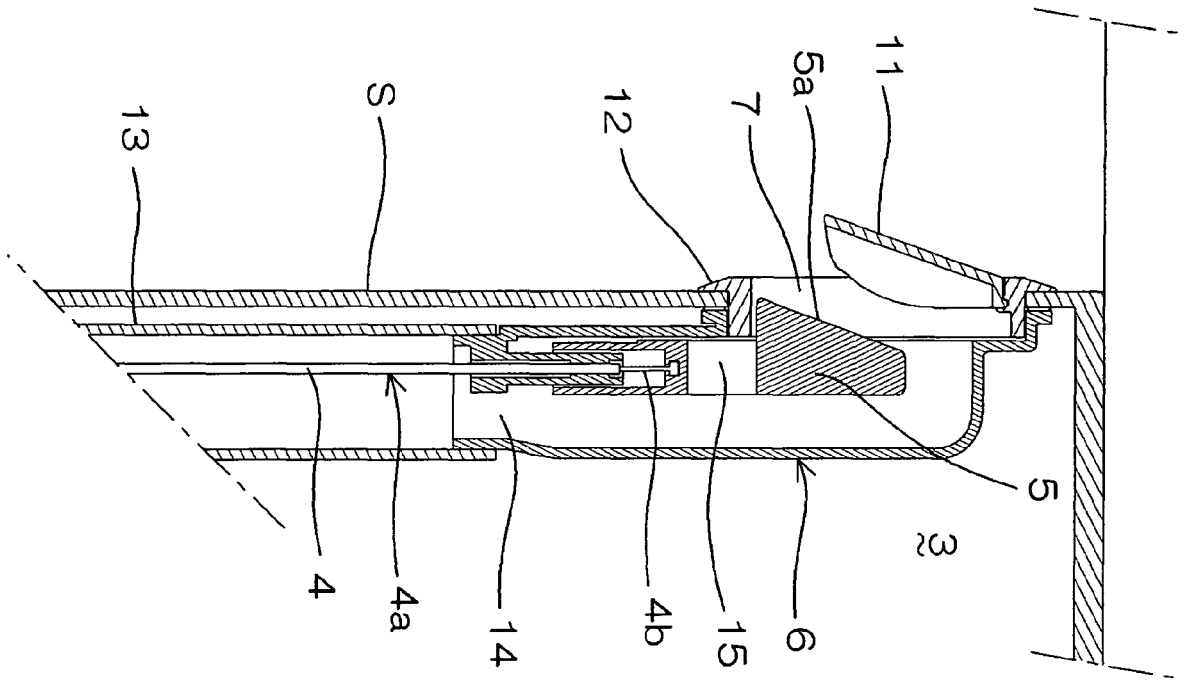
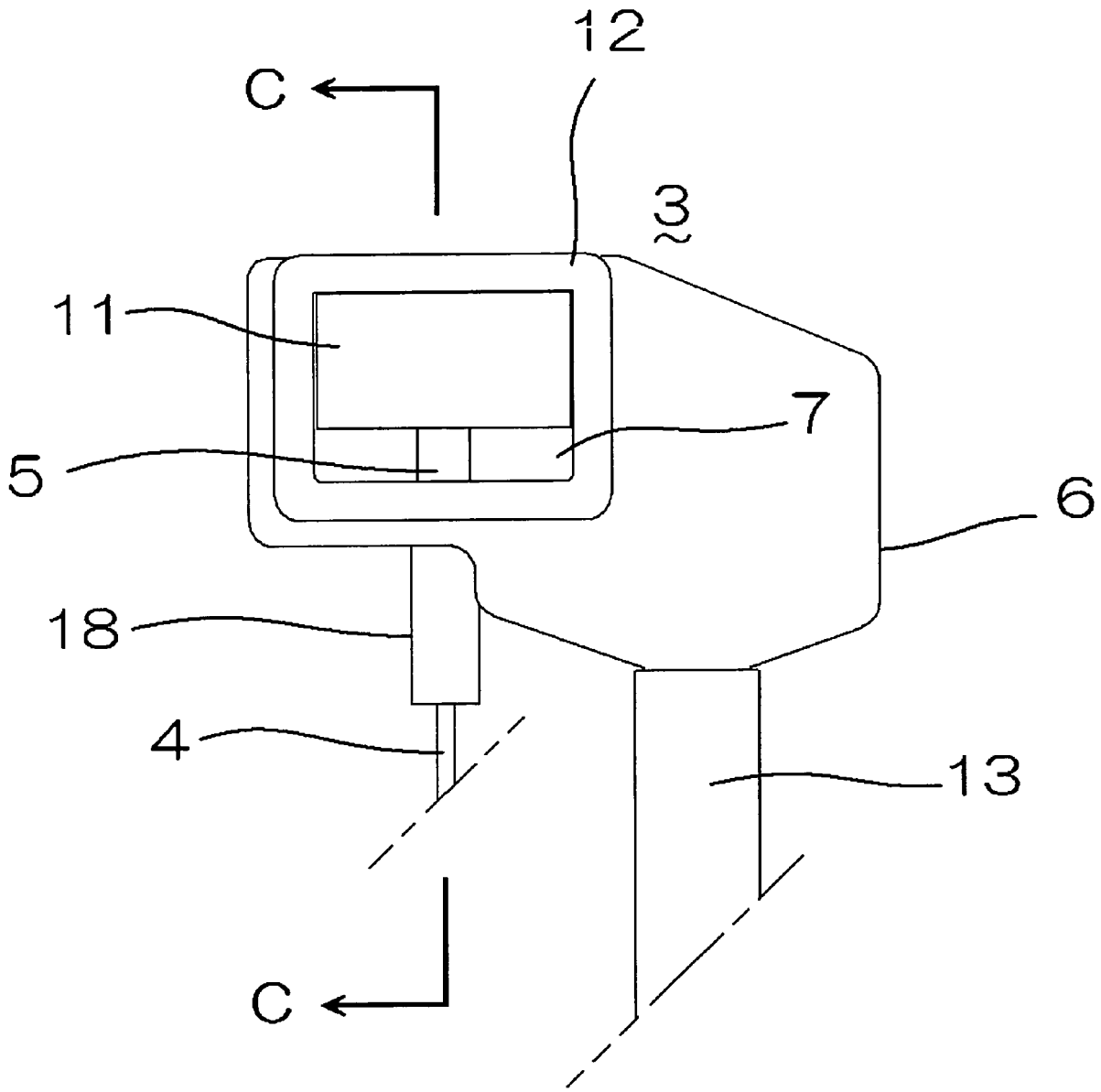


Fig 11

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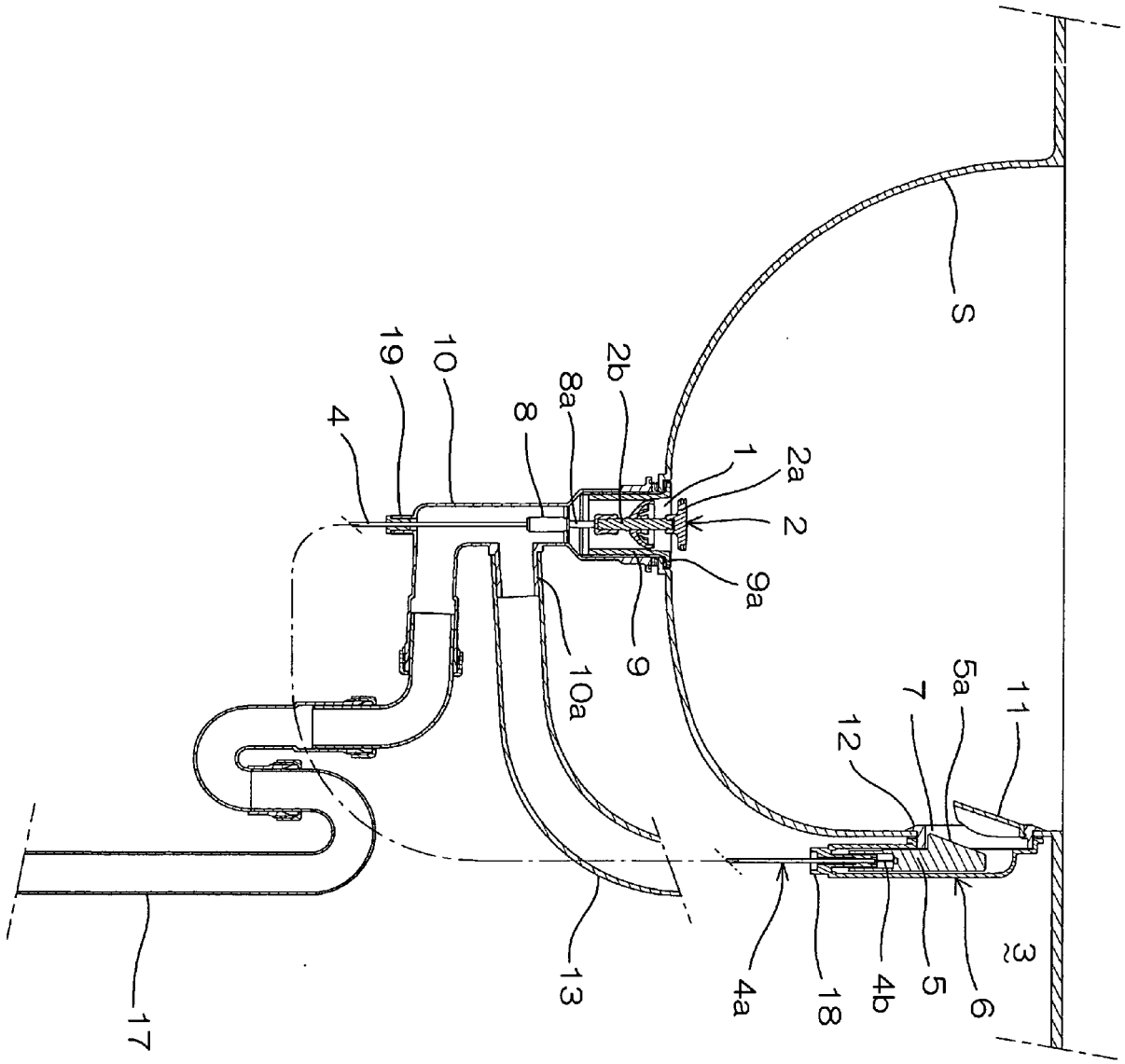
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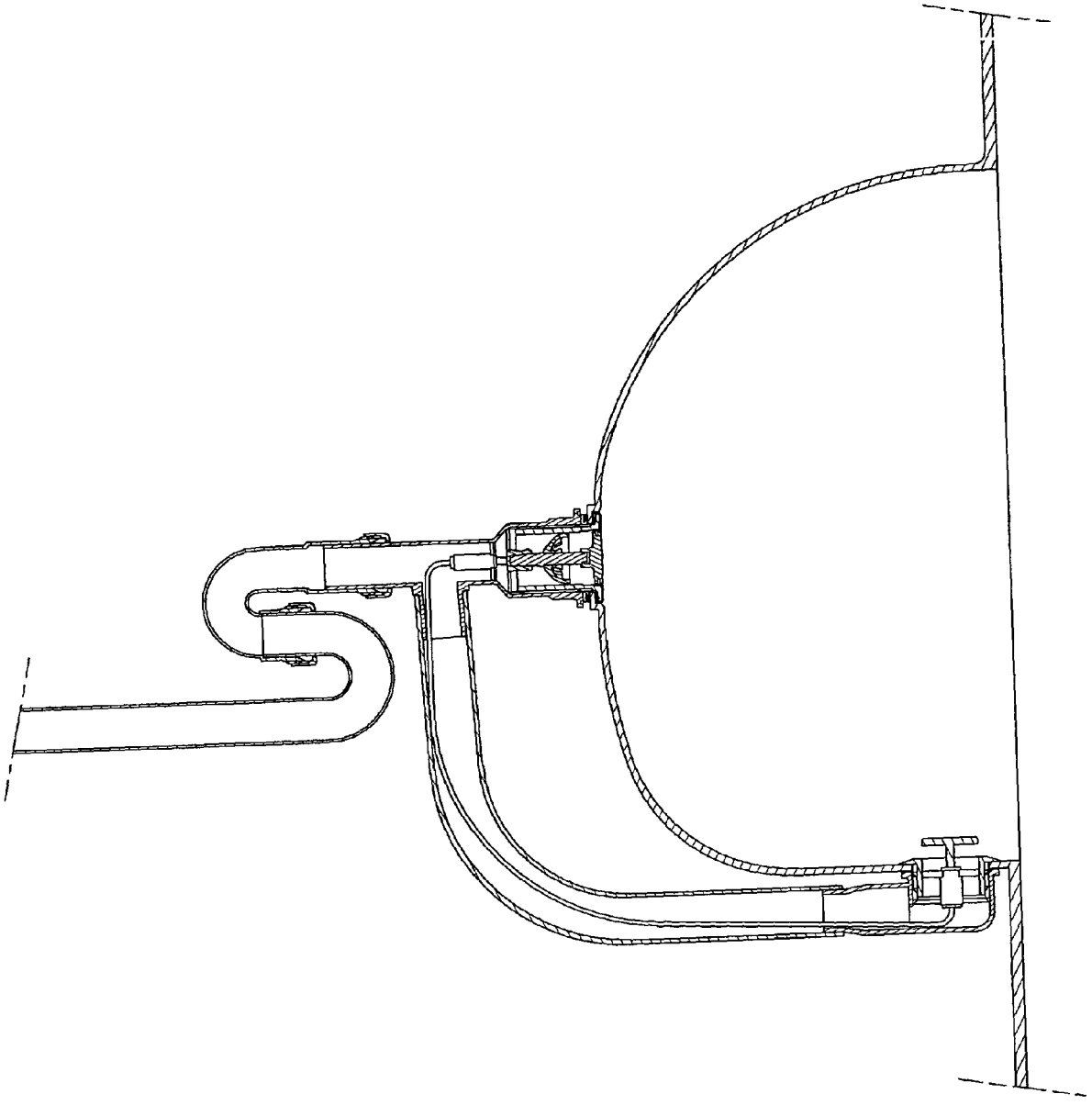

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EUROPEAN SEARCH REPORT

Application Number
EP 10 25 1138

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CH 231 860 A (SIMILOR SA [CH]) 30 April 1944 (1944-04-30) * page 2, line 13 - line 25; figure 1 * * page 1, line 32 - line 41 * -----	1-5	INV. E03C1/232
A	US 2 880 425 A (LENGYEL JOHN F) 7 April 1959 (1959-04-07) * the whole document * -----	1	
A	DE 70 27 210 U (GROHE KG HANS [DE]) 5 November 1970 (1970-11-05) * figure 1 * -----	1	
			TECHNICAL FIELDS SEARCHED (IPC) E03C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 October 2010	Flygare, Esa

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 25 1138

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06-10-2010

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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