

SPECIFICATION

TITLE OF THE INVENTION

CHECK VALVE BODY AND VALVE HAVING CHECK FUNCTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001]

The present invention relates to a check valve body for use in a valve having check function such as a check valve and a check function provided water stop valve, and a valve having the check function using the same check valve body.

2. Description of Related Art

[0002]

Conventionally, as a valve having the check function, there are available a ball check valve and a water stop valve having check function(for example, patent document 1).

In the ball check valve, a valve seat is provided on a secondary side of a valve port which communicates with a primary side passage and a secondary side passage and a ball-like valve body is provided in the valve seat such that it can be attached or detached freely. Usually, when the valve body is detached from the valve seat, water is supplied and when water flows back because the primary side turns to a negative pressure or the pressure of the secondary side becomes higher than that of the primary side, the valve body settles on the valve seat so as to block flow-back of polluted water.

The water stop valve having check function has a valve seat

on the secondary side of a valve port communicating with the primary side passage and the secondary side passage, and a ball-like valve body is provided in the valve seat such that it can be attached or detached freely. The valve body has a plunger-like valve body pressing element which expands/contracts corresponding to advancement/retraction of spindle relative to the valve body between the same valve body and the spindle capable of advancing/retracting in the axial direction of the valve port, the valve body pressing element being inserted slidably freely into a guide hole provided in the bottom end of the spindle in its axial direction. The valve body pressing element always presses the valve body by its own weight.

When the spindle is advanced in the direction of closing the valve, the valve body is settled on the valve seat forcibly by the valve body pressing element so as to stop water and the spindle can be retracted from this condition so that the valve body and the valve body pressing element are movable in the axial direction to open the valve. Even if backflow is generated when the valve body is opened to feed water, the valve body is settled on the valve seat by the secondary side pressure of that backflow and the weight of the valve body in order to block the backflow to the primary side.

[0003]

Patent document 1: Japanese Utility Model No.7-40777 (FIGS. 1, 4)

[0004]

In the ball check valve or the water stop valve having check function using the spherical valve body as described above, when water is fed, pressurized fluid flowing from the primary side through the valve port flows along the spherical surface of the valve body and then, flows to the rear side of the valve body to generate swirling current. This flow turns to resistance to opening of the valve body, acting on the valve body in the direction of closing the valve to increase pressure loss. Because this phenomenon is intensified as the amount of flow increases, the pressure loss increases further in this case, so that the valve body cannot be opened with a degree of opening corresponding to such an increased flow amount and thus, no desired flow amount can be secured, which is a problem to be solved.

For example, in the water stop valve having check function having the above-described structure, even if the spindle is retracted to its upper limit position in order to increase the flow amount, only the pressure loss is increased as described above, and further the valve body pressing element existing behind the valve body strongly disturbs the swirling current behind the valve body into turbulent flow, so that its turbulence makes the flow more likely to go behind the rear of the valve body, thereby sometimes forcing the valve body to a low degree of opening just near complete closing of the valve.

[0005]

To solve such a disadvantage, in the water stop valve having check function and the ball check valve as described above, a moving distance of the valve body from a valve closing (settling) position to a complete valve opening position needs to be set short by forming the valve body into a larger diameter than the valve port so as to reduce the pressure loss when the valve is opened completely, to secure a rated flow amount.

However, if such a means is employed, sinking of the valve body into the valve port in a valve closing condition is shallow and as a result, if the valve is installed in an inclined state even if slightly, the valve body cannot be settled on the valve seat securely, thereby excellent water stop or check function cannot be attained. Further, there is a necessity of forming the valve in a large size with increased diameter of the valve body.

Particularly, the water stop valve having check function has such a problem that it is difficult to adjust the amount of flow by advancement/retraction of the spindle if the moving distance between closing of the valve and opening of the valve is set short as described above.

Accordingly, an object of the present invention is to provide a check valve body which reduces a flow pressing the valve body in a direction of closing the valve from the rear portion of the valve body by interrupting a flow running along the spherical surface of the valve body from the primary side

through the valve port when water is allowed to be fed and keeps the valve body in a proper opening condition to secure a rated flow amount, and a valve having check function using the same check valve body.

[0006]

To achieve the above-mentioned object, according to an aspect of the present invention, there is provided a check valve body which is a spherical valve body capable of being attached to/detached from a valve seat provided on a secondary side of a valve port communicating with a primary side passage and a secondary side passage, wherein a primary side pressure receiving side of the valve body is insertedly passed through an inside diameter portion of a ring-like buoyant force assisting body whose outside diameter is larger than the valve body diameter, and whose inside diameter is larger than the valve port diameter and is smaller than the valve body diameter, and wherein the buoyant force assisting body is provided to be capable of being attached to/detached from an end surface of a secondary side opening portion of the valve port in such a manner that, when the valve is opened, the inside diameter portion of the buoyant force assisting body comes into contact with the outside of the valve body, and the buoyant force assisting body and the valve body moves upward together.

According to another aspect of the present invention,

there is provided a valve having check valve function comprising a valve seat on a secondary side of a valve port communicating with a primary side passage and a secondary side passage, wherein a spherical valve body provided on the valve seat to be capable of being attached to/detached from the valve seat, the valve body is urged in the direction of closing the valve by an urging means, and a primary side pressure receiving side of the valve body is insertedly passed through an inside diameter portion of a ring-like buoyant force assisting body whose outside diameter is larger than the diameter of the valve body, and whose inside diameter is larger than the diameter of the valve port and is smaller than the diameter of the valve body, and wherein the buoyant force assisting body is provided to be capable of being attached to/detached from an end surface of a secondary side opening portion of the valve port in such a manner that, when the valve is opened, the inside diameter portion of the buoyant force assisting body comes into contact with the outside of the valve body, and the buoyant force assisting body and the valve body moves upward together.

Further, the valve having check valve function according to the invention may include a spindle capable of advancing or retracting freely in an axial direction of the valve port and it is permissible to interpose an urging means which expands/contracts corresponding to advancement/retraction of the spindle between the spindle and the valve body.

Further, the buoyant force assisting body may have a peripheral wall surrounding the valve body while a plurality of water passage holes is arranged at a small interval throughout the entire circumference thereof on the bottom of the peripheral wall. A plurality of guide rods may be disposed around the buoyant force assisting body over a moving range of the valve body in parallel to the axis of the valve port.

[Effect]

[0007]

The invention according to claim 1 provides a check valve body which is a spherical valve body capable of being attached to/detached from a valve seat provided on a secondary side of a valve port communicating with a primary side passage and a secondary side passage, wherein a primary side pressure receiving side of the valve body is insertedly passed through an inside diameter portion of a ring-like buoyant force assisting body whose outside diameter is larger than the diameter of the valve body, and whose inside diameter is larger than the diameter of the valve port and is smaller than the diameter of the valve body, and wherein the buoyant force assisting body is provided to be capable of being attached to/detached from an end surface of a secondary side opening portion of the valve port in such a manner that, when the valve is opened, the inside diameter portion of the buoyant force assisting body comes into contact with the outside of the valve body, and the buoyant force assisting

body and the valve body moves upward together. Consequently, when the valve is opened, the buoyant force assisting body receives the primary side pressure as well as the valve body and is raised in the direction of opening the valve and the inside diameter portion of the buoyant force assisting body rises together with the valve body while contacting the outside of the valve body. As a result, flow of pressurized fluid running along the spherical surface of the valve body can be intercepted because the outside diameter of the buoyant force assisting body has a larger diameter than the valve body and consequently, generation of flow pressing the valve body in the direction of closing the valve body behind the valve body is blocked, thereby reducing pressure loss.

Because the buoyant force assisting body is not in contact with the outside of the valve body water-tightly, part of flow of pressurized fluid running along the spherical surface of the valve body intercepted by the buoyant force assisting body presses the primary side pressure receiving side of the valve body in the direction of opening the valve through the inside diameter portion and the buoyant force assisting body rising in the direction of opening the valve together with the valve body assists for opening of the valve body. Consequently, the valve body can be opened with an appropriate degree of opening corresponding to the amount of flow thereby securing a rated flow amount.

Therefore, according to the present invention, the valve body does not need to be formed to have a large diameter

unlike a conventional example, thereby facilitating reduction of the size of the valve main body.

[0008]

According to the invention of claim 2, the buoyant force assisting body has a peripheral wall surrounding the valve body while a plurality of water passage holes is arranged at a small interval throughout the entire circumference thereof on the bottom of the peripheral wall. Consequently, part of flow of pressurized fluid running along the spherical surface of the valve body intercepted by the buoyant force assisting body presses the primary side pressure receiving side of the valve body in the direction of opening the valve via its inside diameter portion so as to form passages leading to water passage holes provided in the substantially entire circumference of the peripheral wall. Consequently, a valve body pressure receiving area sufficient for moving the valve body to the upper limit position for opening the valve can be secured as well as the pressure receiving area of the buoyant force assisting body. As a result, the same condition as when the valve body is inserted into the ring-like buoyant force assisting body can be achieved like the invention of claim 1 and thus, the same effect as the invention of claim 1 is attained and a condition in which the periphery of the valve body is always surrounded by the peripheral wall provided on the buoyant force assisting body can be maintained. Thus, the inside diameter portion of the buoyant force assisting body can make contact with the

outside of the valve body in a horizontal condition perpendicular to the axis of the valve port, so that it can always follow up ascent or descent of the valve body in a stable horizontal condition. Because the buoyant force assisting body is never tilted with respect to the valve body, the buoyant force assisting body is never nipped between the valve body and the valve port when the valve body is settled on the valve seat.

[0009]

According to the invention of claim 3, a plurality of guide rods is disposed around the buoyant force assisting body over a moving range of the valve body in parallel to the axis of the valve port. Consequently, the ascent or descent of the valve body and the buoyant force assisting body can be guided securely along the axis of the valve port and the moving range of the valve body is restricted only to the axial direction of the valve port to attain excellent, stable opening/closing operation of the valve body. Further, the posture of the buoyant force assisting body can be always maintained in a stable, horizontal condition.

[0010]

According to the invention of claim 4, a valve seat is provided on a secondary side of a valve port communicating with a primary side passage and a secondary side passage, a spherical valve body is provided on the valve seat to be capable of being attached to/detached from the valve seat, the valve body is urged in the direction of closing the valve

by an urging means, and a primary side pressure receiving side of the valve body is insertedly passed through an inside diameter portion of a ring-like buoyant force assisting body whose outside diameter is larger than the diameter of the valve body, and whose inside diameter is larger than the diameter of the valve port and is smaller than the diameter of the valve body, wherein the buoyant force assisting body is provided to be capable of being attached to/detached from an end surface of a secondary side opening portion of the valve port in such a manner that, when the valve is opened, the inside diameter portion of the buoyant force assisting body comes into contact with the outside of the valve body, and the buoyant force assisting body and the valve body moves upward together. Consequently, the buoyant force assisting body receives the primary side pressure and rises in the direction of opening the valve as well as the valve body when the valve is opened like the invention of claim 1. When the inside diameter portion of the buoyant force assisting body rises with a contact with the outside of the valve body together therewith, the buoyant force assisting body can intercept flow of pressurized fluid running along the spherical surface of the valve body because its outside diameter is larger than the diameter of the valve body. As a result, generation of flow pressing the valve body in the direction of closing the valve behind the valve body is blocked to reduce pressure loss.

Because the buoyant force assisting body is not in

contact with the outside of the valve body water-tightly, part of pressurized fluid running along the spherical surface of the valve body intercepted by the buoyant force assisting body presses the primary side pressure receiving side of the valve body in the direction of opening the valve via the inside diameter portion and the buoyant force assisting body rising in the direction of opening the valve together with the valve body assists opening of the valve body. As a result, the valve body can be opened with an appropriate degree of opening corresponding to the amount of flow to secure a rated flow amount.

Thus, according to the invention, there is no necessity of forming the valve body into a large diameter unlike a conventional example, thereby facilitating reduction of the size of the valve body.

[0011]

According to the invention of claim 5, like the invention of claim 2, the buoyant force assisting body has a peripheral wall surrounding the valve body while a plurality of water passage holes is arranged at a small interval throughout the entire circumference thereof on the bottom of the peripheral wall. Consequently, part of flow of pressurized fluid running along the spherical surface of the valve body intercepted by the buoyant force assisting body presses the primary side pressure receiving side of the valve body in the direction of opening the valve via its inside diameter portion so as to form passages leading to

water passage holes provided in the substantially entire circumference of the peripheral wall. Consequently, a valve body pressure receiving area sufficient for moving the valve body to the upper limit position for opening the valve can be secured as well as the pressure receiving area of the buoyant force assisting body. As a result, the same condition as when the valve body is inserted into the ring-like buoyant force assisting body can be achieved like the invention of claim 4 and thus, the same effect as the invention of claim 4 is attained and a condition in which the periphery of the valve body is always surrounded by the peripheral wall provided on the buoyant force assisting body can be maintained. Thus, the inside diameter portion of the buoyant force assisting body can make contact with the outside of the valve body in a horizontal condition perpendicular to the axis of the valve port, so that it can always follow up ascent or descent of the valve body in a stable horizontal condition. Because the buoyant force assisting body is never tilted with respect to the valve body, the buoyant force assisting body is never nipped between the valve body and the valve port when the valve body is settled on the valve seat.

[0012]

According to the invention of claim 6, like the invention of claim 3, a plurality of guide rods is disposed around the buoyant force assisting body over a moving range of the valve body in parallel to the axis of the valve port.

Consequently, the ascent or descent of the valve body and the buoyant force assisting body can be guided securely along the axis of the valve port and the moving range of the valve body is restricted to only the axial direction of the valve port and the urging force of the urging means is received securely. As a result, excellent, stable opening/closing operation of the valve body can be attained and the posture of the buoyant force assisting body can be always maintained in a stable, horizontal condition.

[0013]

According to the invention of claim 7, the valve having check function is constructed as a water stop valve having check function which is provided with a spindle capable of advancing or retracting freely in an axial direction of the valve port and in which an urging means which expands/contracts corresponding to advancement/retraction of the spindle is interposed between the spindle and the valve body. Consequently, the urging force in the direction of closing the valve to the valve body of the urging means can be adjusted by advancing or retracting the spindle and thus, when the urging means is contracted to the most extent, the valve body is closed to stop water flow.

By relaxing the urging means from the above-mentioned most contracted condition, the valve body is permitted to be opened freely to allow passage of water. There is an effect that the amount of flow can be secured corresponding to the degree of opening of the valve body like the inventions

of claim 4-6.

Additionally, there is no necessity of setting the moving distance from opening of the valve body to closing thereof to a short distance by forming the valve body into a large diameter unlike the conventional example, so that adjustment of the flow amount by advancement/retraction of the spindle is facilitated and reduction of the size of the valve is also facilitated. That is to say, the effects in practical application are remarkably high.

[0014]

[Embodiments]

Hereinafter, an embodiment of the present invention will be described with reference to the accompanying drawings.

FIGS. 1-3 show a water stop valve having check function according to a first embodiment of the valve having check function. FIG. 1 is a longitudinal sectional view showing water stop condition when a valve is closed forcibly, FIG. 2 is a longitudinal sectional view showing a condition in which the valve is opened fully when water feed is enabled and FIG. 3 is a longitudinal sectional view showing water stop condition at the time of back flow when water feed is enabled.

In a valve casing 1 of this valve, centers of a (primary) passage 3 at an intake 2 communicating with the side of water supply and a (secondary) passage 5 at an outlet 4 communicating with a water discharge side are located on a

straight line and a valve port 6 communicating with the primary side passage 3 and the secondary side passage 5 is provided horizontally such that it is perpendicular to the axis of the primary side passage 3.

[0015]

The top portion of the valve casing 1 is formed substantially cylindrically along the axis extending in the perpendicular direction of the valve port 6 while its top end is open. Its opening portion 1a is fastened and closed water-tightly by a lid body 9 with an O-ring 8 which supports water-tightly a spindle 7 capable of advancing/retracting in the axial direction of the valve port 6.

[0016]

The secondary side of the valve port 6 has a tapered valve seat 10 whose diameter is decreased gradually toward the primary side.

The valve seat 10 is provided with a spherical valve body 11 such that it can be attached/detached freely and the valve body 11 receives an urging means 12 which is expanded/contracted relative to the valve body 11 corresponding to advancement/retraction of the spindle 7, the urging means 12 being provided between the valve body 11 and the spindle 7, so that the urging means 12 always urges the valve body 11 in a direction of closing the valve.

The materials of the valve body 11 and the valve seat 10 are not restricted to any particular one as long as they are so constructed to secure water-tightness in a closed

state in which the valve body 11 settles on the valve seat 10.

[0017]

As shown in FIG. 4, the valve body 11 is constructed as a check valve body 14 by inserting its primary side pressure receiving side (lower semi-spherical portion of the valve body 11) into the inside diameter portion 13a of a thin ring-like buoyant force assisting body 13 whose outside diameter d is larger than a valve body diameter D and whose inside diameter d_1 is larger than a valve port diameter D_1 and smaller than the valve body diameter D .

The buoyant force assisting body 13 is disposed horizontally to be capable of being attached to/detached from the end face of a secondary side opening portion of the valve port 6 when the valve body 11 is closed and its outside diameter d is set larger than the valve body diameter D so that when the valve is opened, the buoyant force assisting body 13 receives a primary side pressure together with the valve body 11 and is raised in the direction of opening the valve so as to shut down largely a flow of pressurized fluid running along the spherical surface of the valve body 11. Consequently, generation of flow which presses the valve body 11 in a direction of closing the valve behind (above) the valve body is blocked.

To allow the valve body 11 to settle in the valve seat 10 without any trouble when the valve is closed, the inside diameter d_1 is set larger than the valve port diameter D_1

and smaller than the valve body diameter D for the buoyant force assisting body 13 to possess a predetermined pressure receiving area.

The buoyant force assisting body 13 interrupts a flow of pressurized fluid running along the spherical surface of the valve body 11 when the valve is opened. Because the buoyant force assisting body 13 is not in contact with the valve body 11 water-tightly, part of pressurized fluid interrupted by the buoyant force assisting body 13 is received by the primary side pressure receiving side which is a lower semi-spherical portion of the valve body 11 through the inside diameter portion 13a, so that a pressure receiving area of the valve body 11 sufficient for moving the valve body 11 to its upper limit position is secured as well as the pressure receiving area of the buoyant force assisting body 13 and consequently, the valve body 11 can be raised stably in the direction of opening the valve.

The material of the buoyant force assisting body 13 is not restricted to any particular one as long as it is of material having stiffness and capable of floating up when it receives the primary side pressure, such as plastic and light metal.

[0018]

Although the buoyant force assisting body 13 may be ring-like as described above, preferably, peripheral walls 15 which surround the valve body 11 are erected and a plurality of water passage holes 16 is provided at a small

interval on the entire circumference on the bottom of the peripheral walls 15 as shown in the figures (see FIGS. 4, 5) to attain stable ascending/descending movement.

Because the valve body 11 is surrounded by the peripheral walls 15, the posture of the buoyant force assisting body 13 when it is raised is stabilized. Further, because the water passage holes 16 are disposed on the entire circumference on the bottom end of the peripheral walls 15, a passage for pressurized fluid is constructed from the inside diameter portion 13a up to the water passage hole 16, so that like the ring-like buoyant force assisting body 13 provided with no peripheral walls 15, a sufficient pressure receiving area of the valve body 11 for moving the valve body 11 to its upper limit position can be secured as well as the pressure receiving area of the buoyant force assisting body 13.

[0019]

A plurality of guide rods 17 is disposed around the buoyant force assisting body 13 over a moving range of the valve body 11 in parallel to the axis of the valve port 6 and the guide rods 17 are disposed at an identical interval along the circumference of upper and lower annular frames 18, 18a between the lower frame 18a fitted to the outer periphery at an opening end on the secondary side of the valve port 6 and the upper frame 18 fitted to a circular concave portion 19 provided at the bottom end of the lid body 9. A guide frame 20 as shown in FIG. 6 is constructed with the

upper/lower frames 18, 18a and the guide rods 17.

[0020]

The lid body 9 includes a short length, non-screw hole 22 having an O-ring 21 in its inner periphery and a long length, screw hole 24, which is provided via an annular face 23 larger than the non-screw hole 22, these two holes being formed successively on an axis of the lid body from its top end to the concave portion 19 of its bottom end.

In the spindle 7, a handle 25 is fixed to the top end and a male screw portion 28 of a predetermined length formed continuously at the bottom end of a main shaft portion 26 of a predetermined length, inserted rotatably freely into the non-screw hole 22 via an annular face 27 having a larger diameter therethan is engaged with the screw hole 24.

When the handle 25 is rotated normally or inversely, the spindle 7 can be advanced or retracted in the axial direction of the valve port 6 and the spindle 7 has its upper limit at a position in which the annular face 27 comes into contact with the annular face 23 of the lid body 9.

[0021]

The spindle 7 contains a guide hole 29 for the urging means 12 which is provided in an upward direction from the bottom end of the male screw 28 by a predetermined length on its axis line.

In the urging means 12, a supporting rod 31 projecting upward from the vertex of a umbrella-like pressing piece 30 whose concave face is in contact with the top portion of the

valve body 11 is inserted slidably into a guide hole 29 and a compression coil-like spring 33 is interposed between a spring receiving hole 32 provided in a downward direction from the top end of the supporting rod 31 by a predetermined length and the top end of the guide hole 29.

[0022]

In FIGS. 1-3, reference numeral 34 denotes a butterfly valve provided in the primary side passage 3 and reference numeral 35 denotes a pipe joint connected to the secondary side passage 5.

[0023]

In the water stop valve having check function constructed as described above, in the water stop condition shown in FIG. 1, the spindle 7 is moved in the direction of closing the valve by turning the handle 25 so as to contract the urging means 12 (spring 33) to the most extent so that the valve body 11 is settled on the valve seat 10 forcibly via the pressing piece 30 of the urging means 12 to stop water. At this time, the buoyant force assisting body 13 is settled on the end face of the secondary side opening portion of the valve port 6.

When the handle 25 is rotated to retract the spindle 7 in this water stop condition, the urging means 12 is elongated between the valve body 11 and the spindle 7 to weaken the urging force (valve closing force relative to the valve body 11) of the spring 33 in the urging means 12. Consequently, water is allowed to pass through.

[0024]

When under such conditions, the primary side pressure acting in the valve opening direction of the valve body 11 beats the urging force of the spring 33 in the urging means 12 and the secondary side pressure, acting in the valve closing direction of the valve body 11, the valve body 11 receiving the primary side pressure is released from the valve seat 10 to contract the urging means 12 and then, water flows from the primary side to the secondary side so that water is supplied (see FIG. 2).

FIG. 2 shows a condition in which the spindle 7 is retracted up to the upper limit position. By operating the handle 25, the advancement and retraction of the spindle 7 is adjusted to restrict a valve opening distance of the valve body 11, adjusting an amount of flow.

[0025]

At the same time when the valve body 11 is opened, the buoyant force assisting body 13 is raised in the direction of opening the valve receiving the primary side pressure so that the inside diameter portion 13a of the buoyant force assisting body 13 is raised together with the valve body 11 in contact with the outside of the valve body 11.

Because the outside diameter d of the buoyant force assisting body 13 is larger than the valve body diameter D , it interrupts flow of pressurized fluid running along the spherical surface of the valve body 11 largely.

Consequently, generation of flow forcing the valve body

11 in the direction of closing the valve behind (above) the valve body 11 is blocked to reduce pressure loss and when the buoyant force assisting body 13 receives the primary side pressure together with the valve body 11, opening of the valve body 11 is accelerated. Consequently, the valve body 11 is opened with an appropriate opening degree corresponding to the amount of flow thereby securing a rated flow rate.

[0026]

If backwater is generated when the valve body 11 is opened to allow water to pass, the secondary side pressure of that backwater becomes higher than the primary side pressure and then, the valve body 11 is settled on the valve seat 10 immediately by this backwater pressure and an urging force of the spring 33 of the urging means 12 always acting in the valve closing direction of the valve body 11, in order to prevent backwater to the primary side (see FIG. 3).

Because the urging force of the spring 33 of the urging means 12 is always urged in the direction of closing the valve of the valve body 11, even if a difference of pressure between the primary side and the secondary side is slight when backwater is generated, the valve can be closed firmly by the urging means 12 before the primary side pressure and the secondary side pressure become the same pressure and further, because that valve closing condition can be maintained, more accurate backwater prevention can be achieved.

[0027]

When the valve body 11 is moved to open or close the

valve, the peripheral wall 15 of the buoyant force assisting body 13 following up the valve body 11 always surrounds the valve body 11 and ascent/descent of the valve body 11 and the buoyant force assisting body 13 is securely guided by the guide rod 17 disposed around the buoyant force assisting body 13 along the axis of the valve port 6. Consequently, the moving range of the valve body 11 is limited to the axial direction of the valve port 6 and the urging force of the urging means 12 is securely received by the valve body 11 so as to enable the valve body 11 to execute valve opening/closing action excellently and stably and always maintain the posture of the buoyant force assisting body 13 in a stable horizontal condition.

Because the valve body 11 is spherical, the portion which stays on the valve seat 10 differs each time when the valve is operated, thereby preventing foreign matter from being caught between the valve body 11 and the valve seat 10, there is no slight leakage of water when water flow is stopped, thereby achieving maintenance free system.

[0028]

The valve having check function of the second embodiment shown in FIGS. 7, 8 is a ball check valve having the check valve body 14. The spindle 7 supported by the lid body 9 in the first embodiment is abolished and the guide hole 29 through which the supporting rod 31 of the pressing piece 30 in the urging means 12 is passed slidably is provided in the lid body 9. The valve body 11 in the check valve body

14 is urged by the urging means 12 in the direction of closing the valve. Because the other structure is the same as the first embodiment, like reference numerals are attached to the same as or equivalent components to the first embodiment and description thereof is omitted.

[0029]

The valve having the check function of the third embodiment shown in FIGS. 9, 10 is a modification of the ball check valve in the second embodiment and more specifically, the urging means 12 of the valve body 11 is abolished and in the check valve body 14, the valve body 11 is just disposed such that it can be attached or detached freely with respect to the valve seat 10.

Thus, the lid body 9 has the concave portion 19 in which the upper frame 18 of the guide frame 20 is to be inserted and fitted so that the opening portion 1a of the valve casing 1 is fastened and closed water-tightly.

Because the other structure is the same as the second embodiment, like reference numerals are attached to the same components or equivalent ones to the second embodiment and description thereof is omitted.

Because the ball check valve of the third embodiment contains no urging means 12, the valve body 11 is not settled on the valve seat 10 securely by the urging means 12's always urging the valve body 11 in the direction of closing the valve unlike the first and second embodiments. Therefore, in the third embodiment, the valve body 11 is formed of material

having a relatively large specific gravity and the valve needs to be always disposed in a horizontal condition in order to open/close the valve body 11 normally.

[0030]

In the ball check valve having the above-described structure of the second embodiment, when the primary side pressure acting in the valve opening direction of the valve body 11 beats the urging force of the spring 33 in the urging means 12 acting in the valve closing direction of the valve body 11 and the secondary side pressure, the valve body 11 receiving the primary side pressure is detached from the valve seat 10 so as to contract the urging means 12, so that water passes from the primary side to the secondary side through the valve port 6 (see FIG. 7).

When the primary side pressure acting in the valve opening direction of the valve body 11 is raised over the secondary side pressure in the third embodiment, the valve body 11 receiving the primary side pressure is detached from the valve seat 10 so that water passes from the primary side to the secondary side through the valve port 6 (see FIG. 9).

[0031]

In both the second and third embodiments, when the valve body 11 is opened, the buoyant force assisting body 13 receives the primary side pressure and is raised in the valve opening direction, so that the inside diameter portion 13a of the buoyant force assisting body 13 comes into contact with the valve body 11 and is raised together with the valve

body 11.

Because the outside diameter d of the buoyant force assisting body 13 is larger than the valve body diameter D , flow of pressurized fluid along the spherical surface of the valve body 11 is interrupted largely.

Consequently, generation of flow forcing the valve body 11 in the direction of closing the valve behind (above) the valve body 11 is blocked to reduce pressure loss and when the buoyant force assisting body 13 receives the primary side pressure together with the valve body 11, opening of the valve body 11 is accelerated. Consequently, the valve body 11 is opened with an appropriate opening degree corresponding to the amount of flow, thereby securing a rated flow rate.

[0032]

If backwater is generated when the valve is opened, according to the second embodiment, the secondary side pressure of the backwater becomes higher than the primary side pressure and consequently, the valve body 11 is settled on the valve seat 10 immediately by this backwater pressure and the urging force of the spring 33 of the urging means 12 always acting in the valve closing direction of the valve body 11 to prevent the backwater to the primary side (see FIG. 8).

Because the urging force of the spring 33 of the urging means 12 is always urged in the direction of closing the valve of the valve body 11, even if a difference of pressure between the primary side and the secondary side is slight when

backwater is generated, the valve can be closed securely and firmly by the spring 33 before the primary side pressure and the secondary side pressure become the same pressure and further, and because that valve closing condition can be maintained, more accurate backwater prevention can be achieved.

If the backwater is generated when the valve is opened in the third embodiment, the valve body 11 is settled on the valve seat 10 by the backwater pressure to prevent the backwater to the primary side (see FIG. 10).

[0033]

Because the valve body 11 of the second and third embodiment is spherical like the first embodiment, the portion which stays on the valve seat 10 differs each time when the valve is operated, thereby preventing foreign matter from being caught between the valve body 11 and the valve seat 10. Consequently, there is no slight leakage of water when water flow is stopped, thereby achieving maintenance free system.

When the valve body 11 is moved to open or close the valve, the peripheral wall 15 of the buoyant force assisting body 13 following up the valve body 11 always surrounds the valve body 11 and ascent/descent of the valve body 11 and the buoyant force assisting body 13 is guided securely by the guide rod 17 disposed around the buoyant force assisting body 13 along the axis of the valve port 6. Consequently, the moving range of the valve body 11 is limited to the axial

direction of the valve port 6 and the posture of the buoyant force assisting body 13 is always maintained in a stable horizontal condition. Particularly, in the second embodiment, the urging force of the urging means 12 is securely received by the valve body 11 so as to enable excellent, stable valve opening/closing operation of the valve body 11.

[Brief Description of the Drawings]

[0034]

[Fig. 1] A longitudinal cross-sectional view showing a state where water is stopped by forcibly closing the valve by a stop cock having a non-return function.

[Fig. 2] A longitudinal cross-sectional view showing a state where the valve is full open in the same water conduction enabled state as above.

[Fig. 3] A longitudinal cross-sectional view showing a water stopped state where backflow occurs in the same water conduction enabled state as above.

[Fig. 4] A longitudinal cross-sectional view showing a check valve.

[Fig. 5] An enlarged cross-sectional view taken along A-A of Fig. 1 from which illustration of some parts is omitted.

[Fig. 6] A half cross-sectional view of a guide frame.

[Fig. 7] A longitudinal cross-sectional view showing a valve opened state in a second embodiment.

[Fig. 8] A longitudinal cross-sectional view showing

the same valve closed state as above.

[Fig. 9] A longitudinal cross-sectional view showing a valve opened state in a third embodiment.

[Fig. 10] A longitudinal cross-sectional view showing the same valve closed state as above.

[Description of Reference Numerals]

[0035]

- 3: Primary-side flow path
- 5: Secondary-side flow path
- 6: Valve port
- 7: Spindle
- 10: Valve seat
- 11: Valve body
- 12: Biasing means
- 13: Buoyancy assisting body
- 13a: Inner diameter portion
- 15: Peripheral wall
- 16: Water conducting port
- 17: Guide bar
- D: Valve body diameter
- D1: Valve port diameter
- d: Outer diameter
- d1: Inner diameter

WHAT IS CLAIMED IS:

1. A check valve body which is a spherical valve body capable of being attached to/detached from a valve seat provided on a secondary side of a valve port communicating with a primary side passage and a secondary side passage, wherein a primary side pressure receiving side of the valve body is insertedly passed through an inside diameter portion of a ring-like buoyant force assisting body whose outside diameter is larger than the diameter of the valve body, and whose inside diameter is larger than the diameter of the valve port and is smaller than the diameter of the valve body, and wherein the buoyant force assisting body is provided to be capable of being attached to/detached from an end surface of a secondary side opening portion of the valve port in such a manner that, when the valve is opened, the inside diameter portion of the buoyant force assisting body comes into contact with the outside of the valve body, and the buoyant force assisting body and the valve body moves upward together.

2. The check valve body according to claim 1 wherein the buoyant force assisting body has a peripheral wall surrounding the valve body while a plurality of water passage holes is arranged at a small interval throughout the entire circumference thereof on the bottom of the peripheral wall.

3. The check valve body according to claim 1 or 2 wherein a plurality of guide rods is disposed around the buoyant force assisting body over a moving range of the valve

body in parallel to the axis of the valve port.

4. A valve having check valve function including a valve seat on a secondary side of a valve port communicating with a primary side passage and a secondary side passage, wherein a spherical valve body is provided to the valve seat to be attached to/detached from the valve seat, the valve body is urged in the direction of closing the valve by an urging means, and a primary side pressure receiving side of the valve body is insertedly passed through an inside diameter portion of a ring-like buoyant force assisting body whose outside diameter is larger than the diameter of the valve body, and whose inside diameter is larger than the diameter of the valve port and is smaller than the diameter of the valve body, and wherein the buoyant force assisting body is provided to be capable of being attached to/detached from an end surface of a secondary side opening portion of the valve port in such a manner that, when the valve is opened, the inside diameter portion of the buoyant force assisting body comes into contact with the outside of the valve body, and the buoyant force assisting body and the valve body moves upward together.

5. The valve having check valve function according to claim 4 wherein the buoyant force assisting body has a peripheral wall surrounding the valve body while a plurality of water passage holes is arranged at a small interval throughout the entire circumference thereof on the bottom of the peripheral wall.

6. The valve having check valve function according to claim 4 or 5 wherein a plurality of guide rods is disposed around the buoyant force assisting body over a moving range of the valve body in parallel to the axis of the valve port.

7. The valve having check valve function according to claim 5 or 6 including a spindle capable of advancing or retracting freely in an axial direction of the valve port wherein an urging means which expands/contracts corresponding to advancement/retraction of the spindle is interposed between the spindle and the valve body.