

DESCRIPTION

BUTTERFLY VALVE

TECHNICAL FIELD

[0001] The present invention relates to a butterfly valve, and more particularly to a centered butterfly valve suitable for condensation prevention, and even more particularly to a butterfly valve that prevents condensation in a portion exposed to air, the condensation being caused by the difference in temperature between the air and a fluid flowing down a conduit line.

BACKGROUND ART

[0002] In conduit lines in which a low-temperature fluid flows, such as piping for cooling or refrigerating, moisture contained in the air condensates on the outer surface of the flow passage due to the difference in temperature between the flowing fluid and the air. For this reason, measures are taken to prevent the condensation by providing a thermally insulating cover on the outer surface of the conduit line. Because of such thermally insulating cover, in a butterfly valve mounted on the conduit line, parts of the valve body and valve shaft housing are also covered and thermally insulated.

[0003] However, a large portion of the valve shaft cylindrical portion that extends from the valve body perpendicular to the conduit line, that is, the outer end portion of the valve shaft cylindrical portion, and an actuator connected to the outer end of the valve shaft cylindrical portion are difficult to cover with a thermally insulating cover because they have complex shape and an orientation different from that of the conduit line. Accordingly, these components are often not provided with a thermally insulating cover and are exposed to the atmosphere. In such cases, moisture contained in the atmosphere condensates on the outer surface of the exposed valve shaft cylindrical portion or actuator, causing corrosion. Yet

another problem is that water drops fall down, staining the floor.

[0004] Further, as shown in FIG. 18, the valve shaft cylindrical portion or actuator can be also thermally insulated by a thermally insulating cover that is separate from the thermally insulating cover covering the conduit line or integrated therewith, thereby preventing the condensation, but the problem arising when such measure is employed to prevent the condensation is that because butterfly valves of a variety of shapes and sizes are used according to application, installation location, or control system, thermally insulating covers of various types have to be prepared correspondingly to the valves.

[0005] Accordingly, in order to solve the above-described problems, the applicant of the present application has heretofore suggested a structure in which heat transfer between the valve body and the actuator is interrupted or reduced to prevent condensation by providing thermal insulation between the valve body and the valve shaft cylindrical portion. Such condensation preventing structures are disclosed, for example, in Patent documents 1 to 4.

[0006] In the configuration disclosed in Patent document 1, a valve body and a valve shaft insertion portion of a valve shaft cylindrical portion are formed integrally from a cast material such as cast aluminum, and a connection flange portion composed of a thermally insulating resin and serving to mount and fix an actuator is fixedly attached to the outer end of the valve shaft insertion portion. However, the drawback of such a structure is that the number of parts is increased, the number of assembly operations is also increased, and the valve body has to be cast with high precision.

[0007] In the configuration disclosed in Patent document 2, a pipe-shaped column is attached via a thermally insulating plate to the outer end of a valve shaft cylindrical portion, a valve rod is connected to a drive shaft of an actuator inside the column, and a heat-absorbing fin is provided on the outer peripheral surface of the column. In the configuration disclosed in Patent document 3, an actuator is attached to the outer end of a valve shaft cylindrical

portion via an intermediate column made from a synthetic resin having thermal insulating properties, and a valve rod for driving is inserted in the intermediate column and connected to the drive shaft of the actuator. Although such a structure requires no precision casting of the valve body, the drawback thereof is that the height of the valve body is increased and the number of parts is increased due to the addition of the column. Furthermore, the number of assembly operations is increased and the cost is raised.

[0008] With the configuration disclosed in Patent document 4, the condensation on an actuator is prevented by using a valve shaft cylindrical column with thermally insulating properties in which a valve shaft cylindrical portion and an actuator attachment plate are formed integrally, providing mutually mating concavities and convexities on both end surfaces that are joint portions of the valve shaft cylindrical column and the valve body, and fixing them with a tightening member, thereby preventing torsion caused by torsion stresses. However, the drawback of such a structure is that the number of parts is increased, the number of assembling operations is increased, and the valve body has to be cast with high precision.

[0009] The drive-side valve rod and the actuator are connected, so that they can rotate integrally, by an appropriate means such as irregular cross sections or key structures. Where a key structure is employed for coaxially rotating the drive-side valve rod and the actuator, if the key structure is broken, even if the handle of the actuator is rotated, the rotation is not transferred accurately to the drive shaft and the valve rod cannot be rotated correctly. However, with the conventional structure in which the valve rod is accommodated inside the valve shaft cylindrical portion, the valve rod rotation cannot be visually observed from the outside, and the only reliable method to determine whether the valve body is open or closed is to rely upon the injector rotation.

[0010] In the configurations described in Patent documents 1 to 4, no bolt insertion hole

for inserting a piping bolt is provided in the valve body, as in the conventional valve element, machining of the bolt insertion hole is not required, and cost can be reduced. At the same time, there is a certain degree of freedom in attaching to piping flanges with different piping size and also the arrangement and diameter of bolt holes in the flange portions. However, because the configuration is limited to a rib shape for positioning, where the number of piping bolts or arrangement and diameter of bolts are different, it is impossible to abut the bolts against the ribs and reliable positioning cannot be performed.

[0011] Patent document 1: Japanese Patent Application Laid Open No. H09-100946

Patent document 2: Japanese Patent Application Laid Open No. H07-001383

Patent document 3: Japanese Patent Application Laid Open No. H10-281340

Patent document 4: Japanese Patent Application Laid Open No. 2005-133831

DISCLOSURE OF THE INVENTION

[0012] It is an object of the present invention to provide a butterfly valve in which the effect of preventing condensation on an actuator can be improved, the amount of machining required for the valve body can be reduced and the manufacture thereof can be facilitated, thereby reducing the cost, and the operations of connecting to the piping flange and maintenance are simple, whereby convenience and usability are improved.

[0013] The present invention solves the above-described problems by providing a centered butterfly valve configured so that a sheet ring made of an elastic sealing member is mounted in a valve body having a cylindrical flow passage formed to penetrate the valve body, a disk-shaped valve element is pivotally supported inside the valve body by a valve rod arranged to extend from the valve body in the radial direction thereof such that a peripheral edge of the valve element can be brought into contact with and separated from the sheet ring, and a rotation axis of the valve rod is positioned substantially on the central line of the valve element, wherein the valve rod extending from the valve body outwardly in the radial

direction extends to the outer peripheral portion of the valve body, an attachment plate for installing and fixing an actuator is supported by at least two support arms extending from the valve body, the support arms do not come into contact with the valve rod, and a space is provided between the outer peripheral portion of the valve body, the attachment plate, and the support arms.

[0014] Further, the valve rod extending from the valve body in the radial direction is exposed to an outer space between the outer peripheral portion of the valve body and the attachment plate.

[0015] In addition, a pipe is freely inserted onto a portion of the valve rod extending from the valve body in the radial direction, between the outer peripheral portion of the valve body and the attachment plate so as to cover and protect the valve rod with the pipe.

[0016] Further, a mating groove is formed in the valve rod, a pressing plate is mounted on the mating groove portion to lock a bushing and also to lock the valve rod.

[0017] Further, the pressing plate and a bushing are locked by fixing a locking plate to the attachment plate while pushing the pipe with the locking plate, and the valve rod is pivotally supported by the pressing plate.

[0018] Further, the pressing plate is fixed to the valve body with a threaded member such as a bolt.

[0019] Further, the pipe that is freely inserted onto the valve rod is transparent.

[0020] Further, an opening degree indication unit that enables an opening degree of the valve to be viewed from the outside or an opening degree display that displays the opening degree of the valve is provided in a valve rod portion positioned between the outer peripheral portion of the valve body and the attachment plate.

[0021] Further, a bolt for fixing a piping is abutted against the support arm to position the valve body and piping.

[0022] Further, a bolt for fixing a piping is abutted against the support arm and the outer peripheral surface of the body to position the valve body and piping.

[0023] In accordance with the present invention, a structure is employed in which a valve shaft cylindrical portion that accommodates and pivotally supports the drive-side valve rod is not provided, and the valve rod is caused to be present in a space between the outer peripheral portion of the valve body, the attachment plate, and the support arms, without being in contact with the support arms, and is directly or indirectly exposed to the external air. As a result, the drive-side valve rod comes into contact with the external air, heat of the warm external air can be easily transferred, and cooling of the actuator is reduced. In addition, because a configuration is employed in which the drive-side valve rod does not come into direct contact with the attachment plate for installing and fixing the actuator, heat conduction occurring between the inside of the valve and the actuator via the drive-side valve rod can be reduced, the entire outer peripheral surface of the support arms comes into contact with the external air, and contact surface area with the external air is increased, whereby the cold air transferred from the inner peripheral surface of the valve body can be dissipated, cooling of the attachment plate can be reduced, and condensation can be effectively prevented.

[0024] By employing a structure in which the drive-side valve rod is caused to be present in a space between the outer peripheral portion of the valve body, the attachment plate, and the support arms, without being in contact with the support arms, the rotation of the drive-side valve rod can be easily observed from the outside, the valve rod rotation can be visually confirmed, the drive-side valve rod can be easily replaced, and maintenance ability thereof can be increased. Because the rotation of the drive-side valve rod can be visually confirmed, it can be easily understood whether a trouble has occurred on the actuator side or the valve side.

[0025] The drive-side valve rod and the actuator are connected, so that they can rotate

integrally, by an appropriate means such as irregular cross sections or key structures. For example, where a key structure is employed for coaxially rotating the drive-side valve rod and the actuator, if the key structure is broken, even if the handle of the actuator is rotated, the rotation of the drive-side valve rod is not transferred correctly. However, because the drive shaft rotation can be visually confirmed, the problem that has occurred can be solved rapidly and reliably.

[0026] Furthermore, because the entire length of the valve rod hole for inserting the drive-side valve rod that passes through in the radial direction of the valve body is shortened, a core that has been conventionally used during casting to reduce the amount of machining becomes unnecessary and a high dimensional accuracy is not required for the external shape of the valve body. Therefore, it is not necessary to use precision casting in the production process. As a result, production can be performed in the countries where high-level casting technology is unavailable. In addition, the casting deburring treatment performed after casting is facilitated by providing a convex portion for casting burrs on the mating surface of a mold for the outer shape of the valve body.

[0027] Further, a configuration is employed in which the valve body and the actuator attachment plate are connected by a support arm structure, and the drive-side valve rod is caused to be present in a space between the outer peripheral portion of the valve body, the attachment plate, and the support arms, without being in contact with the support arms. Accordingly, the operations of incorporating the drive-side valve rod in the valve body, mounting the bush, and assembling a bush portion, a valve element, and a valve rod, e.g. locking them, are facilitated. As a result, the number of parts and production steps can be reduced, the production cost of the entire butterfly valve can be greatly reduced, and a sufficient strength against a load of an operation torque can be ensured.

[0028] By abutting a bolt for fixing the piping on the two support arms or on a support

arm and an outer peripheral surface of the valve body, it is possible to facilitate the positioning of the valve body and piping. Further, because the support arms are inclined, even if the number of piping bolts or arrangement and diameter of bolts are different, the butterfly valve can be easily adapted to such bolts. Yet another effect is that because the material for suspending the piping, such as a wire, can be attached to the support arms, the piping operability can be improved.

[0029] By freely inserting a protective pipe onto the drive-side valve rod in the space between the outer peripheral portion of the valve body, the attachment plate, and the support arms, it is possible to prevent arms or body from coming into direct contact with the drive-side valve rod. Moreover, where the expandable thermally insulating material is loaded, the thermally insulating material can be prevented by the pipe from directly adhering to the valve rod. Further, by cutting out part of the pipe to form a cut-out window hole or by using a transparent pipe, it is possible to ensure the visibility of the valve rod, and the opening degree display unit or indicator can be made visible.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] FIG. 1 is a front view of the valve body of the butterfly valve in accordance with the present invention.

FIG. 2 is a cross-sectional view along the A-A line in FIG. 1.

FIG. 3 is a front view of the butterfly valve in a state in which the actuator is attached and covered with a thermally insulating cover.

FIG. 4 illustrates the relationship between the butterfly valve and the piping attachment bolt.

FIG. 5 illustrates another relationship between the butterfly valve and the piping attachment bolt.

FIG. 6 illustrates an example of a structure displaying the opening degree of the

valve rod.

FIG. 7 illustrates another example of a structure displaying the opening degree of the valve rod.

FIG. 8 is a front view of a valve body of a butterfly valve of another embodiment of the present invention.

FIG. 9 is a cross-sectional view along the A-A line in FIG. 8.

FIG. 10 is a front view of the butterfly valve in a state in which the actuator in another embodiment is attached and covered with a thermally insulating cover.

FIG. 11 illustrates an example of a structure displaying the opening degree of the valve rod in another embodiment.

FIG. 12 illustrates another example of a structure displaying the opening degree of the valve rod in another embodiment.

FIG. 13 illustrates the open valve state in the example shown in FIG. 12.

FIG. 14 illustrates an example of a structure in which an opening degree display device is mounted on the valve rod in another embodiment.

FIG. 15 illustrates the open valve state in the example shown in FIG. 14.

FIG. 16 is a front view of a valve body of a butterfly valve in which a pipe of another shape is freely inserted.

FIG. 17 is a cross-sectional view along the B-B line in FIG. 16.

FIG. 18 illustrates a state of covering with the conventional thermally insulating cover.

EXPLANATION OF REFERENCE NUMERALS

[0046]	1 Valve body
	2 Flow passage
	3 Valve element

4 Inner peripheral surface
5 Sheet ring
6 Outer peripheral surface
7 Actuator
8 Drive-side valve rod
8a Mating groove
9 Lower shaft support portion
10 Idle-side valve rod
11 Convex portion
12 Upper shaft support portion
13 External space
14 Attachment plate
15 Support arm
15a Rising portion
15b Inclined portion
17 Bolt
18 Pressing plate
19 Locking plate
20 Bush
21 Concave portion
22 Pipe
22a Window hole
22b Open portion
23 Thermally insulating cover
24 to 26 Symbol

27 Drive-side valve rod

27a Large-diameter portion

27b Small-diameter portion

28 Pipe

29 to 32 Symbol

33 Opening degree display device

BEST MODE FOR CARRYING OUT THE INVENTION

[0030] The preferred embodiments of the present invention will be described below in greater detail with reference to the appended drawings. In the figures, the reference symbol (1) stands for a cast article that has a valve body of a butterfly valve attached to have a wafer-like shape between flanges of pipe constituting a flow passage and has a cylindrical flow passage (2) formed to penetrate the inside of the cast article. A disk-shaped valve element (3) is pivotally supported inside the valve body (1). A sheet ring (5) composed of a rubber with soft elasticity, or the like, is inserted between the inner peripheral surface (4) of the valve body (1) and the valve element (3), and the flow passage is opened or closed, or the flow rate is controlled therein by bringing the sheet ring (5) into contact with the outer peripheral surface of the rotating valve element (3) and separating the sheet ring therefrom. The valve element (3) is pivotally support by a drive-side valve rod (8) that extends from the outer peripheral surface (6) of the valve body (1) and has an outer end thereof connected to an actuator (7) and by an idle-side valve rod (10) extending outwardly from the outer peripheral surface (6) of the valve body (1) in the radial direction and having the outer end thereof inserted in the lower shaft support portion (9). These two valve rods (8), (10) are positioned coaxially with the central axis of the valve element (3).

[0031] A convex portion (11) surrounding the outer peripheral surface is formed in the central portion of the outer peripheral surface (6) of the valve body (1). Because of the

presence of the this convex portion (11), where a mold division portion of the casting mold is disposed on this convex portion (11), the casting burrs can be caused to occur on the convex portion (11), thereby facilitating the removal thereof.

[0032] The drive-side valve rod (8) extending outwardly from the outer peripheral surface (6) of the valve body (1) in the radial direction ensures the presence of the drive-side valve rod, without a contact with the support arms, in the space between the outer peripheral surface of the valve body, the attachment plate, and the support arms outside the outer end of an upper shaft support portion (12) that protrudes convexly to a certain degree outwardly from the outer peripheral surface (6) of the valve body (1) in the radial direction. The outer end of the drive-side valve rod (8) is connected to the actuator (7) and is driven and rotated thereby. The attachment plate (14) that serves to mount and support the actuator (7) is installed on two support arms (15) rising from the outer peripheral surface (6) of the valve body (1) integrally therewith at a predetermined distance from the valve body (1). The support arms (15) are disposed with a predetermined spacing on both sides of the valve rod (8), so that the drive-side valve rod (8) extending from the outer peripheral surface of the valve body (1) is disposed therebetween, and integrally connect the valve body (1) and the attachment plate (14)

[0033] The drive-side valve rod (8) and actuator (7) are connected, so that they can rotate integrally, by irregular cross sections or key structures. In this case, because a structure is assumed in which the drive-side valve rod is present in an exposed state, without being inserted through a valve shaft tube, in a space between the outer periphery of the valve body, the attachment plate, and the support arms, the drive-side valve rod (8) can be visually observed by forming a window hole (22a) in a pipe (22) freely inserted in the respective zone, as described hereinbelow, or by using the pipe (22) that is itself transparent. For example, when the key is broken and the drive-side valve rod (8) and actuator (7) do not rotate

integrally, the non-rotation state of the drive-side valve rod (8) can be visually confirmed and specific examination of the failure location can be performed very easily and reliably. In addition, because the entire circumference of the support arms (15) is in contact with the external air and cold air on the inner peripheral surface of the valve body (1) is replaced with the warm air, cooling of the attachment plate (14) can be reduced.

[0034] The two support arms (15) are preferably composed of rising portions (15a) that extend in the radial direction from the outer peripheral surface (6) of the valve body (1) and the inclined portions (15b) that are bent to produce a curved shape such that the support arms come closer to the valve rod from the rising portions (15a), and the attachment plate (14) is connected to the outer ends of the inclined portions (15b). As a result, even when the butterfly valve is attached to a piping flange with a different size of a piping constituting the flow passage and a different arrangement and diameter of bolt holes of the flange portion, the butterfly valve can be adapted to bolts (17) of different arrangement and diameter, as shown in FIG. 4. Further, as shown in FIG. 5, the bolts (17) designed for fixing the piping can be brought into contact with the outer surface of the base portion of the rising portions (15a) to support the butterfly valve.

[0035] A mating groove (8a) is formed in the drive-side valve rod (8), and a pressing plate (18) is mounted on the mating groove (8a). The pressing plate (18) has a structure in which a disk-shaped member is divided in two, this member having formed in the center thereof a gap and has a diameter almost equal to the outer diameter of the mating groove portion (8a). After the pressing plate is mounted so as to insert the mating groove portion (8a), the pressing plate is mated with a concave portion (21) formed in the open end of the upper shaft support portion (12), in a state of applying pressure to a bush (20) by the lower surface side thereof.

[0036] A pipe (22) is freely inserted onto the drive-side valve rod (8), and the lower end

of the pipe (22) abuts against the upper surface side of the pressing plate (18). Further, the upper end abuts against a locking plate (19). The locking plate (19) is screwed to the attachment plate (14), while applying pressure to the pipe (22), the pressing force is transferred through the pipe (22) to the pressing plate (18), and the pressing plate (18) can be locked together with the bush (20). Further, as described hereinabove, the pressing plate (18) is mounted on the mating groove (8a) of the drive-side valve rod (8), thereby making it possible to lock the drive-side valve rod (8). The pipe (22) is not limited to the cylindrical shape and can have any shape, provided that the pressing force of the locking plate (19) can be transferred to the pressing plate (18).

[0037] As described hereinabove, the drive-side valve rod (8) has a structure such that it is present in the space between the outer peripheral portion of the valve body, the attachment plate, and the support arms, without coming into contact with the support arms, and the pipe is inserted around the drive-side valve rod (8) in this position, but the pipe has a small thickness and can transfer warm external air to the drive-side valve rod (8). As a result, the drive-side valve rod (8) can receive the external warm air through the pipe (22) in the aforementioned space, and the external heat can be easily transferred to the drive-side valve rod (8), thereby making it possible to reduce the cooling of the actuator (7). Further, because the pipe (22) has a structure obtained by bending a plate material to an almost cylindrical shape, so that the end portions such as shown in FIGS. 16, 17 are not connected, the warm external air can be introduced into the pipe (22) via the open portion (22b), and the drive-side valve rod (8) can be effectively brought into contact with the external air by using the pipe having a cylindrical shape.

[0038] In the case the valve body is provided with a thermally insulating cover (23), when it is filled with an expandable thermally insulating agent, for example, foamed polyurethane, the pipe (22) can effectively prevent the thermally insulating agent from

adhering directly to the valve rod. Further, as shown in FIG. 6, by cutting out part of the pipe (22) and forming a window hole (22a), as shown in FIG. 6, it is possible to confirm visually the rotation state of the valve rod. Furthermore, if markings for indicating the degree of valve opening are provided on the surface of the drive-side valve rod (8), the degree of valve opening can be confirmed from the outside or the conformance thereto can be verified.

[0039] FIGS. 6, 7 show an example of the preferred indicator. In this example, a symbol (24) "C" of a closed position and a symbol (25) "O" of an open position are provided at the drive-side valve rod (8) with an angular pitch of 90 degrees and the open/close state can be confirmed by matching with a symbol (26) on the attachment plate (14). The pipe (22) can be also made from a transparent material, and in this case, the same effect can be obtained without forming the window hole (22a). Further, where the pressing plate (18) is fixed to the upper shaft support portion (12) by screwing or the like, the pipe (22) and the locking plate (19) become unnecessary, a state is thus assumed in which the drive-side valve rod (8) can be viewed directly, and the same effect can be obtained. Further, cooling of the drive-side valve rod (8) can be efficiently prevented.

[0040] When the valve body (1) of the above-described configuration is attached to a flow passage, a cylindrical thermally insulating cover (23) for condensation prevention that covers the outer peripheral surface of the piping as shown in FIG. 3, is provided so that the cover reaches the intermediate zone between the support arms (15), and the upper portion of the external space (13) is opened to the outside of the thermally insulating cover (23). The external space as referred to in this description of the invention means a space in which the structural components of the valve body are not present around the drive-side valve rod (8) and which is opened to the atmosphere. In this case, it means that a state is assumed in which the drive-side valve rod (8) is exposed to this space, without being covered by the structure of the valve body. Further, the actuator (7) that is mounted on, and fixed to the attachment plate

(14) is also exposed to the external air. The drive-side valve rod (8) is present in the space between the outer peripheral portion of the valve body, the attachment plate, and the support arms, without coming into contact with the support arms, and is directly or indirectly exposed to the external air. As a result, the warm external air is easily transferred to the drive-side valve rod (8) and the transfer of cold air to the drive portion can be reduced. The butterfly valve of the present embodiment is configured as described above, but it goes without saying that the configuration of the butterfly valve can be changed without departing from the scope of the present invention.

[0041] FIGS. 8 to 10 illustrate another embodiment. The structure of the valve body (1) is basically the same as in the above-described embodiment, the difference being in the structures of the drive-side valve rod and pipe. A drive-side valve rod (27) has a large-diameter portion (27a) in the center and small-diameter portions (27b) above and below it. A step is formed on the boundary between the large-diameter portion (27a) and small-diameter portions (27b). The large-diameter portion (27a) located in the center is exposed from an upper shaft support portion (12) of the valve body (1) to an external space (13). The external space means a space in which the structural components of the valve body are not present around the drive-side valve rod (27) and which is opened to the atmosphere. In this case, it means that the drive-side valve rod (27) is exposed to the external air, without being covered by the structure of the valve body. Because large-diameter portion (27a) located in the center of the drive-side valve rod (27) has no relation to the structural components of the valve body no precise finish machining is required, and only a portion to be inserted between the small diameter portions (27b) on the side of the valve element (3) and the valve element (3) are machined with high precision.

[0042] A pressing plate (18) that is installed in the upper shaft support portion (12) and serves to lock a bush (20) for tightly closing the valve can be stopped and locked by the step

formed below the large-diameter portion (27a). The upper step pivotally supports the attachment plate (14), while abutting against a locking plate (19) and locking it. Any large-diameter portion (27a), which is the exposed portion of the drive-side valve rod (27), may be selected, provided that a pipe (28) can be freely inserted thereonto to prevent hands or body from coming into direct contact with the valve rod.

[0043] A thermally insulating cover (23) can be also provided in this embodiment, and by exposing the drive-side valve rod (27) to the external air, it is possible to facilitate the transfer of warm external air to the drive-side valve rod (27) and reduce the transfer of cold air to the actuator. Further, the valve body is filled with an expandable thermally insulating agent, for example, foamed polyurethane, and the inserted pipe (28) can effectively prevent the thermally insulating agent from adhering directly to the drive-side valve rod (27). Further, it is preferred that a mark for indicating the valve opening degree be provided on the surface of the drive-side valve rod (27), thereby making it possible to verify the valve opening degree from the outside or perform verification corresponding thereto.

[0044] FIGS. 11 to 15 illustrate other embodiments of the injector. FIG. 11 shows a configuration in which a triangular symbol (29) is provided on the drive-side valve rod (27) and the closed state is indicated by matching with a triangular symbol (30) CLOSE formed at the attachment plate (14). FIGS. 12, 13 show configurations in which a symbol (31) indicating the closed position and a symbol (32) indicating an open position are provided with an angular pitch of 90 degrees on the valve rod, and the open or closed state can be confirmed by matching with a symbol (30) on the attachment plate (14). FIGS. 14, 15 show configurations in which an opening degree display device (33) is mounted instead of the symbols indicating the open and close position that are formed on the valve rod, and the opening degree can be displayed by the rotation of the display device that follows the rotation of the valve rod. If necessary, an indication needle may be installed in the display device.

CLAIMS

1. A centered butterfly valve configured so that a sheet ring made of an elastic sealing member is mounted in a valve body having a cylindrical flow passage formed to penetrate the valve body, a disk-shaped valve element is pivotally supported inside the valve body by a valve rod arranged to extend from the valve body in the radial direction thereof such that a peripheral edge of the valve element can be brought into contact with and separated from the sheet ring, and a rotation axis of the valve rod is positioned substantially on the central line of the valve element, wherein the valve rod extending from the valve body outwardly in the radial direction extends to the outer peripheral portion of the valve body, an attachment plate for installing and fixing an actuator is supported by at least two support arms extending from the valve body, the support arms do not come into contact with the valve rod, and a space is provided between the outer peripheral portion of the valve body, the attachment plate, and the support arms.

2. The butterfly valve according to claim 1, wherein the valve rod extending from the valve body in the radial direction is exposed to an outer space between the outer peripheral portion of the valve body and the attachment plate.

3. The butterfly valve according to claim 1, wherein a pipe is freely inserted onto a portion of the valve rod extending from the valve body in the radial direction, between the outer peripheral portion of the valve body and the attachment plate so as to cover and protect the valve rod with the pipe.

4. The butterfly valve according to any of claims 1 to 3, wherein a mating groove is formed in the valve rod, a pressing plate is mounted on the mating groove portion to lock a bushing and also to lock the valve rod.

5. The butterfly valve according to claim 3 or 4, wherein the pressing plate and a bushing are locked by fixing a locking plate to the attachment plate while pushing

the pipe with the locking plate, and the valve rod is pivotally supported by the pressing plate.

6. The butterfly valve according to any of claims 1 to 4, wherein the pressing plate is fixed to the valve body with a threaded member such as a bolt.

7. The butterfly valve according to any of claims 3 to 6, wherein the pipe that is freely inserted onto the valve rod is transparent.

8. The butterfly valve according to any of claims 1 to 7, wherein an opening degree indication unit that enables an opening degree of the valve to be viewed from the outside or an opening degree display that displays the opening degree of the valve is provided in a valve rod portion positioned between the outer peripheral portion of the valve body and the attachment plate.

9. The butterfly valve according to any of claims 1 to 8, wherein a bolt for fixing a piping is abutted against the support arm to position the valve body and piping.

10. The butterfly valve according to any of claims 1 to 8, wherein a bolt for fixing a piping is abutted against the support arm and the outer peripheral surface of the body to position the valve body and piping.