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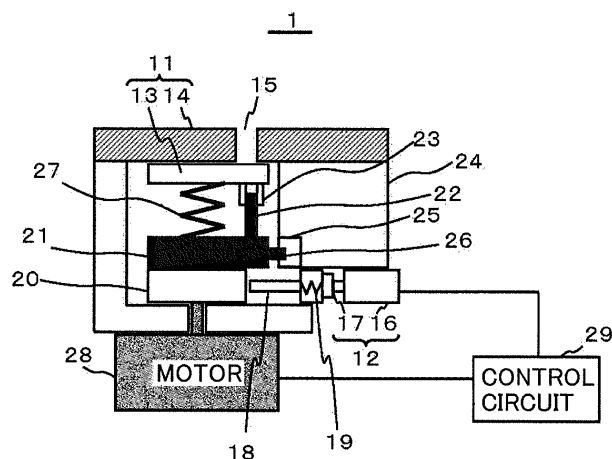
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(54) **GAS CONTROL VALVE**

(57) Friction between a rotary disk (13) and a fixed disk (14) is prevented from being produced by providing a transmission interruption unit (a stopper (25) and an engaging portion (26)) for interrupting power transmission from a motor (28) to the rotary disk (13) in a safety valve operation range to stop rotation of the rotary disk in the safety valve operation range. Moreover, an adhesion varying unit (a spring member (27) and a carriage

lifting-lowering cam unit) for varying adhesion of the rotary disk (13) to the fixed disk (14) is further provided, and the adhesion of the rotary disk (13) to the fixed disk (14) in a flow rate control range is lessened from that in the safety valve operation range, so that friction to be produced between the rotary disk (13) and the fixed disk (14) can be suppressed in the flow rate control range.

Fig. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a gas control valve which controls a supply amount of a fuel gas to a gas burner of gas equipment.

BACKGROUND ART

[0002] In general, a flow rate control valve for controlling a gas supply flow rate and a safety valve for blocking gas supply are arranged in series in gas equipment such as a gas stove.

[0003] Conventionally, there has been proposed a gas valve in which open-close operations of a flow rate control valve and a safety valve are performed with one motor (for example, see Patent Literature 1). In the gas valve disclosed in Patent Literature 1, a flow rate control valve includes a shutoff-function-provided rotating member to prohibit gas communication in a given rotational angular range of a motor. The rotating member includes a rotary disk which is linked to a motor rotary shaft and a fixed disk which has a plurality of communication holes whose sizes are different to each other for

[0004] controlling a gas flow rate.

[0005] The rotational angular range of the motor in which gas communication is prohibited is a range from starting of advancing of an operation rod which holds the safety valve to retracting thereof. In the gas valve in Patent Literature 1, first, owing to rotation of the motor, the operation rod is advanced along with rotation of the rotary disk and the safety valve is opened. Subsequently, the operation rod is retracted by further rotating the motor while the safety valve is kept in an opened state by an electromagnet. During the above, a communication port of the rotary disk and a communication port of the fixed disk are prevented from being matched in position to prevent a gas from flowing through the flow rate control valve. Subsequently, when the motor is further rotated, the communication port of the rotary disk and the communication port, having any of sizes, of the fixed disk are matched in position and gas communication through the flow rate control valve is allowed.

[0006] Patent Literature 1: Japanese Patent Application Laid-Open No. 2002-323218

SUMMARY OF THE INVENTION

[0007] The gas valve disclosed in Patent Literature 1 has a structure that the rotary disk is rotated along with the rotation of the motor and both the safety valve and the flow rate control valve are operated in accordance with rotation of the rotary disk. Here, the rotary disk is rotated continuously even when the safety valve is operated as well as when the flow rate control valve is operated. The rotary disk and the fixed disk are configured to be contacted tightly to each other at closing faces with

a coil spring to prevent a gas from leaking to the downstream side through a gap between the disks. Here, friction is produced between the rotary disk and the fixed disk continuously in operation of each of the safety valve and the flow rate control valve. Accordingly, there has been a problem that wear thereat deteriorates reliability of the closing faces.

[0008] To address the above issue, an object of the present invention is to suppress wear at the closing faces while reducing friction to be produced between the rotary disk and the fixed disk.

[0009] To resolve the abovementioned problem, the present invention provides a gas control valve configured to perform open-close operations of a flow rate control valve and a safety valve with one motor. Here, the gas control valve includes a rotary disk and a fixed disk as a shutoff-function-provided rotating member to prohibit gas communication through the flow rate control valve in a safety valve operation range, and a transmission interruption unit for interrupting power transmission from the motor to the rotary disk in the safety valve operation range.

[0010] In another aspect of the present invention, an adhesion varying unit for varying adhesion of the rotary disk to the fixed disk is further provided, so that the adhesion is caused to differ between in the safety valve operation range and in a flow rate control range.

[0011] According to the present invention structured as described above, the rotation of the rotary disk is stopped in the safety valve operation range. Accordingly, friction between the rotary disk and the fixed disk is prevented from being produced and wear at the closing faces between both the disks can be prevented.

[0012] According to the other aspect of the present invention, adhesion of the rotary disk to the fixed disk in the flow rate control range can be lessened from that in the safety valve operation range. During operation of the safety valve, it is required to enlarge adhesion at the closing faces to prevent a gas from leaking to the downstream side through a gap between the rotary disk and the fixed disk just in case. Here, since the rotary disk is stopped, disk friction is prevented from being produced even when the adhesive is enlarged and wear at the closing faces can be prevented. In contrast, during operation of the flow rate control valve, the adhesion between the rotary disk and the fixed disk can be lessened to some extent as supplying the gas. Since the adhesive is small, friction to be produced between the rotary disk and the fixed disk is lessened even when the rotary disk is rotated and wear at the closing faces between both the disks can be suppressed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is a schematic view illustrating main structure of a gas control valve according to an embodiment.

FIG. 2 is a sectional view of the gas control valve according to the present embodiment.

FIG. 3 is a sectional view at A-A of the gas control valve in FIG. 2.

FIG. 4 is a view illustrating a structural example of a distance varying unit provided in the gas control valve according to the present embodiment.

FIG. 5 is a view illustrating operational states of the distance varying unit according to the present embodiment.

FIG. 6 is a timing chart illustrating an operational example of the gas control valve according to the present embodiment.

FIG. 7 is a view illustrating states of the gas control valve at respective timings indicated by I) to V) in the timing chart of FIG. 6.

FIG. 8 is a view illustrating states of the gas control valve at respective timings indicated by I) to III) and *1 in the timing chart of FIG. 6.

FIG. 9 is a view illustrating states of the gas control valve at respective timings indicated by I), IV), V), *2, and *3 in the timing chart of FIG. 6.

FIG. 10 is a view illustrating states of the gas control valve at respective timings indicated by I) and II) in the timing chart of FIG. 6.

EMBODIMENT OF THE INVENTION

[0014] In the following, an embodiment of the present invention will be described with reference to the drawings. FIG. 1 is a schematic view illustrating a main structure of a gas control valve 1 according to the present embodiment. The gas control valve 1 of the present embodiment is applied to gas equipment such as a gas stove as including a flow rate control valve 11 for controlling a gas supply flow rate and a safety valve 12 for blocking gas supply.

[0015] The gas control valve 1 of the present embodiment is configured to perform open-close operations of the flow rate control valve 11 and the safety valve 12 with a single motor 28. The flow rate control valve 11 includes a shutoff-function-provided rotating member to prohibit gas communication in a safety valve operation range being a rotational angular range in which the safety valve 12 is operated. The shutoff-function-provided rotating member includes a rotary disk 13 which is rotated along with rotation of the motor 28 and a fixed disk 14 which is arranged as being opposed to the rotary disk 13.

[0016] The safety valve 12 includes a magnet case 16. The magnet case 16 accommodates an electromagnet which is magnetized based on a signal from a control circuit 29 and a sticking piece to be stuck thereto. A valve body 17 protruded to the downstream side from the magnet case 16 is linked to the sticking piece. In a state that the safety valve 12 is closed, the valve body 17 blocks a gas passage in a state of being urged to the downstream side by a return spring (not illustrated).

[0017] An opening operation of the safety valve 12 is

performed with an operation rod 18 which is movable in a front-back direction of the gas passage (lateral direction in FIG. 1). The operation rod 18 is moved to the upstream side by a link member 20 which is rotated along with the motor 28 and pushes the valve body 17, so that the gas passage is in an opened state. That is, the safety valve 12 is in an opened state.

[0018] The link member 20 is configured to operate the safety valve 12 by advancing and retracting the operation rod 18 urged to the downstream side by a spring 19 in the front-back direction of the gas passage. That is, when the motor 28 is rotated, the link member 20 is rotated as being interlocked therewith and the operation rod 18 is advanced to the upstream side by a link lever portion (not illustrated) protruded toward the operation rod 18 to open the safety valve 12. Subsequently, the operation rod 18 is retracted by rotating the motor 28 in the opposite direction while the safety valve 12 is kept in the opened state with the electromagnet in the magnet case 16 magnetized with a signal from the control circuit 29.

[0019] The safety valve operation range denotes a rotational angular range of the motor 28 from starting of advancing of the operation rod 18 to retracting thereof to the original position. Here, when magnetizing of the electromagnet is cancelled with a signal from the control circuit 29, the valve body 17 is moved to the downstream side with a force of the return spring and the safety valve 12 returns into the closed state.

[0020] A fixed-side communication port 15 having constant opening area is formed at the fixed disk 14. Meanwhile, a rotating-side communication port (not illustrated) whose opening area is gradually varied along a circumferential direction is formed at the rotary disk 13. When the rotary disk 13 is rotated to match a position of the rotating-side communication port with a position of the fixed-side communication port 15, gas supplied from the upstream side (right side in FIG. 1) of the safety valve 12 flows toward a gas burner (not illustrated) (upward in FIG. 1) via the rotating-side communication port and the fixed-side communication port 15. A flow rate control range denotes a rotational angular range of the motor 28 in which gas communication is allowed between the rotary disk 13 and the fixed disk 14.

[0021] Further, the gas control valve 1 of the present embodiment includes a carriage member 21, between the link member 20 and the rotary disk 13, which transmits power from the motor 28 to the rotary disk 13 as being rotated along with the link member 20. A power transmission shaft 22 is arranged on a face of the carriage member 21 at the side of the rotary disk 13. Meanwhile, a power transmission bearing 23 is arranged on a face of the rotary disk 13 at the side of the carriage member 21. A part of the power transmission shaft 22 at the top end side is inserted to the power transmission bearing 23. The power transmission shaft 22 is configured to be movable in the upper-lower direction at the inside of the power transmission bearing 23.

[0022] Further, the gas control valve 1 of the present

embodiment includes a transmission interruption unit for interrupting power transmission from the motor 28 to the rotary disk 13 in the safety valve operation range. For example, the transmission interruption unit includes a stopper 25 which is arranged at a case 24 of the gas control valve 1 and an engaging portion 26 which is arranged at the carriage member 21 to stop rotation of the carriage member 21 as being engaged with the stopper 25.

[0023] According to the transmission interruption unit arranged as described above, in the safety valve operation range, rotation of the carriage member 21 is stopped and the link member 20 is solely rotated independently from the carriage member 21, so that the safety valve 12 is operated. In contrast, in the flow rate control range being a range in which the flow rate control valve 11 is operated by the motor 28, the carriage member 21 is rotated as being interlocked with the link member 20 and transmits power of the motor 28 to the rotary disk 13.

[0024] Further, the gas control valve 1 of the present embodiment further includes an adhesion varying unit for varying adhesion of the rotary disk 13 to the fixed disk 14, so that adhesion in the safety valve operation range and adhesion in the flow rate control range are caused to differ to each other. It is preferable that the adhesion is maximized in the safety valve operation range and is minimized in the flow rate control range.

[0025] For example, the adhesion varying unit includes a spring member 27 arranged between the carriage member 21 and the rotary disk 13 and a distance varying unit for varying a distance between the carriage member 21 and the rotary disk 13. When the distance between the carriage member 21 and the rotary disk 13 is shortened by the distance varying unit, the spring member 27 is compressed and an urging force to the rotary disk 13 is enlarged. Accordingly, the adhesion of the rotary disk 13 to the fixed disk 14 is enlarged.

[0026] In contrast, when the distance between the carriage member 21 and the rotary disk 13 is enlarged by the distance varying unit, the spring member 27 is extended and the urging force to the rotary disk 13 is lessened. Accordingly, the adhesion of the rotary disk 13 to the fixed disk 14 is lessened. A detailed structural example of the distance varying unit will be described later.

[0027] FIGs. 2 to 5 are views illustrating a specific structural example of the gas control valve 1 of the present embodiment. FIG. 2 is a sectional view of the gas control valve 1 of the present embodiment. FIG. 3 is a sectional view at A-A of the gas control valve 1 in FIG. 2. FIG. 4 is a view illustrating a structural example of the distance varying unit provided in the gas control valve 1 of the present embodiment. FIG. 5 is a view illustrating operational states of the distance varying unit. In FIGs. 2 to 5, the same reference is given to a structural element having the same function as a structural element illustrated in FIG. 1.

[0028] As illustrated in FIGs. 2 and 3, the link member 20 is linked to a motor rotary shaft 31 to be rotated along

with rotation of the motor 28. The carriage member 21 is linked to the link member 20 to be rotated along with rotation of the motor 28 via the link member 20. A carriage lifting-lowering cam unit 32 as the distance varying unit is arranged at the link member 20 and the carriage member 21. The carriage lifting-lowering cam unit 32 also has a function to link the link member 20 and the carriage member 21.

[0029] As illustrated in FIGs. 4 and 5, the carriage lifting-lowering cam unit 32 includes a link cam portion 32a which is arranged at one face of the link member 20 (a face opposed to the carriage member 21) and a carriage cam portion 32b which is arranged at one face of the carriage member 21 (a face opposed to the link member 20).

[0030] The link cam portion 32a includes two concave portions formed along a circumferential direction of the link member 20. One end of the concave portion is formed as an approximately perpendicular face and the other end thereof is formed as an inclined face (taper face) having a predetermined angle. The carriage cam portion 32b includes two convex portions formed along a circumferential direction of the carriage member 21. One end of the convex portion is formed as an approximately perpendicular face and the other end is formed as an inclined face (taper face) having a predetermined angle.

[0031] The concave portions of the link cam portion 32a and the convex portions of the carriage cam portion 32b are formed approximately the same in size and the taper faces thereof have approximately the same inclination as well. Here, as illustrated in FIG. 5(a), the link cam portion 32a and the carriage cam portion 32b are just-fitted to each other, so that the link member 20 and the carriage member 21 are rotated as being interlocked with each other. That is, in a state that the link member 20 and the carriage member 21 are rotated as being interlocked with each other without the engaging portion 26 of the carriage member 21 engaged with the case 24, the link cam portion 32a and the carriage cam portion 32b are fitted to each other and the carriage member 21 is in a lowered state as illustrated in FIG. 5(a).

[0032] Further, the taper face formed at the link cam portion 32a and the taper face formed at the carriage cam portion 32b are arranged to be opposed to each other. When predetermined or larger forces are exerted along the taper faces in mutually opposite directions, the carriage cam portion 32b is slid along the taper face to be raised onto a flat portion where the link cam portion 32a of the link member 20 is not formed, as illustrated in FIG. 5(b). Thus, the carriage member 21 is to be in a lifted state. Here, the spring member 27 is in a compressed state compared to the lowered state in FIG. 5(a).

[0033] That is, in the present embodiment, in a case that the carriage member 21 is not to be rotated even when the motor 28 is rotated owing to that the engaging portion 26 of the carriage member 21 is engaged with the stopper 25 of the case 24, the link member 20 is in a state of being solely rotatable independently from the

carriage member 21. In this case, the engagement of the carriage lifting-lowering cam unit 32 is released and the carriage cam portion 32b is raised onto the flat portion of the link member 20, so that the carriage member 21 is to be in the lifted state.

[0034] As illustrated in FIGs. 2 and 3, in the present embodiment, the motor rotary shaft 31 being at the rotational center of the link member 20 and the carriage member 21 does not exist on an extension line of a rod movement axis 33 on which the operation rod 18 moves in the front-back direction of the gas passage. The motor rotary shaft 31 is arranged at a position being offset from the rod movement axis 33. The link member 20 linked to the motor rotary shaft 31 includes a link lever portion 20a which is protruded toward the rod movement axis 33. When the link member 20 is rotated along with the motor 28, the link lever portion 20a performs a pushing operation on a slider 34 and the operation rod 18 linked to the slider 34 is to be advanced and retracted in the front-back direction of the gas passage.

[0035] As described above, the valve body 17 of the safety valve 12 is arranged ahead (at the upstream side) of the operation rod 18. Owing to that the moved operation rod 18 pushes the valve body 17, the gas passage is in an opened state. An electromagnet 35 for keeping the safety valve 12 in the opened state is arranged further ahead the valve body 17.

[0036] Next, operations of the gas control valve 1 of the present embodiment structured as described above will be described. FIGs. 6 to 10 are views illustrating operational examples of the gas control valve 1 of the present embodiment. Among the above, FIG. 6 is a timing chart. Further, FIGs. 7 to 10 are views illustrating states of the gas control valve 1 at respective timings indicated by I) to V) and *1 to *3 in the timing chart of FIG. 6.

[0037] First, as illustrated in FIG. 6(e), the motor 28 is rotated in reverse (CCW) at timing I). Right after starting of rotation of the motor 28, the link lever portion 20a is not abutted to the slider 34 (see FIG. 8-I), so that the operation rod 18 is not moved to the upstream side as illustrated in FIG. 6(d). Accordingly, the valve body 17 of the safety valve 12 is in the closed state as illustrated in FIG. 6(c) (see FIG. 8-I)).

[0038] Further, at timing I), the link cam portion 32a and the carriage cam portion 32b are fitted to each other, so that the carriage lifting-lowering cam unit 32 is in the lowered state as illustrated in FIG. 6 (b) (see FIGs. 7-I and 10-I)). Further, as illustrated in FIG. 9-I), the fixed-side communication port 15 arranged at the fixed disk 14 and the rotating-side communication port 41 arranged at the rotary disk 13 are completely deviated in position. Accordingly, as illustrated in FIG. 6(a), the flow rate control valve 11 is completely in a closed state.

[0039] Subsequently, when the motor 28 continues to be rotated in reverse, the engaging portion 26 of the carriage member 21 is abutted to and engaged with the stopper 25 of the case 24 and the rotation of the carriage member 21 is stopped. When the motor 28 further con-

tinues to be rotated in reverse from the above state, the link member 20 solely continues to be rotated independently from the carriage member 21 which is in a stopped state. In this case, as illustrated at an early stage of *2 in FIG. 6(b), the carriage cam portion 32b is slid along the taper face and is raised onto the flat portion of the link member 20, so that the carriage lifting-lowering cam unit 32 is in the lifted state (see FIGs. 7-II and 10-II)).

[0040] When the carriage lifting-lowering cam unit 32 is in the lifted state, the spring member 27 arranged between the carriage member 21 and the rotary disk 13 is in the compressed state. That is, as illustrated in FIGs. 10-I) and 10-II), a length d2 of the spring member 27 while the carriage lifting-lowering cam unit 32 is in the lifted state is smaller than a length d1 of the spring member 27 while the carriage member 32 is in the lowered state. Accordingly, a stronger force is exerted from the spring member 27 to the rotary disk 13. As a result, the adhesion of the rotary disk 13 to the fixed disk 14 becomes larger than that when the carriage lifting-lowering cam unit 32 is in the lowered state.

[0041] Further, when the link member 20 is solely rotated independently from the carriage member 21 and the link lever portion 20a pushes the slider 34 owing to the rotation of the link member 20, the operation rod 18 is moved to the upstream side as illustrated at an early stage of *1 in FIG. 6(d). As a result, the safety valve 12 is shifted into the opened state as illustrated in FIG. 6(c) (see FIG. 8-II)). Owing to that the electromagnet 35 is magnetized with a signal from the control circuit 29 in the above state, the safety valve 12 is kept in the opened state.

[0042] Next, the rotation of the motor 28 is switched to a forward rotation (CW) at timing II) in FIG. 6 (e) while keeping the safety valve 12 in the opened state with the force of the electromagnet 35. Accordingly, as illustrated at a later stage of *1 in FIG. 6(d), the operation rod 18 is retracted to the downstream side. Further, as illustrated at a later stage of *2 in FIG. 6(b), the carriage cam portion 32b is slid along the taper face in the direction opposite to the above. As a result, the link cam portion 32a and the carriage cam portion 32b are fitted to each other, so that the carriage lifting-lowering cam unit 32 is in the lowered state (see FIGs. 7-III and 10-I)).

[0043] In the above operations, the rotational angular range of the motor 28 from starting of advancing of the operation rod 18 to the upstream side to retracting thereof to the original position is denoted as the safety valve operation range indicated by *1 in FIGs. 6 and 8. Further, from starting of lifting of the carriage cam portion 32b along the taper face to be in the lifted state to subsequent lowering thereof along the taper face to be in the lowered state again, the rotation of the carriage member 21 is stopped and the link member 20 is solely rotated. Here, the power of the motor 28 is not transmitted to the rotary disk 13 via the carriage member 21. Such a rotational angular range is denoted as a power non-transmission range indicated by *2 in FIGs. 6 and 9.

[0044] After passing through the power non-transmission range, the motor 28 continues to be rotated forwardly (CW). Then, as illustrated in FIGs. 7-IV) and 9-IV), a part of the fixed-side communication port 15 formed at the fixed disk 14 and a part of the rotating-side communication port 41 formed at the rotary disk 13 are matched in position. Thus, as illustrated in FIG. 6(a), the flow rate control valve 11 is shifted into a state of allowing gas communication at a minimum flow rate (see FIG. 7-IV)). When the motor 28 further continues to be forwardly rotated, communicated area between the fixed-side communication port 15 and the rotating-side communication port 41 are increased and the gas flow rate is increased accordingly. Timing V) indicated respectively in FIGs. 6, 7, and 9 indicates a state in which the gas flow rate allowed with the communication is maximized.

[0045] The rotational angular range of the motor 28 while the gas communication is allowed (between the minimum state and the maximum state of the gas flow rate) with the fixed-side communication port 15 and the rotating-side communication port 41 matched in position is denoted as the flow rate control range indicated by *3 in FIGs. 6 and 9. As is clear from FIG. 6, the flow rate control range indicated by *3 is considerably larger than the safety valve operation range indicated by *1.

[0046] As described above in detail, in the present embodiment, in the gas control valve 1 including the rotary disk 13 and the fixed disk 14 as the shutoff-function-provided rotating member to prohibit gas communication through the flow rate control valve 11 in the safety valve operation range, the transmission interruption unit (the stopper 25 and the engaging portion 26) is arranged to interrupt power transmission from the motor 28 to the rotary disk 13 in the safety valve operation range.

[0047] Owing to arranging the transmission interruption unit, the rotation of the rotary disk 13 is stopped in the safety valve operation range. Accordingly, friction between the rotary disk 13 and the fixed disk 14 is prevented from being produced and wear at closing faces between both the disks can be prevented.

[0048] Further, the present embodiment includes the adhesion varying unit (the spring member 27 and the carriage lifting-lowering cam unit 32) for varying adhesion of the rotary disk 13 to the fixed disk 14. In the safety valve operation range, the carriage lifting-lowering cam unit 32 is in the lifted state as compressing the spring member 27 and the adhesion is maximized accordingly. In contrast, in the flow rate control range, the carriage lifting-lowering cam unit 32 is in the lowered state as extending the spring member 27 and the adhesion is minimized accordingly.

[0049] During operation of the safety valve 12, it is required to enlarge adhesion at the closing faces to prevent a gas from leaking to the downstream side through a gap between the rotary disk 13 and the fixed disk 14 just in case. In the present embodiment, since the rotary disk 13 is stopped in the safety valve operation range, disk friction is prevented from being produced even when the

adhesive is enlarged and wear at the closing faces can be prevented.

[0050] In contrast, in the flow rate control range in which the flow rate control valve 11 is operated, the adhesion between the rotary disk 13 and the fixed disk 14 can be lessened to some extent as supplying the gas actually. Since the adhesive is small, friction to be produced between the rotary disk 13 and the fixed disk 14 is lessened even when the rotary disk 13 is rotated and wear at the closing faces between both the disks can be suppressed.

[0051] In the abovementioned embodiment, the power non-transmission range is set larger than the safety valve operation range as illustrated in FIG. 6. However, the present invention is not limited thereto. For example, it is also possible that the safety valve operation range and the power non-transmission range are set to have the same largeness.

[0052] Further, in the description of the abovementioned embodiment, both the transmission interruption unit and the adhesion varying unit are arranged. However, the present invention is not limited thereto. For example, it is also possible to include only the transmission interruption unit while adhesive of the rotary disk 13 to the fixed disk 14 remains the same as the adhesion when the carriage lifting-lowering cam unit 32 is in the lifted state. In this case, it is possible to suppress friction to be produced between the disk 13 and the fixed disk 14 at least in the safety valve operation range.

[0053] Further, the abovementioned embodiment is exemplified with an example that the motor rotary shaft 31 and the rod movement axis 33 are arranged offset in position and the motor 28 is rotated in two directions as being forward rotation and reverse rotation. However, the present invention is not limited thereto. That is, the motor rotary shaft 31 and the rod movement axis 33 are not necessarily arranged offset in position and the motor 28 may be rotated in one direction, as long as the transmission interruption unit and the adhesion varying unit are arranged.

[0054] Each of the abovementioned embodiments is simply a specific example to actualize the present invention. The technical scope of the present invention should not be construed to be limited thereto. The present invention can be actualized variously without departing from the substance or the main features thereof.

Claims

1. A gas control valve configured to perform, with one motor, open-close operations of a flow rate control valve for controlling a gas supply flow rate and a safety valve for blocking gas supply, wherein the flow rate control valve includes a shutoff-function-provided rotating member to prohibit gas communication in a safety valve operation range being a rotational angular range in which the safety

valve is operated by the motor,
the shutoff-function-provided rotating member includes a rotary disk which is rotated along with rotation of the motor and a fixed disk which is arranged as being opposed to the rotary disk, and
a transmission interruption unit is provided for interrupting power transmission from the motor to the rotary disk in the safety valve operation range.

2. The gas control valve according to claim 1, further comprising an adhesion varying unit for varying adhesion of the rotary disk to the fixed disk, so that adhesion in the safety valve operation range and adhesion in a flow rate control range being a rotational angular range in which the flow rate control valve is operated by the motor are caused to differ to each other. 10
3. The gas control valve according to claim 2, wherein the adhesion is maximized in the safety valve operation range and is minimized in the flow rate control range. 20
4. The gas control valve according to claim 2 or claim 3, further comprising a carriage member to transmit power from the motor to the rotary disk as being rotated along with a link member which operates the safety valve by advancing and retracting an operation rod as being rotated along with the motor, the carriage member being arranged between the link member and the rotary disk, 30
wherein the adhesion varying unit includes a spring member which is arranged between the carriage member and the rotary disk, and a distance varying unit for varying a distance between the carriage member and the rotary disk. 35
5. The gas control valve according to claim 1, further comprising a carriage member arranged between the link member and the rotary disk to transmit power from the motor to the rotary disk as being rotated along with a link member which operates the safety valve by advancing and retracting an operation rod as being rotated along with the motor, 40
wherein the transmission interruption unit includes a stopper which is arranged at a case of the gas control valve and an engaging portion which is arranged at the carriage member so that the engaging portion stops rotation of the carriage member by being engaged with the stopper. 45 50
6. The gas control valve according to claim 5, wherein the adhesion varying unit includes a spring member which is arranged between the carriage member and the rotary disk, and a distance varying unit for varying a distance between the carriage member and the rotary disk. 55

7. The gas control valve according to claim 6, wherein the distance varying unit includes a carriage lifting-lowering cam unit which is arranged at the link member and the carriage member, and 5
the carriage lifting-lowering cam unit is in a lifted state when the rotation of the carriage member is stopped by the engaging member being engaged with the stopper and is in a lowered state when the engaging portion is not engaged with the stopper.
8. The gas control valve according to claim 7, wherein the carriage lifting-lowering cam unit includes a link cam portion arranged at the link member and a carriage cam portion arranged at the carriage member, and 15
the carriage member is caused to be rotatable along with the link member by the link cam portion and the carriage cam portion being engaged when the carriage lifting-lowering cam unit is in the lowered state, while the link member is caused to be rotatable independently from the carriage member by the link cam portion and carriage cam portion being disengaged when the carriage lifting-lowering cam unit is in the lifted state. 25 30 35 40 45 50 55

Fig. 1

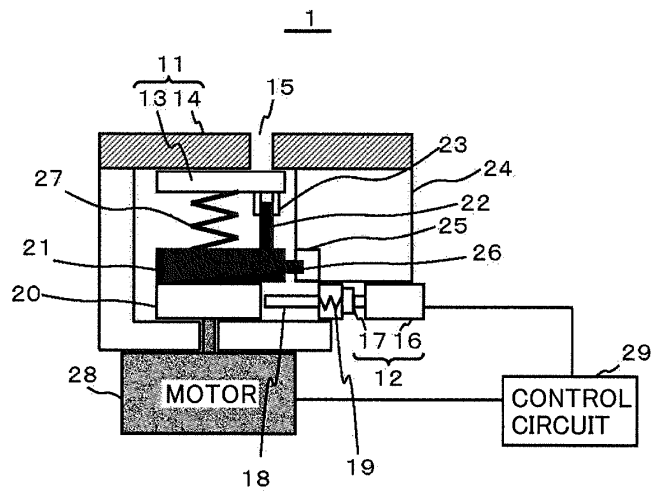


Fig. 2

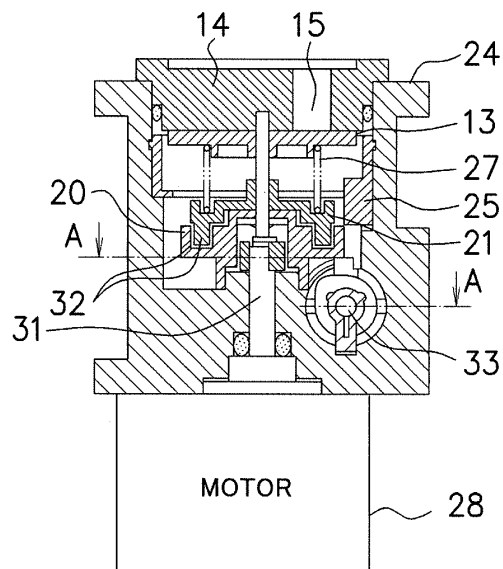


Fig. 3

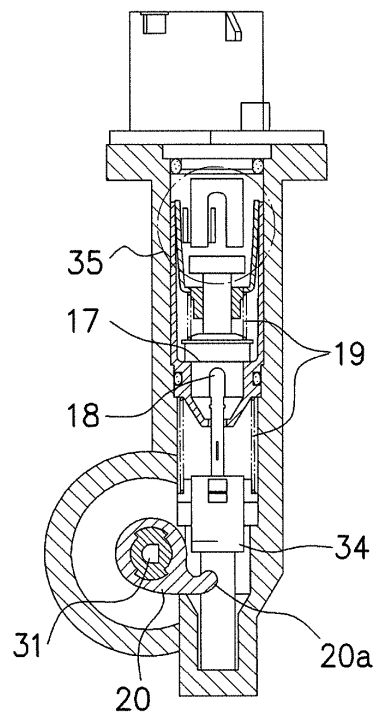


Fig. 4

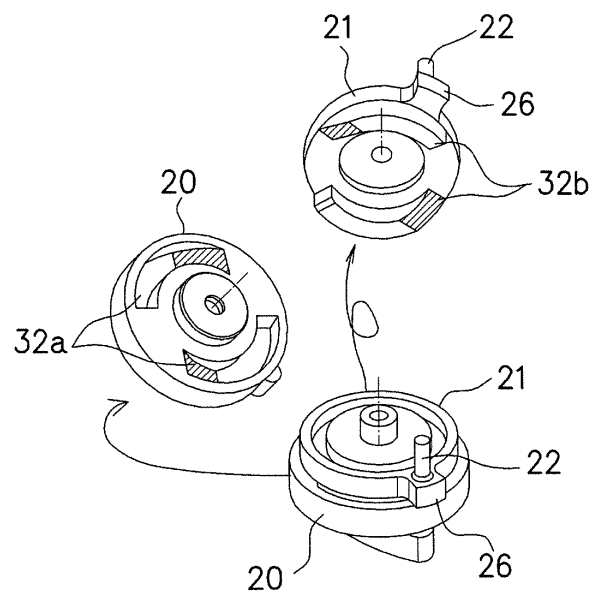


Fig. 5

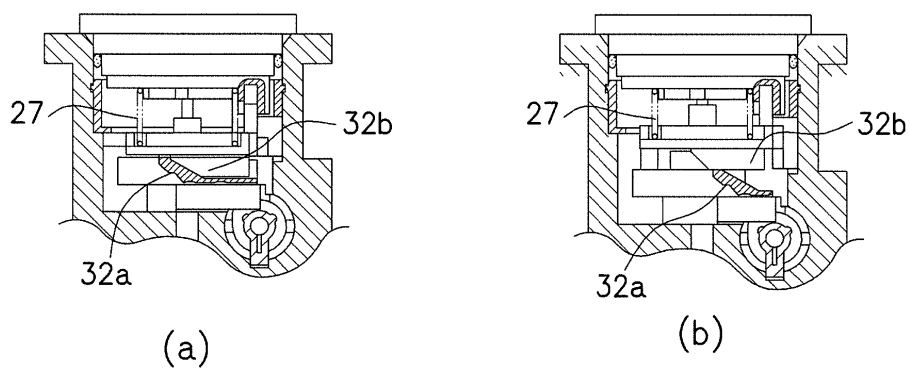


Fig. 6

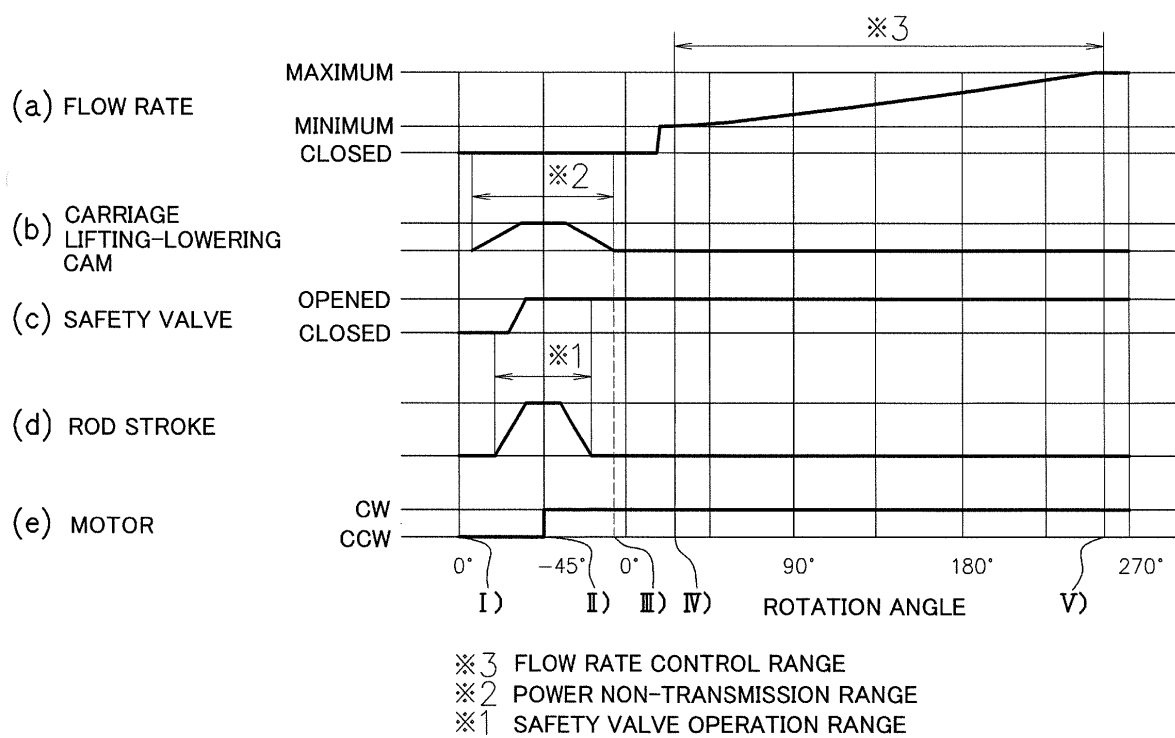


Fig. 7

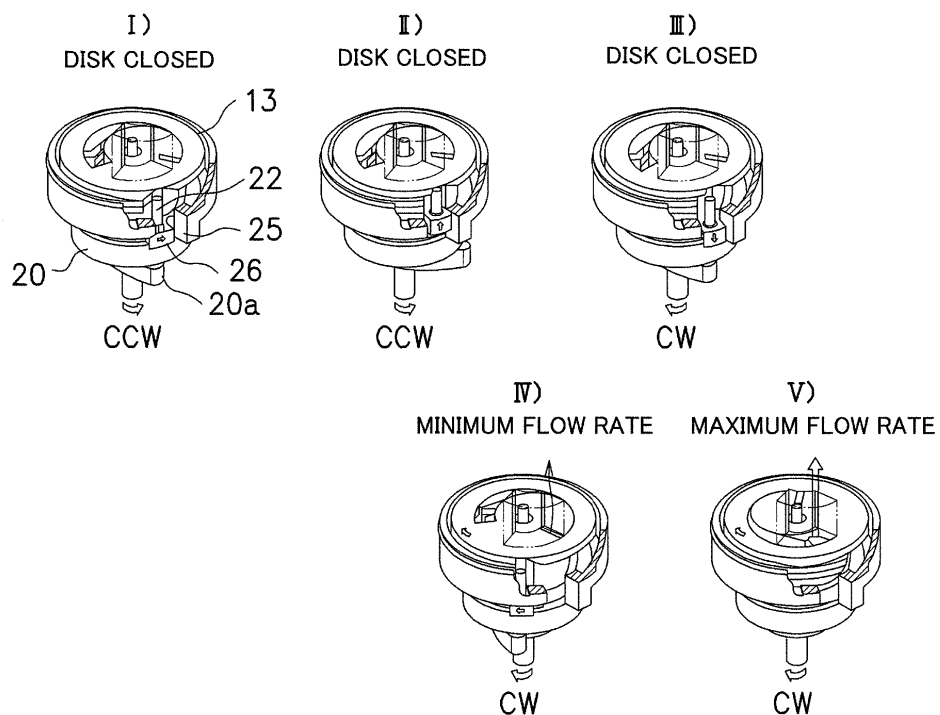


Fig. 8

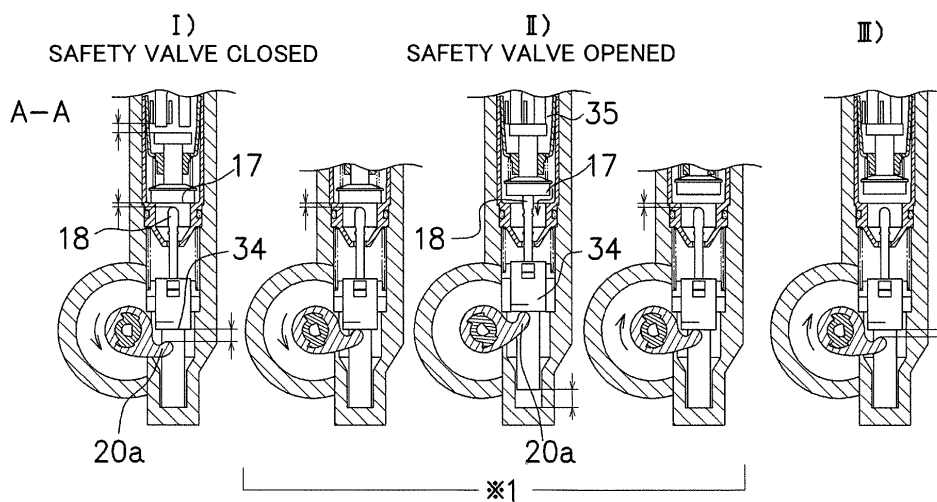


Fig. 9

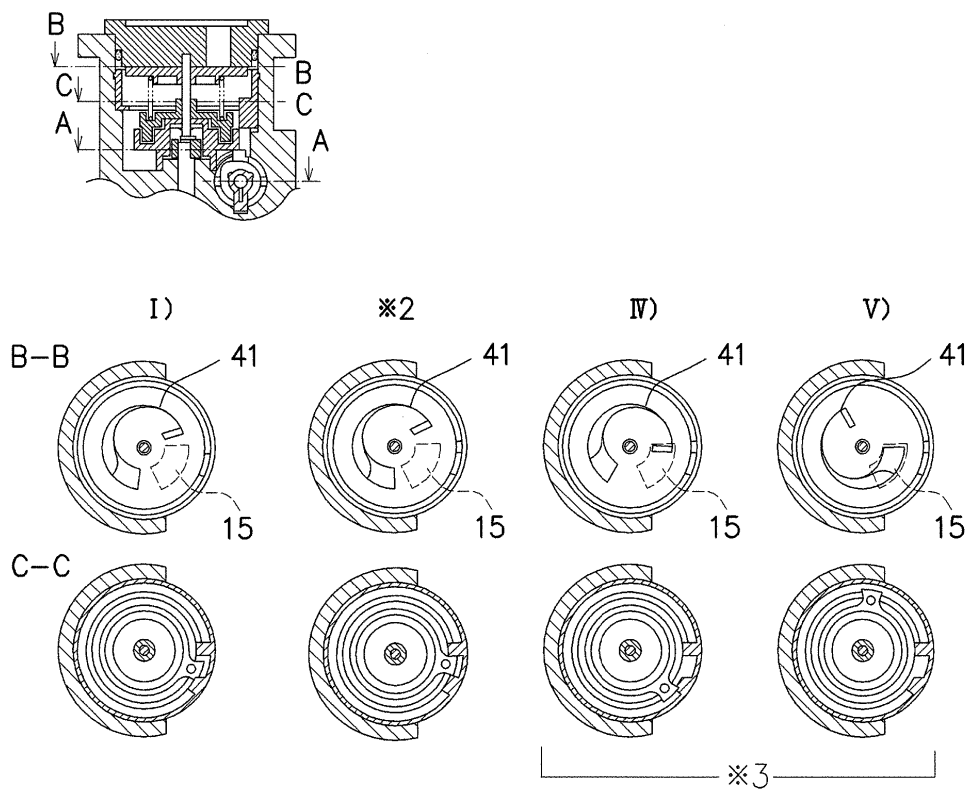
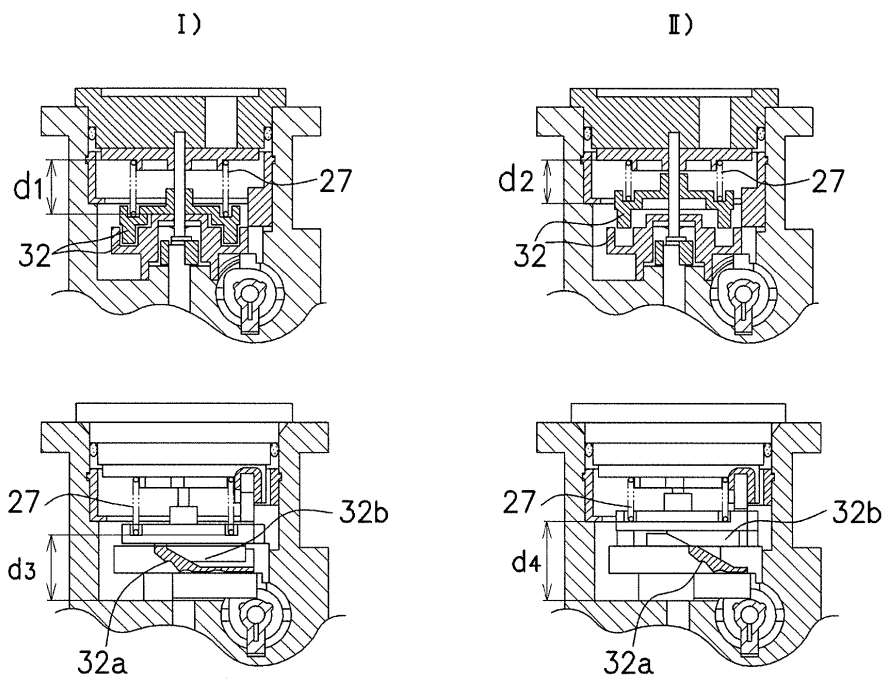


Fig. 10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/058957

A. CLASSIFICATION OF SUBJECT MATTER

F23K5/00 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F23K5/00

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2010-266151 A (Rinnai Corp.), 25 November 2010 (25.11.2010), paragraphs [0018] to [0030]; fig. 1 to 5 (Family: none)	1, 5 2-4, 6-8
A	JP 2008-64210 A (Matsushita Electric Industrial Co., Ltd.), 21 March 2008 (21.03.2008), entire text; all drawings (Family: none)	1-8
A	JP 2011-196416 A (Rinnai Corp.), 06 October 2011 (06.10.2011), entire text; all drawings (Family: none)	1-8

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

17 June, 2013 (17.06.13)

Date of mailing of the international search report

25 June, 2013 (25.06.13)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/058957

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
10 A	JP 2005-261066 A (Rinnai Corp.), 22 September 2005 (22.09.2005), entire text; all drawings & US 2005/0199844 A1 & EP 1582790 A1 & DE 602005002858 D & TW 266017 B & KR 10-2006-0044316 A & CN 1667308 A	1-8
15 A	JP 2006-215778 A (Rinnai Corp.), 17 August 2006 (17.08.2006), entire text; all drawings (Family: none)	1-8
20 A	JP 2004-101077 A (Rinnai Corp.), 02 April 2004 (02.04.2004), entire text; all drawings (Family: none)	1-8
25 A	JP 2002-303418 A (Rinnai Corp.), 18 October 2002 (18.10.2002), entire text; all drawings (Family: none)	1-8
30 A	JP 2002-323218 A (Rinnai Corp.), 08 November 2002 (08.11.2002), entire text; all drawings & TW 226420 B & KR 10-2002-0083414 A	1-8
35		
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/058957

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Document 1: JP 2010-266151 A (Rinnai Corp.), 25 November 2010 (25.11.2010), paragraphs [0018] to [0030]; fig. 1 to 5 (Family: none)
(Continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/058957

Continuation of Box No.III of continuation of first sheet(2)

Disclosed in Document 1 is a gas control valve which allows one motor to open and close a flow control valve for controlling the supply flow rate of a gas and a safety valve for blocking the supply of the gas, the gas control valve being adapted such that the flow control valve includes a rotating body having a closing function for not permitting communication of the gas within the operation range of the safety valve or the range of the rotational angle in which the motor actuates the safety valve, the rotating body having the closing function being made up of a rotary disk to be rotated in an interlocking manner with the motor being rotated and a stationary disk provided so as to be opposed to the rotary disk, the gas control valve including a power blocking part for blocking transmission of power from the motor to the rotary disk within the operation range of the safety valve.

Therefore, the invention of claim 1 cannot be considered to be novel in the light of the invention disclosed in the document 1, and does not have a special technical feature.

Consequently, two inventions (invention groups) each having a special technical feature indicated below are involved in claims.

Meanwhile, the invention of claim 1 having no special technical feature is classified into invention 1.

(Invention 1) the inventions of claims 1-4

[The gas control valve further including a contact force varying part for varying contact force of the rotary disk with the stationary disk, wherein the contact force within the operation range of the safety valve is different from the contact force within a flow control range that is the range of a rotational angle in which the motor actuates the flow control valve.]

(Invention 2) the inventions of claims 5-8

[The gas control valve including a carriage member between a link member and the rotary disk, the carriage member being rotated in an interlocking manner with the link member so as to transfer power from the motor to the rotary disk, the link member actuating the safety valve by being rotated in an interlocking manner with the motor so as to move a manipulation rod back and forth, the gas control valve being adapted such that the power blocking part is made up of a stopper provided in a casing of the gas control valve and an engagement part provided on the carriage member, so that the engagement part engages the stopper so as to stop the rotation of the carriage member.]

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002323218 A [0006]