Claims:

1. A flow rate control unit comprising:

(a) a housing having

a hollow cylindrical wall configured to form thereinside a flow passage that guides liquid from an upstream side toward a downstream side along a central axis of the hollow cylindrical wall,

an upstream wall disposed on the upstream side of the flow passage,

a downstream wall disposed on the downstream side of the flow passage,

an inlet opening formed in the upstream wall, and

an outlet opening formed in the downstream wall;

(b) a valve member disposed inside the hollow cylindrical wall and between the upstream wall and the downstream wall,

the valve member being moveable between a most upstream position at which a movement of the valve member toward the upstream side is restricted by the upstream wall and a most downstream position at which a movement of the valve member toward the downstream side is restricted by the downstream wall,

the valve member having a pressure receiving portion that faces the inlet opening and receives a force, in a direction toward the downstream side, from the liquid flowing into the flow passage from the inlet opening; and

(c) an elastic biasing member configured to bias the valve member toward the most upstream position and deform such that the movement of the valve member toward the downstream side increases in response to a force received at the pressure receiving portion from the liquid increases,

(d) wherein the valve member or the cylindrical wall forms a first guide flow passage that guides the liquid flowing into the flow passage from the inlet opening to the downstream side of the valve member,

(e) wherein the valve member cooperates with the downstream wall to form, between the valve member and the downstream wall, a second guide flow passage that guides the liquid from the first guide flow passage to the outlet opening,

(f) wherein the second guide flow passage cooperates with the valve member and the downstream wall to constitute a variable resistance portion that gives a resistance to the liquid passing through the second guide flow passage, the resistance increasing as the valve member moves from the upstream wall toward the downstream side,

(g) wherein the first guide flow passage extends through the valve member along a central axis of the flow passage,

(h) wherein the valve member has an inner hollow cylindrical portion extending from the upstream side toward the downstream side along the central axis and having an opening at a downstream side end portion of the valve member,

(i) wherein the downstream wall has an outer hollow cylindrical portion extending from the downstream side toward the upstream side along the central axis and having an opening at an upstream side end portion of the cylindrical portion,

(j) wherein an outer diameter of the inner hollow cylindrical portion is smaller than an inner diameter of the outer hollow cylindrical portion,

(k) the inner hollow cylindrical portion is telescopically insertable inside the outer hollow cylindrical portion and, when inserted, leaving a gap extending inside the outer hollow cylindrical portion and forming the second guide cylindrical passage between the inner hollow cylindrical portion and the outer hollow cylindrical portion, and

(l) wherein a length of the second guide flow passage increases with the

movement of the valve member from the upstream side toward the downstream side in a direction along the central axis, which in turn increases a resistance applied to the liquid passing through the second guide flow passage.

2. The flow rate control unit according to claim 1, wherein the valve member has an outer peripheral surface having a shape corresponding to an inner peripheral surface of the cylindrical wall, and the outer peripheral surface of the valve member is configured to be guided by the inner peripheral surface of the cylindrical wall when the valve member moves.

3. A flow rate control unit comprising:

(a) a housing having

a hollow cylindrical wall configured to form thereinside a flow passage that guides liquid from an upstream side toward a downstream side along a central axis of the hollow cylindrical wall,

an upstream wall disposed on the upstream side of the flow passage,

a downstream wall disposed on the downstream side of the flow passage,

an inlet opening formed in the upstream wall, and

an outlet opening formed in the downstream wall;

(b) a valve member disposed inside the hollow cylindrical wall and between the upstream wall and the downstream wall,

the valve member being moveable between a most upstream position at which a movement of the valve member toward the upstream side is restricted by the upstream wall and a most downstream position at which a movement of the valve

member toward the downstream side is restricted by the downstream wall,

the valve member having a pressure receiving portion that faces the inlet opening and receives a force, in a direction toward the downstream side, from the liquid flowing into the flow passage from the inlet opening; and

(c) an elastic biasing member configured to bias the valve member toward the most upstream position and deform such that the movement of the valve member toward the downstream side increases in response to a force received at the pressure receiving portion from the liquid increases,

(d) wherein the valve member or the cylindrical wall forms a first guide flow passage that guides the liquid flowing into the flow passage from the inlet opening to the downstream side of the valve member,

(e) wherein the valve member cooperates with the downstream wall to form, between the valve member and the downstream wall, a second guide flow passage that guides the liquid from the first guide flow passage to the outlet opening,

(f) wherein the second guide flow passage cooperates with the valve member and the downstream wall to constitute a variable resistance portion that gives a resistance to the liquid passing through the second guide flow passage, the resistance increasing as the valve member moves from the upstream wall toward the downstream side,

(g) wherein the first guide flow passage extends through the valve member along a central axis of the flow passage,

(h) wherein the valve member has an inner hollow cylindrical portion extending from the upstream side toward the downstream side along the central axis and having an opening at a downstream side end portion of the valve member,

(i) wherein the downstream wall has an outer hollow cylindrical portion extending from the downstream side toward the upstream side along the central axis and having an

opening at an upstream side end portion of the downstream wall,

(j) wherein an outer diameter of the inner hollow cylindrical portion is substantially the same as an inner diameter of the outer hollow cylindrical portion,

(k) wherein the inner hollow cylindrical portion is telescopically insertable inside the outer hollow cylindrical portion,

(l) wherein grooves that extend along the central axis to form the second guide flow passage are formed on an outer peripheral surface of the inner hollow cylindrical portion or an inner peripheral surface of the outer hollow cylindrical portion or both, and

(m) wherein a length of the second guide flow passage increases with the movement of the valve member from the upstream side toward the downstream side in a direction along the central axis, which in turn increases a resistance applied to the liquid passing through the second guide flow passage.

4. The flow rate control unit according to claim 3, wherein the valve member has an outer peripheral surface having a shape corresponding to an inner peripheral surface of the cylindrical wall, and the outer peripheral surface of the valve member is configured to be guided by the inner peripheral surface of the cylindrical wall when the valve member moves.

5. A flow rate control unit comprising:

(a) a housing having

a hollow cylindrical wall configured to form thereinside a flow passage that guides liquid from an upstream side toward a downstream side in a direction along a central axis of the hollow cylindrical wall,

an upstream wall disposed on the upstream side of the flow passage,

a downstream wall disposed on the downstream side of the flow passage,

an inlet opening formed in the upstream wall, and

an outlet opening formed in the downstream wall;

(b) a valve member disposed inside the hollow cylindrical wall and between the upstream wall and the downstream wall,

the valve member being moveable between a most upstream position at which a movement of the valve member toward the upstream side is restricted by the upstream wall and a most downstream position at which a movement of the valve member toward the downstream side is restricted by the downstream wall,

the valve member having a pressure receiving portion that faces the inlet opening and receives a force, in a direction toward the downstream side, from the liquid flowing into the flow passage from the inlet opening; and

(c) an elastic biasing member configured to bias the valve member toward the most upstream position and deform such that the movement of the valve member toward the downstream side increases in response to a force received at the pressure receiving portion from the liquid increases,

(d) wherein the valve member or the cylindrical wall forms a first guide flow passage that guides the liquid flowing into the flow passage from the inlet opening to the downstream side of the valve member,

(e) wherein the valve member cooperates with the downstream wall to form, between the valve member and the downstream wall, a second guide flow passage that guides the liquid from the first guide flow passage to the outlet opening,

(f) wherein the second guide flow passage cooperates with the valve member and

the downstream wall to constitute a variable resistance portion that gives a resistance to the liquid passing through the second guide flow passage, the resistance increasing as the valve member moves from the upstream wall toward the downstream side,

(g) wherein the first guide flow passage extends through the valve member in parallel to a central axis of the flow passage,

(h) wherein the valve member has an outer hollow cylindrical portion extending from the upstream side toward the downstream side along the central axis and having an opening at a downstream side end portion of the valve member,

(i) wherein the downstream wall has an inner hollow cylindrical portion extending from the downstream side toward the upstream side along the central axis and having an opening at an upstream side end portion of the downstream wall,

(j) wherein an inner diameter of the outer hollow cylindrical portion is larger than an outer diameter of the inner hollow cylindrical portion,

(k) the inner hollow cylindrical portion is capable of being telescopically inserted inside the outer hollow cylindrical portion and, when inserted, leaving a gap extending outside the inner hollow cylindrical portion and forming the second guide cylindrical portion between the inner hollow cylindrical portion and the outer hollow cylindrical portion, and

(l) wherein a length of the second guide flow passage increases with a movement of the valve member from the upstream side toward the downstream side in a direction along the central axis, which in turn increases a resistance applied to the liquid passing through the second guide flow passage.

6. A flow rate control unit comprising:

(a) a housing having

a hollow cylindrical wall configured to form thereinside a flow passage that guides liquid from an upstream side toward a downstream side in a direction along the central axis of the hollow cylindrical wall,

an upstream wall disposed on the upstream side of the flow passage,

a downstream wall disposed on the downstream side of the flow passage,

an inlet opening formed in the upstream wall, and

an outlet opening formed in the downstream wall;

(b) a valve member disposed inside the hollow cylindrical wall and between the upstream wall and the downstream wall,

the valve member being moveable between a most upstream position at which a movement of the valve member toward the upstream side is restricted by the upstream wall and a most downstream position at which a movement of the valve member toward the downstream side is restricted by the downstream wall,

the valve member having a pressure receiving portion that faces the inlet opening and receives a force, in a direction toward the downstream side, from the liquid flowing into the flow passage from the inlet opening; and

(c) an elastic biasing member configured to bias the valve member toward the most upstream position and deform such that the movement of the valve member toward the downstream side increases in response to a force received at the pressure receiving portion from the liquid increases,

(d) wherein the valve member or the cylindrical wall forms a first guide flow passage that guides the liquid flowing into the flow passage from the inlet opening to the downstream side of the valve member,

(e) wherein the valve member cooperates with the downstream wall to form,

between the valve member and the downstream wall, a second guide flow passage that guides the liquid from the first guide flow passage to the outlet opening,

(f) wherein the second guide flow passage cooperates with the valve member and the downstream wall to constitute a variable resistance portion that gives a resistance to the liquid passing through the second guide flow passage, the resistance increasing as the valve member moves from the upstream wall toward the downstream side,

(g) wherein the first guide flow passage extends through the valve member in parallel to a central axis of the flow passage,

(h) wherein the valve member has an outer hollow cylindrical portion extending from the upstream side toward the downstream side along the central axis and having an opening at a downstream side end portion of the valve member,

(i) wherein the downstream wall has an inner hollow cylindrical portion extending from the downstream side toward the upstream side along the central axis and having an opening at an upstream side end portion of the downstream wall,

(j) wherein an inner diameter of the outer hollow cylindrical portion is substantially the same as an outer diameter of the inner hollow cylindrical portion,

(k) wherein the inner hollow cylindrical portion is telescopically inserted inside the outer hollow cylindrical portion,

(l) wherein grooves that extend along the central axis to form the second guide flow passage are formed on an outer peripheral surface of the inner hollow cylindrical portion or an inner peripheral surface of the outer hollow or both, and

(m) wherein a length of the second guide flow passage increases with a movement of the valve member from the upstream side toward the downstream side in a direction along the central axis, which in turn increases a resistance applied to the liquid passing through the second guide flow passage.

7. A flow rate control unit, comprising:

(a) a housing defining a flow passage, the housing having

a hollow cylindrical peripheral wall extending along a central axis running in liquid flow direction,

an upstream wall disposed on an upstream side of the peripheral wall with respect to the liquid flow direction and integrally formed with the peripheral wall,

a downstream wall disposed on a downstream side of the peripheral wall with respect to the liquid flow direction and integrally formed with the peripheral wall, and

a flow passage space surrounded by the peripheral wall, the upstream wall and the downstream wall, wherein liquid flows within the flow passage space from the upstream side toward the downstream side,

(b) a valve member disposed inside the flow passage space to move along the central axis from the upstream side toward the downstream side and vice versa as the valve member is guided by the peripheral wall, and

(c) a biasing member configured to bias the valve member toward the upstream wall,

(d) wherein the upstream wall has

a restriction that protrudes radially inward from the peripheral wall toward the central axis to restrict a movement of the biased valve member from the downstream side toward the upstream side, and

an upstream side opening communicating the flow passage space with an upstream side external space on the upstream side of the upstream wall;

(e) wherein the upstream wall and the valve member are constructed such

that the liquid flowing from the upstream external space into the flow passage space hits the valve member to force the valve member from the upstream side toward the downstream side,

(f) wherein the biasing member permits the valve member to move such that a movement of the valve member in the downstream direction away from the restriction increases with an increase of a force that the valve member receives from the liquid,

(g) wherein the valve member has an upstream passage formed therein to guide the fluid in the flow passage space in the downstream direction,

(h) wherein the downstream wall has a downstream opening that guides the liquid in the flow passage space toward a downstream external space on the downstream side of the downstream wall,

(i) wherein a downstream passage is formed between the valve member and the downstream wall to communicate the upstream passage with the downstream opening,

(j) wherein the downstream passage constitutes a variable resistance portion that gives a resistance to the liquid flowing in the downstream passage, wherein a length of the downstream passage increases with an increase of a movement of the valve member in the downstream direction, which in turn increases the variable resistance against the fluid flowing in the downstream passage,

(k) wherein the variable resistance portion comprises

an upstream hollow cylindrical portion formed in the valve member and extending along the central axis toward the downstream wall,

a downstream hollow cylindrical portion formed in the downstream wall and extending along the central axis toward the valve member,

wherein the upstream hollow cylindrical portion and the downstream hollow cylindrical portion are configured such that the upstream hollow cylindrical portion moves telescopically with respect to the downstream hollow cylindrical portion in response to the movement of the valve member along the central axis and thereby increases the resistance that the liquid passing through the downstream passage receives with an increase of the movement of the valve member in the downstream direction.

8. The flow rate control unit of claim 7, wherein

in order for the upstream hollow cylindrical portion to move in and out of the downstream hollow cylindrical portion, an outer diameter of the upstream hollow cylindrical portion is smaller than an inner diameter of the downstream hollow cylindrical portion and thereby a gap is formed between an outer peripheral surface of the upstream hollow cylindrical portion and an inner peripheral surface of the downstream hollow cylindrical portion, the gap defining the variable resistance portion.

9. The flow rate control unit of claim 7, wherein

in order for the downstream hollow cylindrical portion to move in and out of the upstream hollow cylindrical portion, an inner diameter of the upstream hollow cylindrical portion is larger than an outer diameter of the downstream hollow cylindrical portion and thereby a gap is formed between an inner peripheral surface of the upstream hollow cylindrical portion and an outer peripheral surface of the downstream hollow cylindrical portion, the gap defining the variable resistance portion.

10. The flow rate control unit of claim 7, wherein

an inner diameter of the upstream hollow cylindrical portion is the same as or

substantially the same as an outer diameter of the downstream hollow cylindrical portion, and

grooves formed in at least one of the inner peripheral surface of the upstream hollow cylindrical portion and the outer peripheral of the downstream hollow cylindrical portion.

11. The flow rate control unit of claim 7, wherein

an outer diameter of the upstream hollow cylindrical portion is the same as or substantially the same as an inner diameter of the downstream hollow cylindrical portion, and

at least one groove formed in at least one of the outer peripheral surface of the upstream hollow cylindrical portion and the inner peripheral of the downstream hollow cylindrical portion.

12. A water supply apparatus comprising the flow rate control unit in any one of claims 1-11.

13. The water supply apparatus of claim 12, comprising a fine bubble generating unit incorporated on a downstream side of the flow rate control unit with respect to a liquid flowing direction in the apparatus.