Claims

[Claim 1]

A watertight structure for a flap gate including a door, the door being supported in a weight balance in which the door opens an opening portion of a floodgate in a state in which no external force other than gravity is applied, the watertight structure comprising:

a gap opening-closing member that provides a gap between a lower edge of the door and a bottom face of the floodgate in a state in which the door closes the floodgate, and opens and closes the gap by swinging in a water flow direction; and

opening operation assist means for operating the gap opening-closing member into an open state by lifting up the gap opening-closing member to an outer water side.

[Claim 2]

The watertight structure for ~~a~~ the flap gate according to claim 1, comprising closing operation assist means for operating the gap opening-closing member held in ~~an~~ the open state into a closed state by buoyancy generated when submerged in water.

[Claim 3]

The watertight structure for ~~a~~ the flap gate according to claim 1 or 2, wherein the opening operation assist means includes an assist arm that is fixed to a lower surface of the gap opening-closing member and that

extends to an inner water side relative to the gap opening-closing member, and an open state holding weight that is disposed at an inner water-side end portion of the assist arm and that brings the gap opening-closing member into an open state by lifting up the gap opening-closing member to the outer water side via a weight balance.

[Claim 4]

The watertight structure for ~~a~~ the flap gate according to claim 3, wherein ~~the~~ a closing operation assist means includes a close-contact float that is disposed at the inner water-side end portion of the assist arm and that brings the gap opening-closing member into close contact with a doorstop of the floodgate opening portion by pulling the gap opening-closing member to the inner water side by buoyancy generated when submerged in water.

[Claim 5]

The watertight structure for ~~a~~ the flap gate according to claim 3, wherein ~~the~~ a closing operation assist means includes a connection member including an end connected to the inner water-side end portion of the assist arm, and a close-contact float that is connected to another end of the connection member, that is provided on an inner water-side surface of the door in such a manner as to be capable of moving upward and downward and that along with a rise due to buoyancy generated when

submerged in water, lifts up the inner water-side end portion of the assist arm to pull the gap opening-closing member to the inner water side and thereby bring the gap opening-closing member into close contact with a doorstop of the floodgate opening portion.

[Claim 6]

The watertight structure for ~~a~~ the flap gate according to claim 1 or 2, wherein the opening operation assist means includes a lifting weight capable of moving upward and downward, and a lift-up operation section that operates the gap opening-closing member into an open state by lifting up the gap opening-closing member to the outer water side via a direction conversion mechanism that converts tension in a gravity direction generated by self-weight of the lifting weight into a force in a lift-up direction.

[Claim 7]

The watertight structure for ~~a~~ the flap gate according to claim 6, wherein the lifting weight has a floating function that makes the lifting weight rise by buoyancy generated when submerged in water along with a rise in water level.

[Claim 8]

The watertight structure for ~~a~~ the flap gate according to claim 6 or 7, wherein the lift-up operation section includes a seesaw portion that is swingably supported and that includes an end portion at which the

lifting weight is provided, and a lift-up connection portion that connects another end portion of the seesaw portion and the gap opening-closing member and that lifts up the gap opening-closing member to the outer water side.

[Claim 9]

The watertight structure for ~~a~~ the flap gate according to claim 8, wherein the lift-up connection portion includes a rigid body and further functions as closing operation assist means for operating the gap opening-closing member into a closed state by buoyancy of the lifting weights generated when submerged in water.

[Claim 10]

A flap gate comprising a door supported in a weight balance in which the door opens an opening portion of a floodgate in a state in which no external force other than gravity is applied, wherein the door includes the watertight structure for ~~a~~ the flap gate according to any one of claims 1 to 9.

[Claim 11]

The flap gate according to claim 10, wherein a gap opening-closing member receiving portion that is to be in abutment with the gap opening-closing member is provided at each of lower end corner portions of right and left side doorstop portions of a doorstop of the flap gate.

[Claim 12]

The flap gate according to claim 10 or 11, wherein a swing portion damage preventing portion that is formed in

such a manner as to extend to the outer water side continuously along an upper surface of a lower doorstop portion and that includes an upper surface that is flat and smooth is provided in a doorstop of the flap gate.