Claims:

1. A gate valve, comprising:

a body with a flow passage intersected by a gate cavity;\

a downstream seat ring at an intersection of the flow passage with the gate cavity;

a gate that is movable in the gate cavity between a closed position and an open position;

a seal member in the gate that seals against the downstream seat ring when the gate is in the closed position; and

a cam member carried by the gate and in cooperative engagement with the seal member for moving the seal member in an upstream direction in response to beginning movement of the gate from the closed position toward the open position.

2. The gate valve according to claim 1, wherein the seal member is movable in upstream and downstream directions relative to the gate.

3. The gate valve according to claim 1, wherein the seal member is movable in closing and opening directions relative to the gate.

4. The gate valve according to claim 1, wherein the cam member is movable in unison with the

gate.

5. The gate valve according to claim 1, wherein the cam member has a cam surface that engages a portion of the seal member so as to push the seal member in a direction that is between the closing direction and the upstream direction.

6. The gate valve according to claim 1, wherein the seal member comprises:

a plug located within a plug hole extending through the gate from an upstream side to a downstream side, the plug having a downstream end that contacts and seals against the downstream seat ring.

7. The gate valve according to claim 6, wherein the cam member comprises:

a key mounted to the gate for movement therewith, the key extending through a key hole in the plug that is transverse to the plug hole.

8. The gate valve according to claim 6, wherein:

the gate moves in an upward direction when opening and a downward direction when closing;

the plug is movable in the plug hole in the upward and downward directions as well as in the upstream and downstream directions;

the key hole is configured to allow the plug to move relative to the key in a downward and upstream direction and an upward and downstream direction; and

the key hole is configured to prevent the plug from moving relative to the key in an upward and upstream direction and in a downward and downstream direction.

9. A gate valve, comprising:

a body with a flow passage intersected by a gate cavity;\

a downstream seat ring at an intersection of the flow passage with the gate cavity;

a gate that is movable in the gate cavity between a lower closed position and an upper open position;

a seal member in the gate that seals against the downstream seat ring when the gate is in the closed position, the seal member being moveable in upward and direction directions as well as upstream and downstream directions relative to the gate, the seal member being in an upper and downstream position relative to the gate while the gate is in the closed position; and

a cam member carried by the gate for movement in unison therewith and in engagement with the seal member, the cam member moving the seal member to an upstream and downward position in response to initial movement of the gate from the closed position toward the open

position.

10. The gate valve according to claim 9, wherein:

the seal member is located within a seal member hole in the gate valve; and

the cam member extends through a slot provided in the seal member, the slot extending perpendicular to an axis of the seal member hole.

11. The gate valve according to claim 9, wherein:

the seal member is located within a seal member hole in the gate valve;

the cam member extends through a slot in the seal member, and comprises:

an upward and upstream flank that faces upward and upstream and is in contact with the seal member while the gate is in the closed position;

an upward and downstream flank that faces upward and downstream and is spaced from the seal member by a gap while the gate is in the closed position and contacts the seal member while the gate is moving toward and in the open position.

12. The gate valve according to claim 9, wherein the cam member comprises:

a key that inserts into a key hole formed in the seal member; wherein

the key has a triangular shape in cross-section, having first and second flanks that are parallel each other and third and fourth flanks that are parallel each other, the first flank facing upward and upstream, the second flank facing downward and downstream, the third flank facing downward and upstream, and the fourth flank facing upward and downstream;

the key hole has a triangular shape with first and second sides that are parallel to each other and third and fourth sides that are parallel to each other;

a distance between the first and second sides is substantially the same as the distance between the first and second flanks, so that the first and second sides simultaneously engage the first and second flanks; and

a distance between the third and fourth sides is greater than a distance between the third and fourth flanks, so that a gap exists between the third side and the third flanks while the fourth side is engaging the fourth flank, and a gap exists between the fourth side and the fourth flank while the third side is engaging the third flank.

13. The gate valve according to claim 9, wherein the seal member comprises a plug mounted loosely in a plug hole in the gate so as to be moveable in upward and downward directions as upstream and downstream directions relative to the gate.

14. A gate valve, comprising:

a body with a flow passage intersected by a gate cavity;\

a downstream seat ring at an intersection of the flow passage with the gate cavity;

a gate that is movable in the gate cavity between a closed position and an open position;

a plug movably mounted in a plug hole in the gate and having a downstream end dimensioned for sealing contact with the downstream seat ring when the gate is in the closed position; and

a key mounted in the gate for movement therewith and extending through a key hole in the plug that is transverse to the plug hole, the key hole and the plug hole being dimensioned such that when the gate starts to move from the closed position, the key shifts in the key hole, which causes the plug to shift in the plug hole in an upstream direction to break contact with the seat ring.

15. The gate valve according to claim 14, wherein the key is movable in the key hole in directions transverse to an axis of the key.

16. The gate valve according to claim 14, wherein the downstream end of the plug protrudes past the gate while in the closed position.

17. The gate valve according to claim 14, wherein:

the opening movement of the gate is in a first direction; and

the plug hole is larger than the plug so that when beginning to move from the closed position, the gate is movable a short distance in the first direction relative to the plug.

18. The gate valve according to claim 14, wherein:

the opening movement of the gate is in a first direction and the closing movement of the gate is in a second direction;

the key hole is larger than the key in a direction that is between the upstream and the first directions; and

the key hole snuggly receives the key in a direction that is between the downstream and the first direction, so that the initial opening movement in the first direction of the gate pushes the plug in a direction between the downstream and the second directions relative to the gate.

19. The gate valve according to claim 14, wherein:

the key has a triangular shape in cross-section, having first and second flanks that are parallel each other and third and fourth flanks that are parallel each other, the first flank facing upward and upstream, the second flank facing downward and downstream, the third flank facing downward and upstream, and the fourth flank facing upward and downstream;

the key hole has a triangular shape with first and second sides that are parallel to each other and third and fourth sides that are parallel to each other;

a distance between the first and second sides is substantially the same as the distance between the first and second flanks, so that the first and second sides simultaneously engage the first and second flanks; and

a distance between the third and fourth sides is greater than a distance between the third and fourth flanks, so that a gap exists between the third side and the third flanks while the fourth side is engaging the fourth flank, and a gap exists between the fourth side and the fourth flank while the third side is engaging the third flank.

20. The gate valve according to claim 19, wherein

the plug has a dimension between its lower side and upper side that is less than the dimension of the hole between its upper side and lower side, so as to allow upward and downward movement of the plug relative to the gate.

The invention claimed is:

1. A gate valve, comprising:

a body with a flow passage intersected by a gate cavity;

a first seat ring at an intersection of the flow passage with the gate cavity;

a second seat ring at an intersection of the flow passage with the gate cavity on an opposite side of the gate cavity from the first seat ring;

a gate that is movable in the gate cavity between a closed position and an open position;

a seal member in the gate having a first end that seals against the first seat ring when the gate is in the closed position and the first seat ring is downstream of the second seat ring relative to flow through the flow passage, the seal member having a second end that seals against the second seat ring when the gate is in the closed position and the second seat ring is downstream of the first seat ring relative to flow through the flow passage; and

a cam member carried by the gate and in cooperative engagement with the seal member for moving the seal member in an upstream direction relative to the gate in response to beginning movement of the gate from the closed position toward the open position regardless whether the seal member is sealing against the first seat ring or the second seat ring.

2. The gate valve according to claim **1**, further comprising:

a stem coupled to the gate for moving the gate between the open and closed positions, the stem having a stem axis; and

the gate being substantially centered on the stem axis both in the open position and the closed position.

3. The gate valve according to claim 1, wherein the seal member is movable in closing and opening directions relative to the gate.

4. The gate valve according to claim 1, wherein the cam member is movable in unison with the gate.

5. The gate valve according to claim 1, wherein the cam member has a cam surface that engages a portion of the seal member so as to push the seal member in a direction that is between the closing direction and the upstream direction.

6. The gate valve according to claim 1, wherein the seal member comprises:

a plug located within a plug hole extending through the gate from an upstream side to a downstream side.

7. The gate valve according to claim 6, wherein the cam member comprises:

a key mounted to the gate for movement therewith, the key extending through a key hole in the plug that is transverse to the plug hole.

8. The gate valve according to claim 7, wherein:

the gate moves in an upward direction when opening and a downward direction when closing;

the plug is movable in the plug hole in the upward and downward directions as well as in the upstream and downstream directions;

the key hole is configured to allow the plug to move relative to the key in a downward and upstream direction and an upward and downstream direction; and

the key hole is configured to prevent the plug from moving relative to the key in an upward and upstream direction and in a downward and downstream direction.

9. A gate valve, comprising:

a body with a flow passage intersected by a gate cavity;

a downstream seat ring at an intersection of the flow passage with the gate cavity;

a gate that is movable in the gate cavity between a lower closed position and an upper open position;

a seal member in the gate that seals against the downstream seat ring when the gate is in the closed position, the seal member being moveable in upward and downward directions as well as upstream and downstream directions relative to the gate, the seal member being in an upper and downstream position relative to the gate while the gate is in the closed position;

a cam member carried by the gate for movement in unison therewith and in engagement with the seal member, the cam member moving the seal member to an upstream and downward position relative to the gate in response to initial movement of the gate from the closed position toward the open position; and wherein,

the movement of the seal member caused by the cam member begins simultaneously with the initial movement of the gate.

10. The gate valve according to claim 9, wherein:

the seal member is located within a seal member hole in the gate valve; and

the cam member extends through a slot provided in the seal member, the slot extending perpendicular to an axis of the seal member hole.

11. The gate valve according to claim 9, wherein:

the seal member is located within a seal member hole in the gate valve;

the cam member extends through a slot in the seal member, and comprises:

an upward and upstream flank that faces upward and upstream and is in contact with the seal member while the gate is in the closed position;

an upward and downstream flank that faces upward and downstream and is spaced from the seal member by a gap while the gate is in the closed position and contacts the seal member while the gate is moving toward and in the open position.

12. The gate valve according to claim **9**, wherein the cam member comprises:

a key that inserts into a key hole formed in the seal member; wherein

the key has a triangular shape in cross-section, having first and second flanks that are parallel each other and third and fourth flanks that are parallel each other, the first flank facing upward and upstream, the second flank facing downward and downstream, the third flank facing downward and upstream, and the fourth flank facing upward and downstream;

the key hole has a triangular shape with first and second sides that are parallel to each other and third and fourth sides that are parallel to each other;

a distance between the first and second sides is substantially the same as the distance between the first and second flanks, so that the first and second sides simultaneously engage the first and second flanks; and

a distance between the third and fourth sides is greater than a distance between the third and fourth flanks, so that a gap exists between the third side and the third flanks while the fourth side is engaging the fourth flank, and a gap exists between the fourth side and the fourth flank while the third side is engaging the third flank.

13. The gate valve according to claim **9**, further comprising:

a stem coupled to the gate for moving the gate between the open and closed positions, the stem having a stem axis; and

the gate being substantially centered on the stem axis both in the open position and the closed position.

14. A gate valve, comprising:

a body with a flow passage intersected by a gate cavity;

a downstream seat ring at an intersection of the flow passage with the gate cavity;

a gate that is movable in the gate cavity between a closed position and an open position;

a plug movably mounted in a plug hole in the gate and having a downstream end dimensioned for sealing contact with the downstream seat ring when the gate is in the closed position; and

a key mounted in the gate for movement therewith and extending through a key hole in the plug that is transverse to the plug hole, the key hole and the plug hole being dimensioned such that when the gate starts to move from the closed position, the key shifts in the key

hole, which causes the plug to shift in the plug hole in an upstream direction to break contact with the seat ring.

15. The gate valve according to claim **14**, wherein the key is movable in the key hole in directions transverse to an axis of the key.

16. The gate valve according to claim **14**, wherein the downstream end of the plug protrudes past the gate while in the closed position.

17. The gate valve according to claim **14**, wherein:

the opening movement of the gate is in a first direction; and

the plug hole is larger than the plug so that when beginning to move from the closed position, the gate is movable a short distance in the first direction relative to the plug.

18. The gate valve according to claim **14**, wherein:

the opening movement of the gate is in a first direction and the closing movement of the gate is in a second direction;

the key hole is larger than the key in a direction that is between the upstream and the first directions; and

the key hole snuggly receives the key in a direction that is between the downstream and the first direction, so that the initial opening movement in the first direction of the gate pushes the plug in a direction between the downstream and the second directions relative to the gate.

19. The gate valve according to claim **14**, wherein:

the key has a triangular shape in cross-section, having first and second flanks that are parallel each other and third and fourth flanks that are parallel each other, the first flank facing upward and upstream, the second flank facing downward and downstream, the third flank facing downward and upstream, and the fourth flank facing upward and downstream;

the key hole has a triangular shape with first and second sides that are parallel to each other and third and fourth sides that are parallel to each other;

a distance between the first and second sides is substantially the same as the distance between the first and second flanks, so that the first and second sides simultaneously engage the first and second flanks; and

a distance between the third and fourth sides is greater than a distance between the third and fourth flanks, so that a gap exists between the third side and the third flanks while the fourth side is engaging the fourth flank, and a gap exists between the fourth side and the fourth flank while the third side is engaging the third flank.

20. The gate valve according to claim **19**, wherein

the plug has a dimension between its lower side and upper side that is less than the dimension of the hole between its upper side and lower side, so as to allow upward and downward movement of the plug relative to the gate.