CLAIMS

WHAT IS CLAIMED IS:

1. A gate valve (40) characterized by:

a body (42) with a chamber (45);

a flow passage (44) having an axis and extending through and intersecting the chamber (45);

a counterbore (54) in the flow passage (44) at the intersection with the chamber (45) defining an inward facing end face (58);

an annular seat ring (50) carried in the counterbore (54), the seat ring (50) having an outward facing endface (72) and being axially movable in the counterbore (54) between an open position with the end faces (58, 72) axially separated and a closed position with the end faces (58, 72) abutting each other;

a gate (46) in the chamber (45) and having an engaging face (80) that slidingly engages a seal face (82) on the seat (50) while being moved between open and closed positions; and

a hardcoating (70, 74) on the end faces (58,72) for sealing against each other while the seat ring (50) is in the closed position.

2. The apparatus according to claim 1, further comprising a spring element (60) between the seat ring (50) and the end face (58) of the counterbore (54), the spring element (60) urging the seat ring (50) toward the open position.

3. The apparatus according to claim 1, wherein the hardcoating (70, 74) is a cemented carbide.

4. The apparatus according to claim 1, wherein the seat ring (50) moves axially to the closed position in response to fluid pressure on a high pressure side of the flow passage (44).

5. The apparatus according to claim 1, wherein the hardcoating (70, 74) has hardness greater than the seat (50) and the body (42) of the valve (40).

6. The apparatus according to claims 1, wherein the hardcoating (70, 74) comprises:

a substrate of cemented carbide bonded to the end faces (58,72).

7. The apparatus according to claim 1, wherein the hardcoating (70, 74) comprises:

a layer comprising a cemented carbide hardfacing (70, 74) welded, coated, brazed, or glued onto the end of end faces (58,72).

8. The apparatus according to claim 1, wherein the end faces (58,72).are perpendicular to the axis.

9. The apparatus according to claim 1, wherein the hardcoating (70, 74) on each of the end faces has thickness ranging from about 0.001 inches thick to about 0.5 inches thick.

10. The apparatus according to claim 1, further comprising:

an annular recess (56) at an intersection of an outer diameter of the seat ring (50) and the end face (72) of the seat ring (50); and

a spring (60) in the recess (56) and in engagement with the end face (58) of the counterbore (54), the spring (60) urging the seat ring (50) toward the open position.

11. The apparatus according to claim 1, further comprising an annular clearance between an outer diameter of the seat ring (50) and the counterbore (54), the clearance communicating fluid in the chamber (45) to the end faces (58, 72).

12. The apparatus according to claim 1, wherein the seat ring (50) is free of any elastomeric sealing elements.

13. A method of controlling a flow of a wellbore fluid with a gate valve (40), characterized by:

providing a body (42) with a chamber (45), a flow passage (44) having an axis and extending through and intersecting the chamber (45), a counterbore (54) in the flow passage (44) at the intersection with the chamber (45) defining an inward facing end face (58), an annular downstream seat ring (50) carried in the counterbore (54), the seat ring (50) having an outward

facing endface (72) and being axially movable in the counterbore (54) between an open position with the end faces (58, 72) axially separated and a closed position with the end faces (58, 72) abutting each other, a gate (46) in the chamber (46) and having an engaging face (80) that slidingly engages a seal face (82) on the seat (50) while being moved between open and closed positions, and a hardcoating (70,74) on the end faces (58, 72) for sealing against each other while the seat ring (50) is in the closed position;

flowing wellbore fluid through the flow passage (44) by positioning the gate (46) into an open position;

blocking flow through the flow passage (44) by positioning the gate into a closed position allowing fluid to leak into the chamber (46) from a high pressure side of the valve (40) to thereby pressurize the chamber (46), wherein

the downstream seat ring (50) moves axially in the counterbore (54) from an open position to a closed position in response to fluid pressure on upstream side of the flow passage (44); and

sealing a low pressure side of the valve (40) to prevent fluid flow from the chamber (46) into the flow passage (44) on the low pressure side via sealing engagement of the hardcoated end faces (58, 72) of the counterbore (54) and downstream seat ring (50) of the valve (40) when the gate (46) is closed, wherein the hardcoated end faces (58, 72) axially abut each other

14. The method of claim 13, wherein while gate valve (40) is in open position, a spring (60) urges end faces (58, 72) apart from each other.

15. The method of claim 13, wherein an upstream seat ring (92) is in an open position while the gate (46) is closed and downstream seat ring (50) is in closed position.

CLAIMS

What is claimed is:

1. A gate valve comprising:

a body with a chamber;

a flow passage having an axis and extending through and having a counterbore intersecting the chamber;

a counterbore in the flow passage at the intersection with the chamber defining an inward facing end face;

an annular seat ring carried in the counterbore, the seat ring having an outward facing endface and being axially movable in the counterbore between an open position with the end faces axially separated and a closed position with the end faces abutting each other;

a gate in the cavity and having an engaging face that slidingly engages a seal face on the seat while being moved between open and closed positions; and

a hardcoating on the end faces for sealing against each other while the seat ring is in the closed position.

2. The apparatus according to claim 1, further comprising a spring element between the seat ring and the end face of the counterbore, the spring element urging the seat ring toward the open position.

3. The apparatus according to claim 1, wherein the hardcoating is a cemented carbide.

4. The apparatus according to claim 1, wherein the seat ring moves axially to the closed position in response to fluid pressure on a high pressure side of the flow passage.

5. The apparatus according to claim 1, wherein the hard coating has hardness greater than the seat and the body of the valve.

6. The apparatus according to claim 1, wherein the hardcoating comprises:

a substrate of cemented carbide bonded to the end faces.

7. The apparatus according to claim 1, wherein the hardcoating comprises:

a layer comprising a cemented carbide hardfacing welded, coated, brazed, or glued onto the end of end faces.

8. The apparatus according to claim 1, wherein the end faces are perpendicular to the axis.

9. The apparatus according to claim 1, wherein the hardcoating on each of the end faces has thickness ranging from about 0.001 inches thick to about 0.5 inches thick.

10. The apparatus according to claim 1, further comprising:

an annular recess at an intersection of an outer diameter of the seat ring and the end face of the seat ring; and

a spring in the recess and in engagement with the end face of the counterbore, the spring urging the seat ring toward the open position.

11. The apparatus according to claim 1, further comprising an annular clearance between an outer diameter of the seat ring and the counterbore, the clearance communicating fluid in the cavity to the end faces.

12. The apparatus according to claim 1, wherein the seat ring is free of any elastomeric sealing elements.

13. A gate valve comprising:

a body with a cavity;

a passage through the body and intersecting the cavity, defining upstream and downstream passage positions for handling a flow of a fluid;

an upstream counterbore in the flow passage at the intersection with the chamber defining an inward facing end face;

a downstream counterbore in the flow passage at the intersection with the chamber defining an inward facing end face;

an annular upstream seat ring carried in the upstream counterbore, the seat ring having an outward facing endface and being axially movable in the upstream counterbore between an open position with the end faces axially separated and a closed position with the end faces abutting each other;

an annular downstream seat ring carried in the downstream counterbore, the seat ring having an outward facing endface and being axially movable in the downstream counterbore between an open position with the end faces axially separated and a closed position with the end faces abutting each other;

a gate in the cavity selectively movable and having an engaging face that slidingly engages a seal face on each of the seat rings while being moved between open and closed positions; and

a hardcoating on the end faces of the upstream and downstream seat rings and of the end faces of the counterbores for sealing against each other while either of the seat rings is in the closed position;

a hardcoating layer on a sealing surface of the seat ring, the sealing surface of the seat ring being in sealing and sliding engagement with the gate;

wherein while the downstream seat ring is in the closed position, the upstream sealing ring is in the open position.

14. The apparatus according to claim 13, further comprising a spring element between either of the upstream or downstream seat rings and the corresponding end face of the upstream or downstream counterbore, the spring element urging the seat ring toward the open position.

15. The apparatus according to claim 13, wherein either of the seat rings move axially to the closed position in response to fluid pressure on a high pressure side of the flow passage.

16. The apparatus according to claim 13, wherein the hardcoating comprises:
a layer comprising a cemented carbide hardfacing welded onto the end of end faces.

17. The apparatus according to claim 13, wherein the hardcoating on each of the end faces has thickness ranging from about 0.001 inches thick to about 0.5 inches thick.

18. A method of controlling a flow of a wellbore fluid with a gate valve, comprising:

providing a body with a chamber, a flow passage having an axis and extending through and having a counterbore intersecting the chamber, a counterbore in the flow passage at the intersection with the chamber defining an inward facing end face, an annular downstream seat ring carried in the counterbore, the seat ring having an outward facing endface and being axially movable in the counterbore between an open position with the end faces axially separated and a closed position with the end faces abutting each other, a gate in the cavity and having an engaging face that slidingly engages a seal face on the seat while being moved between open and closed positions, and a hardcoating on the end faces for sealing against each other while the seat ring is in the closed position;

flowing wellbore fluid through the flow passage by positioning the gate into an open position;

blocking flow through the flow passage by positioning the gate into a closed position allowing fluid to leak into the chamber from a high pressure side of the valve to thereby pressurize the chamber, wherein

the downstream seat ring moves axially in the counterbore from an open position to a closed position in response to fluid pressure on upstream side of the flow passage; and

sealing a low pressure side of the valve to prevent fluid flow from the chamber into the flow passage on the low pressure side via sealing engagement of the hardcoated end faces of the counterbore and downstream seat ring of the valve when the gate is closed, wherein the hardcoated end faces axially abut each other.

19. The method of claim 18, wherein while gate valve is in open position, a spring urges end faces apart from each other.

20. The method of claim 18, wherein an upstream seat ring is in an open position while the gate is closed and downstream seat ring is in closed position.