CLAIMS

What is claimed is:

1. An expandable apparatus, comprising:

a tubular body comprising a fluid passageway extending therethrough;

a valve piston disposed within the tubular body, the valve piston configured to move axially relative to the tubular body responsive to a pressure of drilling fluid passing through the fluid passageway and configured to selectively control a flow of fluid into an annular chamber; and

a push sleeve disposed within the tubular body and coupled to at least one expandable feature, the push sleeve configured to move axially responsive to the flow of fluid into the annular chamber and extend the at least one expandable feature.

2. The expandable apparatus of claim 1, wherein the valve piston comprises a nozzle.

3. The expandable apparatus of claim 2, wherein the nozzle comprises at least one fluid port extending through a sidewall of the valve piston.

4. The expandable apparatus of claim 3, wherein the at least one fluid port extending through a sidewall of the valve piston is open when at least one expandable feature is extended.

5. The expandable apparatus of claim 1, wherein the valve piston comprises at least one fluid port configured to selectively control a flow of fluid into the annular chamber.

6. The expandable apparatus of claim 5, further comprising at least one screen extending over the at least one fluid port.

7. The expandable apparatus of claim 1, further comprising at least one fluid passageway extending through the tubular body and the push sleeve, wherein the at least one fluid passageway is always open.

8. The expandable apparatus of claim 1, wherein the expandable apparatus comprises at least one of a bonded seal and a chevron seal.

9. The expandable apparatus of claim 1, wherein the annular chamber comprises at least one bleed nozzle or check valve, wherein the at least one bleed nozzle or check valve is always open.

10. The expandable apparatus of claim 1, further comprising a valve housing disposed within the tubular body, wherein the valve piston is disposed within the valve housing.

11. The expandable apparatus of claim 10, further comprising at least one biasing element configured and disposed to exert an axial bias force on the valve piston.

12. The expandable apparatus of claim 3, wherein the valve piston is coupled to the valve housing by at least one pin carried by one of the valve piston and the valve housing, the at least one pin engaged with a track located in the other of the valve piston and the valve housing, the at least one pin and the track, in combination, configured to control rotational and axial movement of the valve piston within and relative to the valve housing responsive to the upward bias force of a spring and selected application of an axial, downward force provided by drilling fluid flow through the fluid passageway of the valve piston.

13. The expandable apparatus of claim 12, wherein the valve piston comprises at least one aperture extending laterally from the fluid passageway to an exterior of the valve piston; and wherein the valve housing comprises at least one valve port alignable with the at least one aperture to communicate drilling fluid from the fluid passageway to the annular chamber responsive to at least one of rotational and longitudinal movement of the valve piston within and relative to the valve housing.

14. The expandable apparatus of claim 13, further comprising at least one screen covering at least a portion of the at least one aperture.

15. A method of operating an expandable apparatus, comprising:

positioning an expandable apparatus in a borehole;

directing a fluid flow through a fluid passageway of a tubular body of the expandable apparatus;

moving a valve piston axially relative to the tubular body in response to fluid flow through the fluid passageway to open at least one fluid port to an annular chamber;

moving a push sleeve axially relative to the tubular body with a fluid flow directed into the annular chamber through the at least one fluid port; and

extending at least one expandable feature coupled to the push sleeve.

16. The method of claim 15, further comprising directing a fluid flow through a nozzle of the valve piston.

17. The method of claim 16, wherein directing the fluid flow into the annular chamber through the at least one fluid port comprises directing the fluid flow into the annular chamber through at least one fluid port extending through a sidewall of the valve piston.

18. The method of claim 17, further comprising directing the fluid flow through the at least one fluid port when the at least one expandable feature is extended.

19. The method of claim 15, wherein opening the at least one fluid port to the annular chamber comprises opening at least one fluid port of the valve piston to the annular chamber.

20. The method of claim 19, further comprising directing the fluid flow through at least one screen extending over the at least one fluid port.

21. The method of claim 15, further comprising directing a fluid flow through at least one fluid passageway extending through the tubular body and the push sleeve when the at least one expandable feature is extended and when the at least one expandable feature is retracted.

22. The method of claim 15, further comprising providing a seal between the valve piston and the tubular body with at least one of a bonded seal and a chevron seal.

23. The method of claim 15, further comprising directing a fluid flow from the annular chamber through at least one bleed nozzle or check valve.

24. The method of claim 15, further comprising moving the valve piston axially relative to a valve housing.

25. The method of claim 15, further comprising exerting an axial bias force on the valve piston.

26. The method of claim 15, further comprising repeatedly extending and retracting the at least one expandable feature while the expandable apparatus is in the borehole.

Claims

What is claimed is:

1. An expandable apparatus, comprising:

a tubular body comprising a fluid passageway extending therethrough and first nozzles extending through the tubular body;

a valve housing disposed within the tubular body, the valve housing comprising a fluid port opening into an annular chamber disposed between the valve housing and the tubular body;

a valve piston disposed within the valve housing, the valve piston comprising a surface configured to move the valve piston axially responsive to drilling fluid pressure and a second nozzle configured to selectively align and misalign with the port of the valve housing, the valve piston configured to move axially relative to the tubular body from a first, neutral position to a second, locked open position responsive to a pressure of drilling fluid passing through the fluid passageway to exert a force on the surface, wherein the second nozzle is misaligned with the fluid port when the valve piston is in the first, neutral position and the second nozzle is aligned with the fluid port when the valve piston is in the second, locked open position; and

a push sleeve disposed within the tubular body and coupled to at least one expandable feature, the push sleeve configured to move axially responsive to the flow of fluid into the annular chamber and extend the at least one expandable feature, the push sleeve comprising nozzle ports extending through the push sleeve to provide fluid communication with the first nozzles, wherein the first nozzles and the nozzle ports are always open,

wherein the at least one expandable feature is in a retracted position when the valve piston is in the first, neutral position and is movable to an extended position when the valve piston is in the second, locked open position.

2. The expandable apparatus of claim 1, wherein the second nozzle comprises at least one fluid aperture extending through a sidewall of the valve piston.

3. The expandable apparatus of claim 2 further comprising at least one screen extending over the at least one fluid aperture of the valve piston.

4. The expandable apparatus of claim 1, wherein the expandable apparatus comprises at least one of a bonded seal and a chevron seal.

5. The expandable apparatus of claim 1, wherein the annular chamber comprises at least one bleed nozzle or check valve, wherein the at least one bleed nozzle or check valve is always open.

6. The expandable apparatus of claim 1, wherein the valve piston is further configured to move axially relative to the tubular body from the second, locked open position to a third, locked closed position between the first, neutral position and the second, locked open position, and wherein the at least one expandable feature is in the retracted position when the valve piston is in the third, locked closed position.

7. The expandable apparatus of claim 1, further comprising at least one biasing element configured and disposed to exert an axial bias force on the valve piston.

8. The expandable apparatus of claim 7, wherein the valve piston is coupled to the valve housing by at least one pin carried by one of the valve piston and the valve housing, the at least one pin engaged with a track located in the other of the valve piston and the valve housing, the at least one pin and the track, in combination, configured to control rotational and axial movement of the valve piston within and relative to the valve housing responsive to the upward bias force of the biasing element and selected application of an axial, downward force provided by drilling fluid flow through the fluid passageway of the valve piston.

9. A method of operating an expandable apparatus, comprising:

positioning an expandable apparatus in a borehole;

directing a fluid flow through a fluid passageway of a tubular body of the expandable apparatus, wherein a valve housing is disposed within the tubular body to define an annular chamber between the valve housing and the tubular body;

moving a valve piston within the valve housing axially relative to the tubular body from a first, neutral position to a second, locked open position in response to fluid flow exerting a force against a surface of the valve piston to unobstruct a fluid port in the valve housing;

aligning a first nozzle of the valve piston with the fluid port of the valve housing responsive to moving the valve piston;

directing at least a portion of the fluid flow aligning the first nozzle and the fluid port into the annular chamber;

moving a push sleeve axially relative to the tubular body with the fluid flow directed into the annular chamber between the valve housing and the tubular body;

extending at least one expandable feature coupled to the push sleeve in response to movement of the push sleeve; and directing a fluid flow through nozzle ports extending through the push sleeve to second nozzles extending through the tubular body when the at least one expandable feature is extended and when the at least one expandable feature is retracted.

10. The method of claim 9, wherein directing the at least a portion of the fluid flow through the first nozzle and the fluid port into the annular chamber comprises directing the fluid flow through the first nozzle comprising at least one aperture extending through a sidewall of the valve piston, the fluid port extending through a sidewall of the valve housing into the annular chamber.

11. The method of claim 10, further comprising directing the fluid flow through the at least one fluid aperture when the at least one expandable feature is extended.

12. The method of claim 11, further comprising directing the fluid flow through at least one screen extending over the at least one aperture.

13. The method of claim 9, further comprising providing a seal between the valve piston and the tubular body with at least one of a bonded seal and a chevron seal.

14. The method of claim 9, further comprising directing a fluid flow from the annular chamber through at least one bleed nozzle or check valve.

15. The method of claim 9, further comprising moving the valve piston from the second, locked open position to a third, locked closed position between the first, neutral position and the second, locked open position, wherein the at least one

expandable feature is in a retracted position when the valve piston is in the third, locked closed position.

16. The method of claim 9, further comprising exerting an axial bias force on the valve piston.

17. The method of claim 9, further comprising repeatedly extending and retracting the at least one expandable feature while the expandable apparatus is in the borehole.