

It is claimed:

1. A downhole fluid flow control system operable to be positioned in a wellbore extending through a subterranean formation and operable to control fluid flow between the wellbore and an internal passageway of a tubular, the system comprising:
 - a tubing-pressure operated device positioned along a flow path between the interior passageway of the tubular and the exterior of the tubular;
 - a piston element, biased towards a first position, slidably disposed in a piston annulus, the piston annulus having a pressure-transmitting port to the interior passageway of the tubular, the piston element movable to a second position responsive to a tubing-pressure change transmitted through the pressure-transmitting port; and
 - a valve element attached to the piston element and movable in response to movement of the piston element between a closed position wherein fluid flow is blocked across the flow path and an open position wherein flow is allowed across the flow path.
2. The system of claim 1, wherein the flow path passes through a bypass port defined in the piston element.
3. The system of claim 2, wherein the piston element further includes a check valve positioned thereon operable to control fluid flow through the bypass port.
4. The system of claim 1, wherein the flow path passes through the piston annulus.
5. The system of claim 1, wherein the valve element is movable to multiple open positions, each open position allowing fluid flow across a pre-selected flow area.
6. The system of claim 1, wherein the valve element is releasably attached to the piston element.
7. The system of claim 6, wherein the valve element and piston element include cooperating one-way ratchet teeth.
8. The system of claim 5, wherein the valve element is stepped, ramped, conical, partially conical or otherwise shaped to define the multiple open positions.
9. The system of claim 7, wherein the piston element further includes a slip, the one-way ratchet teeth defined thereon.
10. The system of claim 1, wherein the valve element is a rotational valve element.
11. The system of claim 10, further comprising a j-slot mechanism for controlling rotational movement of the valve element.

12. The system of claim 11, wherein the j-slot mechanism includes a pin and cooperating groove in which the pin travels relative to the rotational valve element.
13. The system of claim 12, wherein the groove is defined on the surface of the rotational valve element and wherein the pin extends radially into the valve annulus.
14. The system of claim 10, wherein the rotational valve element is rotatable to multiple open positions relative to a cooperating multiple of production ports.
15. The system of claim 10, wherein the rotational valve element can be rotated from a closed position to an open position and then to a closed position.
16. The system of claim 12, wherein the groove is endless.
17. The system of claim 1, further comprising a temporary holding mechanism operatively connected to the piston element.
18. The system of claim 17, wherein the temporary holding mechanism can be repeatedly used.
19. The system of claim 1, wherein the piston element is an annular piston element having a longitudinal axis coincident with the longitudinal axis of the tubular.
20. A method for servicing a subterranean wellbore extending through a formation, the method comprising the steps of:
 - a) positioning at a downhole location a wellbore tubular having a flow control device positioned thereon, the flow control device having a piston element mounted for longitudinal movement within a piston annulus and biased towards a first position, a valve element mounted for movement and operable by the piston element, and defining a flow path between an interior passageway of the wellbore tubular and the wellbore annulus, the valve element positioned along the flow path and operable to selectively block or allow fluid flow along the flow path;
 - b) increasing tubing pressure;
 - c) moving the piston longitudinally in response to step b) from the first position to a second position;
 - d) decreasing tubing pressure;
 - e) moving the piston longitudinally in response to step d) from the second position to the first position;

- f) moving the valve element in response to step c); and
 - g) allowing fluid flow along the fluid flow path in response to step f).
21. The method of claim 20, further comprising the step of sealing a check valve positioned on the piston element in response to step b), thereby blocking fluid flow through a bypass port defined in the piston element.
22. The method of claim 20, further comprising the step of releasably attaching the piston element and valve element to one another in response to step c).
23. The method of claim 22, wherein the step of releasably attaching the piston and valve elements further comprises the step of interlocking cooperating one-way ratchet teeth defined on the valve element with corresponding ratchet teeth defined on the piston element.
24. The method of claim 22, wherein the step of interlocking includes moving a toothed slip into cooperating contact with ratchet teeth of the valve element.
25. The method of claim 20, further comprising the steps of:
cyclically increasing and decreasing tubing pressure;
repeatedly moving the piston element in response thereto;
repeatedly moving the valve element, in response to movement of the piston element, between a closed position and multiple open positions, each open position allowing a different fluid flow rate across the valve element.
26. The method of claim 25, further comprising the steps of repeatedly attaching and detaching the piston element and valve element to one another in response to the repeated movement of the piston element.
27. The method of claim 20 or 25, wherein step f) further comprises the step of rotating the valve element.
28. The method of claim 27, wherein the valve element is operable by relative movement between a pin and a groove.
29. The method of claim 27, wherein the valve element is rotatable between a closed position and at least two open positions, each open position allowing a different flow rate through the device.
30. The method of claim 29, wherein the rotating valve is endlessly rotatable.

It is claimed:

1. A downhole fluid flow control system operable to be positioned in a wellbore extending through a subterranean formation and operable to control fluid flow between the wellbore and an internal passageway of a tubular, the system comprising:

a tubing-pressure operated device positioned along a flow path between the interior passageway of the tubular and the exterior of the tubular;

a piston element, biased towards a first position, slidably disposed in a piston annulus, the piston annulus having a pressure-transmitting port to the interior passageway of the tubular, the piston element movable to a second position responsive to a tubing-pressure change transmitted through the pressure-transmitting port; and

a valve element attached to the piston element and movable in response to movement of the piston element between a closed position wherein fluid flow is blocked across the flow path and an open position wherein flow is allowed across the flow path,

wherein the flow path passes through a bypass port defined in the piston element which further includes a check valve positioned thereon operable to control fluid flow through the bypass port.

2. The system of claim 1, wherein the flow path passes through the piston annulus.

3. The system of claim 1, wherein the valve element is movable to multiple open positions, each open position allowing fluid flow across a pre-selected flow area.

4. The system of claim 1, wherein the valve element is releasably attached to the piston element.

5. The system of claim 4, wherein the valve element and piston element include cooperating one-way ratchet teeth.

6. The system of claim 3, wherein the valve element is stepped, ramped, conical, partially conical or otherwise shaped to define the multiple open positions.

7. The system of claim 5, wherein the piston element further includes a slip, the oneway ratchet teeth defined thereon.

8. The system of claim 1, wherein the valve element is a rotational valve element.

9. The system of claim 8, further comprising a j-slot mechanism for controlling rotational movement of the valve element.

10. The system of claim 9, wherein the j-slot mechanism includes a pin and cooperating groove in which the pin travels relative to the rotational valve element.
11. The system of claim 10, wherein the groove is defined on the surface of the rotational valve element and wherein the pin extends radially into the valve annulus.
12. The system of claim 8, wherein the rotational valve element is rotatable to multiple open positions relative to a cooperating multiple of production ports.
13. The system of claim 8, wherein the rotational valve element can be rotated from a closed position to an open position and then to a closed position.
14. The system of claim 10, wherein the groove is endless.
15. The system of claim 1, further comprising a temporary holding mechanism operatively connected to the piston element.
16. The system of claim 15, wherein the temporary holding mechanism can be repeatedly used.
17. The system of claim 1, wherein the piston element is an annular piston element having a longitudinal axis coincident with the longitudinal axis of the tubular.
18. A method for servicing a subterranean wellbore extending through a formation, the method comprising the steps of:
 - a) positioning at a downhole location a wellbore tubular having a flow control device positioned thereon, the flow control device having a piston element mounted for longitudinal movement within a piston annulus and biased towards a first position, a valve element mounted for movement and operable by the piston element, and defining a flow path between an interior passageway of the wellbore tubular and the wellbore annulus, the valve element positioned along the flow path and operable to selectively block or allow fluid flow along the flow path;
 - b) increasing tubing pressure;
 - c) moving the piston longitudinally in response to step b) from the first position to a second position;
 - d) decreasing tubing pressure;
 - e) moving the piston longitudinally in response to step d) from the second position to the first position;
 - f) moving the valve element in response to step c);
 - g) allowing fluid flow along the fluid flow path in response to step f); and

h) sealing a check valve positioned on the piston element in response to step b), thereby blocking fluid flow through a bypass port defined in the piston element.

19. The method of claim 18, further comprising the step of releasably attaching the piston element and valve element to one another in response to step c).

20. The method of claim 19, wherein the step of releasably attaching the piston and valve elements further comprises the step of interlocking cooperating one-way ratchet teeth defined on the valve element with corresponding ratchet teeth defined on the piston element.

21. The method of claim 20, wherein the step of interlocking includes moving a toothed slip into cooperating contact with ratchet teeth of the valve element.

22. The method of claim 18, further comprising the steps of:

cyclically increasing and decreasing tubing pressure;

repeatedly moving the piston element in response thereto;

repeatedly moving the valve element, in response to movement of the piston element, between a closed position and multiple open positions, each open position allowing a different fluid flow rate across the valve element.

23. The method of claim 22, further comprising the steps of repeatedly attaching and detaching the piston element and valve element to one another in response to the repeated movement of the piston element.

24. The method of claim 18 or 22, wherein step f) further comprises the step of rotating the valve element.

25. The method of claim 24, wherein the valve element is operable by relative movement between a pin and a groove.

26. The method of claim 24, wherein the valve element is rotatable between a closed position and at least two open positions, each open position allowing a different flow rate through the device.

27. The method of claim 26, wherein the rotating valve is endlessly rotatable.