

WHAT IS CLAIMED IS:

1. A wellhead assembly, comprising:

a wellhead member;

a tubing hanger set in the wellhead member;

tubing depending from the tubing hanger into a wellbore;

a tubing annulus circumscribing the tubing;

a shuttle valve assembly in the tubing hanger comprising:

a sleeve, a valve close port, a valve open port, and a piston selectively slidable within the sleeve to a closed position with an amount of pressure applied to the valve close port and the piston selectively slidable to an open position with an amount of pressure applied to the valve open port;

a flow path extending through the tubing hanger, into the tubing annulus, and through the shuttle valve assembly when the piston is in an open position; and

an accumulator in the annulus in fluid communication with the valve close port.

2. The wellhead assembly of claim 1, wherein the wellhead member is selected from the list consisting of a wellhead housing and a production tree.

3. The wellhead assembly of claim 1, wherein the accumulator is pressurized to a pressure above an ambient pressure.

4. The wellhead assembly of claim 1, further comprising a spring biased to urge the shuttle valve into the closed position.
5. The wellhead assembly of claim 1, wherein the piston is moved into the open position from pressure communication with a passage in the wellhead member and wherein the piston is moved into the closed position from pressure communication with the accumulator.
6. The wellhead assembly of claim 1, wherein when the valve is moved into the valve open position, pressure in the accumulator maintains a force on the piston to urge the piston toward the closed position.
7. The wellhead assembly of claim 1, wherein the shuttle valve assembly comprises a first shuttle valve assembly and wherein the flow path comprises a first flow path, the wellhead assembly further comprising a second shuttle valve assembly comprising:
 - a sleeve, a valve close port in communication with the accumulator, a valve open port, and a piston selectively slidable within the sleeve to a closed position with an amount of pressure applied to the valve close port and the piston selectively slidable to an open position with an amount of pressure applied to the valve open port; and
 - a second flow path extending through the tubing hanger, into the tubing annulus, and through the second shuttle valve assembly when the piston is in an open position.
8. A wellhead assembly, comprising:

a wellhead member;

a tubing hanger set in the wellhead member;

tubing depending from the tubing hanger into a wellbore;

a tubing annulus circumscribing the tubing;

a shuttle valve in the tubing hanger comprising an opening port in fluid communication with pressurized fluid for directing pressure within a portion of the shuttle valve for selectively positioning the shuttle valve into an open position;

a flow path extending through the tubing hanger, into the tubing annulus, and through the shuttle valve when the shuttle valve is in the open position; and

an accumulator in the tubing annulus in fluid communication with a closing port on the shuttle valve for directing pressure within another portion of the shuttle valve for selectively positioning the shuttle valve into a closed position.

9. The wellhead assembly of claim 8, wherein the shuttle valve comprises a sleeve and a piston selectively slidable within the sleeve to close the shuttle valve with an amount of pressure applied to the closing port and the piston selectively slidable to open the shuttle valve with an amount of pressure applied to the shuttle valve opening port.

10. The wellhead assembly of claim 9, wherein when the shuttle valve is moved into the shuttle valve open position, pressure in the accumulator maintains a force on the piston to urge the piston in a direction to close the shuttle valve.
11. The wellhead assembly of claim 8, wherein when the valve is moved into the valve open position, pressure in the accumulator maintains a force on the piston to urge the piston toward the closed position.
12. The wellhead assembly of claim 8, wherein the accumulator is suspended in an annulus between a portion of a tubing hanger and a wellhead housing.
13. The wellhead assembly of claim 8, wherein the shuttle valve is actuated into the open position by pressurized fluid in a single line passing through the wellhead housing and actuated into the closed position by pressure in the accumulator.
14. The wellhead assembly of claim 8, wherein the shuttle valve comprises a first shuttle valve and wherein the flow path comprises a first flow path, the wellhead assembly further comprising a second shuttle valve comprising:
- an opening port in fluid communication with pressurized fluid for directing pressure within a portion of the second shuttle valve for selectively positioning the second shuttle valve into an open position; and
- a second flow path extending through the tubing hanger, into the tubing annulus, and through the second shuttle valve when the second shuttle valve is in an open position.

15. The wellhead assembly of claim 14, wherein the accumulator is in fluid communication with a closing port on the second shuttle valve for directing pressure within another portion of the second shuttle valve for selectively positioning the second shuttle valve into a closed position.
16. The wellhead assembly of claim 14, wherein the accumulator comprises a first accumulator, and the wellhead assembly comprises a second accumulator that is in fluid communication with a closing port on the second shuttle valve for directing pressure within another portion of the second shuttle valve for selectively positioning the second shuttle valve into a closed position.
17. A method of controlling flow through a wellhead assembly comprising:
- providing a shuttle valve in a bore formed into a tubing hanger;
 - directing pressure to an opening side of the shuttle valve to open the shuttle valve that in turn pressurizes a closing side of the shuttle valve;
 - directing flow through a flow passage that extends within an annulus between the tubing hanger and a wellhead housing, through the open shuttle valve and outside of the wellhead assembly;
 - storing pressure from the closing side of the shuttle valve; and
 - closing the shuttle valve by directing the stored pressure to the closing side of the shuttle valve.
18. The method of claim 17, wherein the step of storing pressure comprises directing pressure from the closing side of the shuttle valve to an accumulator.

19. The method of claim 18, wherein the accumulator is a closed system disposed in the annulus.

WHAT IS CLAIMED IS:

1. A wellhead assembly, comprising:

a wellhead member having an axis;

a tubing hanger set in the wellhead member for supporting a string of tubing extending into the well, defining a tubing annulus below the tubing hanger;

a shuttle valve assembly located within a cavity in the tubing hanger comprising:

a piston selectively slidable in axial directions between a normally closed position and an open position;

a flow path extending through the tubing hanger, into the tubing annulus, and through the shuttle valve assembly for flowing annulus fluid between the tubing annulus and an exterior of the tubing hanger when the piston is in the open position;

an accumulator mounted below the tubing hanger in the tubing annulus, the accumulator comprising a vessel containing a pressurized fluid, the vessel being pressurized with the pressurized fluid prior to installing the tubing hanger in the wellhead member;

a closing function flow line extending from the accumulator to the cavity for applying continuous closing fluid pressure to one side of the piston, continuously urging the piston to maintain shuttle valve in the normally closed position; and

an open function flow passage extending through the tubing hanger from an exterior of the tubing hanger to an opposite side of the piston for selectively supplying opening fluid pressure to move the piston from the normally closed

position to the open position while the accumulator continues to supply closure fluid pressure to said one side of the piston.

2. The wellhead assembly of claim 1, wherein the wellhead member is selected from the list consisting of a wellhead housing and a production tree.

3. The wellhead assembly of claim 1, wherein the accumulator is pressurized to a pressure above an ambient pressure.

4. The wellhead assembly of claim 1, further comprising a spring that functions in combination with the accumulator to urge the piston into the closed position.

5. The wellhead assembly of claim 1, wherein when the piston is moved into the open position, the piston urges fluid through the closing function flow line back into the accumulator, increasing the pressure of the fluid in the accumulator.

6. The wellhead assembly of claim 1, wherein when the valve is moved into the closed position, pressure in the accumulator decreases, and when the valve is moved into the open position, pressure in the accumulator increases.

7. The wellhead assembly of claim 1, wherein:

the shuttle valve assembly comprises a first shuttle valve assembly and wherein the flow path comprises a first flow path, the wellhead assembly further comprising a second shuttle valve assembly having a second piston slidable within a second cavity between a closed position and an open position; and the accumulator and the closing fluid flow line are connected to both of the cavities in parallel for urging both of the pistons to the closed position.

8. A wellhead assembly, comprising:

a wellhead member;

a tubing hanger set in the wellhead member;

tubing depending from the tubing hanger into a wellbore;

a tubing annulus circumscribing the tubing;

a shuttle valve in the tubing hanger;

a tubing annulus flow path extending through the tubing hanger, into the tubing annulus, and through the shuttle valve when the shuttle valve is in an open position and blocked when the shuttle valve is in a closed position;

a coil spring within the tubing hanger that urges the shuttle valve to the closed position;

an accumulator comprising a pressurized vessel mounted to and below the tubing hanger in the tubing annulus, the vessel being pressurized with a pressurized fluid prior to being installed in the wellhead member, the vessel being in fluid communication with a closing port on the shuttle valve for supplying continuous closing fluid pressure that combines with the coil spring to bias the shuttle valve into the closed position; and

an opening port on the shuttle valve in selective fluid communication with opening fluid pressure to overcome the bias provided by the spring and the closing fluid pressure from the accumulator and move the shuttle valve into the open position.

9. The wellhead assembly of claim 8, wherein:

when the shuttle valve is moved into the closed position, the pressure of the fluid in the accumulator decreases; and

when the shuttle valve is moved into the open position, the pressure of the fluid in the accumulator increases.

10. The wellhead assembly of claim 8, wherein:

the shuttle valve comprises a first shuttle valve and wherein the flow path comprises a first flow path, the wellhead assembly further comprising a second shuttle valve that selectively opens and closes a second flow path; and the accumulator is in fluid communication with and biases each of the first and second shuttle valves toward the closed position.

11. A method of controlling flow through a wellhead assembly having a tubing hanger supported in a wellhead housing, the tubing hanger having a tubing annulus flow passage extending from exterior of the tubing hanger to a tubing annulus below the tubing hanger, the method comprising:

providing a shuttle valve in a bore formed in the tubing hanger;

mounting an accumulator to and below the tubing hanger, the accumulator being a vessel;

pressurizing a fluid within the vessel; then

installing the tubing hanger in the wellhead housing, which positions the accumulator in a tubing annulus below the tubing hanger;

continuously supplying the pressurized fluid from the accumulator to a closing side of the shuttle valve, maintaining the shuttle valve in a normally closed

position to block fluid communication through the tubing annulus flow passage;
and

selectively directing opening fluid pressure from exterior of the wellhead assembly to an opening side of the shuttle valve to move the shuttle valve from the normally closed position to the open position to open fluid communication through the tubing annulus flow passage while the accumulator continues to supply pressurized fluid to the shuttle valve.

12. The method of claim 11, further comprising mounting a coil spring in the bore, and biasing the shuttle valve to the closed position in combination with the pressurized fluid from the accumulator.

13. The method of claim 11, wherein directing opening fluid pressure to the shuttle valve returns pressurized fluid from the shuttle valve to the accumulator.