

CLAIMS

What is claimed is:

1. A junction fitting for use within a wellbore having at least one lateral branch, comprising:

a generally wye-shaped tubular body formed by a wall and defining a hollow interior, an exterior surface, an uphole end, and downhole main and lateral ends, said uphole end and downhole main and lateral ends being open to said interior;

a first communication line segment extending between said uphole end and said downhole main end; and

a second communication line segment extending between said uphole end and said downhole lateral end;

said first and second communication line segments being located completely outside of said interior of said junction fitting;

wherein a port is formed through the wall of the wye-shaped tubular body and defining a first opening facing towards the hollow interior and a second opening formed through the exterior surface;

wherein the wall forms a tapered valve seat around the first opening;

wherein the junction fitting further comprises a valve assembly that is movable between a first configuration and a second configuration, the valve assembly comprising:

a plug within the second opening;

a check ball within the port; and

a spring between the check ball and the plug, wherein the spring urges the check ball against the tapered valve seat;

wherein, in the first configuration, the check ball is seated in the tapered valve seat to fluidically isolate the first communication line segment from the hollow interior;

wherein, in the first configuration, at least a portion of the check ball protrudes into the hollow interior; and

wherein, in the second configuration, the check ball is spaced from the tapered valve seat to place the first communication line segment in fluid communication with the hollow interior.

2. The junction fitting of claim 1 further comprising:

a first longitudinal groove formed along said exterior surface, said first communication line segment being at least partially disposed within said first longitudinal groove; and
a second longitudinal groove formed along said exterior surface, said second communication line segment being at least partially disposed within said second longitudinal groove.

3. The junction fitting of claim 2 wherein:

said main leg connector is a stinger connector; and
said trunk connector is a receptacle connector.

4. The junction fitting of claim 3 wherein:

at least one of said first and third communication line segments is a hydraulic communication line segment; and

said trunk connector has a socket and provides an uphole hydraulic communication line connection point at an axial location on the interior surface of said socket that is in fluid communication with said hydraulic communication line segment; and

said main leg connector has a cylindrical probe and provides a downhole hydraulic communication line connection point at an axial location on the exterior surface of said probe that is in fluid communication with said hydraulic communication line segment.

5. The junction fitting of claim 1 further comprising:

a trunk connector located at said uphole end;
a main leg connector located at said downhole main end;
a lateral leg connector located at said downhole lateral end;

said trunk connector, said main leg connector, and said lateral leg connector each including an opening formed therethrough that is in fluid communication with said interior of said junction fitting;

said first communication line segment extending between said trunk connector and said main leg connector; and

said second communication line segment extending between said trunk connector and said lateral leg connector.

6. The junction fitting of claim 5 further comprising:

a third communication line segment extending between said trunk connector and said main leg connector;

a fourth communication line segment extending between said trunk connector and said lateral leg connector;

said third communication line segment being at least partially disposed within said first longitudinal groove or a third longitudinal groove formed along said exterior surface; and

said fourth communication line segment being at least partially disposed within said second longitudinal groove or a fourth longitudinal groove formed along said exterior surface.

7. The junction fitting of claim 6 further comprising:

first, second, third and fourth uphole communication line connection points defined by said trunk connector;

first and third downhole communication line connection points defined by said main leg connector;

second and fourth downhole communication line connection points defined by said lateral leg connector;

said first, second, third and fourth communication line segments extending between said first, second, third and fourth uphole and said first, second, third and fourth downhole communication line connection points, respectively;

said trunk connector arranged to connect said first, second, third and fourth communication line segments at said first, second, third and fourth uphole communication line connection points and to connect said interior of said junction fitting via said opening of trunk connector;

said main leg connector arranged to connect said first and third communication line segments at said first and third downhole communication line connection points and to connect said interior of said junction fitting via said opening of main leg connector; and

said lateral leg connector arranged to connect said second and fourth communication line segments at said second and fourth downhole communication line connection points and to connect said interior of said junction fitting via said opening of lateral leg connector.

8. The junction fitting of claim 7 wherein:

said first and third downhole communication line connection points are located at differing first and second axial locations with respect to said main leg connector.

9. The junction fitting of claim 6 wherein:

each of first, second, third and fourth communication line segments is a type from the group consisting of a hydraulic communication line segment, an electric communication line segment, and a fiber optic communication line segment.

10. A method for completing a well, the method comprising:

positioning a main completion string in a main wellbore below a junction in the main wellbore, said main completion string defining an interior;

positioning a lateral completion string in a lateral wellbore extending from the junction, said lateral completion string defining an interior; then

positioning a wye-shaped junction fitting to engage the main and lateral completion strings so as to

i) establish fluid communication between an interior of said junction fitting and the interiors of said main and lateral completion strings,

ii) establish communication between the surface of the well and the main completion string via a first communication line segment positioned outside the interior of the junction fitting, and

iii) establish communication between the surface of the well and the lateral completion string via a second communication line segment positioned outside the interior of the junction fitting;

wherein establishing communication between the surface of the well and the main completion string via the first communication line segment comprises moving a valve assembly from a first configuration to a second configuration;

wherein the valve assembly comprises:

a port formed through the wall of the wye-shaped junction fitting to form a tapered valve seat adjacent the hollow interior and an opposing opening formed through the exterior surface;

a plug positioned within the opposing opening;

a check ball positioned within the port; and

a spring positioned between the check ball and the plug, wherein the spring urges the check ball against the tapered valve seat;

wherein, in the first configuration, the check ball is seated in the tapered valve seat to fluidically isolate the first communication line segment from the hollow interior;

wherein, in the first configuration, at least a portion of the check ball protrudes into the hollow interior; and

wherein, in the second configuration, the check ball is spaced from the tapered valve seat to place the first communication line segment in fluid communication with the hollow interior.

11. A well system for use within a well having a main wellbore and a lateral wellbore, comprising:

- a junction fitting having a generally wye-shaped tubular body formed by a wall and defining a hollow interior, an exterior surface, an uphole end, and downhole main and lateral ends, said uphole end and downhole main and lateral ends being open to said interior, said junction fitting disposed at an intersection of said main wellbore and said lateral wellbore;

- a tubing string disposed in said main wellbore uphole of said junction fitting and coupled to the uphole end of said junction fitting, said tubing string defining an interior that is fluidly coupled with said interior of said junction fitting;

- a main completion string disposed in said main wellbore downhole of said junction fitting and coupled to the downhole main end of said junction fitting, said main completion string having an interior that is fluidly coupled with said interior of said junction fitting;

- a lateral completion string disposed in said lateral wellbore and coupled to the downhole lateral end of said junction fitting, said lateral completion string having an interior that is fluidly coupled with said interior of said junction fitting;

- a first communication line extending between said tubing string and said main completion string;

- a second communication line extending between said tubing string and said lateral completion string;

- said first and second communication lines being located completely outside of said interior of said junction fitting;

- wherein a port is formed through the wall of the wye-shaped tubular body and defining a first opening facing towards the hollow interior and a second opening formed through the exterior surface;

- wherein the wall forms a tapered valve seat around the first opening;

- wherein the junction fitting further comprises a valve assembly that is movable between a first configuration and a second configuration, the valve assembly comprising:

- a plug within the second opening;

- a check ball within the port; and

a spring between the check ball and the plug, wherein the spring urges the check ball against the tapered valve seat;

wherein, in the first configuration, the check ball is seated in the tapered valve seat to fluidically isolate the first communication line from the flow channel of the tubing string;

wherein, in the first configuration, at least a portion of the check ball protrudes into the hollow interior; and

wherein, in the second configuration, the check ball is spaced from the tapered valve seat to place the first communication line in fluid communication with the flow channel of the tubing string.

12. The well system according to claim 11, further comprising:

a trunk connector pair disposed between said tubing string and said junction fitting, said trunk connector pair coupling said interior of said tubing string with said interior of said junction fitting, an upper portion of said first communication line with said mid portion of said first communication line, and an upper portion of said second communication line with said mid portion of said second communication line;

a main leg connector pair disposed between said main completion string and said junction fitting, said main leg connector pair coupling said interior of said main completion string with said interior of said junction fitting and a lower portion of said first communication line with said mid portion of said first communication line; and

a lateral leg connector pair disposed between said lateral completion string and said junction fitting, said lateral leg connector pair coupling said interior of said lateral completion string with said interior of said junction fitting and a lower portion of said second communication line with said mid portion of said second communication line.

13. The well system of claim 12 further comprising:

a first longitudinal groove formed along said exterior surface of said junction fitting, a mid portion of said first communication line located within said first longitudinal groove; and a second longitudinal groove formed along said exterior surface of said junction fitting, a mid portion of said second communication line located within said second longitudinal groove.

14. The well system of claim 13 further comprising:

a third communication line extending between said tubing string and said main completion string;

a fourth communication line extending between said tubing string and said lateral completion string;

a mid portion of said third communication line located within said first longitudinal groove or a third longitudinal groove formed along said exterior surface of said junction fitting; and

a mid portion of said fourth communication line located within said second longitudinal groove or a fourth longitudinal groove formed along said exterior surface of said junction fitting.

15. The well system of claim 14 further comprising:

first, second, third and fourth uphole communication line connection points defined by said trunk connector pair;

first and third downhole communication line connection points defined by said main leg connector pair;

second and fourth downhole communication line connection points defined by said lateral leg connector pair; and

the mid portions of said first, second, third and fourth communication lines extending between said first, second, third and fourth uphole and said first, second, third and fourth downhole communication line connection points, respectively.

16. The well system of claim 15 wherein:

said first and third downhole communication line connection points are located at differing first and second axial locations with respect to said main leg connector pair.

17. The well system of claim 15 wherein:

said trunk connector pair includes a receptacle connector located at said uphole end of said junction fitting;

main leg connector includes a stinger connector located at said downhole main end of said junction fitting.

18. The well system of claim 17 wherein:

at least one of said first and third communication lines is a hydraulic communication line; and

said receptacle connector of said trunk connector pair has a socket and provides a downhole hydraulic communication line connection point at an axial location on the interior surface of said socket that is in fluid communication with said hydraulic communication line; and

said stinger connector of said downhole main connector pair has a cylindrical probe and provides an uphole hydraulic communication line connection point at an axial location on the exterior surface of said probe that is in fluid communication with said hydraulic communication line.

19. The well system of claim 18 further comprising:

first and second ports located at said downhole hydraulic communication line connection point and said uphole hydraulic communication line connection point, respectively;

first and second valves disposed within said first and second ports, respectively.

20. The well system of claim 17 wherein:

at least one of said first and third communication lines is an electrical communication line; and

said receptacle connector of said trunk connector pair has a socket and provides a downhole electrical communication line connection point at an axial location on the interior surface of said socket that is electrically coupled with said electrical communication line; and

said stinger connector of said downhole main connector pair has a cylindrical probe and provides an uphole electrical communication line connection point at an axial location on the exterior surface of said probe that is electrically coupled with said electrical communication line.

21. The well system of claim 20 further comprising:

first and second electrical slip rings located at said downhole electrical communication line connection point and said uphole electrical communication line connection point, respectively.

22. The well system of claim 17 wherein:

at least one of said first and third communication lines is an optical communication line; and

said receptacle connector of said trunk connector pair has a socket and provides a downhole optical communication line connection point at an axial location on the interior surface of said socket that is optically coupled with said optical communication line; and

said stinger connector of said downhole main connector pair has a cylindrical probe and provides an uphole optical communication line connection point at an axial location on the exterior surface of said probe that is optically coupled with said optical communication line.

23. The well system of claim 22 further comprising:

first and second optical slip rings located at said downhole optical communication line connection point and said uphole optical communication line connection point, respectively.

24. The well system of claim 14 wherein:

each of first, second, third and fourth communication lines is a type from the group consisting of a hydraulic communication line, an electric communication line, and a fiber optic communication line.