ZONE ISOLATION SYSTEM WITH INTEGRAL ANNULAR FLOW CONTROL VALVE

Applicants: Nicholas J. Clem, Houston, TX (US); Wilfred Provost, Saint Martinville, LA (US)

Inventors: Nicholas J. Clem, Houston, TX (US); Wilfred Provost, Saint Martinville, LA (US)

Assignee: BAKER HUGHES INCORPORATED, Houston, TX (US)

Appl. No.: 14/172,430

Filed: Feb. 4, 2014

Publication Classification

Int. Cl.

E21B 34/10 (2006.01)
E21B 33/124 (2006.01)
E21B 43/14 (2006.01)

U.S. Cl.

E21B 34/10 (2013.01); E21B 43/14 (2013.01); E21B 33/124 (2013.01)

ABSTRACT

A zone isolation system comprising an isolation flow path arranged radially outwardly with respect to an internal bore of a production tubing. An isolation valve assembly is arranged in the isolation flow path. The isolation flow path is fluidly connected to a screen flow path defined by the annular space between a filtering assembly and a basepipe. The isolation flow path may traverse one or more zones and can extend to the wellhead, connecting to an isolation pump. The basepipe may further comprise an inflow control device such as a sliding sleeve.
ZONE ISOLATION SYSTEM WITH INTEGRAL ANNULAR FLOW CONTROL VALVE

BACKGROUND

[0001] A typical multizone well, requiring selective production of at least one zone is generally configured where one or more upper layers have a control valve assembly, such as a mechanical sliding sleeve located internal to the basepipe, whereby the mechanical sliding sleeve controls circulating fluid during the gravel packing operation. Due to the necessity to locate the mechanical sliding sleeve on a concentric tubular internal to the basepipe, the resulting internal diameter becomes small, inhibiting production flow. Accordingly, the industry is receptive to advancements in zone isolation technology, particularly systems that preserve the internal diameter of the production tubing while maintaining control of production flow in independent zones.

SUMMARY

[0002] Disclosed herein is an isolation system for a subsurface borehole having multiple production zones comprising a tubular string including a basepipe, the tubular string comprising an internal bore. An isolation flow path arranged radially outwardly of the internal bore is connected to a screen flow path. A fluid connection between the screen flow path and the isolation flow path is controlled by an isolation valve assembly.

[0003] Also disclosed herein is an isolation system for a well having multiple production zones, comprising a filtering assembly arranged on a basepipe, an annular space between the filtering assembly and the basepipe defining a screen flow path. The system further comprises a tubular coupled to the basepipe. The tubular has an isolation flow path arranged radially outwardly of an internal bore of the tubular. The tubular is arranged relative to the basepipe such that the isolation flow path is in fluid communication with the screen flow path. An isolation valve assembly is arranged in the isolation flow path.

[0004] Also disclosed herein is an isolation system for a well having one or more production zones, comprising a basepipe arranged in a tubing string adjacent to a production zone. A filtering assembly is arranged on the basepipe, defining at least one screen flow path between the filtering assembly and the basepipe. A flow control device is arranged on the basepipe to permit fluid communication between the production zone and an internal bore of the basepipe. A production tubing is also arranged in the tubing string having at least one isolation flow path. The isolation flow path is fluidly connected to the at least one screen flow path and is isolated from an internal bore of the production tubing. An isolation valve assembly is arranged in the isolation flow path.

[0005] Also disclosed herein is an isolation valve assembly having a first opening connected to a first flow path and a second opening connected to a second flow path, the second flow path located radially inwardly relative to the first flow path. The isolation valve assembly comprises a first piston with a first flanged section configured to obstruct fluid communication between the first opening and the second opening when the first piston is in a first position and to permit fluid communication when the first piston is in a second position. The first piston also comprises a second flanged section. A second piston is arranged between the first flanged section of the first piston, with a biasing member located between the second piston and the second flanged section. The isolation valve assembly further includes one or more locking dogs, configured to have a first position in which the one or more locking dogs restrict the movement of the first piston while not restricting the movement of the second piston, and a second position in which the one or more locking dogs restrict the movement of the second piston while not restricting the movement of the first piston.

[0006] Also disclosed herein is an isolation system for a subsurface borehole comprising a tubular string including a basepipe. A screen flow path is located radially outwardly of the basepipe. The screen flow path, located radially outwardly of an internal bore of the tubular string, is fluidly connected to an isolation flow path by an isolation valve assembly. The isolation valve assembly is configured having two or more positions, including a first position in which the isolation valve assembly is arranged to fluidly connect the screen flow path to the internal bore, and a second position in which the isolation valve assembly is arranged to fluidly connect the screen flow path to the isolation flow path.

[0007] Also disclosed herein is an isolation system for a subsurface borehole having multiple production zones, comprising an outer tubing string and an inner tubing string. The outer tubing string spans over or through zones while the inner tubing string spans one or more zones. The outer tubing string includes at least one circumferential flow path associated with each of the production zones. The inner tubing also includes one or more flow ports in at least one of the production zones. One or more sealing subas are arranged in the annular space between the inner tubing string and the outer tubing string. One or more shifting tools are arranged on the inner tubing for arming the one or more circumferential flow ports, the annular flow valves being operable by hydraulic pressure when so armed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

[0009] FIG. 1 is a schematic of a zone isolation system according to one embodiment;

[0010] FIGS. 2A and 2B are quarter-sectional views of a zone isolation system according to another embodiment;

[0011] FIG. 3 is an illustration of a base pipe and screen assembly of the zone isolation system illustrated in FIGS. 2A and 2B;

[0012] FIGS. 4A-C are quarter-sectional views of various positions of an isolation valve assembly according to one embodiment;

[0013] FIG. 5 is a schematic of an isolation valve assembly according to another embodiment;

[0014] FIG. 6 is a schematic of an isolation valve assembly according to another embodiment; and

[0015] FIG. 7 is a partially sectioned view of a zone isolation system having a production string run through one or more production zones according to another embodiment.

DETAILED DESCRIPTION

[0016] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures. It is to be understood that other embodiments
may be utilized and changes may be made without departing from the scope of the present disclosure. In particular, the disclosure provides various examples related to a zone isolation system for use in well operations, whereas the advantages of the present disclosure as applied in a related field would be apparent to one having ordinary skill in the art and are considered to be within the scope of the present invention. [0017] FIG. 1 illustrates one embodiment of a zone isolation system 1 of the present disclosure, which is installed with a tubing string 2 in a wellbore 3 having one or more production zones 4. The zone isolation system 1 will be described with respect to a first production zone 4, but as discussed below, may be any one of a plurality of production zones, without regard to any ordering of zones within the well. The wellbore 3 may further comprise a casing or liner surrounding all or a portion of the length of the tubing string 2.

[0018] A basepipe 5 and filtering assembly 6 are arranged adjacent to the production zone 4 between one or more packing elements 7, 8. An inflow control device such as a sliding sleeve 9 is arranged on the basepipe 5, the sliding sleeve 9 having one or more openings 10. The basepipe 5 further comprises one or more inflow ports 11 which allow fluid communication between the production zone 4 and the internal bore 12 of the tubing string 2. The sliding sleeve 9 is configured to traverse in an axial direction such that the one or more openings 10 in the sliding sleeve can be aligned with the one or more inflow ports 11 of the basepipe 5. The sliding sleeve 9 may be pressure-activated and/or tool-shiftable, as desired, to support gravel-pack, frac, fluid production, and other operations.

[0019] FIGS. 2A and 2B provide detailed illustration of adjacent portions of the tubing string 2. The filtering assembly 6, shown in more detail in FIG. 2B, comprises a wire wrap 13 that overlaps a series of ribs 14, which extend in parallel in an axial direction along the basepipe 5 to end ring 15. The ribs 14 may extend between a portion of the end ring 15 and the basepipe 5. As shown in FIG. 3, the ribs 14 maintain a space between the wire wrap 13 and the basepipe 5, defining a number of screen flow paths 16, which may extend into the end ring 15.

[0020] One end of the end ring 15, opposite the filtering assembly 6, forms a flow-through seal bore 17. The flow-through seal bore 17 is an annular space connecting the basepipe 5 and the screen flow paths 16 with another tubular, such as a coupling 18, having an isolation flow path 19 therein. The flow-through seal bore 17 is associated with one or more sealing elements 20 that maintain the isolation of the isolation flow path 19 from the internal bore 12 of the tubing string 2.

[0021] The coupling 18 is further connected to a production tubing 21, which continues the flow path 19. As shown in FIG. 1, the isolation flow path 19 traverses the packing elements 7 which isolates the production zone 4 from the rest of the formation. The isolation flow path 19 may further traverse other packing elements and extend to the wellhead where the isolation flow path may be connected to an isolation pump 22, used to pump fluid from or into the isolation flow path, as may be desired. The isolation flow path 19 may comprise one or more axially extending channels, an isolation space, or any other configuration as may be apparent to one with skill in the art.

[0022] The isolation flow path 19 of the zone isolation system 1 discussed herein enables flow control over one or more production zones in isolation without requiring an isolation pipe. Fluid flow through the isolation flow path 19 is further controlled by an isolation flow control device, such as isolation valve assembly 23 shown in FIG. 2A. The isolation valve assembly 23 may comprise a pressure-activated and/or tool-shiftable valve or group of valves, as desired, to support various well functions. The isolation valve assembly 23 illustrated in FIG. 2A may be an annular valve assembly comprising a mandrel 24 having one or more valve ports 25. The mandrel 24 is configured to displace axially upon the application of pressure, via chamber 26, or by using a tool, via tool interface 27.

[0023] Referring again to FIG. 1, the isolation valve assembly 23 may be used to fluidly connect the production zone 4 with other production zones or with the isolation pump 22 or another device at the wellhead. Alternatively, the isolation valve assembly 23 may be used in connection with additional inflow control devices such as a second sliding sleeve (not shown) arranged internal to the production tubing 21 and separated from the production zone 4 by the isolation valve assembly 23.

[0024] As shown in FIG. 1, the isolation flow path 19 is formed in a radially outward portion of the tubular string 2 that is fluidly connected to a screen flow path 16 between the filtering assembly 6 and the basepipe 5. The isolation flow path 19 may be provided in a number of configurations to emphasize desired attributes of the present disclosure. For example, while the isolation flow path 19 could be configured as an annular space between two concentric tubulars, the isolation flow path 19 may also be formed as one or more passages in a radially outward portion of a single tubular. The isolation flow path 19 may be configured to provide a flow path that is isolated from the internal bore 12 of the tubing string 2 while having a negligible impact on the overall diameter of the internal bore 12. In one embodiment, portions of the isolation flow path 19 may comprise an annulus or a portion of an annulus formed between an inner wall and an outer wall of a production tubing 21. Alternatively, the isolation flow path 19 may comprise an annular space between a production tubing 21 and a blank pipe or other external tubular that exists between the production tubing 21 and the wellbore or casing thereof.

[0025] In some embodiments, the operation of the isolation valve assembly 23 is coordinated with the operation of the sliding sleeve 9 arranged with the basepipe 5. For example, the tool interface 27 may be connected to both the isolation valve assembly 23 and the sliding sleeve 9. In a further embodiment, the isolation valve assembly 23 and the sliding sleeve 9 are operatively constrained such that only one valve may be opened at any given time.

[0026] The isolation valve assembly 23 of the embodiments illustrated in FIGS. 1 and 2A is shown as being integrated into the production tubing 21 of the tubing string 2. Other embodiments of the present disclosure may further arrange the isolation valve assembly in any number of configurations relative to the basepipe 5 and other features of the zone isolation system 1, such as upheave, downhole, in close proximity to the basepipe 5, or near the wellhead.

[0027] FIGS. 4A-C illustrate another embodiment of the isolation system of the present disclosure, in which the isolation valve assembly 23 comprises a circular flow valve 28 for controlling fluid flow between an annular volume and the radially adjacent internal bore 12. The circular flow valve 28 fluidly connects or disconnects the screen flow path 16 with the internal bore 12 through one or more radial flow ports.
29 on the internal diameter of the isolation valve assembly 23. A seal piston 30 is arranged to isolate the radial flow ports 29 when in a closed position, as shown in FIGS. 4A and 4B.

[0028] Referring to FIG. 4A, which shows the circular flow valve 28 in a closed position, the seal piston 30 further comprises a first flanged section 31 and a second flanged section 32. The first flanged section 31 is configured to interrupt the fluid communication between the screen flow path 16 and the internal bore 12 and includes one or more sealing elements 33. The second flanged section 32 is configured to support a spring 34 or other biasing member. The circular flow valve 28 further comprises a spring piston 35 that is used to actuate the seal piston 30. The spring piston 35 includes one or more collet fingers 36 that are initially held in place, for example, by a support ring 37. The collet fingers 36 extend into a housing 38 and engage the support ring 37 adjacent to a cavity 39. The spring 34 is arranged in a spring chamber 40, formed between the spring piston 35 and the second flanged section 32 of the seal piston 30. The housing 38 further includes one or more locking dogs 41 arranged in a recess 42 of the housing 38. As shown in FIG. 4A, the locking dogs 41 are arranged to prevent the movement of the seal piston 30.

[0029] As shown in FIG. 4B, the circular flow valve 28 is made operable by disengaging the support ring 37 from the collet fingers 36 so that the spring piston 35 can translate. This is done, for example, by using a tool to move the support ring 37 in an axial direction, for example, beyond the distal ends of the collet fingers 36, the distal ends being the location on the collet fingers that is furthest from the spring piston 35. The cavity 39 is arranged in the housing 38 to allow the collet fingers 36 to deflect in a radial direction and disengage from the support ring 37. With the support ring 37 removed from the collet fingers 36, the spring piston 35 is influenced by a difference in pressure between the internal bore 12 and the spring chamber 40. In particular, when the fluid pressure in the internal bore 12 is greater than the fluid pressure in the spring chamber 40, the spring piston 35 will be forced against the spring 34.

[0030] When the difference in pressure is great enough to displace the spring piston 35 such that the collet fingers 36 are no longer radially adjacent to the locking dogs 41, the locking dogs are free to move in a radial direction, thereby releasing the seal piston 30 and allowing it to move in an axial direction. This is illustrated in FIG. 4C. In this position, the locking dogs 41 may also prevent the spring piston 35 from returning to its original position. With the locking dogs 41 disengaged from the seal piston 30, the compressed spring 34 causes the seal piston 30 to move in an axial direction from a first position to a second position in which the radial flow ports 29 are no longer obstructed, thereby placing the internal bore 12 in fluid communication with the one or more screen flow paths or isolation paths 19. The circular flow valve 28 may further comprise one or more stops 43 for limiting the range of motion of the seal piston 30 and/or the spring piston 35, in one or more directions.

[0031] The circular flow valve 28 depicted in FIGS. 4A-C may be configured to open when production from a particular zone is desired. In some embodiments, the circular flow valve 28 may include a tool or hydraulic device that will return the seal piston 30, the spring piston 35, the locking dogs 41, or other elements to their original positions shown in FIG. 4A.

[0032] In another embodiment of the present disclosure, shown in FIG. 5, the isolation valve assembly 23 may combine the functionality of an isolation valve component 44, controlling axially directed flow through an annular space, and a second valve component 45, controlling radially directed flow. The first valve component 44 may be configured, for example, having an axially moving mandrel and one or more first valve component ports 46, similar to the valve depicted in FIGS. 2A and 2B. In the embodiment illustrated in FIG. 5, the second valve component 45 is located between the first valve component 44 and the screen flow path 16. The second valve component 45 allows fluid communication between the screen flow path 16 and the internal bore 12, similar to the valves shown in FIGS. 4A-4C. Alternatively, as shown in FIG. 4, a second tubular string 48 may be arranged in the internal bore.

[0033] As shown in FIG. 5, the second valve component may comprise one or more second valve component ports 48 which are opened and closed by the movement of second valve component sleeve 49. The second valve component sleeve 49 may be controlled by hydraulic pressure or by tool intervention, as may be useful for isolation of the various production zones. FIG. 4 depicts the second valve component sleeve 49 extending into a radial sleeve chamber 50, by which the movement of the second valve component sleeve 49 may be controlled by differential hydraulic pressure.

[0034] The first valve component 44 and the second valve component 45 may be operated as part of a control scheme to isolate any number of production zones without limit into two or more production flows. In a further embodiment, shown in FIG. 6, the functionality of the first valve component 44 and the second valve component 45 are combined into an isolation control valve 51. The isolation control valve 51 allows the isolation valve assembly 23 to selectively connect the screen flow path 16 to either the isolation flow path 19 or to the internal bore 12 of the tubing string. The isolation control valve 51 depicted in FIG. 6 comprises an isolation control mandrel 52 that extends into an isolation control chamber 53. The isolation control mandrel 52 is configured to interface with one or more second valve component ports 47 and with one or more first valve component ports 46. The isolation control mandrel 52 may be arranged to radially traverse a space between the second valve component ports 47 and the first valve component ports 46, as shown, or the isolation control valve 51 may be arranged in any other configuration, including those that would allow for a substantially cylindrical isolation control mandrel 52. One or more openings 54 may be formed in the isolation control mandrel 52 in order to align with the first valve component ports 46, as shown, or with the second valve component ports 47.

[0035] In operation the isolation control valve 51 is configured to have two or more positions, including, for example, a position in which the screen flow path 16 is not fluidly connected to the isolation flow path 19 or to the internal bore, a position in which the isolation valve assembly 23 is configured to fluidly connect the screen flow path 16 to the internal bore only, a position in which the isolation valve assembly 23 is configured to fluidly connect the screen flow path 16 with the isolation flow path 19, and a position in which the isolation valve assembly 23 is configured to fluidly connect the screen flow path 16 with both the isolation flow path 19 and the internal bore. In the isolation control valve 51 of FIG. 6, each of these positions is achieved by axial displacement of the isolation control mandrel 52. As may be appreciated by those in the art, the relative positions of the various ports and openings may be selected to operate the isolation control valve 51 in a specific manner as desired. Referring to FIGS. 4 and 5, the functionality of the isolation control valve 51 may
also be achieved by coupling the operation of the first valve component 44 with the second valve component 45. In each configuration, the various operations of the valve may be controlled by either pressure or by tool intervention in order to isolation the various production zones as desired.

Another embodiment of the present disclosure, shown in FIG. 7, comprises a production string 55 run internal to the tubing string 2 and adjacent to two or more production zones 4. The production string 55 may be used, for example, with the circular flow valve 28 depicted in FIGS. 4A-C to isolate the two or more production zones 4 into two or more isolated production flows that may combine production from selected production zones 4. Each production zone 4 is isolated, for example by gravel pack, and includes one or more screen assemblies 56 and one or more circular flow valves 28, each of which is included in the radially outward tubing string 2. The production string 55 separates a production string bore 57 from an annular space 58 located between the production string 55 and the tubing string 2.

One or more shifting tools 59 are run provided with the production string 55. The one or more shifting tools 59 are used to arm the individual isolation valve assemblies 23, for example by shifting the associated support ring 37 (See FIGS. 4A-C). The one or more shifting tools 59 may comprise a single tool at the distal end of the production string 55, as indicated in FIG. 7, used to arm each of the isolation valve assemblies 23 upon insertion of the production string 55 in a single pass. Alternatively, the one or more shifting tools 59 may comprise a plurality of tools arranged adjacent to each of the isolation valve assemblies 23 for further control of the circular flow valves. The production string 55 also comprises one or more sealing sub 60 to isolate two or more of the production zones 4. The sealing sub 60 may comprise valves or ports to communicate the annular space 58 associated with one production zone 4 with the annular space 58 associated with another production zone 4.

Within one or more of the production zones 4, the production string 55 further comprises one or more production openings 61, such as perforated pps, ported sub, sliding sleeve devices, or the like. Flow between the annular space 58 and the production string bore 57 may be controlled by selectively opening or closing the production openings 61. In some embodiments, the production openings 61 are opened or closed by a mechanism such as a hydraulic pressure. In these embodiments, the fluid connection between the production zones 4 and the annular space 58, such as through a sliding sleeve on the basepipe, would be operable by shifting tool, but not by hydraulic pressure. In this configuration, the isolation of various flows is distinct from the control of access to individual zones.

The production string 55 of this embodiment allows the circular flow valves 28 in individual production zones 4 to be selectively opened and/or closed to customize the grouping of the isolated production flows. Alternatively, the production string 55 may be used in connection with the isolation control valve 51 of FIG. 6, or with screen assemblies equipped with a sleeve for controlling radial flow, or with similarly configured systems.

The terms “inflow,” “uphole,” and other words and phrases suggesting orientation are provided herein as exemplary and do not constrain the present disclosure to embodiments in which the orientation matches those of the examples given. For example, while the sliding sleeve 9 is described above as an “inflow control device,” the feature is equally suited to permitting circulating flow in gravel packing and other operations in which the direction of the fluid flow is radially outwardly.

While the invention has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Also, in the drawings and the description, there have been disclosed exemplary embodiments of the invention and, although specific terms may have been employed, they are unless otherwise stated used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention therefore not being so limited. Moreover, the use of the terms first, second, etc., do not denote any order or importance, but rather the terms first, second, etc. are used to distinguish one element from another. Furthermore, the use of the terms a, an, etc. do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced item.

1. An isolation system for a subsurface borehole having multiple production zones, comprising:
   a tubular string having an internal bore, the tubular string comprising a basepipe;
   an isolation flow path arranged radially outwardly of the internal bore; and
   an isolation valve assembly arranged in the isolation flow path, the isolation valve assembly arranged to fluidly connect the isolation flow path to a screen flow path, the screen flow path comprising a volume arranged radially outwardly of the basepipe.

2. The isolation system of claim 1, further comprising an inflow control device for fluidly connecting the isolation flow path to the internal bore.

3. The isolation system of claim 2, the isolation valve assembly being operably coupled to the inflow control device.

4. The isolation system of claim 1, the isolation flow path traversing at least one packing element.

5. An isolation system for a well having multiple production zones, comprising:
   a filtering assembly arranged on a basepipe, an annular space between the filtering assembly and the basepipe defining a screen flow path;
   a tubular having an isolation flow path formed therein, the tubular being coupled to the basepipe such that the isolation flow path is in fluid communication with the screen flow path; and
   an isolation valve assembly arranged in the isolation flow path.

6. The isolation system of claim 5, the isolation flow path comprising one or more axially extending channels.

7. The isolation system of claim 5, further comprising a flow control device configured to control fluid communication between the production zone and an internal bore of the base pipe.

8. The isolation system of claim 5, the isolation valve assembly being configured to selectively open and close by using a tool or hydraulic pressure.

9. The isolation system of claim 5, the isolation valve assembly being operably coupled to the flow control device.
10. The isolation system of claim 5, the isolation flow path traversing at least one packing element.

11. The isolation system of claim 5, the isolation flow path extending to a wellhead.

12. The isolation system of claim 5, the isolation flow path connected to an isolation pump.

13. An isolation system for a well having one or more production zones, comprising:
   a base pipe arranged in a tubing string adjacent to a production zone;
   a filtering assembly arranged on the base pipe, defining at least one screen flow path between the filtering assembly and the base pipe;
   a flow control device configured to permit fluid communication between the production zone and an internal bore of the base pipe;
   at least one isolation flow path arranged in the tubing string and fluidly connected to the at least one screen flow path, the isolation flow path being isolated from an internal bore of the tubing string; and
   an isolation valve assembly arranged in the isolation flow path.

14. The isolation system of claim 13, the isolation valve assembly being configured to selectively open and close by using a tool or hydraulic pressure.

15. The isolation system of claim 13, the isolation valve assembly being operably coupled to the flow control device.

16. The isolation system of claim 13, the isolation flow path traversing at least one packing element.

17. The isolation system of claim 13, the isolation flow path extending to a wellhead.

18. The isolation system of claim 13, the isolation flow path connected to an isolation pump.

19. A isolation valve assembly, comprising:
   a first opening connected to a first flow path;
   a second opening connected to a second flow path, the second flow path located radially inwardly relative to the first flow path;
   a first piston comprising a first flanged section and a second flanged section, the first piston having a first position in which the first flanged section obstructs fluid communication between the first opening and the second opening and a second position in which the first flanged section does not obstruct fluid communication between the first opening and the second opening;
   a second piston located between the first flanged section and the second flanged section of the first piston;
   a biasing member located between the second piston and the second flanged section; and
   one or more locking dogs, the locking dogs having a first position in which the one or more locking dogs restrict the movement of the first piston while not restricting the movement of the second piston, and a second position in which the one or more locking dogs restrict the movement of the second piston while not restricting the movement of the first piston.

20. The isolation valve assembly of claim 19, further comprising a support ring, the second piston further comprising one or more collet fingers configured to engage the support ring.

21. The isolation valve assembly of claim 19, the seal piston further comprising at least one seal.

22. The isolation valve assembly of claim 19, the first opening connected to a screen flow path.

23. An isolation system for a subsurface borehole having multiple production zones, comprising:
   a tubular string having an internal bore, the tubular string comprising a basepipe;
   a screen flow path arranged radially outwardly of the basepipe;
   an isolation flow path arranged radially outwardly of the tubular string; and
   an isolation valve assembly arranged connected to the isolation flow path and the screen flow path, the isolation valve assembly having two or more positions, including a first position in which the isolation valve assembly is arranged to fluidly connect the screen flow path to the internal bore, and a second position in which the isolation valve assembly is arranged to fluidly connect the screen flow path to the isolation flow path.

24. The isolation system of claim 23, the isolation valve assembly having a third position in which the isolation valve assembly is arranged to fluidly connect the screen flow path to both the internal bore and the isolation flow path.

25. The isolation system of claim 23, the isolation flow path traversing at least one packing element.

26. The isolation system of claim 23, the isolation valve assembly comprising a first valve component, configured to selectively control fluid flow in an axial direction, and a second valve component, configured to selectively control fluid flow in a radial direction.

27. An isolation system for a subsurface borehole having multiple production zones, comprising:
   an outer tubing string spanning two or more production zones, the outer tubing string comprising one or more circular flow valves in each of the two or more production zones;
   an inner tubing string spanning one or more production zones, the inner tubing string having one or more flow ports located in at least one of the one or more production zones, the inner tubing and the outer tubing forming an annular space therebetween;
   one or more sealing elements arranged in the annular space; at least one shifting tool arranged on the inner tubing for arming the one or more circular flow valves, the armed circular flow valves being operable by hydraulic pressure.

28. The system of claim 27, the one or more sealing elements comprising an second flow valve configured to selectively control fluid flow in an axial direction.

29. The system of claim 27, at least one of the flow ports of the inner tubing comprising a flow control device for connecting an internal bore of the inner tubing with an annular space, the flow control device being hydraulically operated.

* * * * *