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ABSTRACT

APPARATUS, SYSTEMS AND METHODS FOR A FLOW CONTROL DEVICE

A flow control device for control of fluid flow through a tubular member
5 comprises a control chamber having a piston disposed therein, where the piston is
moveable from an open piston position to a closed piston position by the application
of a first fluid pressure, and a valve chamber having a valve therein, where the valve
is moveable from a closed valve position to an open valve position by the
application of a second fluid pressure. A seal preventing fluid flow through the
10 control chamber into the tubular member is formed in the closed piston position, and
a flow path through the valve chamber and into the tubular member is formed in the
open valve position.

15 FIG. 2

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WE CLAIM:

1. A flow control device comprising:
 - a tubular member having an interior passageway for conveying fluids;
 - a housing disposed about the tubular member and forming a chamber
 - 5 between the housing and the tubular member, wherein the housing is divided into a control chamber and a valve chamber;
 - a piston disposed within the control chamber and moveable between a first piston position and a second piston position that is displaced from the first piston position, wherein the piston divides the control chamber
 - 10 into first and second portions; and
 - a valve disposed within the valve chamber and moveable between a first valve position and a second valve position that is displaced from the first valve position, wherein the valve provides for selective fluid communication between a first portion of the valve chamber and a
 - 15 second portion of the valve chamber,
 - wherein the piston provides a first flow path between the control chamber and interior passageway of the tubular member in the first piston position, and
 - wherein the valve provides a second flow path between the valve chamber
 - 20 and interior passageway of the tubular member in the second valve position.
2. A flow control device as claimed in claim 1, further comprising a valve retaining member, wherein the retaining member comprises a shear member that is configured to shear in response to a first pressure being applied to the valve.
- 25 3. A flow control device as claimed in claim 1, further comprising a valve retaining member, wherein the retaining member comprises a J-slot mechanism that is configured to actuate in response to a second pressure being applied to the valve.
4. A flow control device as claimed in claim 1, wherein the valve comprises a collet and valve plug assembly.
- 30 5. A flow control device as claimed in claim 1, wherein the valve comprises a piston and flange assembly.

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6. A flow control device as claimed in claim 1, further comprising a flow restrictor disposed in the first portion of the control chamber, wherein fluid flow along the first flow path through the control chamber results in a pressure drop.
7. A flow control device as claimed in claim 1, wherein the valve provides for fluid communication between the first portion of the valve chamber and the second portion of the valve chamber when the valve is disposed in the second position.
8. A flow control device as claimed in claim 1, wherein the piston, when disposed in the second position, and the valve, when disposed in the first position, provides a seal against fluid communication with the interior passageway of the tubular member.
9. A flow control device for control of fluid flow through a tubular member comprising:
- a control chamber having a piston disposed therein, wherein the piston is moveable from an open piston position to a closed piston position by the application of a first fluid pressure; and
 - a valve chamber having a valve therein, wherein the valve is moveable from a closed valve position to an open valve position by the application of a second fluid pressure;
- wherein a seal preventing fluid flow through the control chamber into the tubular member is formed in the closed piston position, and
- wherein a flow path through the valve chamber and into the tubular member is formed in the open valve position.
10. A flow control device as claimed in claim 9, further comprising a restraining member configured to be actuated by movement of the piston in response to the first fluid pressure.
11. A flow control device as claimed in claim 9, further comprising a restraining member configured to be actuated by movement of the valve in response to the second fluid pressure.
12. A flow control device as claimed in claim 9, wherein the valve forms a seal against a fluid flow between at least a portion of the valve chamber and the tubular member during the application of the first fluid pressure.

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13. A flow control device as claimed in claim 9, wherein a first flow path through the control chamber into the tubular member creates a first pressure drop, wherein a second flow path through the valve chamber into the tubular member creates a second pressure drop, and wherein the second pressure drop is less than the first pressure drop.
14. A flow control device as claimed in claim 9, wherein the second fluid pressure is greater than the first fluid pressure.
15. A flow control device as claimed in claim 9, further comprising a flow restrictor disposed within the control chamber, wherein the flow restrictor is configured to provide a helical flow path.
16. A flow control device as claimed in claim 9, further comprising a nozzle disposed within the control chamber.
17. A method for controlling flow into a tubular member comprising:
providing fluid communication between an interior of the tubular member and a subterranean formation along a first flow path;
substantially sealing the first flow path in response to a first pressure;
establishing a second flow path between the interior of the tubular member and the subterranean formation in response to a second pressure; and
providing fluid communication between the interior of the tubular member and the subterranean formation along the second flow path.
18. A method as claimed in claim 17, wherein substantially sealing the first flow path comprises applying a first pressure to a flow restrictor disposed in the first flow path and to a piston that is disposed in a first position, translating the piston from the first position to a second position in response to the first pressure, and substantially sealing fluid flow through the flow restrictor and into the interior of the tubular member along the first flow path.
19. A method as claimed in claim 17, wherein establishing a second flow path comprises applying a second pressure greater than the first pressure to a valve, actuating the valve from a closed position to an open position in response to the second pressure, and flowing fluid through the valve into the interior of the tubular member through a second flow path.

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20. A method as claimed in claim 17, wherein the first flow path is substantially sealed prior to establishing the second flow path.

Dated this 7th day of Sept., 2014.

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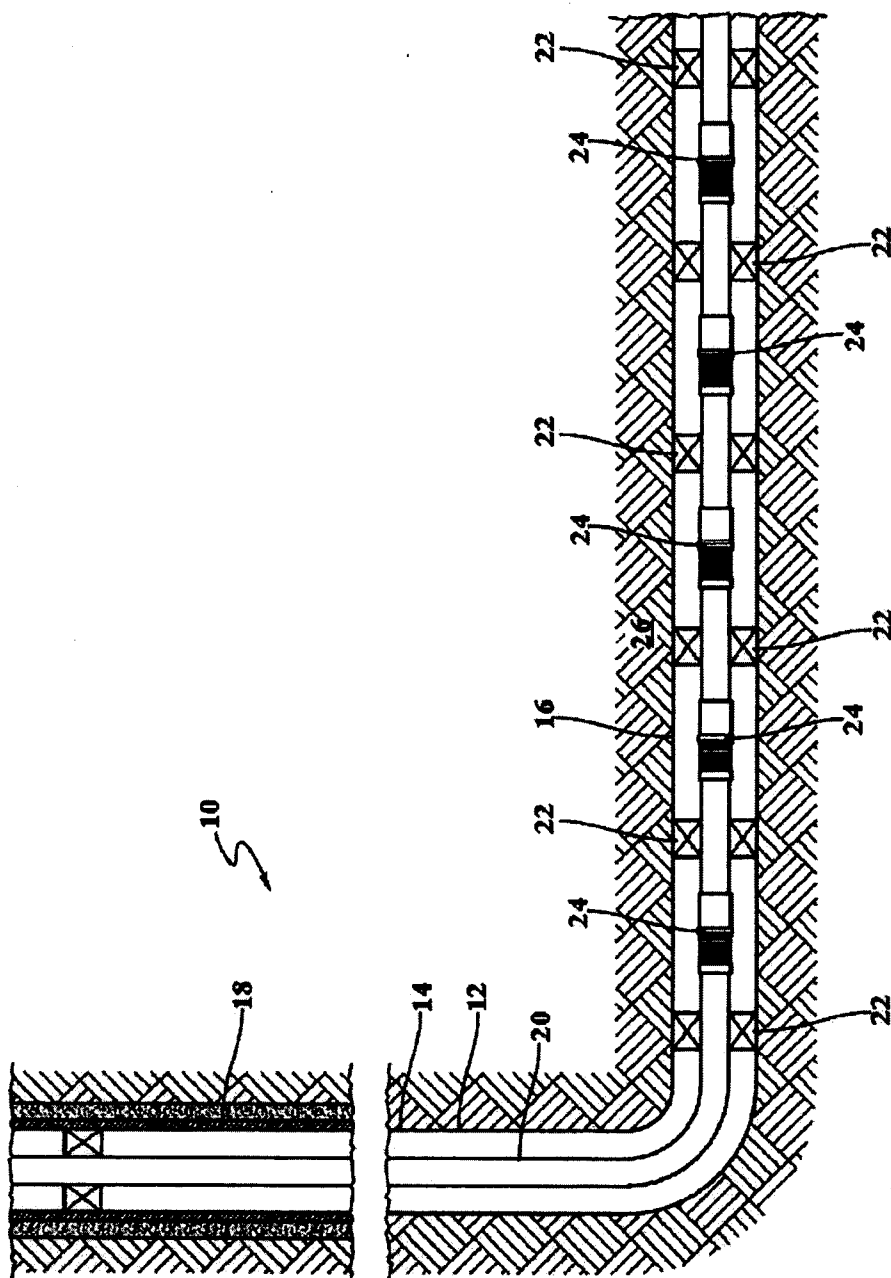


FIGURE 1

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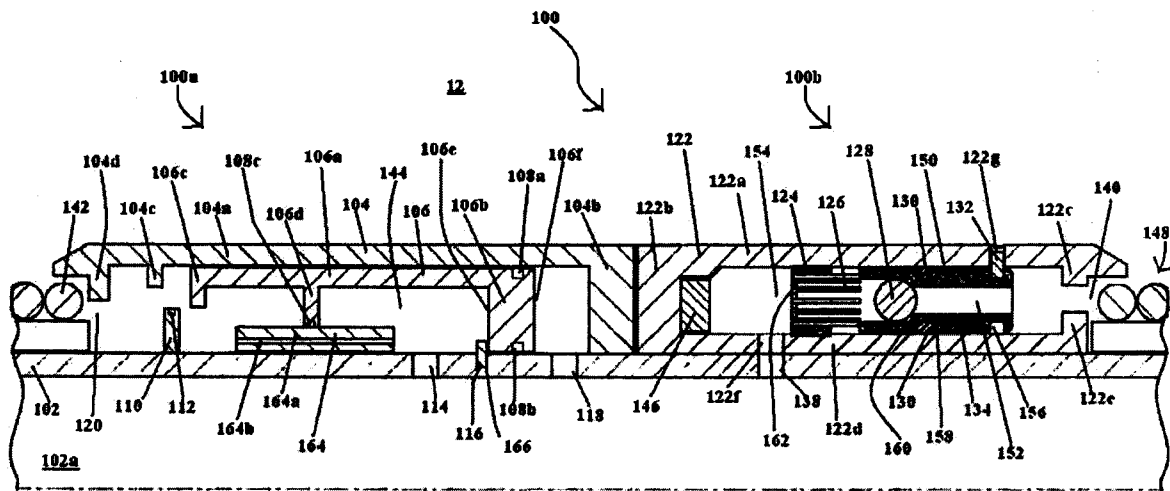


FIGURE 2

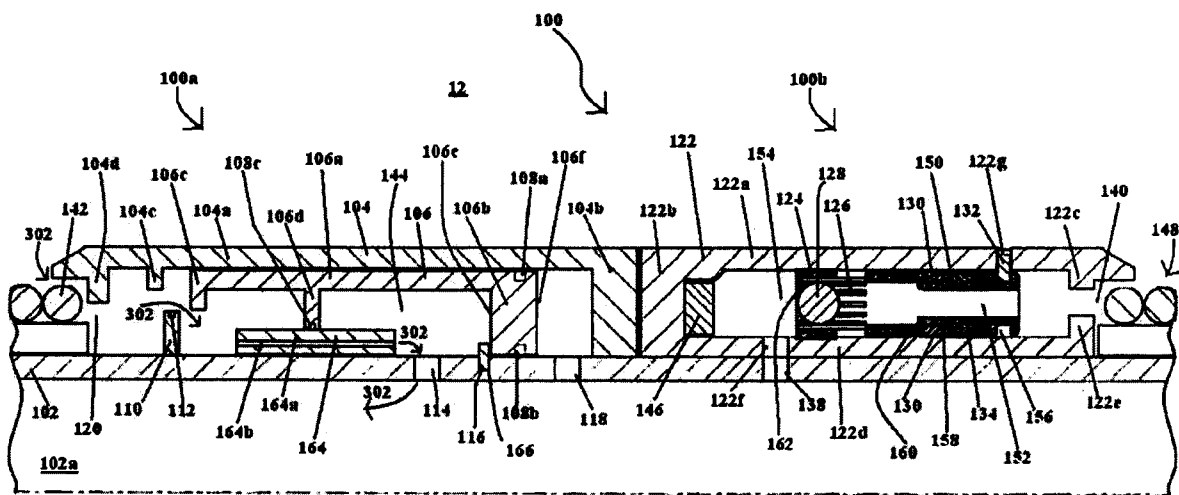


FIGURE 3A

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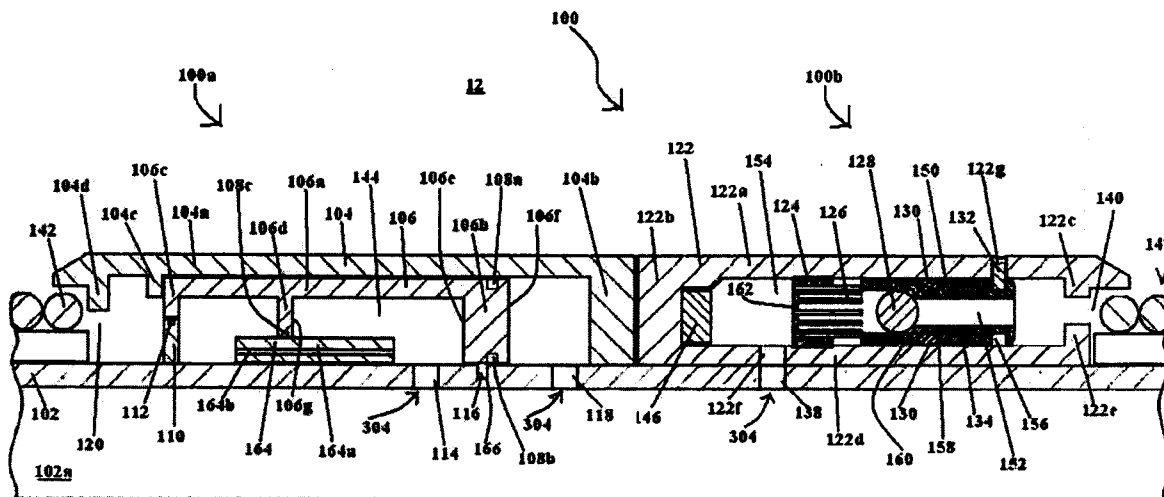


FIGURE 3B

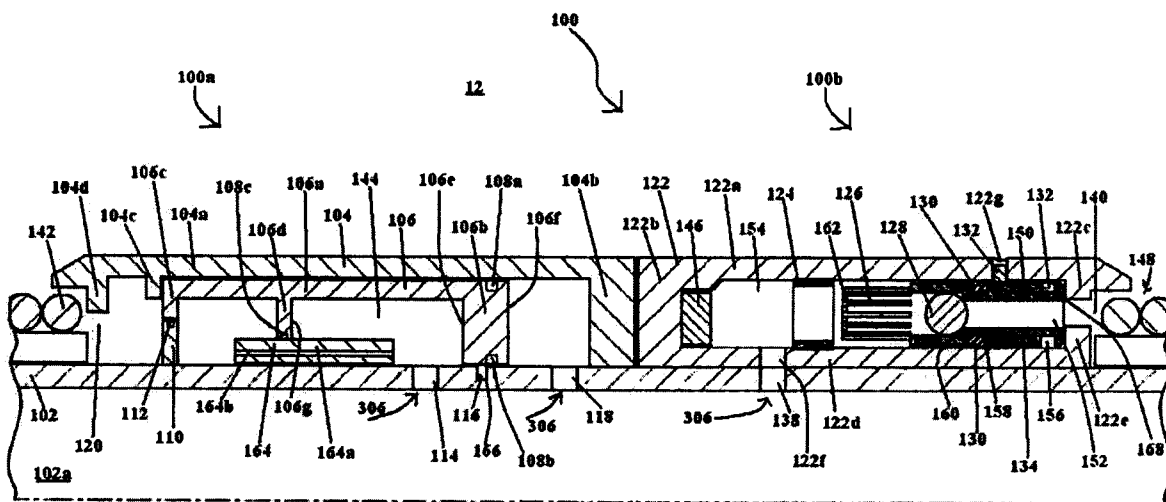


FIGURE 3C

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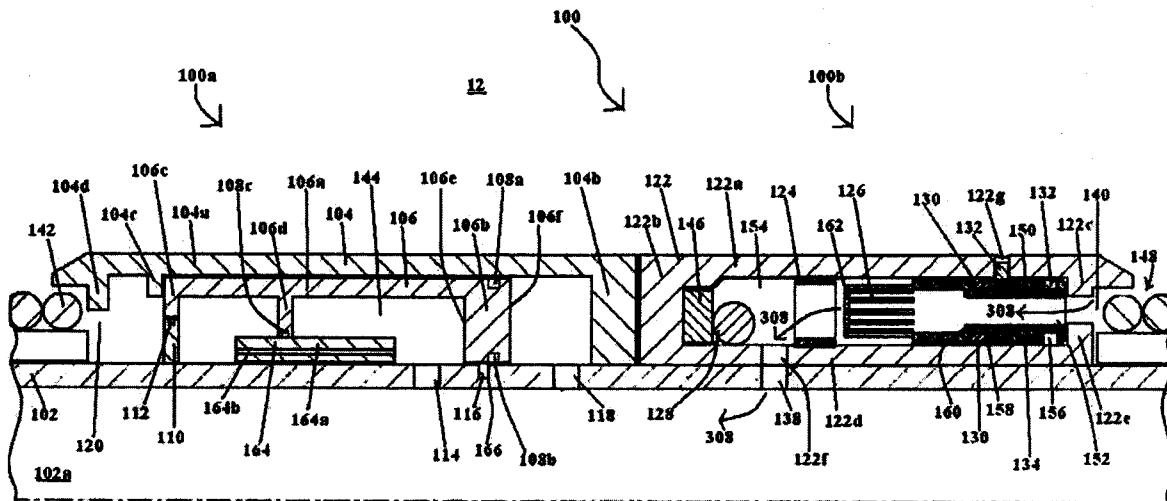


FIGURE 3D

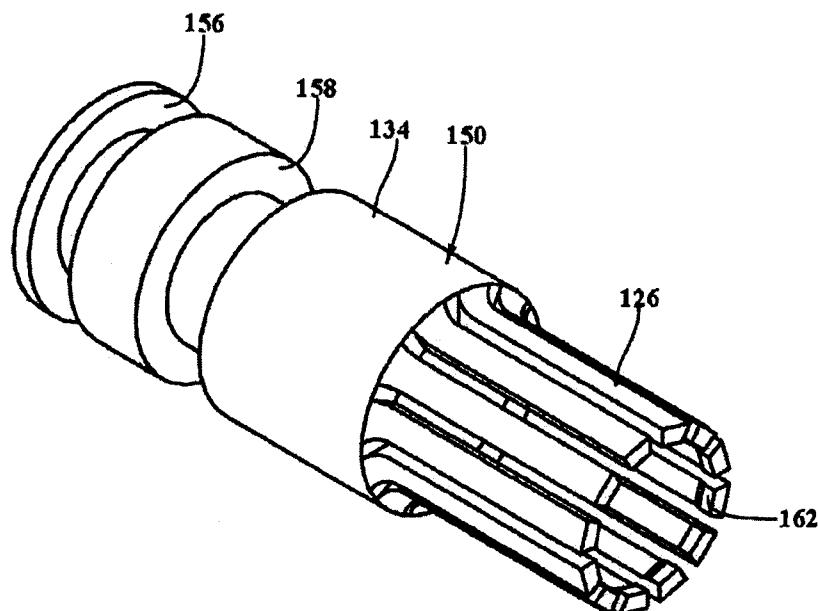


FIGURE 4

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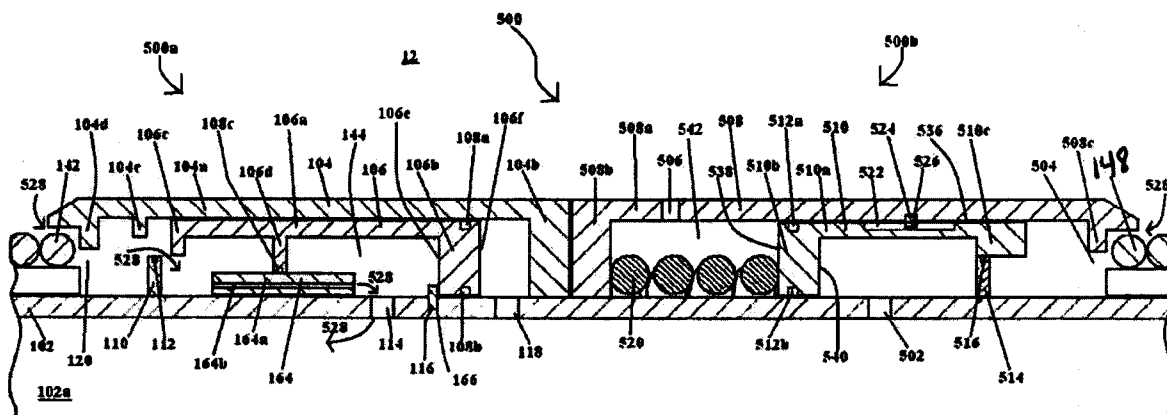
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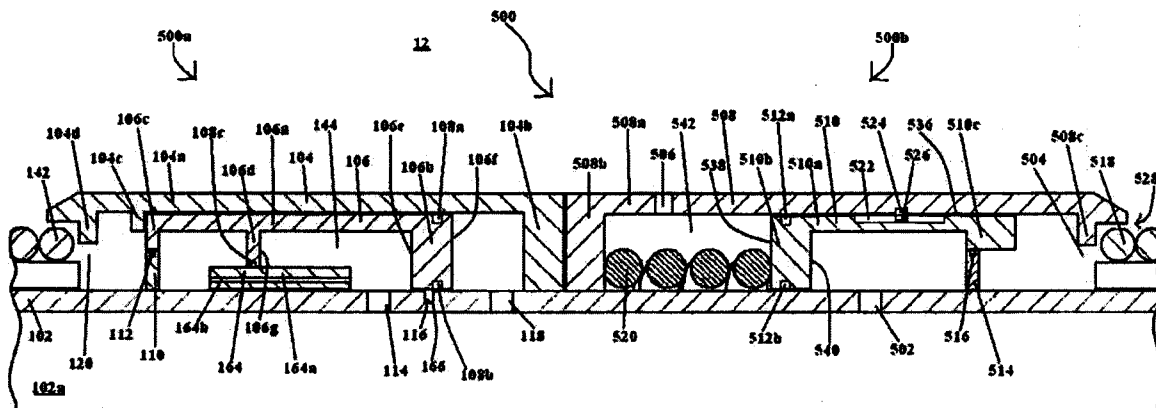


FIGURE 5C

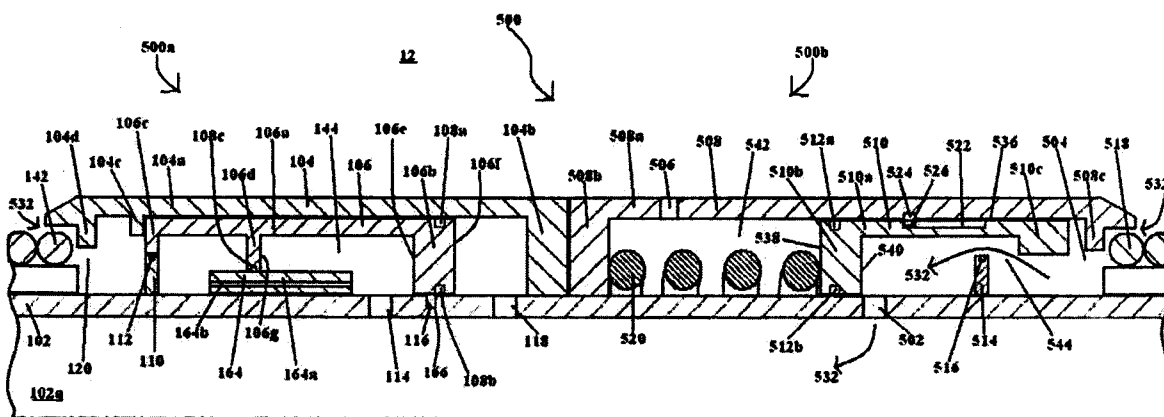


FIGURE 5D

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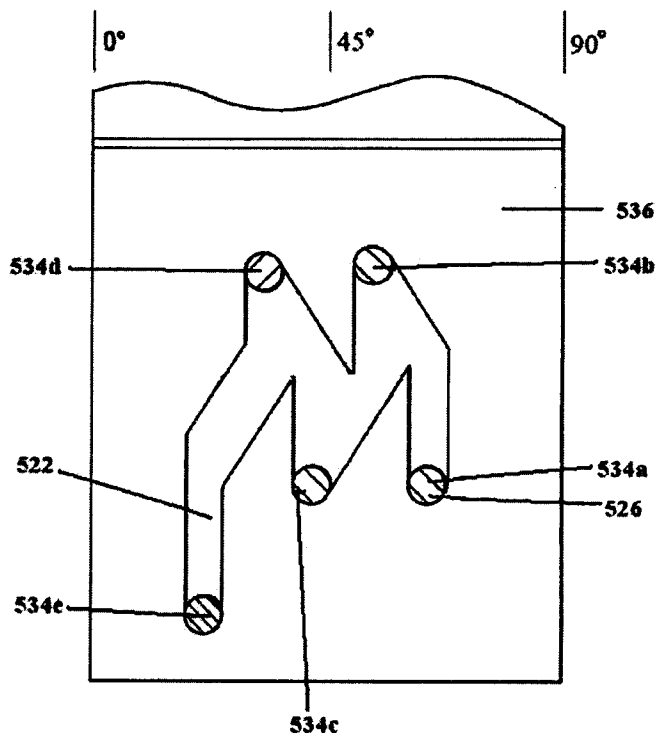


FIGURE 6

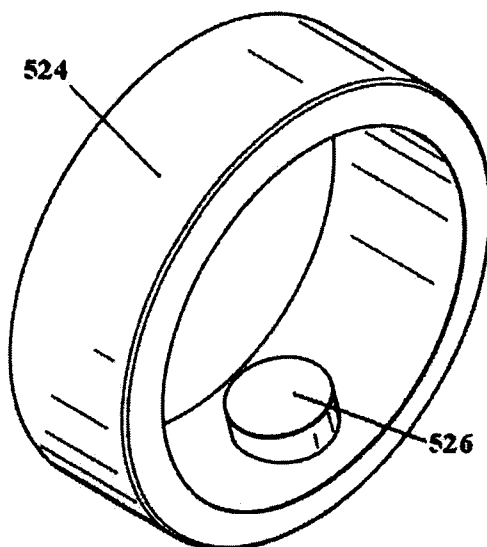


FIGURE 7

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FIELD OF INVENTION

The present invention relates to apparatus, systems and methods for a flow control device. The present invention relates generally to equipment utilized and operations performed in conjunction with a subterranean well and, more particularly,
5 to the application of flow control devices to manage fluid flow into and out of a tubular body.

BACKGROUND TECHNICAL INFORMATION

Without limiting the scope of the disclosure, its background will be described with reference to producing fluid from a hydrocarbon bearing subterranean formation,
10 as an example.

During the production of hydrocarbons from a subterranean well, it is desirable to substantially reduce or exclude the production of water produced from the well. For example, it may be desirable for the fluid produced from the well to have a relatively high proportion of hydrocarbons, and a relatively low proportion of water.
15 In some cases, it is also desirable to restrict the production of hydrocarbon gas from a well.

In addition, where fluid is produced from a long interval of a formation penetrated by a wellbore, it is known that balancing the production of fluid along the interval can lead to reduced water and gas "coning," and more controlled
20 conformance, thereby increasing the proportion and overall quantity of oil produced from the interval. Inflow control devices (ICDs) have been used in the past to restrict flow of produced fluid through the ICDs for the purpose of balancing production along an interval. For example, in a long horizontal wellbore, fluid flow near the "heel" of the wellbore may be more restricted as compared to fluid flow near a "toe"

of the wellbore, to counteract a horizontal well's tendency to produce at a higher flow rate at the "heel" of the well as compared to the "toe."

However, after the onset of water or gas production in the well due to coning, it is sometimes desirable to reduce any flow restrictions created by the ICDs in order to maximize production. Thus, while ICDs are desirable for delaying the point when water or gas production begins, higher flow rates into the well may be needed after this point in time in order to extract any remaining hydrocarbons from the surrounding formation. Further, it may also be desirable to isolate the well from the surrounding formation without the need for physical intervention into the well, such as for setting particular tools in the well or for abandoning the well.

SUMMARY OF THE INVENTION

In an embodiment, a flow control device comprises a tubular member having an interior passageway for conveying fluids, a housing disposed about the tubular member and forming a chamber between the housing and the tubular member, where the housing is divided into a control chamber and a valve chamber, a piston disposed within the control chamber and moveable between a first piston position and a second piston position that is displaced from the first piston position, where the piston divides the control chamber into first and second portions, and a valve disposed within the valve chamber and moveable between a first valve position and a second valve position that is displaced from the first valve position, where the valve provides for selective fluid communication between a first portion of the valve chamber and a second portion of the valve chamber. The piston provides a first flow path between the control chamber and interior passageway of the tubular member in the first piston position, and the valve provides a second flow path between the valve chamber and interior passageway of the tubular member in the second valve position.

In an embodiment, a flow control device for control of fluid flow through a

