

CLAIMS

WHAT IS CLAIMED IS:

1. ~~A wellbore flow control system, comprising:~~

~~a base pipe defining an interior passageway and having at least one radial opening defined therein;~~

~~a flow control housing secured to the base pipe and defining a flow path extending to the radial opening in the base pipe;~~

~~a piston disposed in the flow path, the piston responsive to the application of an activation pressure from the interior passageway of the base pipe to move in a first direction from an initial position;~~

~~a plunger disposed in the flow path, the plunger responsive the application of activation pressure to move in a second direction opposite the first direction to engage the flow control housing and thereby close the flow path;~~

~~a first biasing member operably coupled to the plunger to urge the plunger in the first direction to disengage the flow control housing in response to relief of the activation pressure; and~~

~~a latch operably coupled to the piston to move in the first direction in response to the application of the activation pressure, the latch operably coupled to the plunger to maintain the plunger disengaged from the flow control housing in response to relief of the activation pressure.~~

2. ~~The system of claim 1, further comprising an outer sleeve having a connector thereon for selectively coupling the outer sleeve to the flow control housing, wherein the piston, plunger, first biasing member and latch are all carried by the outer sleeve.~~

3. ~~The system of claim 2, wherein the connector on the outer sleeve includes a thread engaged with a corresponding thread defined in an access port of the flow control housing.~~

4. ~~The system of claim 2, wherein the latch engages the outer sleeve to maintain the plunger disengaged from the flow control housing.~~

5. ~~The system of claim 1, further comprising a second biasing member operably coupled to plunger to bias the plunger in the second direction into engagement with the flow control~~

housing when the piston is disposed in the initial position and operable to permit the plunger to disengage the flow control housing when the piston is moved to an activated position and the activation pressure is relieved.

5 6. — The system of claim 5, wherein the first biasing member comprises a relatively strong spring and the second biasing member comprises a relatively weak spring, and wherein the relatively strong spring counteracts the bias of the relatively weak spring.

10 7. — The system of claim 6, further comprising a shear member operably coupled to the relatively strong spring to prevent the relatively strong spring from counteracting the bias of the relatively weak spring when the piston is in the initial position, and wherein the shear member shears in response to the application of the activation pressure to permit the strong spring to counteract the bias of the relatively weak spring.

8. — The system of claim 7, further comprising an elongated rod operably coupled between the piston and the plunger by the shear member, the elongated rod placed in tension by the application of the activation pressure.

15 9. — The system of claim 1, wherein the latch comprises at least one of the group consisting of a snap ring, a collet, and one-way ratchet teeth.

10. — The system of claim 1, further comprising a flow control screen including an outer sheath and a filter element disposed around the base pipe in fluid communication with the flow path defined in the flow control housing.

20 11. — The system of claim 1, further comprising an end cap coupled to the flow control housing to define a chamber between the piston and the end cap, the end cap defining a pressure relief port therethrough.

12 1. A method of operating a wellbore flow control system, the method comprising:
running a base pipe into a wellbore on a tubing string;
25 applying an activation pressure to a flow control housing coupled the base pipe by increasing a fluid pressure in the tubing string;

urging a piston and a plunger in opposite first and second directions by the activation pressure, the piston urged in the first direction from an initial position in the flow control housing to an activated position, and the plunger urged in the second direction to engage the flow control housing and thereby close flow path extending through the flow control housing to the base pipe;

conducting wellbore operations while applying the activation pressure to maintain the plunger engaged with the flow control housing; and thereafter

relieving the activation pressure to permit a first biasing member to disengage the plunger from the flow control housing to thereby open the flow path through the flow control housing and to permit a latch to lock the plunger in a disengaged position with respect to the flow control housing.

2 ~~13~~. The method of claim 1~~2~~; further comprising installing an outer sleeve into an access port of the flow control housing, wherein the piston, plunger, first biasing member and latch are all carried by the outer sleeve.

3 ~~14~~. The method of claim 1~~2~~ further comprising urging the plunger in the second direction with a second biasing member to engage the flow control housing while the piston is disposed in the initial position.

4 ~~15~~. The method of claim 3~~14~~, further comprising shearing a shear member with the activation pressure to permit the first biasing member to counteract a bias of the second biasing member.

5 ~~16~~. The method of claim 1~~2~~, wherein urging the piston in the first direction further comprises engaging ratchet teeth on the piston with ratchet teeth defined within the flow control housing.

6 ~~17~~. The method of claim 5~~16~~, wherein engaging the ratchet teeth on the piston further comprises engaging one-way ratchet teeth such that the piston is locked in an actuated position to lock the plunger in the disengaged position.

7 ~~18~~. The method of claim 1~~2~~, wherein conducting wellbore operations while applying the activation pressure further comprises conducting washdown or circulation operations, and

wherein the method further comprises conducting production or injection operations through the flow control housing with the plunger locked in the disengaged configuration.

~~19. An isolation plug apparatus for a wellbore flow control system, the isolation plug apparatus comprising:~~

- ~~5 an outer sleeve having a connector thereon for selectively coupling the outer sleeve to a flow control housing of the flow control system;~~
- ~~a piston disposed in the outer sleeve, the piston responsive to the application of an activation pressure to move in a first direction from an initial position within the outer sleeve;~~
- ~~a plunger extending from the outer sleeve, the plunger responsive to the application of the~~
- ~~10 activation pressure to move in a second direction opposite the first direction;~~
- ~~a first biasing member operably coupled to the plunger to urge the plunger in the first direction in response to relief of the activation pressure; and~~
- ~~a latch operably coupled to the piston to move in the first direction in response to the application of the activation pressure, the latch operably coupled to the plunger to lock the~~
- ~~15 plunger in a retracted position with respect to the outer sleeve in response to relief of the activation pressure.~~

~~20. The apparatus of claim 19, further comprising a second biasing member operably coupled to plunger to bias the plunger in the second direction to an extended position with respect to the outer sleeve when the piston is disposed in the initial position.~~

20 8 24. A method of controlling fluid flow in a wellbore, the method comprising:

assembling an isolation plug into a flow control housing of an inflow control device such that a plunger of the isolation plug engages the flow control housing and thereby closes a flow path through the flow control housing;

25 running the inflow control device into a wellbore on a base pipe fluidly coupled to the flow path through the flow control housing;

applying an activation pressure through the interior passageway of the base pipe;

urging the plunger to maintain engagement with the flow control housing with the activation pressure;

urging a piston to unlock a first biasing member with the activation pressure;

5 relieving the activation pressure to permit the first biasing member to disengage the plunger from the flow control housing to thereby open the flow path through the flow control housing; and

flowing fluid between the base pipe and the inflow control device through the flow path with the plunger disengaged from the flow control housing.

9 22. The method of claim 824, wherein assembling the isolation plug into the flow
10 control housing comprises threading an outer sleeve of the isolation plug into an access port defined in the flow control housing.

10 23. The method of claim 824, where assembling an isolation plug into a flow control housing comprises engaging a seal member between the plunger and the flow control housing.

15 11 24. The method of claim 824, wherein unlocking the first biasing member comprises shearing a shear member with the piston and the activation pressure.

12 25. The method of claim 824, further comprising urging the plunger in a first direction into engagement with the with the flow control housing with a second biasing member.

20 13 26. The method of claim 1225, further comprising counteracting a bias of the second biasing member in the first direction with a bias of the first biasing member in a second direction opposite the first direction.

14 27. The method of claim 824, further comprising latching the plunger in the isolation plug in response to applying the activation pressure such that the plunger is

maintained in a disengaged position with respect to the flow control housing in response to relieving the activation pressure.

15 ~~28~~. A method of controlling fluid flow through an inflow control device; the method comprising:

- 5 assembling an isolation plug into a flow control housing of the inflow control device such that a plunger of the isolation plug engages the flow control housing and thereby closes a flow path through the flow control housing;

applying an activation pressure to the flow path;

- 10 urging the plunger in a first direction with the activation pressure to maintain engagement between the plunger and the flow control housing;

urging a piston in a second direction with the activation pressure to apply a bias to the plunger in the second direction opposite the first direction; and

- 15 relieving the activation pressure to permit the bias to the plunger in the second direction to disengage the plunger from the flow control housing to thereby open the flow path through the flow control housing.

16 ~~29~~. The method of claim 15~~28~~, wherein assembling the isolation plug into the flow control housing comprises installing the isolation plug through an access port extending to an exterior of the flow control housing.

- 20 17 ~~30~~. The method of claim 15~~28~~, wherein urging the piston in the second direction shears a shear member to unlock a first biasing member for biasing the piston in the second direction.

18 ~~31~~. The method of claim 17~~30~~, further comprising biasing the plunger in the first direction with a second biasing member, wherein the first biasing member imparts a greater force to the plunger than the second biasing member.

19 32. The method of claim 1528, further comprising latching the plunger to an outer sleeve of the isolation plug after disengaging the plunger from the flow control housing.

20 33. The method of claim 1528, further comprising running the inflow control device into a wellbore prior to applying the activation pressure and flowing fluid through
5 the inflow control device subsequent to relieving the activation pressure.