SUMMARY OF THE INVENTION

According to a first aspect, the invention provides a flow restriction tool for use in a subterranean well, the flow restriction tool comprising:

a closure device reciprocably displaceable between first and second positions in which flow is permitted longitudinally through the flow restriction tool, wherein in the first position a first flow passage is open to the flow and the closure device blocks the flow through a second flow passage, and in the second position the first and second flow passages are open to the flow;

a biasing device which displaces the closure device to the first position in response to a flow rate of the flow being reduced to less than a first predetermined level; and

a retaining device that releasably retains the closure device in the first position,

wherein the retaining device releases the closure device in response to the flow rate being increased to greater than a second predetermined level, thereby permitting displacement of the closure device from the first position to the second position.

According to a further aspect, the invention provides a well tool string, comprising:

an orientation tool that selectively permits and prevents fluid communication between an interior and an exterior of the well tool string and thereby transmits orientation data via multiple pressure pulses in a flow passage extending longitudinally through the well tool string; and

a flow restriction tool according to any one of the embodiments disclosed herein.

According to a further aspect, the invention provides a method of orienting a well tool string in a well, the method comprising:

flowing fluid through a well tool string according to any one of the embodiments disclosed herein, wherein the closure device of the flow restriction tool is in the first position and wherein a flow rate of the fluid is less than the second predetermined level; transmitting orientation data encoded via multiple pressure pulses produced by selectively permitting and preventing fluid communication between the interior and the exterior of the well tool string; and

increasing the flow rate of the fluid to greater than the second predetermined level, thereby displacing the closure device to the second position, but say well stirring tool according to any of the embodiments disclosed herein

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A flow restriction tool for use in a subterranean well, the flow restriction tool comprising:

a closure device reciprocably displaceable between first and second positions in which flow is permitted longitudinally through the flow restriction tool, wherein in the first position a first flow passage is open to the flow and the closure device blocks the flow through a second flow passage, and in the second position the first and second flow passages are open to the flow;

a biasing device which displaces the closure device to the first position in response to a flow rate of the flow being reduced to less than a first predetermined level; and

a retaining device that releasably retains the closure device in the first position,

wherein the retaining device releases the closure device in response to the flow rate being increased to greater than a second predetermined level, thereby permitting displacement of the closure device from the first position to the second position.

2. The flow restriction tool of claim 1, wherein the retaining device comprises at least one resilient collet.

3. The flow restriction tool of claim 2, wherein the retaining device retains the closure device by engagement of the at least one resilient collet with at least one recess in a housing of the flow restriction tool.

4. The flow restriction tool of claim 3, wherein the retaining device releases the closure device when the at least one resilient collet is sufficiently deformed in response to the flow rate being increased to greater than the second

predetermined level that the at least one resilient collet is no longer engaged with the at least one recess.

5. The flow restriction tool of any one of claims 1 to 4, wherein the biasing device comprises at least one resilient collet.

6. The flow restriction tool of any one of claims 1 to 5, wherein the closure device comprises a sleeve, and in the second position the flow passes through a wall of the sleeve.

7. The flow restriction tool of any one of claims 1 to 6, wherein the biasing device radially outwardly surrounds a generally conically shaped outer surface connected to the closure device.

8. The flow restriction tool of any one of claims 1 to 7, wherein a total flow area through the flow restriction tool is reduced when the closure device is displaced from the second position to the first position, the total flow area being a sum of a least available flow area through the first passage and a least available flow area through the second passage.

9. A well tool string, comprising:

an orientation tool that selectively permits and prevents fluid communication between an interior and an exterior of the well tool string and thereby transmits orientation data via multiple pressure pulses in a flow passage extending longitudinally through the well tool string; and

a flow restriction tool according to any one of claims 1 to 8.

10. The well tool string of claim 9, wherein the flow restriction tool is positioned downstream of the orientation tool.

11. The well tool string of claim 10, wherein the flow restriction tool increases a fluid pressure upstream of the flow restriction tool when fluid flows through the flow restriction tool with the closure device in the first position, thereby permitting the orientation tool to transmit the orientation data via negative pressure pulses.

12. A method of orienting a well tool string in a well, the method comprising:

flowing fluid through a well tool string according to any one of claims 7 to 11, wherein the closure device of the flow restriction tool is in the first position and wherein a flow rate of the fluid is less than the second predetermined level;

transmitting orientation data encoded via multiple pressure pulses produced by selectively permitting and preventing fluid communication between the interior and the exterior of the well tool string; and

increasing the flow rate of the fluid to greater than the second predetermined level, thereby displacing the closure device to the second position.

13. A method according to claim 12, further comprising:

decreasing the flow rate to less than the first predetermined level, thereby displacing the closure device to the first position.