CLAIMS

What is claimed is:

1. A well system, comprising:

a tubing string extendable within a wellbore;

a subsurface safety valve interconnected with the tubing string and including :

a housing that defines a central flow passageway and includes a flapper pivotable within the central flow passageway between closed and open positions;

a flow tube movably positioned within the central flow passageway and engageable with the flapper to move the flapper to the open position;

an actuation piston movably positioned within an actuation piston bore defined in a wall of the housing and operatively coupled to the flow tube;

a balance piston movably positioned within a balance piston bore defined in the wall and operatively coupled to the flow tube; and

a lock-open piston movably positioned within a lock-open piston bore defined in the wall and engageable with an actuator sleeve operatively coupled to the flow tube; and

a lock-open tool positionable within the central flow passageway to convey hydraulic pressure into the lock-open piston bore and thereby actuate the lock-open piston to an actuated position that moves the flow tube and permanently locks the flapper in the open position.

2. The well system of claim 1, wherein the subsurface safety valve further includes a filter positioned within the central flow passageway to facilitate fluid communication between the central flow passageway and the balance piston bore and the lock-open piston bore.

3. The well system of claim 2, wherein the lock-open tool comprises:

a cylindrical housing defining an inner flow bore that transitions into an inner flow chamber;

an upper seal provided on the cylindrical housing to sealingly engage an upper seal bore provided within the central flow passageway; and

a lower seal provided on the cylindrical housing to sealingly engage a lower seal bore provided within the central flow passageway, wherein the upper and lower seal bores are provided on opposing axial ends of the filter.

4. The well system of claim 3, wherein the lock-open tool further comprises:

a plurality of radial flow ports defined in the cylindrical housing to provide fluid communication between the inner flow bore and the balance piston bore and the lock-open piston bore via the filter;

a dart seat secured within the inner flow chamber; and

a dart extending longitudinally within the cylindrical housing and providing a head positioned within the inner flow chamber to sealingly engage the dart seat and thereby divert fluid pressure through the radial flow ports and into the balance piston bore and the lock-open piston bore.

5. The well system of claim 1, wherein the lock-open tool comprises an outer profile engageable with a no-go profile defined in the central flow passageway.

6. The well system of claim 1, wherein upper and lower ends of each of the balance piston and the lock-open piston are exposed to tubing pressure present in the central flow passageway.

7. The well system of claim 1, wherein the subsurface safety valve further includes a locking mechanism arranged in the lock-open piston bore to secure the lock-open piston in the actuated position.

8. A method, comprising :

advancing a lock-open tool within a tubing string to a subsurface safety valve interconnected with the tubing string, the subsurface safety valve including:

a housing that defines a central flow passageway and includes a flapper pivotable within the central flow passageway between closed and open positions;

a flow tube movably positioned within the central flow passageway;

an actuation piston movably positioned within an actuation piston bore defined in a wall of the housing and operatively coupled to the flow tube;

a balance piston movably positioned within a balance piston bore defined in the wall and operatively coupled to the flow tube;

a lock-open piston movably positioned within a lock-open piston bore defined in the wall and engageable with an actuator sleeve operatively coupled to the flow tube; and

a filter positioned within the central flow passageway to facilitate fluid communication between the central flow passageway and the balance piston bore and the lock-open piston bore;

jarring down on the lock-open tool to sealingly engage an upper seal against an upper seal bore of the housing and sealingly engage a lower seal against a lower seal bore of the housing, wherein the upper and lower seal bores are provided on opposing axial ends of the filter;

pressurizing the tubing string and thereby pressurizing the lock-open piston bore via one or more radial flow ports defined in the lock-open tool that fluidly communicate with the filter between the upper and lower seals; and

moving the lock-open piston to an actuated position within the lock-open piston bore and thereby advancing the flow tube to move the flapper to the open position.

9. The method of claim 8, wherein jarring down on the lock-open tool further comprises jarring down on the lock-open tool until an outer profile provided on the lock-open tool engages a no-go profile defined on an inner surface of the central flow passage.

10. The method of claim 8, further comprising locking the lock-open piston in the actuated position with a locking mechanism arranged in the lock-open piston bore.

11. The method of claim 8, wherein pressurizing the tubing string further comprises pressurizing the balance piston bore via the one or more radial flow ports and thereby moving the balance piston within the balance piston bore.

12. The method of claim 8, wherein pressurizing the tubing string and thereby pressurizing the lock-open piston bore is preceded by applying an axial load on the lock-open tool and thereby forcing a head of a dart into sealing engagement with a dart seat secured within an inner flow chamber of the lock-open tool.

13. The method of claim 8, further comprising securing the lock-open piston in the actuated position with a locking mechanism arranged in the lock-open piston bore.

14. The method of claim 8, further comprising jarring up on the lock-open tool to retract the lock-open tool from the central flow passageway.

15. A subsurface safety valve, comprising :

a housing that defines a central flow passageway and includes a flapper pivotable within the central flow passageway between closed and open positions;

a flow tube movably positioned within the central flow passageway and engageable with the flapper to move the flapper to the open position;

an actuation piston movably positioned within an actuation piston bore defined in a wall of the housing and operatively coupled to the flow tube;

a balance piston movably positioned within a balance piston bore defined in the wall and operatively coupled to the flow tube; and

a lock-open piston movably arranged within a lock-open piston bore defined in the wall and engageable with an actuator sleeve operatively coupled to the flow tube, wherein the lock-open piston is actuatable to an actuated position that moves the flow tube and permanently locks the flapper in the open position.

16. The subsurface safety valve of claim 15, further comprising a filter positioned within the central flow passageway to facilitate fluid communication between the central flow passageway and the balance piston bore and the lock-open piston bore.

17. The subsurface safety valve of claim 16, wherein the filter defines slots to filter debris of a predetermined size from entering the balance piston bore and the lock-open piston bore.

18. The subsurface safety valve of claim 15, wherein upper and lower ends of each of the balance piston and the lock-open piston are exposed to tubing pressure present in the central flow passageway.

19. The subsurface safety valve of claim 15, further comprising a locking mechanism arranged in the lock-open piston bore that secures the lock-open piston in the actuated position.

20. The subsurface safety valve of claim 19, wherein the locking mechanism comprises:

a collet fixed within the lock-open piston bore;

a series of teeth defined on an outer surface of the lock-open piston rod,

wherein the collet receives the lock-open piston rod and ratchets against the series of teeth as the lock-open piston moves to the actuated position, and

wherein the collet engages the teeth to secure lock-open piston in the actuated position.