CLAIMS

1. An aerator valve assembly comprising:

an outer housing with front and back ends terminating a central passageway;

a movable valve member having a one-piece unitary metal construction slidably engaged within the central passageway in the outer housing, the valve member having an enlarged head termination sealing the front end of the passageway;

a spring-loaded spring guide member having a one-piece unitary metal construction which is fixed within the central passageway in the outer housing intermediate the front and back ends;

a wave spring having a predetermined spring constant for supplying spring tension to keep the moveable valve member sealed; and

a gas valve mechanism for supplying a pressurized gas sufficient to overcome the spring tension and to drive the valve member forward unsealing the front end of the central passageway and releasing the pressurized gas,

the aerator valve assembly further comprising at least one sensor for sensing events,

wherein the at least one sensor comprises a linear shaft displacement counter for counting the number of times the valve member opens and closes.

2. The aerator valve assembly as in claim 1, further comprising a calibrated tension adjuster,

wherein the calibrated tension adjuster and the spring-loaded spring guide are disposed on either end of the wave spring for compressing the wave spring.

3. The aerator valve assembly as in claim 2, wherein the wave spring further comprises a 360 degree contact wave spring,

wherein the 360 degree wave spring provides continuous contact between the 360 degree wave spring-calibrated tension adjuster and the 360 degree wave spring-spring loaded spring guide.

4. The aerator valve assembly as in claim 2, further comprising a one-piece unitary valve member slidable for a predetermined distance within a portion of the central passageway,

wherein the one-piece unitary valve member comprises:

an enlarged head disposed at one end of the one-piece unitary valve member for sealing one end of the central passageway; and

a calibrated threaded length end disposed at an end opposite the enlarged head end.

5. The aerator valve assembly as in claim 4, wherein the one-piece unitary valve member further comprises a tension spring hole,

wherein the location of the spring tension hole is predetermined as a function of the spring constant, air pressure, the calibrated threaded length end of the valve member and a first predetermined air gap.

6. The aerator valve assembly as in claim 5, wherein the calibrated tension adjuster further comprises a tension adjuster calibrated as a function of the tension spring

hole location, the spring constant, the calibrated threaded length end of the valve member and a second predetermined air gap.

7. The aerator valve assembly as in claim 1, wherein the at least one sensor comprises a vibration sensor for measuring vibration.

8. The aerator valve assembly as in claim 1, wherein the at least one sensor comprises a temperature sensor.

9. The aerator valve assembly as in claim 1, wherein the at least one sensor comprises an air pressure sensor.

10. The aerator valve assembly as in claim 1, further comprising externally accessible on-board memory for storing sensing data.

11. An aerator valve assembly comprising:

an outer housing with front and back ends terminating a central passageway;

a movable valve member having a one-piece unitary metal construction slidably engaged within the central passageway in the outer housing, the valve member having an enlarged head termination for sealing the front end of the passageway;

a calibrated threaded length end disposed at an end opposite the enlarged head end;

a spring-loaded spring guide member having a one-piece unitary metal

construction which is fixed within the central passageway in the outer housing intermediate the front and back ends of the central passageway;

a wave spring having a predetermined spring constant for supplying spring tension for keeping the moveable valve member sealed in the absence of pressurized gas;

a gas valve mechanism for supplying the pressurized gas sufficient to overcome the spring tension and to drive the moveable valve member forward unsealing the front end of the central passageway and releasing the pressurized gas;

a calibrated tension adjuster; and

at least one sensor for sensing events associated with the high-pressure aerator valve assembly,

wherein the calibrated tension adjuster and the spring-loaded spring guide are disposed on either end of the wave spring for compressing the wave spring,

wherein the wave spring comprises:

a 360-degree contact wave spring, wherein the 360-degree wave spring provides continuous contact between the 360-degree wave spring-calibrated tension adjuster and the 360-degree wave spring-spring loaded spring guide; and

a tension spring hole, wherein the location of the spring tension hole is predetermined as a function of the spring constant, air pressure, the calibrated threaded length end of the valve member and a first predetermined air gap associated with the predetermined distance,

wherein the calibrated tension adjuster is calibrated as a function of the tension spring hole location, the spring constant, the calibrated threaded length end of the valve

member and the first predetermined air gap,

wherein the at least one sensor comprises a linear shaft displacement counter for counting the number of times the valve member opens and closes.

12. The aerator valve assembly as in claim 11, wherein the moveable valve member comprises a first valve member for releasing the pressurized gas at approximately perpendicular to the moveable valve member.

13. The aerator valve assembly as in claim 11, wherein the moveable valve member comprises a second valve member for releasing the pressurized gas at approximately horizontal to the moveable valve member.

14. The aerator valve assembly as in claim 11, further comprising a passive directional air flow device.

15. The aerator valve assembly as in claim 14, wherein the passive directional air flow device comprises an internal directional air flow device.

16. The aerator valve assembly as in claim 14, wherein the passive directional air flow device comprises an external air flow device.