CLAIMS

1. An apparatus for actuating a valve, the apparatus comprising:

a cylindrical housing having a valve end, a cap end, and a sidewall defining an inner diameter (“ID”) of the housing;

a cap connected to the cap end of the housing with an inlet located in the cap;

a plate positioned within the housing, the plate having a center portion and an outer diameter (“OD”) that slidingly engages the ID of the housing, the OD of the plate being located axially nearer the valve end of the housing than the center portion, the plate moving between an extended position and a retracted position in response to pressure media from the inlet, the plate being nearer the valve end in the extended position than in the retracted position;

an outer diameter sidewall seal located between the ID of the housing and the OD of the plate sealing all flow paths between the ID of the housing and the OD of the plate;

a diaphragm, the diaphragm being fully supported by the plate and the housing when the plate is in the extended position;

a retainer connected to the plate, the retainer operable to engage an inner diameter orifice of a the diaphragm; and

a down stop in contact with the plate, the down stop being urged toward the valve end of the housing when the plate moves toward the extended position, and the down stop being operable to be connected to a valve stem for actuating a valve.

2. The apparatus according to claim 1, wherein the diaphragm covers the plate and extends to the cap end, the diaphragm and cap defining a pressure chamber.

3. The apparatus according to claim 2, wherein the diaphragm does not extend axially past the plate in each of the retracted and extended positions.

4. The apparatus according to claim 1, wherein the plate comprises a hub having a threaded outer diameter and a sealing plate having a threaded inner diameter, the sealing plate threadingly engaging the hub.

5. The apparatus according to claim 1, further comprising an indicator stem connected to the plate and protruding through an orifice of the cap.

6. The apparatus according to claim 1, wherein the plate comprises a convex surface and a concave surface, each of the convex and concave surfaces facing the cap and the concave surface being spaced radially outward from the convex surface.

7. The apparatus according to claim 6, wherein the diaphragm is in contact with each of the convex and concave surfaces when the plate is in the extended position.

8. The apparatus according to claim 1, wherein the plate does not extend axially past the cap end of the cylindrical body.

9. The apparatus according to claim 1, further comprising a retainer seal circumscribing an outer diameter of the retainer and sealing between the outer diameter of the retainer and an inner diameter of the plate.

10. The apparatus according to claim 1, further comprising:

an outer diameter diaphragm seal formed by the diaphragm between the cap and the housing;

a first inner diameter seal formed by the diaphragm between the retainer and the plate; and

a second inner diameter seal formed by a retainer seal, the retainer seal being located on an opposite side of the diaphragm relative to the cap and circumscribing an outer diameter of the retainer, the retainer seal further forming a seal between the outer diameter of the retainer and an inner diameter of the plate.

11. An apparatus for actuating a valve, the apparatus comprising:

a cylindrical housing having a valve end, a cap end, and a sidewall, the sidewall defining an inner diameter (“ID”) of the housing;

a cap connected to the cap end of the housing with an inlet located in the cap;

a plate positioned in the housing, the plate having a center portion and an outer diameter (“OD”) that slidingly engages the ID of the housing, the OD of the plate being located axially nearer the valve end of the housing than the center portion, the plate

moving between an extended position and a retracted position in response to pressure media from the inlet, the plate being nearer the valve end in the extended position than in the retracted position;

a down stop operatively connected to the plate such that the plate urges the down stop toward the valve end of the housing when the plate moves to the extended position, the down stop being operable to engage a valve stem;

an outer diameter sidewall seal located between the ID of the housing and the OD of the plate sealing all flow paths between the ID of the housing and the OD of the plate;

a retainer connected to the plate, the retainer being operable to engage a valve stem;

a diaphragm having an outer diameter portion forming a seal between the cap and the housing and an inner diameter forming a seal between the retainer and the plate, the diaphragm being fully supported by the plate and the housing when the plate is in the extended position; and

a retainer seal circumscribing an outer diameter of the retainer and spaced apart from the diaphragm, the retainer seal sealing between the outer diameter of the retainer and an inner diameter of the plate.

12. The apparatus according to claim 11, wherein the plate comprises a hub having a threaded outer diameter and a sealing plate having a threaded inner diameter, the sealing plate threadingly engaging the hub.

13. The apparatus according to claim 11, further comprising an indicator stem connected to the plate and protruding through the cap.

14. The apparatus according to claim 11, wherein the plate comprises a convex surface and a concave surface, each of the convex and concave surfaces facing the cap and the concave surface being spaced radially outward from the convex surface.

15. The apparatus according to claim 11, wherein the plate is concentric with the housing in each of the extended and retracted positions.

16. The apparatus according to claim 11, wherein:

a first outer diameter seal is formed by the diaphragm between the cap and the housing;

the outer diameter sidewall seal forms a second outer diameter seal;

a first inner diameter seal is formed by the diaphragm between the retainer and the plate; and

a second inner diameter seal is formed by a retainer seal, the retainer seal circumscribing an outer diameter of the retainer and sealing between the outer diameter of the retainer and an inner diameter of the plate.

17. An apparatus for actuating a valve, the apparatus comprising:

a cylindrical housing having a valve end, a cap end, and a sidewall defining an inner diameter (“ID”) of the housing;

a cap connected to the cap end of the housing with an inlet located in the cap;

a plate connected to a down stop, the down stop being operable to be connected to a valve stem, the plate having a center portion and an outer diameter (“OD”) that slidingly engages the ID of the housing, the plate moving between an extended position and a retracted position in response to pressure media from the inlet, and the plate not extending axially past the cap end of the housing;

a retainer connected to the plate,

a diaphragm having an outer diameter portion forming a seal between the cap and the housing and an inner diameter forming a seal between the retainer and the plate, the diaphragm not extending axially past the plate in each of the retracted and extended positions; and

an indicator stem connected to the plate and protruding through the cap.

18. The apparatus according to claim 17, wherein the plate comprises a hub having a threaded outer diameter and a sealing plate having a threaded inner diameter, the sealing plate threadingly engaging the hub.

19. The apparatus according to claim 17, further comprising a seal ring between the plate and the housing, wherein the seal ring forms a dynamic seal between the plate and the inner diameter surface of the housing.

20. The apparatus according to claim 17, further comprising a retainer seal circumscribing an outer diameter of the retainer on a portion of the retainer located on an opposite side of the diaphragm relative to the cap and, the retainer seal forming a seal between the outer diameter of the retainer and an inner diameter of the plate.