CLAIMS

What is claimed is:

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

a housing having an axis, a valve end, a cap end, and a cylindrical sidewall defining an inner diameter surface of the housing;

a cap connected to the cap end of the housing;

an inlet located in one of the cap and the housing;

a plate positioned within the housing, the plate having a center portion and an outer diameter that slidingly engages the inner diameter surface of the housing, 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 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 the valve; and

a seal nut with a first end in engagement with the down stop, the seal nut having a second end with an end surface, the end surface being spaced apart from the cap when the plate is in the extended position.

2. The apparatus of claim 1, further comprising:

an orifice in a surface of the housing proximate to the valve end of the housing and offset from the axis of the housing; and

an indicator stem parallel to and offset from the axis of the housing protruding through the orifice, the indicator stem having an end for selective engagement with a surface of the plate that faces the valve end of the housing.

3. The apparatus of claim 2, wherein the indicator stem is biased towards the surface of the plate, the indicator stem moving between a plate-up position and a plate-down position in response to movement of the plate between the extended position and the retracted position.

4. The apparatus of claim 2, further comprising:

an indicator housing located in the orifice, the indicator housing having an annular housing shoulder;

a rib protruding from an outer diameter of the indicator stem; and

a spring located concentric with a portion of the indicator stem, a first end of the spring engaging the housing shoulder and a second end of the spring engaging the rib, biasing the indicator stem towards the surface of the plate.

5. The apparatus of claim 1, further comprising a bonnet operable to be connected to the valve, the valve stem passing through the bonnet, the housing being detachably connectable to the bonnet by engaging the bonnet and rotating the housing from a released position to a locked position, the housing rotating less than one full revolution between the released and locked positions.

6. The apparatus of claim 1, further comprising:

a bonnet detachably connected to the housing and operable to be connected to the valve, the valve stem passing through the bonnet; and

a rotational lock, the rotational lock preventing the housing from rotating relative to the bonnet when the housing is in a locked position.

7. The apparatus of claim 6, further comprising:

an orifice in a surface of the housing proximate to the valve end of the housing; and

an indicator stem protruding through the orifice, the indicator stem having a first end in engagement with a surface of the plate facing the valve end of the housing and a second end located exterior of the housing radially outward from and axially aligned with the rotational lock, relative to the axis of the housing, when the plate is in the extended position.

8. The apparatus of claim 1, further comprising:

a bonnet detachably connected to the housing and operable to be connected to the valve, the valve stem passing through the bonnet;

a latch body connected to the housing, the latch body selectively preventing the housing from rotating relative to the bonnet when the latch body is in a latched position;

an indicator stem protruding through the housing proximate to the valve end of the housing, the indicator stem being in a plate-up position when the plate is in the retracted position and the indicator stem being in a plate-down position when the plate is in the extended position; wherein

the indicator stem prevents the latch body from moving to an unlatched position when the indicator stem is in the plate-down position.

9. The apparatus of claim 1, further comprising a diaphragm covering the plate and extending to the cap end, the diaphragm and cap defining a pressure chamber, and wherein an inner diameter orifice of the diaphragm is engaged by the seal nut.

10. The apparatus of 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, and wherein the outer diameter of the plate is located axially nearer the valve end of the housing than the center portion.

11. The apparatus of claim 10, further comprising a diaphragm, the diaphragm being in contact with each of the convex and concave surfaces when the plate is in the extended position.

12. The apparatus of claim 1, wherein the inlet is offset from the axis of the housing.

13. The apparatus of claim 1, wherein a central portion of the cap on the axis is free of an aperture.

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

a housing having an axis, a valve end, a cap end, and a cylindrical sidewall defining an inner diameter surface of the housing;

a plate positioned within the housing, the plate moving between an extended position and a retracted position in response to pressure media applied within the housing on a pressure side of the plate, the plate being nearer the valve end in the extended position than in the retracted position;

a pressure chamber located between the cap and the pressure side of the plate; and

an indicator stem protruding from the housing and located axially offset from the axis of the housing, the indicator stem selectively engaging an indicator side of the plate that is opposite the pressure side of the plate, the indicator stem moving between a plate-up position and a plate-down position in response to movement of the plate between the extended position and the retracted position.

15. The apparatus of claim 14, wherein the indicator stem is biased towards the plate.

16. The apparatus of claim 14, wherein the indicator stem is located in an atmospheric pressure portion of the housing.

17. The apparatus of claim 14, further comprising:

a bonnet detachably connected to the housing and operable to be connected to the valve;

a latch body connected to the housing, the latch body selectively preventing the housing from rotating relative to the bonnet when the latch body is in a latched position; wherein

the indicator stem prevents the latch body from moving to an unlatched position when the indicator stem is in the plate-down position.

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

a housing having an axis, a valve end, a cap end, and a cylindrical sidewall defining an inner diameter surface of the housing;

a cap connected to the cap end of the housing;

a plate positioned within the housing, the plate moving between an extended position and a retracted position in response to pressure media applied within the housing on a pressure side of the plate, the plate being nearer the valve end in the extended position than in the retracted position;

a bonnet detachably connected to the housing and operable to be connected to the valve;

a latch body connected to the housing, the latch body selectively preventing the housing from rotating relative to the bonnet when the latch body is in a latched position;

an orifice in a surface of the housing proximate to the valve end of the housing and axially offset from the axis of the housing; and

an indicator stem protruding through the orifice, the indicator stem having a first end in engagement with a surface of the plate facing the valve end of the housing and a second end located exterior of the housing radially outward from and axially aligned

with the rotational lock, relative to an axis of the housing, when the plate is in the extended position; wherein

the indicator stem prevents the latch body from moving to an unlatched position when the indicator stem is in the plate-down position.

19. The apparatus of claim 18, further comprising:

an indicator housing located in the orifice, the indicator housing having an annular housing shoulder;

a rib protruding from an outer diameter of the indicator stem; and

a spring located concentric with a portion of the indicator stem, a first end of the spring engaging the housing shoulder and a second end of the spring engaging the rib, biasing the indicator stem towards the surface of the plate.

20. The apparatus of claim 18, wherein the housing is detachably connectable to the bonnet by engaging the bonnet and rotating the housing from a released position to a locked position, the housing rotating less than one full revolution between the released and locked positions.

CLAIMS

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

a housing having an axis, a valve end, a cap end, and a cylindrical sidewall defining an inner diameter surface of the housing;

a cap connected to the cap end of the housing;

an inlet located in one of the cap and the housing;

a plate positioned within the housing, the plate having a center portion and an outer diameter that slidingly engages the inner diameter surface of the housing, 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 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 the valve;

a seal nut with a first end in engagement with the down stop, the seal nut having a second end with an end surface, the end surface being spaced apart from the cap when the plate is in the extended position; and

an indicator stem protruding through the housing, the indicator stem being in a plate-up position when the plate is in the retracted position, and the indicator stem being in a plate-down position and preventing a latch mechanism from moving to an unlatched position to prevent the housing from being detached from a bonnet when the plate is in the extended position.

2. The apparatus of claim 1, further comprising:

an orifice in a surface of the housing proximate to the valve end of the housing and offset from the axis of the housing; and wherein

the indicator stem is parallel to, and offset from, the axis of the housing and protrudes through the orifice, the indicator stem having an end for selective engagement with a surface of the plate that faces the valve end of the housing.

3. The apparatus of claim 1, wherein the indicator stem is biased towards a surface of the plate, the indicator stem moving between the plate-up position and the plate-down position in response to movement of the plate between the extended position and the retracted position.

4. The apparatus of claim 2, further comprising:

an indicator housing located in the orifice, the indicator housing having an annular housing shoulder;

a rib protruding from an outer diameter of the indicator stem; and

a spring located concentric with a portion of the indicator stem, a first end of the spring engaging the housing shoulder and a second end of the spring engaging the rib, biasing the indicator stem towards the surface of the plate that faces the valve end of the housing.

5. The apparatus of claim 1, wherein the bonnet is selectively connected to the valve, the valve stem passing through the bonnet, the housing being detachably connectable to the bonnet by engaging the bonnet and rotating the housing from a released position to a locked position, the housing rotating less than one full revolution between the released and locked positions.

6. The apparatus of claim 1, wherein:

the bonnet is detachably connected to the housing and selectively connected to the valve, the valve stem passing through the bonnet; and

the apparatus further comprises a rotational lock, the rotational lock preventing the housing from rotating relative to the bonnet when the housing is in a locked position.

7. The apparatus of claim 6, further comprising:

an orifice in a surface of the housing proximate to the valve end of the housing; and wherein

the indicator stem protrudes through the orifice, the indicator stem having a first end in engagement with a surface of the plate facing the valve end of the housing and a second end located exterior of the housing radially outward from and axially aligned with the rotational lock, relative to the axis of the housing, when the plate is in the extended position.

8. The apparatus of claim 1, wherein:

the bonnet is detachably connected to the housing and selectively connected to the valve, the valve stem passing through the bonnet;

the apparatus further comprises a latch body connected to the housing, the latch body preventing the housing from rotating relative to the bonnet when the latch body is in a latched position;

the indicator stem protrudes through the housing proximate to the valve end of the housing; and

the indicator stem prevents the latch body from moving to an unlatched position when the indicator stem is in the plate-down position.

9. The apparatus of claim 1, further comprising a diaphragm covering the plate and extending to the cap end, the diaphragm and the cap defining a pressure chamber, and wherein an inner diameter orifice of the diaphragm is engaged by the seal nut.

10. The apparatus of 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, and wherein the outer diameter of the plate is located axially nearer the valve end of the housing than the center portion.

11. The apparatus of claim 10, further comprising a diaphragm, the diaphragm being in contact with each of the convex and concave surfaces when the plate is in the extended position.

12. The apparatus of claim 1, wherein the inlet is offset from the axis of the housing.

13. The apparatus of claim 1, wherein a central portion of the cap on the axis is free of an aperture.

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

a housing having an axis, a valve end, a cap end, and a cylindrical sidewall defining an inner diameter surface of the housing;

a plate positioned within the housing, the plate moving between an extended position and a retracted position in response to pressure media applied within the housing on a pressure side of the plate, the plate being nearer the valve end in the extended position than in the retracted position;

a latch body connected to the housing, the latch body preventing the housing from disconnecting from a bonnet when the latch body is in a latched position; and

an indicator stem protruding from the housing and located axially offset from the axis of the housing, the indicator stem selectively engaging an indicator side of the plate that is opposite the pressure side of the plate, the indicator stem moving between a plate-up position and a plate-down position in response to movement of the plate between the extended position and the retracted position, the indicator stem preventing the latch body from moving from the latched position to an unlatched position when the indicator stem is in the plate-down position.

15. The apparatus of claim 14, wherein the indicator stem is biased towards the plate.

16. The apparatus of claim 14, wherein the indicator stem is located in an atmospheric pressure portion of the housing.

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

a housing having an axis, a valve end, a cap end, and a cylindrical sidewall defining an inner diameter surface of the housing;

a cap connected to the cap end of the housing;

a plate positioned within the housing, the plate moving between an extended position and a retracted position in response to pressure media applied within the housing on a pressure side of the plate, the plate being nearer the valve end in the extended position than in the retracted position;

a bonnet detachably connected to the housing and operable to be connected to the valve;

a latch body connected to the housing, the latch body preventing the housing from rotating relative to the bonnet when the latch body is in a latched position;

an orifice in a surface of the housing proximate to the valve end of the housing and axially offset from the axis of the housing; and

an indicator stem protruding through the orifice, the indicator stem having a first end in engagement with a surface of the plate facing the valve end of the housing and a second end located exterior of the housing radially outward from and axially aligned with the latch body, relative to the axis of the housing, when the plate is in the extended position; wherein

the indicator stem prevents the latch body from moving to an unlatched position when the plate is in the extended position.

18. The apparatus of claim 17, further comprising:

an indicator housing located in the orifice, the indicator housing having an annular housing shoulder;

a rib protruding from an outer diameter of the indicator stem; and

a spring located concentric with a portion of the indicator stem, a first end of the spring engaging the housing shoulder and a second end of the spring engaging the rib, biasing the indicator stem towards the surface of the plate.

19. The apparatus of claim 17, wherein the housing is detachably connectable to the bonnet by engaging the bonnet and rotating the housing from a released position to a locked position, the housing rotating less than one full revolution between the released and locked positions.