CLAIMS

1. A system for actuating a valve, the apparatus comprising:

a cylindrical housing having a valve end and a housing annular surface proximate to the valve end;

a valve stem, a portion of the valve stem being positioned within the housing and being unsecured in a longitudinal direction within the housing relative to a sealed pressure chamber within the housing, and another portion of the valve stem extending from the valve end of the housing and operable to be connected to a valve, the valve stem moving between an extended position and a retracted position, the valve stem extending further from the valve end in the extended position than in the retracted position; and

a bonnet operable to be connected to the valve, the valve stem passing through the bonnet and limited in the longitudinal direction by 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, the housing maintaining the sealed pressure chamber in the released position and when detached from the bonnet and separated from the valve stem.

2. The system according to claim 1, wherein the housing comprises a plurality of housing lugs spaced apart around the housing annular surface, the housing lugs protruding from the housing annular surface to define a plurality of slots therebetween; and

the bonnet comprises a plurality of bonnet lugs spaced apart around a bonnet annular surface, the bonnet lugs protruding from the bonnet annular surface to define a plurality of bonnet slots therebetween, each of the housing lugs operable to pass axially through a respective one of the bonnet slots when the housing is in a released position and, after passing through the bonnet slots, the housing being rotatable at least until a portion of one or more of the housing lugs is axially aligned with a portion of a respective bonnet lug such that the bonnet lugs prevent axial movement of the housing in at least one direction.

3. The system according to claim 1, further comprising a latch assembly, the latch preventing the housing from rotating relative to the bonnet when the housing is in the locked position.

4. The system according to claim 3, wherein the latch assembly comprises a latch tab connected to one of the housing and the bonnet, the latch tab being positioned in one of the slots and engaging one or more of the lugs in the locked position to prevent the housing from rotating relative to the bonnet.

5. The system according to claim 4, wherein the latch tab is positioned in an aperture of the housing, the latch tab being pivotable between a latched position and an unlatched position, the latch tab further comprising a latch body having a contour matching an outer diameter contour of the housing in the vicinity of the aperture so that the latch body is substantially flush with the outer diameter contour in the latched position.

6. The system according to claim 1, further comprising

a plate positioned within the housing and spanning at least a portion of the inner diameter of the housing;

a diaphragm spanning the diameter of the housing, the diaphragm being at least partially supported by the plate; and

a down stop in contact with the plate and connected to the stem, wherein pressurized media through an inlet urges the diaphragm toward the valve end, and the diaphragm urges the plate and downstop toward the valve end to urge the stem toward the extended position.

7. The system according to claim 6, wherein the plate spans the inner diameter of the housing and further comprising a seal between the plate and the housing.

8. The system according to claim 1, further comprising a piston within the housing, the piston moving axially within the housing in response to pressure media from an inlet, the piston causing the stem to move from the retracted position to the extended position.

9. The system according to claim 1, further comprising a valve assembly connected to the bonnet, the valve assembly movable between an open position and a closed position in response to movement of the stem and wherein there is an absence of fluid communication between the valve assembly and the housing.

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

a cylindrical housing having a valve end, a piston end, and a piston end annular surface, a plurality of circumferentially spaced apart piston end lugs protruding from the piston end annular surface to define a plurality of piston end slots therebetween;

a piston head detachably connectable to the piston end of the housing, the piston head comprising:

an inlet,

a cylindrical piston housing, the piston housing having a plurality of piston housing lugs spaced apart around a piston housing annular surface, the piston housing lugs protruding from the piston housing annular surface to define a plurality of piston housing slots therebetween, each of the piston housing lugs operable to pass axially through a respective one of the piston end slots when the piston head is in a released position and, after passing through the piston end slots, the piston head being rotatable at least until a portion of one or more of the piston housing lugs is axially aligned with a portion of a respective piston end lug such that the piston end lugs prevent axial movement of the piston head in at least one direction to define a locked position, and

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

a down stop in contact with the piston, the down stop being urged toward the valve end of the housing when the piston moves toward the extended position;

a plurality of housing lugs spaced apart around a housing annular surface, the housing lugs protruding from the housing annular surface to define a plurality of slots therebetween;

a bonnet operable to be connected to a valve, the bonnet having a plurality of bonnet lugs spaced apart around a bonnet annular surface, the bonnet lugs protruding from the bonnet annular surface to define a plurality of bonnet slots therebetween, each of the housing lugs operable to pass axially through a respective one of the bonnet slots when the housing is in a released position and, after passing through the bonnet slots, the housing being rotatable at least until a portion of one or more of the housing lugs is axially aligned with a portion of a respective bonnet lug such that the bonnet lugs prevent axial movement of the housing in at least one direction to define a locked position, wherein the housing maintains a sealed pressure chamber in the released position and when detached from the bonnet; and

a stem, the stem extending through the bonnet and contacting the downstop so that when the downstop is urged toward the valve end, the stem extends further through the bonnet toward the valve.

11. The apparatus according to claim 10, wherein the valve end and the piston end are substantially similar so that each of the valve end and the piston end are operable to be connected to one of the piston housing and the bonnet.

12. The apparatus according to claim 10, wherein the bonnet further comprises a radial groove having one side defined by an annular shoulder and the other side defined by a surface of the bonnet lugs facing toward the annular shoulder, the housing lugs sliding within the annular groove when moving between the locked position and the released position.

13. The apparatus according to claim 10, wherein the housing lugs are on an inner diameter surface of the housing and the bonnet lugs are on an outer diameter surface of the bonnet.

14. The apparatus according to claim 10, further comprising a latch assembly, the latch preventing the housing from rotating relative to the bonnet when the housing is in the locked position.

15. The apparatus according to claim 14, wherein the latch assembly comprises a latch tab connected to one of the housing and the bonnet, the latch tab being positioned in one of the slots and engaging one or more of the lugs in the locked position to prevent the housing from rotating relative to the bonnet.

16. The apparatus according to claim 15, wherein the latch tab is positioned in an aperture of the housing, the latch tab being pivotable between a latched position and an unlatched position, the latch tab further comprising a latch body having a contour matching an outer diameter contour of the housing in the vicinity of the aperture so that the latch body is flush with the outer diameter contour in the latched position.

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

a cylindrical housing having a valve end, a piston end, and a piston end annular surface, a plurality of circumferentially spaced apart piston end lugs protruding from the piston end annular surface to define a plurality of piston end slots therebetween, the housing maintaining a sealed pressure chamber in a released position relative to a bonnet that is operable to be connected to the valve, and when the housing is detached from the bonnet;

a piston head detachably connectable to the piston end of the housing, the piston head comprising:

an inlet,

a cylindrical piston housing, the piston housing having a plurality of piston housing lugs spaced apart around a piston housing annular surface, the piston housing lugs protruding from the piston housing annular surface to define a plurality of piston housing slots therebetween, each of the piston housing lugs operable to pass axially through a respective one of the piston end slots when the piston head is in a released position and, after passing through the piston end slots, the piston head being rotatable at least until a portion of one or more of the piston housing lugs is axially aligned with a portion of a respective piston end lug such that the piston end lugs prevent axial movement of the piston head in at least one direction to define a locked position, and

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

a down stop in contact with the piston, the down stop being urged toward the valve end of the housing when the piston moves toward the extended position;

a stem, the stem extending through the bonnet and contacting the downstop so that when the downstop is urged toward the valve end, the stem extends further through the bonnet toward the valve;

a plurality of housing lugs spaced apart around a housing annular surface, the housing lugs protruding from the housing annular surface to define a plurality of slots therebetween; and

a bonnet, the bonnet having a plurality of bonnet lugs spaced apart around a bonnet annular surface, the bonnet lugs protruding from the bonnet annular surface to define a plurality of bonnet slots therebetween, each of the housing lugs operable to pass axially through a respective one of the bonnet slots when the housing is in the released position and, after passing through the bonnet slots, the housing being rotatable at least until a portion of one or more of the housing lugs is axially aligned with a portion of a respective bonnet lug such that the bonnet lugs prevent axial movement of the housing in at least one direction to define a locked position.

18. The apparatus according to claim 17, further comprising a latch assembly, the latch assembly preventing the piston head from rotating relative to the housing when the piston head is in the locked position.

19. The apparatus according to claim 18, wherein the latch assembly comprises a latch tab connected to the housing, wherein the latch tab is located within one of the slots and engages one or more of the piston head lugs in the locked position to prevent the housing from rotating relative to the bonnet.