CLAIMS

1. A diaphragm valve, comprising:

an inlet port;

an outlet port;

a valve seat proximate one of the inlet port or the outlet port;

a diaphragm positioned relative to the valve seat, the diaphragm having an open state wherein the diaphragm is spaced from the valve seat to enable a fluid path between the inlet port and the outlet port, and the diaphragm having a closed state wherein the diaphragm is seated on the valve seat to block the fluid path;

a reciprocatable member coupled to the diaphragm and configured to transition between an open position and a closed position, the open position moving the diaphragm to the open state, and the closed position moving the diaphragm to the closed state;

and

a coupling member coupled between the diaphragm and the reciprocatable member, wherein the coupling member has a first end and a second end opposite the first end, the first end coupled to the diaphragm and the second end coupled to the reciprocatable member via a connection that provides displacement of the coupling member relative to at least one of the reciprocatable member or the diaphragm, and the second end of the coupling member including a loop member and a pin extending through the loop member.

2. The diaphragm valve of claim 1 wherein the coupling member is configured to pull the diaphragm to the open state and maintain the diaphragm at a predefined minimum distance from the valve seat when the reciprocatable member is in the open position.

3. The diaphragm valve of claim 1 wherein the second end provides for a clearance gap of the coupling member relative to the reciprocatable member.

4. The diaphragm valve of claim 1 wherein the coupling member is rigid.

5. The diaphragm valve of claim 1 wherein the coupling member is flexible.

6. The diaphragm valve of claim 1 wherein the diaphragm and the coupling member are formed from a same material.

7. The diaphragm valve of claim 1 wherein the diaphragm is comprised of a Co-Cr-Ni alloy.

8. The diaphragm valve of claim 1 wherein the coupling member is configured to maintain the diaphragm in the open state while the reciprocatable member is in the open position, and wherein the coupling member has a clearance gap relative to the reciprocatable member when the reciprocatable member is in the closed position.

9. The diaphragm valve of claim 1 further comprising an insert positioned between the diaphragm and the reciprocatable member, the insert configured to press the diaphragm against the valve seat when the reciprocatable member is in the closed position.

10. The diaphragm valve of claim 1 further comprising a fluid channel extending through the reciprocatable member and to a chamber, wherein positive fluid pressure in the chamber forces the reciprocatable member to the open position.

11. The diaphragm valve of claim 1 wherein the coupling member maintains a minimum distance between the diaphragm and the valve seat under vacuum conditions ranging between 1.0 milliTorr and 500 Torr.

12. The diaphragm valve of claim 1 wherein the coupling member maintains a minimum distance between the diaphragm and the valve seat under temperature conditions between 20ºC and 500ºC.

13. The diaphragm valve of claim 1 wherein the diaphragm is comprised of multiple layers.

14. The diaphragm valve of claim 1 wherein the open state of the diaphragm includes a range of states including partially open and fully open states.

15. A diaphragm valve, comprising:

an inlet port;

an outlet port;

a valve seat proximate one of the inlet port or the outlet port;

a diaphragm positioned relative to the valve seat, the diaphragm having an open state wherein the diaphragm is spaced from the valve seat to enable a fluid path between the inlet port and the outlet port, and the diaphragm having a closed state wherein the diaphragm is seated on the valve seat to block the fluid path;

a reciprocatable member coupled to the diaphragm and configured to transition between an open position and a closed position, the open position moving the diaphragm to the open state, and the closed position moving the diaphragm to the closed state;

a coupling member coupled between the diaphragm and the reciprocatable member; and

an insert located between the reciprocatable member and the diaphragm, the insert having a channel wherein the coupling member passes through the channel.

16. A diaphragm valve, comprising:

an inlet port;

an outlet port;

a valve seat proximate one of the inlet port or the outlet port;

a diaphragm positioned relative to the valve seat, the diaphragm having an open state wherein the diaphragm is spaced from the valve seat to enable a fluid path between the inlet port and the outlet port, and the diaphragm having a closed state wherein the diaphragm is seated on the valve seat to block the fluid path;

a reciprocatable member coupled to the diaphragm and configured to transition between an open position and a closed position, the open position moving the diaphragm to the open state, and the closed position moving the diaphragm to the closed state, wherein the reciprocatable member comprises a piston; and

a coupling member coupled between the diaphragm and the reciprocatable member, wherein the coupling member has a first end and a second end opposite the first end, the first end coupled to the diaphragm and the second end coupled to the reciprocatable member via a connection that provides displacement of the coupling member relative to at least one of the reciprocatable member or the diaphragm, and the second end of the coupling member including a loop member and a pin extending through the loop member.

17. The diaphragm valve of claim 16 wherein the coupling member is configured to maintain the diaphragm in the open state while the reciprocatable member is in the open position, and wherein the coupling member has a clearance gap relative to the reciprocatable member when the reciprocatable member is in the closed position.

18. The diaphragm valve of claim 16 further comprising a fluid channel extending through the reciprocatable member and to a chamber, wherein positive fluid pressure in the chamber forces the reciprocatable member to the open position.

19. The diaphragm valve of claim 1 further comprising a spring configured to bias the reciprocatable member in the closed position.