SUMMARY OF THE DISCLOSURE

[0005] In one aspect, embodiments disclosed herein relate to a solenoid actuated valve assembly including a valve body comprising a fluid inlet and fluid outlet, a valve member disposed within the valve body, wherein a position of the valve member controls a fluid flow between the fluid inlet and fluid outlet, a fluid chamber above the valve member, wherein the fluid chamber is fluidly isolated from the fluid inlet and outlet, a bleed screw disposed in a first port in fluid communication with the fluid chamber, wherein the bleed screw includes a bleed channel therethrough, ~~and~~ a solenoid adjustment screw ~~having a bleed channel therethrough~~ disposed in a second port in fluid communication with the fluid chamber. The solenoid actuated valve assembly further includes a solenoid actuator coupled to the valve body comprising a solenoid plunger proximate the fluid chamber, wherein a force multiplying ratio of a surface area of the valve member exposed to the fluid chamber to a surface area of the solenoid plunger exposed to the fluid chamber is at least 1.5:1.

[0006] In other aspects, embodiments disclosed herein relate to a method for assembling a solenoid actuated valve including providing a valve comprising a fluid inlet and fluid outlet, a valve member disposed within the valve body, wherein a position of the valve member controls a fluid flow between the fluid inlet and fluid outlet, and a fluid chamber above the valve member, wherein the fluid chamber is fluidly isolated from the fluid inlet and outlet. The method further includes providing a solenoid actuator comprising a solenoid plunger, positioning the valve member in a closed position, filling the fluid chamber with hydraulic fluid, coupling the solenoid actuator to the valve body, wherein a stem portion of the solenoid plunger is positioned proximate the fluid chamber, relieving excess hydraulic fluid from the fluid chamber through a bleed screw port in the valve body and adjusting a position of the solenoid plunger with a solenoid adjustment screw, wherein the solenoid adjustment screw is disposed in a port in fluid communication with the fluid chamber, and the solenoid adjustment screw displaces the hydraulic fluid locked in the fluid chamber in order to move the solenoid plunger.

[0007] In other aspects, embodiments disclosed herein relate to a method for using a solenoid actuated valve including providing the solenoid actuated valve comprising a valve body comprising, a fluid inlet and fluid outlet, a valve member disposed within the valve body, wherein a position of the valve member controls a fluid flow between the fluid inlet and fluid outlet, and a fluid chamber above the valve member filled with hydraulic fluid, wherein the fluid chamber is fluidly isolated from the fluid inlet and outlet, and a solenoid actuator coupled to the valve body comprising a solenoid plunger proximate the fluid chamber. The method further includes relieving excess hydraulic fluid from the fluid chamber through a bleed screw port in the valve body, and providing a multiplied force against the valve member, wherein the multiplied force corresponds

with a force multiplying ratio of a surface area of the valve member exposed to the fluid chamber to a surface area of the solenoid plunger exposed to the fluid chamber, wherein the solenoid adjustment screw is disposed in a port in fluid communication with the fluid chamber, and the solenoid adjustment screw displaces the hydraulic fluid locked in the fluid chamber in order to move the solenoid plunger.

[0008] Other aspects and advantages of the invention will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0009] Figure 1A illustrates an isometric view of a solenoid actuator and valve in accordance with one or more embodiments of the present disclosure.

[0010] Figure 1B illustrates a top view of the solenoid actuator and valve of Figure 1A.

[0011] Figure 2A illustrates a cross-section view of the solenoid actuator and valve shown in Figure 1B in accordance with one or more embodiments of the present disclosure.

[0012] Figure 2B illustrates a cross-section view of the solenoid actuator and valve shown in Figure 1B in a final assembled position in accordance with one or more embodiments of the present disclosure.

[0013] Figure 2C illustrates a cross-section view of the solenoid actuator and valve shown in Figure 1B in an open position in accordance with one or more embodiments of the present disclosure.

[0014] Figure 3A illustrates a cross-section view of a fluid chamber of the valve shown in Figure 2A in accordance with one or more embodiments of the present disclosure.

[0015] Figure 3B illustrates a cross-section view of a fluid chamber of the valve shown in Figure 2A in accordance with one or more embodiments of the present disclosure.

CLAIMS

~~What is claimed is:~~

1. A solenoid actuated valve assembly comprising:

a valve body comprising:

a fluid inlet and fluid outlet;

a valve member disposed within the valve body, wherein a position of the valve member controls a fluid flow between the fluid inlet and fluid outlet;

a fluid chamber above the valve member, wherein the fluid chamber is fluidly isolated from the fluid inlet and outlet; ~~and~~

a bleed screw disposed in a first port in fluid communication with the fluid chamber, wherein the bleed screw includes a bleed channel therethrough;

a solenoid adjustment screw ~~having a bleed channel therethrough~~ disposed in a second port in fluid communication with the fluid chamber;

a solenoid actuator coupled to the valve body comprising:

a solenoid plunger proximate the fluid chamber;

wherein a force multiplying ratio of a surface area of the valve member exposed to the fluid chamber to a surface area of the solenoid plunger exposed to the fluid chamber is at least 1.5:1.

2. The solenoid actuated valve assembly of claim 1, further comprising a lower cage disposed in the valve body in which the valve member slides.

3. The solenoid actuated valve assembly of claim 2, wherein the lower cage comprises a valve seat that contacts the valve member.

4. The solenoid actuated valve assembly of claim 1, further comprising an upper cage positioned above the fluid chamber.

5. The solenoid actuated valve assembly of claim 4, wherein the upper cage comprises one or more ports spaced around a circumference thereof and positioned adjacent an annular groove of the valve body.

~~6. The solenoid actuated valve assembly of claim 1, further comprising a bleed screw disposed in a first port in fluid communication with the fluid chamber.~~

6. The solenoid actuated valve assembly of claim 1, further comprising:

a visual indicator on an end of the solenoid plunger,

wherein the solenoid adjustment screw is configured to set the visual indicator at a distance off the solenoid actuator greater than 0.015 of an inch.

7. The solenoid actuated valve assembly of claim 1, further comprising:

~~a solenoid adjustment screw disposed in a second port in fluid communication with the fluid chamber; and~~

a visual indicator on an end of the solenoid plunger,

wherein the solenoid adjustment screw is configured to set the visual indicator at a distance off the solenoid of between about 0.015 and 0.045 of an inch.

8. The solenoid actuated valve assembly of claim 1, wherein the solenoid adjustment screw further comprises an O-ring.

9. The solenoid actuated valve assembly of claim 1, further comprising a valve seat in the valve body which contacts the valve member.

10. The solenoid actuated valve assembly of claim 1, further comprising a spring in the fluid chamber which biases the valve member in a first direction.

11. A method for assembling a solenoid actuated valve, the method comprising:

providing a valve comprising:

a fluid inlet and fluid outlet;

a valve member disposed within ~~the~~ a valve body, wherein a position of the valve member controls a fluid flow between the fluid inlet and fluid outlet; and

a fluid chamber above the valve member, wherein the fluid chamber is fluidly isolated from the fluid inlet and outlet;

providing a solenoid actuator comprising:

a solenoid plunger;

positioning the valve member in a closed position;

filling the fluid chamber with hydraulic fluid;

coupling the solenoid actuator to the valve body, wherein a stem portion of the solenoid plunger is positioned proximate the fluid chamber; ~~and~~

relieving excess hydraulic fluid from the fluid chamber through a bleed screw port in the valve body; and

adjusting a position of the solenoid plunger with a solenoid adjustment screw;

wherein the solenoid adjustment screw is disposed in a port in fluid communication with the fluid chamber; and

the solenoid adjustment screw displaces the hydraulic fluid locked in the fluid chamber in order to move the solenoid plunger.

~~12. The method of claim 11, further comprising relieving excess hydraulic fluid from the fluid chamber through a bleed screw port in the valve body.~~

12. The method of claim 11, further comprising positioning a visual indicator on an end of the solenoid plunger at a distance greater than 0.015 of an inch off the solenoid actuator.

13. The method of claim 11, further comprising positioning a visual indicator on an end of the solenoid plunger at a distance of between about 0.015 and 0.045 of an inch off the solenoid actuator.

14. A method for using a solenoid actuated valve, the method comprising:

providing the solenoid actuated valve comprising:

a valve body comprising:

a fluid inlet and fluid outlet;

a valve member disposed within the valve body, wherein a position of the valve member controls a fluid flow between the fluid inlet and fluid outlet; and

a fluid chamber above the valve member filled with hydraulic fluid, wherein the fluid chamber is fluidly isolated from the fluid inlet and outlet; and

a solenoid actuator coupled to the valve body comprising:

a solenoid plunger proximate the fluid chamber;

relieving excess hydraulic fluid from the fluid chamber through a bleed screw port in the valve body; and

providing a multiplied force against the valve member,

wherein the multiplied force corresponds with a force multiplying ratio of a surface area of the valve member exposed to the fluid chamber to a surface area of the solenoid plunger exposed to the fluid chamber;

wherein the solenoid adjustment screw is disposed in a port in fluid communication with the fluid chamber; and

the solenoid adjustment screw displaces the hydraulic fluid locked in the fluid chamber in order to move the solenoid plunger.

15. The method of claim 14, wherein the force multiplying ratio is at least 1.5:1.

16. The method of claim 14, wherein providing a multiplied force further comprises energizing the solenoid actuator.