Magnetic Coupler with Force Balancing

Background

[0001] This section is intended to provide relevant background information to facilitate a better understanding of the various aspects of the described embodiments. Accordingly, it should be understood that these statements are to be read in this light and not as admissions of prior art.

[0002] Magnetic couplers are used to translate motion between physical barriers, in which a drive magnet is located on one side of the barrier and a follower magnet is located on the other side. The drive magnet is coupled to an actuator which moves the drive magnet, and the drive magnet induces movement in the follower magnet through magnetic coupling. The follower magnet then moves another element or device to carry out the intended function. Devices with magnetic couplers, such as valves, are often used in oil and gas operations, in which the device may come into contact with various fluids and chemicals that may be potentially detrimental to the device over time. Magnetic couplers allow sensitive components such as actuators and electronics to be contained and isolated from the fluids while still carrying out the device function through actuation of the follower magnet.

[0003] The drive magnet and the follower magnet of a magnetic coupler are attracted to each other and exert an attractive magnet force on each other. This is what enables magnetic coupling. However, the constant pull strains the structural assemblies of the magnets, such as bearings and other components.

Summary

[0003a] According to a first aspect of the present disclosure, there is provided a magnetic coupling system, including: a drive magnet; a follower magnet magnetically coupled to the drive magnet, wherein movement of the drive magnet

induces corresponding movement of the follower magnet; and a magnetic balancing component located to a side of the follower magnet, wherein the magnetic balancing component and the drive magnet exert attractive magnetic forces on the follower magnet in opposite directions.

[0003b] According to a second aspect of the present disclosure, there is provided a magnetically coupled actuation system, including: a drive actuator; a drive magnet coupled to and movable by the actuator; a follower magnet isolated from and magnetically coupled to the drive magnet, wherein movement of the drive magnet induces corresponding movement of the follower magnet; a follower device coupled to and driven by movement of the follower magnet; and a magnetic balancing component located to a side of the follower magnet opposite the drive magnet, wherein the magnetic balancing component and the drive magnet exert attractive magnetic forces on the follower magnet in opposite directions.

[0003c] According to a third aspect of the present disclosure, there is provided **a** method of balancing a magnetic coupler, including: locating a magnetic balancing component to a side of a follower magnet opposite a drive magnet, wherein the follower magnet is magnetically coupled to the drive magnet; and exerting an attractive magnetic force onto the follower magnet in a direction opposite another attractive magnetic force exerted onto the follower magnet by the drive magnet.

Brief Description of the Drawings

[0004] For a detailed description of the embodiments of the invention, reference will now be made to the accompanying drawings in which: