4.21 Cryogenic Butterfly Valve

Statement: A butterfly valve that can rotate and translate.

Problem: Typical butterfly valves cannot seal at ambient and cryogenic temperatures. In cryogenic environments, valves experience vast temperature ranges, causing them to grow and shrink, changing critical dimensions such as distance between the disc and seat. Therefore, valves must be able to compensate for these changing dimensions, and seal tightly at both extremes.

Solution: The Cryogenic Cam Butterfly Valve (CCBV) is designed so that the disc rides on a cam shaft and is held rigid by a torsion spring, which provides both axial movement of the disc in addition to the standard 90 degree rotation of a standard butterfly valve. Because the valves disc can rotate and translate, it can hold a tighter seal, preventing leakage despite dimensional changes caused by changing operating temperatures. The novel concept enables functional advantages similar to a globe valve. The CCBV not only offers also low leakage at both ambient and cryogenic temperatures, but also offers when compared to competing valves, a drastically simpler design as well as reduced manufacturing and maintenance costs.

Technology description: The novel Cryogenic Cam Butterfly Valve (CCBV) design, functions like a typical butterfly valve: the hand-wheel is rotated to open or close the valve. However, unlike a typical butterfly valve disc that can only rotate, the hybrid CCBV implements both control methods, translating and rotating to control flow. The main parts of the CCBV include a body, disc, cam shaft, torsion spring and 180-degree actuator. In the fully open position, disc rotation is 0 degrees, and the disc is situated approximately perpendicular to the valve body to enable maximum flow through the valve. However, unlike a typical butterfly valve where the disc is not pinned to the shaft, the CCBV has a preloaded torsion spring mounted concentrically on the shaft with the spring legs against the disc, and a pin to keep the disc coupled to the shaft.

Benefits: This technology has great potential where flow control is required. It offers many the following advantages, including:

- Improved seat leak performance over a wide range of temperatures.
- Simple seat design with a larger.
- Oxygen compatible soft goods.
- Soft seat ensures zero leakage.

Areas of application: The technology has several potential applications including petrochemical plants-piping systems, chemical industry-piping systems, cryogenic fluid systems.