Background
A quill shaft, by definition, is a thin, solid shaft which is strategically designed and carefully machined so that it carries the same torque that a larger shaft would handle by operating at higher stress levels. In carrying torque the quill shaft acts like a torsional spring, twisting along its length.

Quill shafts have been used for decades in refrigeration compressors with outstanding success rates. There are several reasons for the success of the quill shaft in these applications:

- First, the small diameter of the quill shaft allows for the use of much smaller seals which can work at lower rubbing velocities than their larger counterparts.
- Second, the quill shaft greatly reduces the amount of overhung weight, which, in turn, reduces the vibration in the system.
- Third, the quill shaft is generally used in conjunction with a single hinge coupling. Because the quill shaft is capable of bending in a cantilever fashion, only a single hinge is needed to provide complete misalignment capability.
- Fourth, the thin shaft torsionally isolates the high speed compressor from forcing frequencies such as gear mesh frequencies or driver pulsations.

There are some other subtleties with the quill shaft that add to the success of these applications.

Double Hinge Applications
While the quill shaft has seen much success in compressor applications as a single hinge and cantilever design, there are other applications which have benefited from a quill shaft used between two flexible elements. The term double hinge means that the coupling accepts offset
misalignment of the coupled shafts by angulations of each flexible element at the ends of the spacer.

In a torsionally soft application, the quill shaft would typically be used in a coupling with a flexible element at both ends of the quill shaft. In simple terms, the quill shaft would be the spacer in a spacer coupling. With a flexible element at both ends, the quill shaft does not have to bend in response to misalignment because the flexible elements accept the misalignment. The quill shaft is left with the sole responsibility of reducing torsional vibrations and pulsations.

The quill shaft makes it possible to minimize transmission of torsional pulsations from one machine to another. It can be designed with a low enough spring rate to smooth out vibrations such as those produced by reciprocating engines or compressors.

Some manufacturers make torsionally soft couplings using a rubber element instead of a quill shaft. Using rubber causes several disadvantages:
- Rubber torsional springs are heavier and much larger in diameter
- Rubber has a finite life, and it fails even quicker with hard use
- It is difficult to have a rubber spring with a high torque rating and a very low spring rate.

**Example Application**

An example of a quill shaft application is a diesel engine driving a compressor through a gear box. The pulsating diesel explosions can be isolated from the gear box and compressor with a properly designed low torsional spring rate quill shaft coupling.

Another example is a synchronous motor which produces high torsional pulsations during startup. A low torsional spring rate coupling can greatly reduce torsional stresses in the shafting during this critical period.

Quill shaft with a flywheel and flexible elements.