

# Motion Generator to Transform Linear into Nutation Motion

## Summary

This novel device converts linear motion into nutating motion and can create large angles from small linear displacements. The invention uniquely provides control and precision in the use of nutation motion making it particularly adaptable to micro-applications.

## Addressed Need

- » The theory of nutation motion has been successfully applied in a variety of speed reduction and torque multiplication applications
- » Most devices that make use of nutation motion are large and cumbersome, which eliminates their utility in confined environments
- » Current nutation motion devices cannot be adapted for precise control, greatly reducing their utility

## Technology Description

This novel device uses three high-frequency linear actuators to create nutation motion in a circular drive plate. This drive plate is fitted with teeth that make contact with the “driven” plate at one particular point that is dictated by the nutation motion. The driven plate carries teeth that mesh with the drive plate at one particular point where the perimeter of the drive plate is at maximum extension. This point moves in a circle by virtue of the nutation motion of the drive plate, and thus rotates the driven plate accordingly. In this way the device converts the linear, piston-like action of the linear actuators to a low-speed, high torque rotational output. The control and precision with which the device can operate makes it particularly adaptable to micro applications.

## Technology Features

- » The design attains high-torque, low-speed rotational motion from high frequency linear motion, which makes this device suitable for applications requiring positioning accuracy
- » The small size and high level of control that this device offers make it particularly suitable as a precise control system in micro applications
- » The efficiency with which this device converts high speed linear motion into slow, high-torque rotational motion allows the piezo ceramic linear actuators to operate at high frequencies, where they are most energy-efficient

## Intellectual Property Status

- » US Patent # 5,823,906 was filed Jan 2, 1997 and issued on Oct. 20, 1998

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