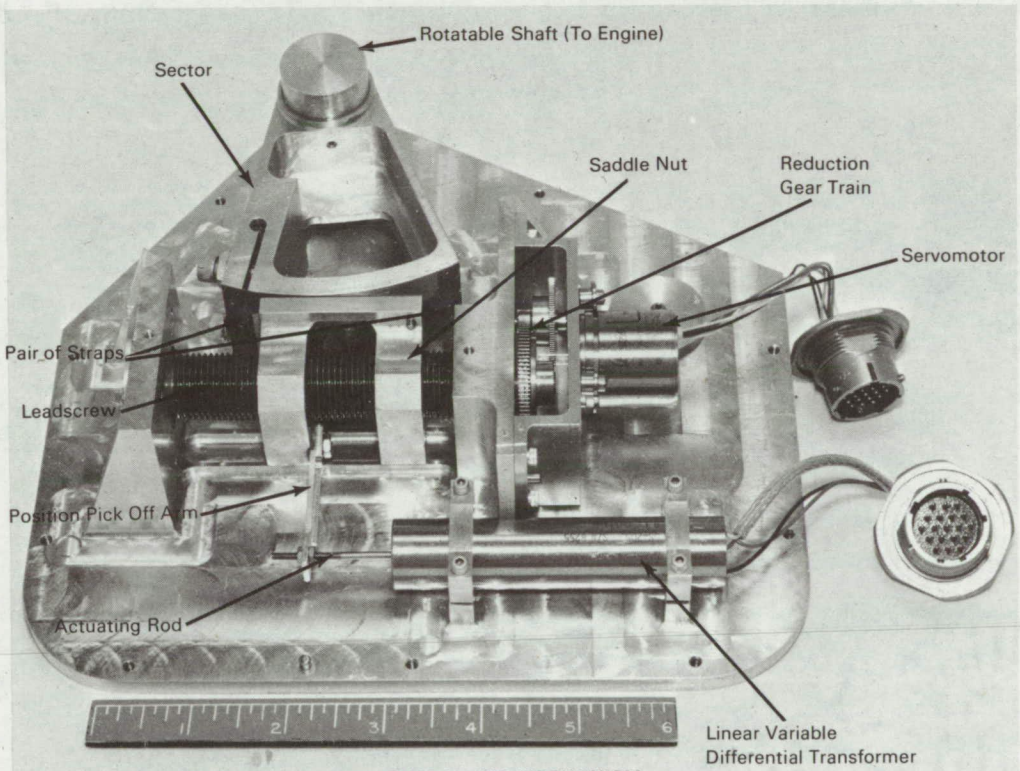
# NASA TECH BRIEF



## Precise Gimballing Mechanism




GIMBALLING MECHANISM

To effect proper roll attitude control of ion engines of future spacecrafts, it was necessary to devise mechanisms that would allow precise and repeatable gimballing of each engine separately, with a minimum of lost motion and backlash. It was also desired to minimize the use of gears and to reduce lubrication requirements for long time space operations of several years duration. The requirements of precise control and reduced numbers of gears have been achieved in a prototype support for the engines. In addition, the principle and means of the support mechanism are such that its application need not be limited to ion engines, but could be helpful to industry in solving related problems where precise movement and control of equipment are necessary.

The photograph is a detail of the support mechanism for producing precisely repeatable gimballing of an ion engine. Controlled movement is achieved by using a reversible, stepper type, servomotor connected by a reduction gear train to an externally threaded

(continued overleaf)

leadscrew. A saddle nut is provided with a precisely machined internal thread which mates with the external thread of the leadscrew. The nut is given a linear or translatory movement by rotation of the leadscrew. A pair of opposed, taut, flexible beryllium copper straps, attached at one end to the saddle nut and at the other end to a sector secured to a rotatable shaft, converts the linear movement of the nut to rotational movement of the engine actuating shaft. It is by the rotation of this shaft that ion engine gimballing is effected.

A position pickoff arm, secured to the actuating rod of a linear variable differential transformer (LVDT), provides an indication of the position of the saddle nut on the leadscrew. The saddle position is used as a reference by the control electronics for further rotary positioning of the ion engine as necessary to effect the desired roll attitude control.

**Note:**

Documentation is available from:

Clearinghouse for Federal Scientific and Technical Information
Springfield, Virginia 22151
Price $3.00
Reference: TSP69-10270

**Patent status:**

No patent action is contemplated by NASA.

Source: J. D. Ferrera, K. G. Johnson, and G. S. Perkins of Caltech/ JPL under contract to NASA Pasadena Office (NPO-11057)