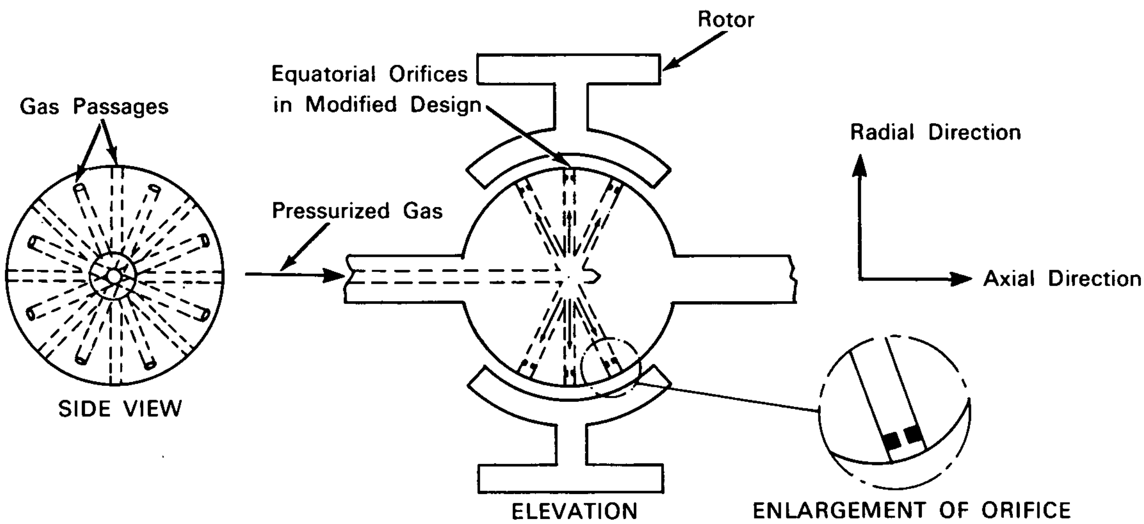
August 1964 Brief 64-10050

NASA TECH BRIEF

Modified Gas Bearing Is Adjustable to Optimum Stiffness Ratio



The problem: Providing a rapid, inexpensive means for accurately adjusting the radial-to-axial stiffness ratio of a spherical gas bearing conventionally used in certain instruments. As shown in the illustration, this type of bearing consists of a rotor with concave spherical inner surfaces that are positioned by a layer of gas in a small annular gap around the convex surface of a sphere. Pressurized gas is fed into the gap by two series of orifices located at equal latitudes on each side of the equatorial plane (perpendicular to the bearing spin axis) through the sphere. The stiffness, or resistance to change in gap width as the load varies, is provided by the regulating effect of gas-pressure variations in the gap. The restoring forces tending to maintain a uniform gap around the sphere can be resolved into radial and axial components, which in many instrument applications must be kept nearly equal. In the unmodified bearing. the stiffness ratio is primarily a function of the bearing geometry, and changes in this ratio can be made only by precise machining of the parts.

The solution: Adding a series of gas passages in the equatorial plane of the sphere which feed into orifices that can be readily changed in size to provide the desired stiffness ratio.

How it's done: The gas passages and orifices are machined at uniform intervals along the equatorial section of the sphere. The effect of the equatorial orifices is to increase the stiffness ratio by changing the radial stiffness without changing the axial stiffness. The magnitude of this effect can be varied by plugging some of the equatorial orifices or by changing their

(continued overleaf)

size. Both methods of changing the orifices may be used simultaneously to provide considerable flexibility in adjusting the stiffness ratio of the bearing.

Notes:

1. The modified bearing permits rapid and inexpensive adjustments of the stiffness ratio, since precision machining is not required to accomplish the desired result.
2. Without equatorial orifices, the pressure at the equator is always near some average value, regardless of the displacement of the rotor relative to the sphere, and therefore contributes negligibly to the radial stiffness. With the added equatorial orifices, the pressure at the equator is largely determined by these orifices and adds to the radial stiffness without contributing to the axial stiffness.
3. For further information about this invention inquiries may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama, 35812
   Reference: B64-10050

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C., 20546.

Source: John L. Evans
(M-FS-145)