NASA TECH BRIEF

NASA Pasadena Office

Linear Kinematic Air Bearing

The problem:

Servo driven precision optical systems require continuous and very smooth servo action to maintain optimum optical performance. Sometimes this is difficult to develop. In one practical example, an interferometer, in which a servo drive is used for a cat's-eye mirror, incorporates a bearing consisting of precision-made rollers moving on a glass surface. Microconchoidal fractures may develop on this surface and cause rough servo action and oscillation.

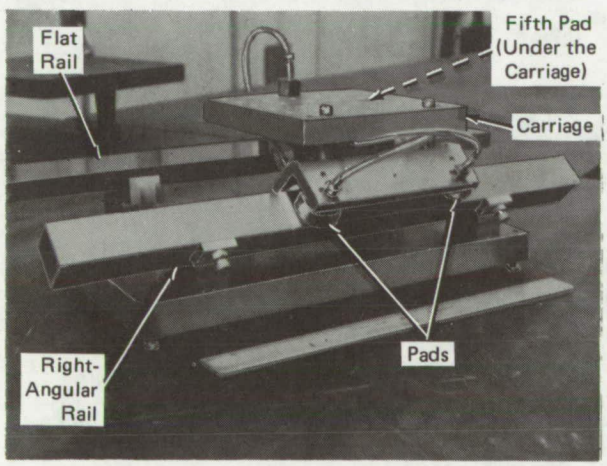
The solution:

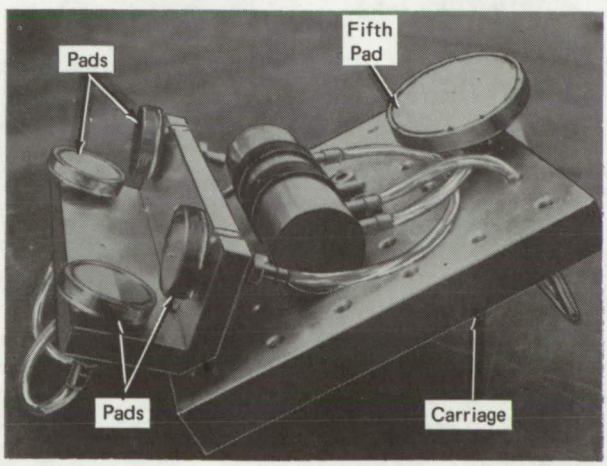
A linear kinematic air bearing provides a continuous, smooth movement of the cat's-eye mirror, eliminating the wear and deterioration of the bearing surface and the resulting oscillation effects in the servo system.

How it's done:

In the design shown in the figure, a self-aligning carriage is mounted on two rails by means of five air-bearing pads. The four pads pivotally mounted on the inside of a right-angular extrusion align the carriage with the right-angular rail. The fifth pad engages a flat rail to support the end of the carriage opposite the right-angular rail.

The carriage is essentially a triangularly mounted, self-aligning, floating support having negligible friction. It should be noted that the gap between the pads and the rails is 0.0001 inch (0.0025 mm) in normal operation. This would appear to put a severe constraint on the machining of the rails, particularly on the orthogonality of the right-angle rail. However, this is obviated by the fact that each pad is pivotally mounted at its center by a single screw, having a hemispherical superfinished end which mates to a conical superfinished bore in the body of each pad. Each screw has a central bore which serves as a conduit for pressurized air to the pad. A plenum chamber is mounted underneath the carriage baseplate. The chamber, as in all pneumatic devices, absorbs elastic shocks originating anywhere in the fluid system.





Interferometer Servo Drive

(continued overleaf)

The design features the following:

1. The self-aligning configuration, including the tri-angular structure traveling on the right-angular and flat rails;
2. The single-point, pivotal pad mounting, having the air passage through it; and
3. The design of the pads that allows for the precise control of the discharge path of air from the pads.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP73-10456

Patent status:

NASA has decided not to apply for a patent.

Source: Sherwood D. Mayall of
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