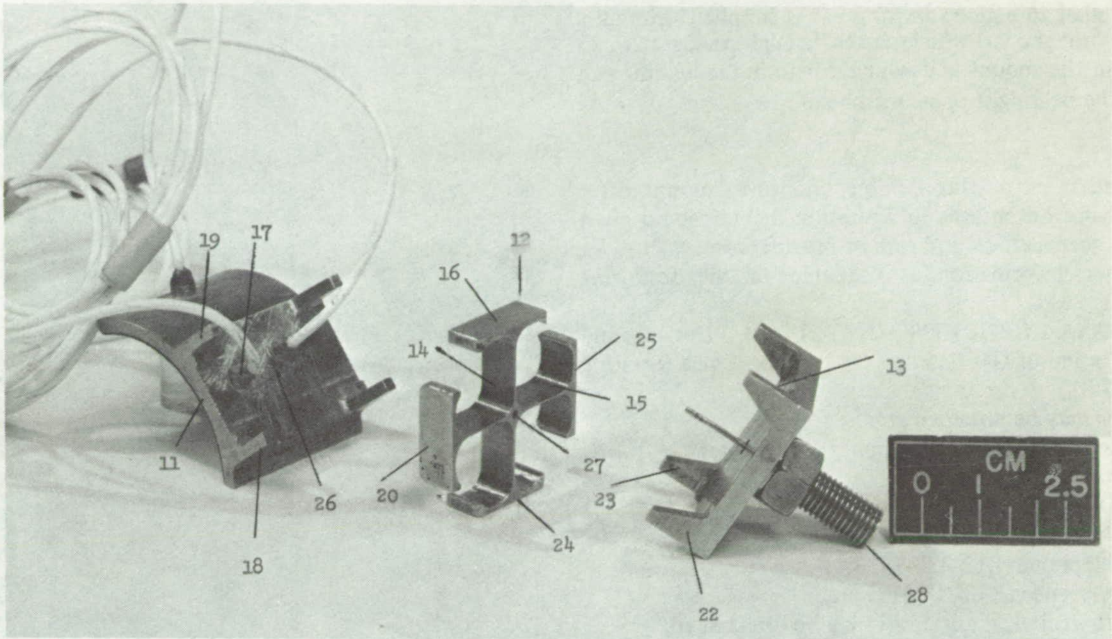
November 1973 B73-10001

NASA TECH BRIEF
Lewis Research Center

A Flexible Cruciform Journal Bearing Mount



A flexible journal bearing mount has been developed which achieves low roll, pitch and yaw stiffnesses while maintaining high radial stiffness by holding the bearing pad in fixed relationship to a deep web cruciform member and holding this member in fixed relationship to the bearing support. This flexible mount has particular application in small, high performance gas turbines.

The design of the crossed beam, or cruciform, provides roll, pitch and yaw cruciform stiffnesses two orders of magnitude less than the gas film stiffnesses in these same directions. Thus, all motion between pad and journal will be accommodated by the cruciform rather than the gas film. Also, the design radial stiffness of the cruciform is approximately that of currently used pivot pad configurations. The cruciform replaces the pivoted pad bearings without changing the rotor dynamic response and without reducing the ability of the bearing to accommodate radial temperature gradients.

Additionally, the cruciform design is sufficiently rugged to avoid assembly problems.

Basically, the innovation involves attaching a thin beam to each end of a bearing pad; the beam passing over the pad pivot point. A second beam is attached to the first at a point located over the pivot point. The second beam, which is at right angles to the first, is attached at its ends to a member which is rigidly attached to the bearing support structure. Thus the pitch motions of the pad will place the first beam in torsion, roll will place the second beam in torsion, while yaw puts both beams in bending.

As shown in the figure, the journal bearing mount is composed of three parts: the bearing pad 11, the cruciform member 12, and the bearing support member 13 by means of which the mount is attached to the machine casing (not shown). The important feature of this innovation is the cruciform member which comprises two thin deep-sectioned beams 14 and 15 attached to each other in symmetric cruciform configuration. Each end of these beams is attached to a transverse member by which it is held in fixed relationship to the adjacent mount

(continued overleaf)

member. Thus, when the mount is assembled, transverse member 16 attached to beam 14 fits into the recess 17 between lugs 18 and 19 on the bearing pad 11, where it is held by a tight fit. Similarly, transverse member 20 attached to beam 15 fits into the recess 21 between lugs 22 and 23 on the bearing support member 13 and is held there. Likewise, transverse members 24 and 25 attach to bearing pad 11 and bearing support member 13, respectively. The roll axis is parallel to beam 15, the pitch axis is parallel to beam 14 and the yaw axis, which coincides with the radial axis of the mount, passes through the pivot point. Thus roll and pitch place beams 15 and 14, respectively, in torsion, and yaw places both beams in bending. The mount has consequently low stiffness in these directions. Both beams are deep and, therefore, stiff in the radial direction. Jacking gas is supplied through a conduit (not shown) which passes through passages 26, 27 and 28 in the mount and which is held in the bearing pad 11 and the bearing support member 13.

Notes:

1. The features of this flexible cruciform mount offer particular advantages in operation including: no pivot wear, compactness and ease of manufacture.
2. Further information is available in the following report:

   NASA CR-121098 (N73-21410), Design and Testing of Gas Bearings for Brayton Cycle Rotating Unit

   Copies may be obtained at cost from:

   Aerospace Research Applications Center
   Indiana University
   400 East Seventh Street
   Bloomington, Indiana 47401
   Telephone: 812-337-7833
   Reference: B73-10001
3. Specific technical questions may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B73-10001

Patent Status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

NASA Patent Counsel
Mail Stop 500-113
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135

Source: A.E. Frost and W.A. Geiger
Mechanical Technology, Inc.
under contract to
Lewis Research Center
(LEW-11035)