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Brief 66-10678

NASA TECH BRIEF

Improved Rolling Element Bearings Provide Low Torque and Small Temperature Rise in Ultrahigh Vacuum Environment

The problem:

In many rolling element bearings used in vacuum operations, the bearing retainer or cage is conventionally fabricated from a solid lubricating material to space the rolling elements (balls or rollers) and to provide lubrication. Thin films of the retainer material are transferred to the rolling elements by the rubbing action of the rolling elements on the retainer pockets as the bearing rotates. The lubricant is subsequently transferred by the rolling elements to the inner and outer races. Prior art used plastics such as polytetrafluoroethylene (PTFE) reinforced and filled with glass fibers and molybdenum disulfide, which caused high bearing torque and high operating temperatures.

The solution:

Fabricate the retainer from porous bronze (copper–tin alloy). Burnish all components of the bearing with molybdenum disulfide.

How it's done:

After fabrication the retainer is placed in a hydrogen furnace at a temperature of 1200° to 1400°F to assure that the cage is free of contaminants such as oils or other organics. The inner race, outer race, and rolling elements are cleaned with acetone and alcohol. The molybdenum disulfide is burnished on the components with a wire brush. Additional burnishing of inaccessible regions such as the rolling element pockets in the retainer can be accomplished by forcing an air–molybdenum disulfide mixture into the bearing while it is rotating.

Notes:

1. Rolling element bearings fabricated as described have been successfully operated in ultrahigh vacuum environments (10^{-11} torr) at a lower torque and with a smaller temperature rise than was possible with bearings fabricated from solid lubricant materials.
2. Optical systems and electronic components will not malfunction because of contamination by the bearing lubricant. Bearings produced by this method do not require containers, baffles, or labyrinths to restrict evaporative losses.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 23365
   Reference: B66-10678

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 05