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NASA TECH BRIEF

Test Device Prevents Molecular Bounce-Back

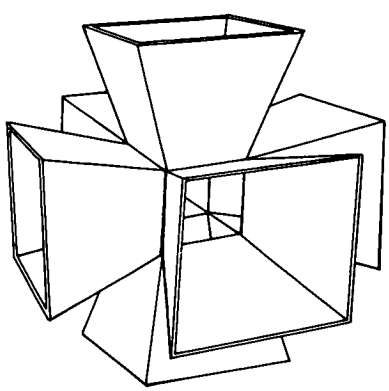

FIGURE 1

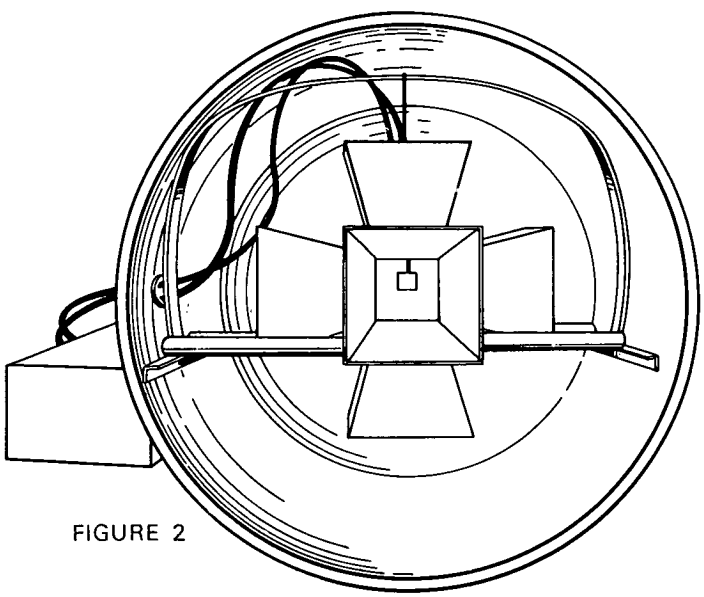

FIGURE 2

The problem: In tests simulating the vacuum environment of space, molecules escaping from the surface of the test item rebound from the chamber walls and strike the test item many times before being removed by the vacuum pump. Some of the molecules will adhere to the test item surface. Since this will not occur in space, where escaping molecules have a mean free path in the order of hundreds of kilometers, an accurate picture of the life in space of the test item surface cannot be obtained using only a vacuum chamber.

The solution: An omnidirectional, anisotropic chamber fabricated to enclose the test item at the intersection of its six truncated pyramids.

How it's done: Six pyramidal or funnel-shaped reflectors are joined together at their narrow ends projected into orthogonal x, y, and z planes. The test item is placed in the cubic space formed by the junction of the six reflectors. This configuration operates to take advantage of the ray characteristics of molecular flow. When a component in the test area vaporizes (or outgasses) a molecule, this molecule may only travel in a direction away from the test area. Normally, it would collide with the wall of the test chamber and rebound to the vicinity of the test item. This test device acts as a baffle to impede the free path of the molecule to the test item by interposing a surface so slanted that it imparts an angular vector to the molecule and

(continued overleaf)

"bounces" it back to the chamber wall. This bouncing action takes place very rapidly and in due course, having given up some of its kinetic energy, the molecule is removed from the test chamber by normal operation of the vacuum pump. Mathematical computations indicate optimum angle of slope for the pyramid walls to be 15 degrees.

Notes:

1. Other baffle shapes such as truncated cones or funnels may offer greater efficiency, depending on the size and shape of both test object and vacuum chamber.
2. Cryogenic cooling of the baffle device and of the vacuum chamber walls will further reduce the number of molecules striking the test item.
3. For further information about this invention inquiries may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland, 20771
   Reference: B63-10546

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.

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