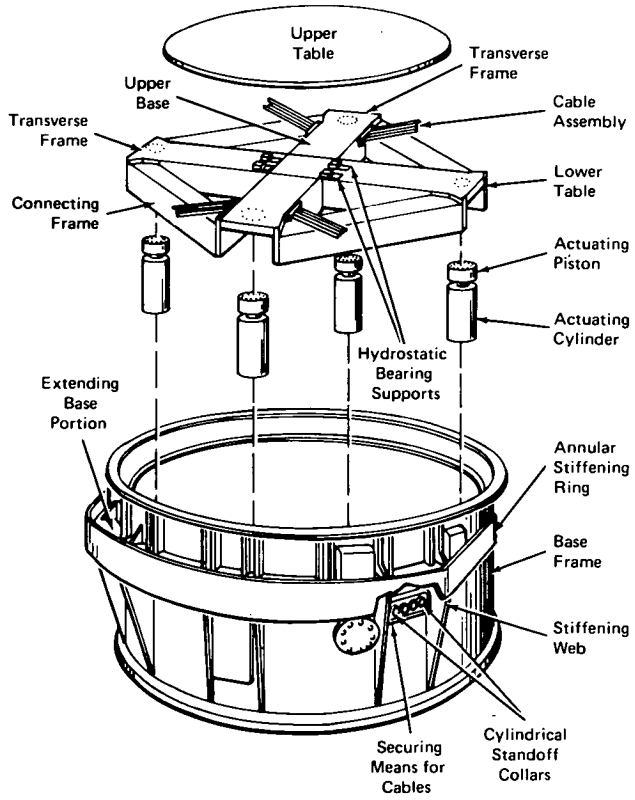
NASA TECH BRIEF

Goddard Space Flight Center

A Multidegree-of-Freedom Vibrational Apparatus

The problem:

A typical vibrational testing apparatus, commonly called a shaker table, consists of a vibrational table supported by a stationary frame. The table is usually connected to the frame by some elastic means such as coil springs, flexible steel rods, or resilient rubber bushings or mountings. None of these elastic materials is prestressed and, therefore, they deteriorate rapidly during vibration. Another problem with this type of apparatus is that the table supporting the object under test usually rests on pistons that impart vibration. The weight of the table and of the object impose heavy stress on the pistons which often break down after short service.



A Multidegree-Of-Freedom Vibrational Apparatus

The solution:

A new vibrational apparatus uses prestressed cables to support the vibrational table. These cables are much more durable than other elastic materials and do not require frequent servicing. Because much of the weight rests on these cables, vibration actuating pistons can provide longer service.

How it's done:

The apparatus (see figure) comprises a vibration table consisting of two members resting on a stationary base frame. The upper table member is a platform for supporting the object under test. This platform is resting on four linear hydrostatic-bearing supports attached to the lower table member.

The lower table member is a metal frame structure; it comprises two transverse frames supported on the periphery by four connecting frames. Four cable assemblies are attached to one of the transverse frames. The lower table member, in turn, is suspended on these assemblies. The cables are attached to cylindrical standoff collars at four locations around the stationary base frame. Located under the lower table member are four actuating pistons which transmit vibrational forces to the table. These pistons are actuated by their respective actuating cylinders.

The stationary base frame is a rigid metal structure reinforced with an annular stiffening ring and stiffening webs around its perimeter.

Each cable supporting the lower table member is pretensioned between 10% and 50% of its breaking strength. Pretensioning value depends on the size of the cable and the weight of objects under test. In general,

(continued overleaf)

heavier cables need larger pretensioning tolerances. The advantage of pretensioning is that it eliminates the compressional forces that have caused the unnecessary wear on elastic materials and actuating pistons. An additional feature of the cables is that they provide increased safety. In the event of structural failure of other supporting components, they will support the entire weight of the vibrational table.

Note:

Requests for further information may be directed to:

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Reference: TSP73-10332

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,699,807). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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