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NASA TECH BRIEF

Compression Springs Used for Vibration Isolation

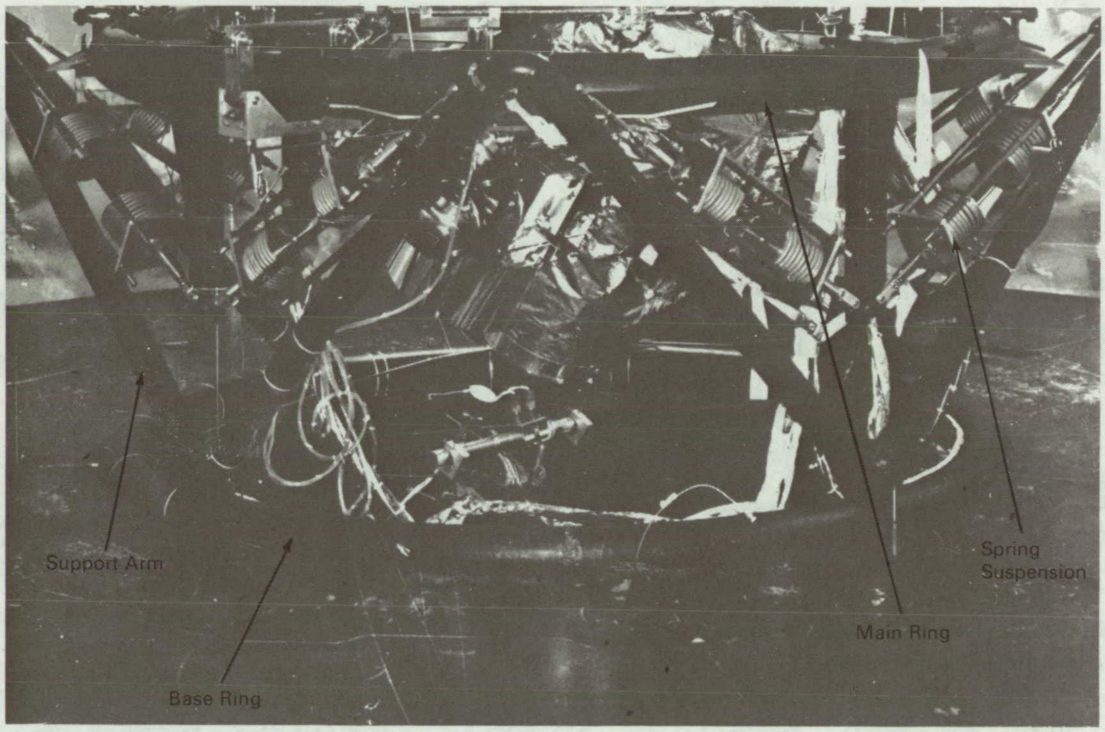

Figure 1. Test Item on Vibration Isolator

The problem:

In testing large hardware in space simulators, it is necessary that the test specimen be essentially "hard mounted" during component installation and adjustment. It is then hung from cables for the test. However, during testing of such items as an attitude control system, if there is outside vibration, the test specimen must be isolated. Prior methods have involved suspension from cables which proved unsatisfactory due to transmission of vibration, or suspension from soft extension springs which required excessive space.

The solution:

A novel vibration isolation system that employs opposed pairs of compression springs that can be totally compressed to provide a "hard mount" during component installation and adjustment, and can be released to a free-floating condition for vibration isolation during test.

(continued overleaf)

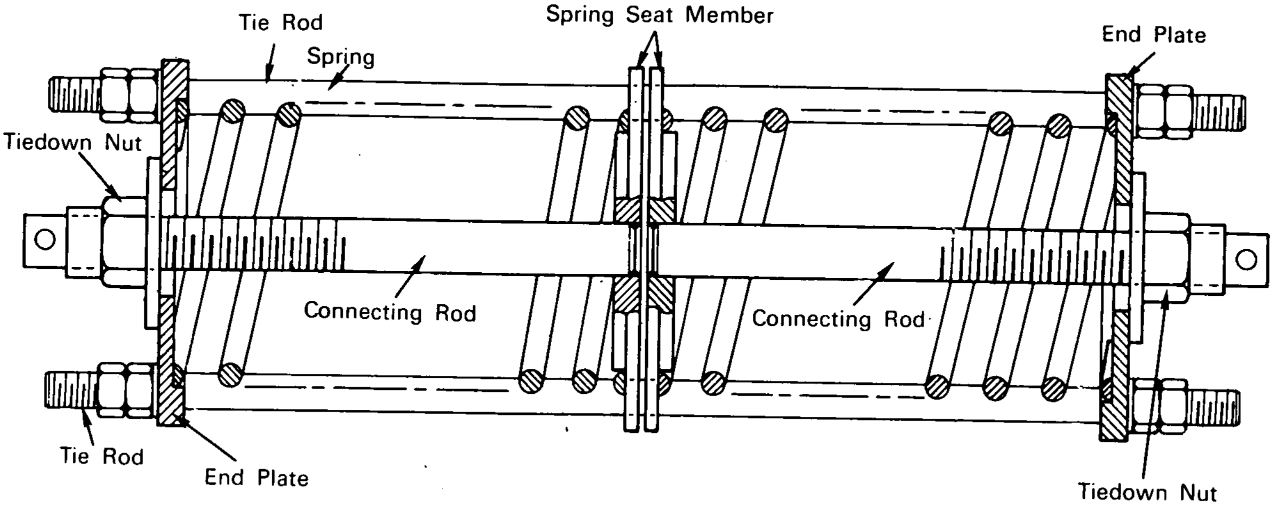

Figure 2. Spring Suspension

How it's done:

As shown in Figure 1, the test item is supported on a main ring by a four-bar linkage arrangement. The main ring has four support arms, each of which is linked to an opposed pair of spring suspensions, which in turn are supported by turnbuckle links, from secondary support arms bolted to a base ring.

Referring to Figure 2, it will be noted that each spring suspension (Figure 1) is made up of four tie rods arranged in rectangular configuration with end plates which are held together by the rods to form a spring-retaining frame. The end plates have central apertures through which opposed connecting rods pass. These rods have threaded portions extending to one end, and are attached at their other ends by welding, to spring seat members; each spring seat member is provided with a step for receiving one of the ends of the springs. The other ends of the springs bear against the recessed inner faces of end plates. Both ends of each spring are wound closed and ground flat to ensure square engagement with the seat member and the end plate to minimize the tendency to buckle. Dividing the isolating spring into two shorter sections also minimizes buckling.

A tiedown nut fits on the threaded portion of the connecting rod, with a washer bearing against the inner face of the nut and outer face of the end plate. The tiedown permits initial placement of the spring in full compression to provide a "hard-mount" rigid support during the installation phase. The test item is rough-levelled by adjusting the turnbuckles, and fine-levelled by installation of a number of lead weights (Figure 1) around the spacecraft perimeter.

After installation and adjustment of components on the test item, the tiedown nuts are backed off until the springs are free-floating to provide vibration isolation.

Although the springs are about 4 in. in diameter, each suspension is only about 28 in. long overall. A tension spring of equivalent softness would have to be so much longer than the combined length of the springs in this suspension, that it would not fit on the vibration isolator. Furthermore, under loading, the failure mode of a tension spring is to fly apart, which might produce catastrophic effects on the test specimen. In case of failure of the springs in the present device, however, the coils of the broken spring would remain on the connecting rod within the frame. There would, therefore, be less likelihood of damage to the test specimen.

Notes:

1. This vibration isolation system should find wide use in both domestic and commercial laundry equipment, especially where space conservation is important. In its "hard-mount" mode it would protect equipment during shipping and installation.
2. Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP70-10111

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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