The head in a disk drive in positioned in the parking zone and latched during shipping to protect it from hitting the platter. Recently, however, disk drive manufacturers have found that the head of the drive will sometimes come unlatched during shipping and subsequently cause damage to the disks. It is believed that this unlatching of the head is due mainly to rotational vibration and/or shock.

In order to determine the adequacy of the latching mechanism of each disk drive, computer companies are now beginning to require disk drive companies to include rotational vibration and shock tests in their processes for qualifying drives.

Several crude rotational shock devices are now available on the market. However, to the best of the author's knowledge, there is no rotational *vibration* device for sale at present. For most rotational shock devices, either a spring-loaded plunger hitting a pivoted plate is used, or gravity is used to let a horizontally pivoted plate rotate downward until it hits a stop. The advantages of these approaches are:

- they are relatively simple to design;
- prices for these devices are usually relatively low. However, one of the spring-loaded devices has been selling for about $20,000.00 each.

There are some very serious limitations to these types of devices. Namely, they are:

- the shock level is difficult to accurately control;
- repeatability is poor;
- they are usually limited to low shock levels;
- they are unable to perform repetitive shock;
- it is very difficult to change pulse time duration.

In order to meet the need of the disk-drive industries for this rotational vibration and shock testing, the author has developed a rotational vibration and shock apparatus (patent disclosure has been filed for this apparatus). The principle underlying this apparatus is connecting a shaker with a rotating g box structure to translate the shaker's linear vibration and shock to a rotational vibration and shock at the box structure (Figures 1 and 2).

Figures 3 and 4 show the vibrational and shock responses of the accelerometer mounted on the outside vertical plate of the box structure. Relatively smooth vibrational and shock responses were produced by this apparatus. The maximum angular acceleration of rotational shock achieved by the apparatus to date is approximately 20,000 radians/sec$^2$.

A new design capable of producing angular acceleration in excess of 100,000 radians/sec$^2$ is now underway and should be available for testing by the time this article is published. The new design also will employ a larger box structure, which will allow the drive under test to be mounted with its head pivoting axis aligned with the rotational axis of the apparatus. This will enable the drives to be tested at their most sensitive rotational axis.

Hopefully, with the availability of this rotational vibration/shock apparatus, the latching mechanism of the disk drive head can be tested and redesigned as necessary to prevent unlatching problems in the future.

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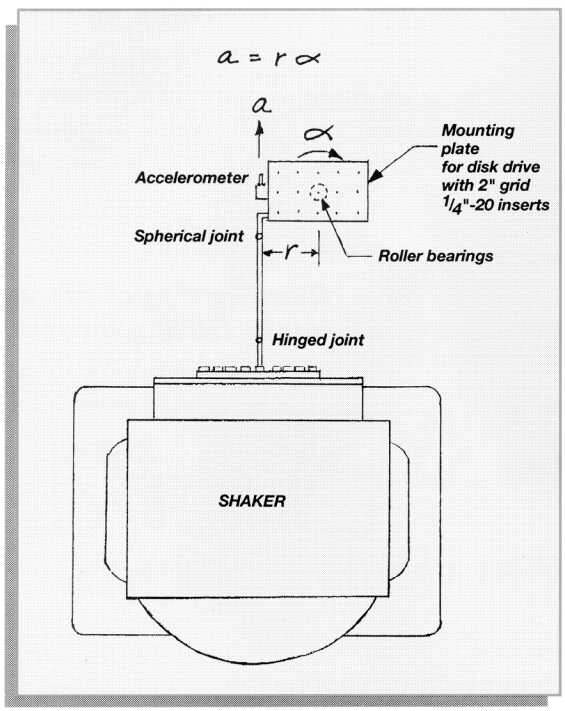


**FIG. 1—Schematic of rotational vibration and shock device.**

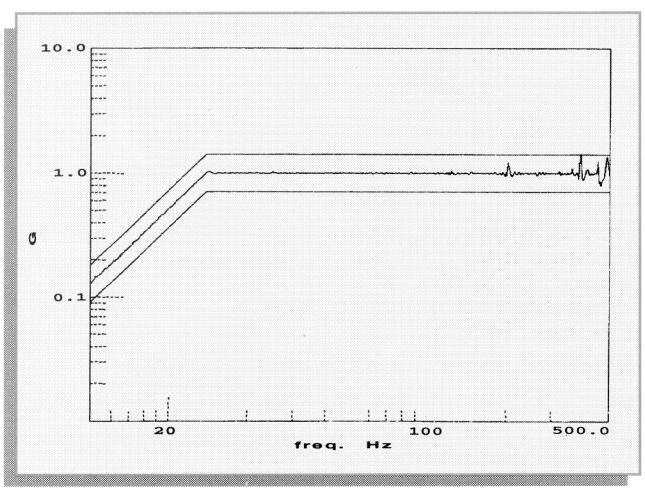


**FIG. 3—Rotational vibration response of the accelerometer, which was mounted on the outside vertical plate of the box structure.**

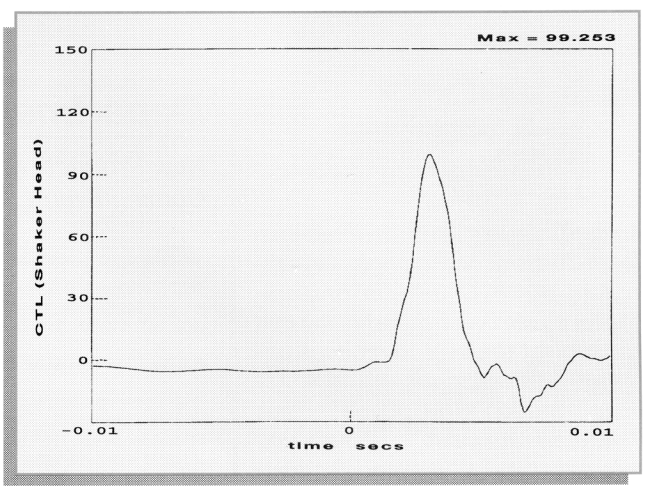


**FIG. 4—Rotational shock response of the accelerometer mounted on the outside vertical plate of the box structure.**

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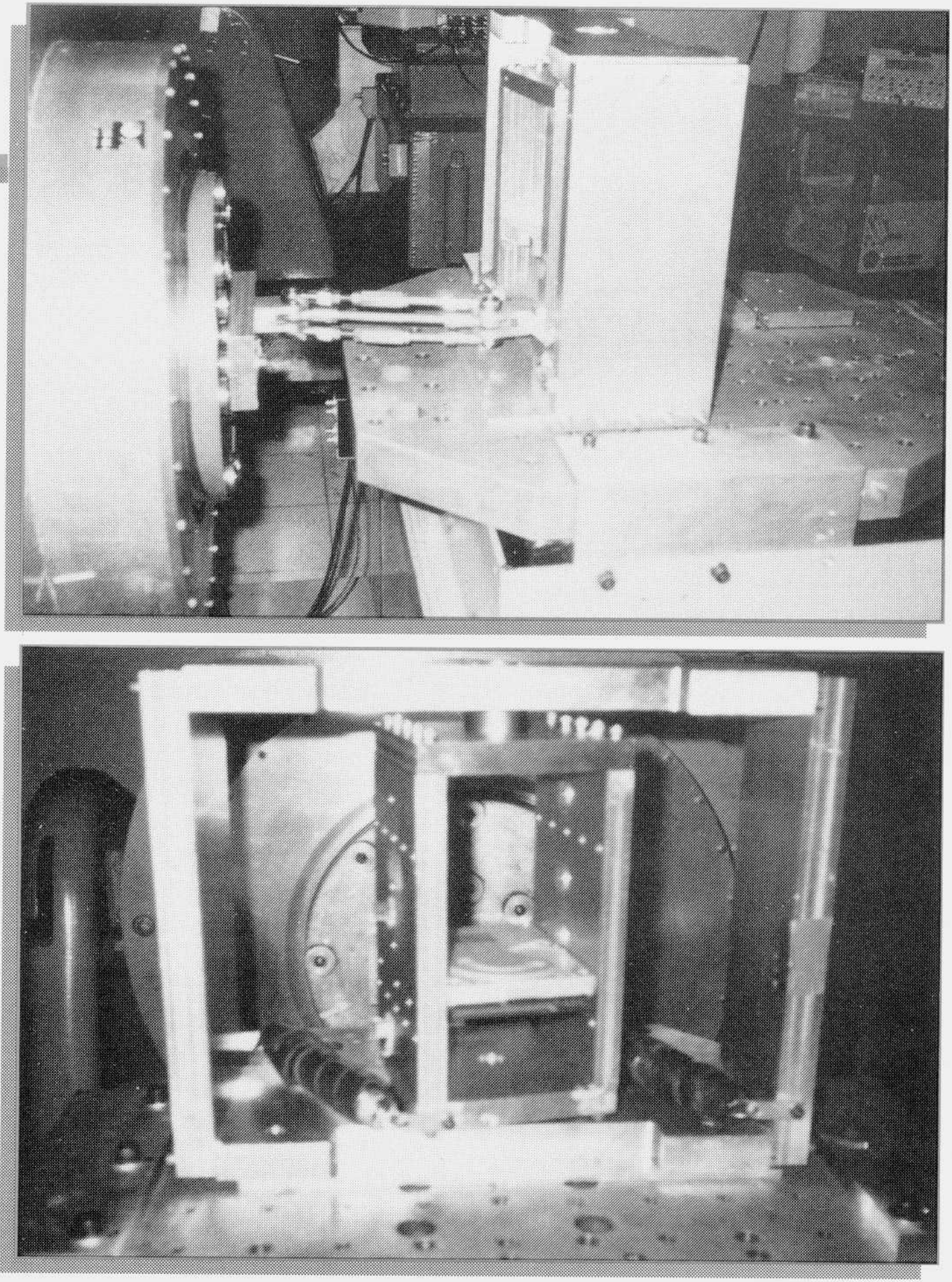

FIG. 2—Two views of rotational vibration and shock device.