



Improved Descent-Rate Limiting Mechanism

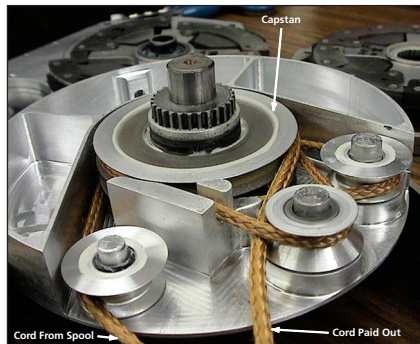
This braking device can be used to capture and slow a moving vehicle.

NASA's Jet Propulsion Laboratory, Pasadena, California

An improved braking cable-payout mechanism has been developed. Like other such mechanisms, this mechanism can be used as a braking or shock-absorbing device for any of a variety of purposes — for example, enabling a person to descend from an upper floor of a burning building at a safe speed, capturing and slowing a moving vehicle, or limiting the shock load generated by opening of a parachute. Whereas other such mechanisms operate at payout speeds that vary with the length of payout, this mechanism operates at approximately constant payout speed, regardless of the length of cord that has already been paid out.

In a prior mechanism of this type, a cord is paid out from a spool on a shaft connected to a centrifugal brake. Because the payout radius on the spool decreases as cord is paid out, the speed decreases by a corresponding amount.

The present mechanism (see figure) includes a spool, a capstan assembly, and centrifugal brakes. The spool is used to store the cord and, unlike in the prior mechanism, is not involved in the primary braking function. That is, the spool operates in such a way that the cord is unwound from the spool at low



The Cord Is Paid Out at Constant Radius from the capstan, which is connected to the centrifugal brake.

tension. The spool is connected to the rest of the mechanism through a constant-torque slip clutch. The clutch must slip in order to pay out the cord.

As the cord leaves the spool, it passes into the capstan assembly, wherein its direction is changed by use of the first of three idler sheaves and it is then routed into the first of three grooves on a capstan. After completing less than a full circle in the first groove, the cord passes over the second idler sheave, which is positioned to enable the cord to make

the transition to the second groove on the capstan. Similarly, a third idler sheave enables the cord to make the transition to the third groove on the capstan. After traveling less than a full circle in the third groove, the cord leaves the capstan along the payout path. The total wrap angle afforded by this capstan-and-idler arrangement is large enough to prevent slippage between the cord and the capstan.

The capstan is connected to a shaft that, in turn, is connected to a centrifugal brake. Hence, the effective payout radius, for purposes of braking, is not the varying radius of the remaining cord on the spool but, rather, the constant radius of the grooves in the capstan. The payout speed is determined primarily by this radius and by the characteristics of the centrifugal brake. Therefore, the payout speed is more nearly constant in this mechanism than in the prior mechanism.

This work was done by Tommaso P. Rivellini, Donald B. Bickler, Bradford Swenson, John Gallon, and Jack Ingle of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-40109

Alignment-Insensitive Lower-Cost Telescope Architecture

This next-generation architecture enables construction of very large telescopes.

Goddard Space Flight Center, Greenbelt, Maryland

This architecture features an active wavefront sensing and control scheme along with methods for measuring the relative positions of the primary to aft optics, such as the secondary mirror, and should enable larger and cheaper telescope architectures needed for future applications. This design overcomes the stability requirements of large telescope primary mirrors.

A wavefront source/sensor is placed at the center of curvature of the primary mirror. The system provides continuous light onto a primary mirror that is retro-reflected onto itself. This allows the

wavefront controller to constantly update the positions of the primary mirror segments (or deformable mirror actuators). For spherical primaries (where replicated mirrors can be used), a spherical source is used. For aspheric primaries, a null is used. The return beam can be analyzed through focus by using established wavefront sensing and control techniques, including prisms for coarse alignment, multi-wavelength interferometry, or phase retrieval. The light can be monochromatic or white light. This same source and sensor can also be used to check out the system during assembly.

Another function of this innovation involves using a concave mirror on the back of the secondary mirror (or other aft optic) that has the same center-of-curvature location (in defocus) as the primary mirror. The two return beams can be aligned next to each other on a detector, or radially on top of each other. This provides a means with which to measure the relative position of the primary to the secondary (or other aft optics), thus allowing for the removal of misalignment of the center-of-curvature source/sensor (meaning it doesn't need precision placement) and also provides