July 1971 Brief 71-10260

NASA TECH BRIEF
Goddard Space Flight Center

Thermal Heliotrope: A Passive Sun-Tracker

The problem:

To design a simple, inexpensive, sun tracking system. Conventional electromechanical tracking systems are complex and expensive, making a passive system more desirable.

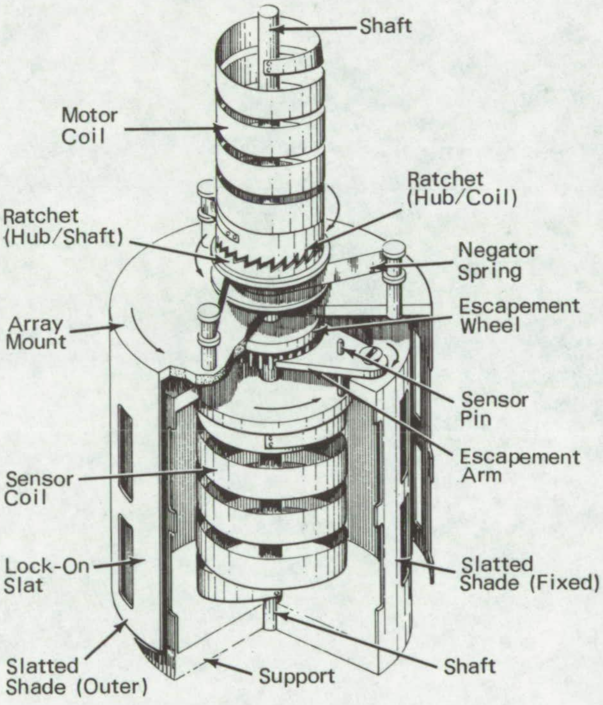

Figure 1.

The solution:

A passive thermal heliotrope tracker (see Fig. 1) capable of continuous sun tracking. The device consists of two main components: a helical bimetallic coil and a control mechanism. The bimetallic motor coil produces the torque and angular displacement with temperature change, and acts as the driving element of the device. The control mechanism, a concentric shading mechanism containing a bimetallic sensor coil, controls the tracking rate and provides for the reset cycle.

How it's done:

The shades are mechanically synchronized with an escapement mechanism consisting of an escapement arm actuated by a sensor pin. For each heating and cooling cycle of the sensor coil, the escapement slips two increments. When the slots in the shades align, the bimetallic coil is illuminated, the sensor pin actuates the escapement arm, and the array rotates one increment. The shades are then closed and the coil begins to cool. During the cool-down period, another escapement motion occurs and the coil again becomes illuminated, repeating the cycle. The cycle sequence continues until the lock-on slat, which is coplanar with the surface to be oriented, is normal to the sun. In this position, the sensor coil is shaded, regardless of slot alignment, and no further rotation will occur until the control surface becomes misaligned. A typical application of a simple reset type of thermal heliotrope is presented in Figure 2.

The critical design parameter is the size of the coil. For maximum available torque, the coil should be relatively wide, since torque is directly proportional to the width and the square of thickness. However, an important tradeoff is concerned because transient heating and cooling rates are inversely proportional to thickness. The design approach, then, sizes the coil thickness to provide the necessary thermal response, and maximizes the

(continued overleaf)

width within the limits of the physical size and diameter of the winding.

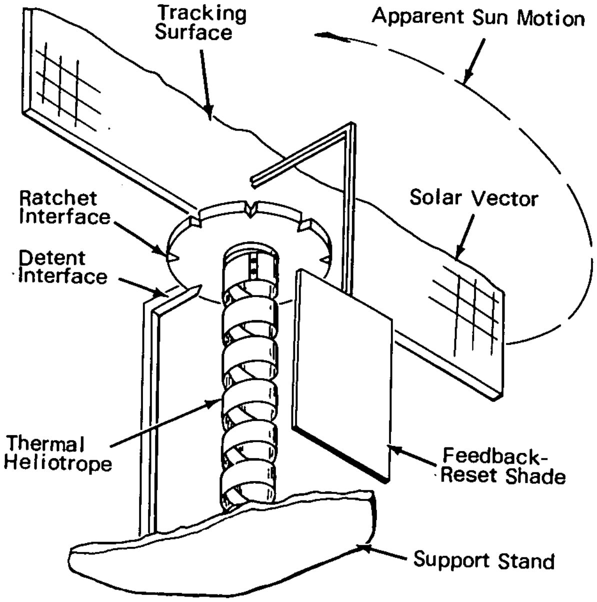

Figure 2.

Note:

Requests for further information may be directed to:

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Reference: B71-10260

Patent status:

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Patent Counsel
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