NASA TECH BRIEF

Thumb-Actuated Control Device

The problem:

Multiple-axis control of aircraft requires full visual attention of the pilot and the simultaneous operation of hands and feet. Since the pilot's attention should not be diverted to seek the location of other flight controls, it was considered desirable to design a device to provide servo control of certain flight characteristics, which would require no visual attention and a minimum of operational movement.

The solution:

A rotary-potentiometer device on a spoke of an aircraft steering wheel to provide complete servo control of other flight characteristics by thumb movement.

How it's done:

A rotary potentiometer with a gear sector and cam secured to its shaft is mounted on a housing or bracket. Pivotal movement of the arm by thumb pressure through 15 to 20 degrees on each side of a neutral position causes rotation of the potentiometer shaft through agency of an internal gear sector connected to the arm and engaged with the gear on the potentiometer shaft.

The cam on the potentiometer shaft is profiled to have a central depressed portion which acts as the reference or zero position of the potentiometer when a spring-loaded follower is engaged with the cam surface. Inasmuch as the cam profile is formed so that it provides fairly uniform torque throughout rotation of the driving arm, the reference or zero position can be detected by a sudden change in thumb pressure.

The cam follower is carried on a slide that pivots on the potentiometer shaft. Since the force exerted on the cam face by the follower is opposed by a force applied directly to the shaft on which the cam is mounted, there is a reduced net force acting on the potentiometer shaft. As a result, it is not always necessary to provide additional bearings on the mounting bracket to relieve strains on the potentiometer shaft.

Three modes of operation can be provided by the control device: (1) spring-return self-centering action; (2) free (no spring) action by a cam-follower detent; and (3) friction-restrained action by a finger-operated pressure screw.

Notes:

1. Similar devices have been patented for aircraft control; the novelty of this disclosure is in the locking and spring-loaded bypass features, and the load-reducing feature for the potentiometer shaft.
2. The cam profile can be designed to provide holding action at the extremes of potentiometer travel.
3. Requests for further information may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B70-10407

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,472,086) and royalty-free license rights will be granted for its commercial development. Inquiries about obtaining a license should be addressed to NASA, Code GP, Washington, D.C. 20546.

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Category 01