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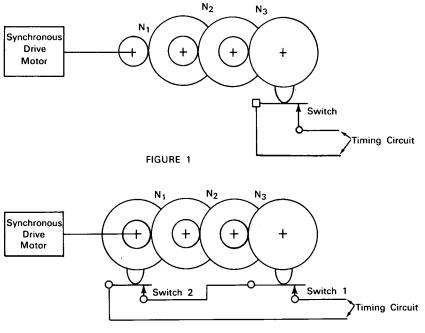
Brief 63-10143

## NASA TECH BRIEF



This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

## Coincident Switch Closing Reduces Error in Motor-Driven Timer





**The problem:** Conventional motor-driven timing devices depend on a gear train to time a cam that closes and opens a switch. Because of the inherent laglead nature of the last member of a gear train, the cam dwell angle is affected and the precise moment of switch closure varies in proportion to the lag-lead factor.

**The solution:** The extension of the timing circuit to include a second switch actuated in time with the first but driven directly at a speed x times faster than the first.

How it's done: A conventional electromechanical timing device is shown in figure 1. In this configuration, the switch closure variable can be expressed in terms of cam dwell angle  $\theta$  (the angular period during which the cam holds the switch closed) in degrees, or time ( $T = N_1N_2N_3\theta/360A$  minutes) where:  $N_1N_2N_3$  are the gear ratios. A is the speed in revolutions per minute of the drive motor. By extending the timing circuit to include an additional switch and cam as shown in figure 2, the timing error T is appreciably reduced. By synchronizing the cams so that switch 1 closes prior to a closure of switch 2 and remains closed (continued overleaf)

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## Notes:

- 1. This method could be used to provide precision timing over a range of intervals limited only by the availability of gear train configurations and drive motor speeds.
- 2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer Jet Propulsion Laboratory 4800 Oak Grove Drive Pasadena, California, 91103 Reference: B63-10143

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated. Source: Samuel Rich (JPL-182)