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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

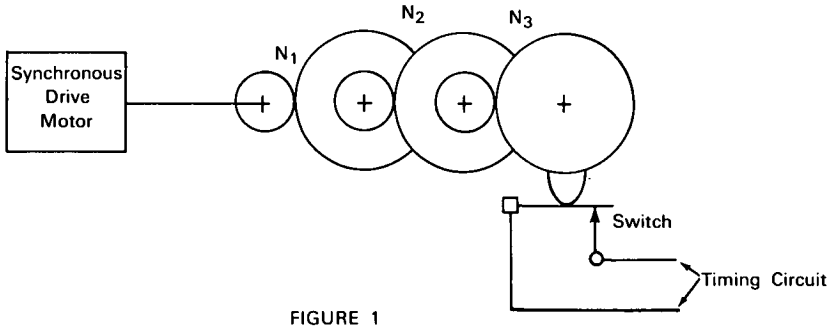

FIGURE 1

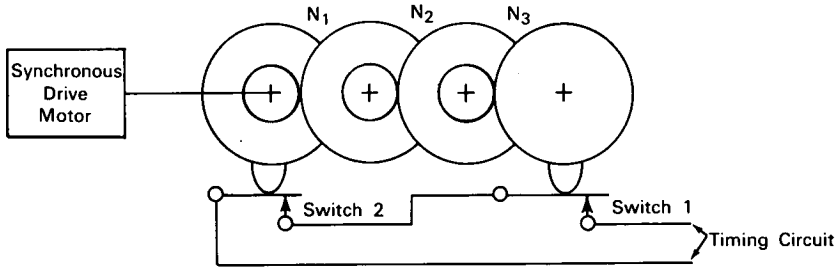

FIGURE 2

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 lag-lead 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 Θ (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)

during that closure of switch 2, the circuit closure variable is limited to that occurring in switch 2. This amounts to $T = \theta/360A$ minutes, the gear-train effect having been removed. Although switch 2 will close more times per unit time interval than switch 1 due to the effect of the gear train, overall timing function remains in switch 1.

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
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   Pasadena, California, 91103
   Reference: B63-10143

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

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(JPL-182)