NASA TECH BRIEF

Capacitance-Coupled Wiper Increases Potentiometer Life

The inherent friction that exists between the sliding contact and the potentiometer element in conventional potentiometers limits their use to applications where friction is not critical. The sliding contactor produces wear and eventual failure of the potentiometer.

A capacitively-coupled wiper that does not contact the resistance element of the potentiometer and, hence, cannot introduce friction, provides a means of reducing the friction between a potentiometer element and its sliding contact. A small preamplifier may be employed close to the wiper to reduce errors caused by output cable capacitance. Experience with the device has shown it to be friction free with resultant low wear and also that it has high speed and high resolution.

The capacitance-coupled wiper moves close to but not in actual physical contact with the resistance element of the potentiometer. The electrical circuit is completed by electrostatic coupling across the gap between the resistance element and the contactor. The application of an alternating voltage to the resistance element of the potentiometer produces an electrostatically-coupled alternating voltage at the contactor which is correlated with the position of the contactor. The application of a direct unvarying voltage to the ends of the resistance element produces an electrostatically-coupled voltage at the contactor which varies only when the position of the contactor varies. Due to the small size of the equivalent series capacitance presented by the contactor, the loading of the output circuit is important and in many applications necessitates the use of special circuits to minimize the output current flow and the effects of cable capacitance. The capacitively-coupled wiper is extremely linear because it is designed to average the potential of several turns on the resistance wire. This minimizes the nonlinearities resulting from normal turn-to-turn winding irregularities.

Notes:

1. The lack of friction between the wiper and the resistance element results in a device having low wear, high speed, and high resolution. These characteristics suggest many applications in recording or control equipment utilizing potentiometers.
2. Complete details of operation of the capacitance coupled wiper are described in United States Patent No. 2,844,776, July 22, 1958.
3. A specific application of the capacitance-coupled wiper in a situation where the friction associated with conventional potentiometers would not have been acceptable is described in *A Pendulous Angle Sensor,* by John Dimeff and Albert G. Oswald, NASA TM X-1235, Ames Research Center, May 1966. This report is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151; price $1.00.
4. In the application described in the above report, an ac servo-balanced bridge provides readout and, at the same time, readjusts the grounding point of the circuit so as to maintain the capacitive contactor at zero potential relative to the cable shield and instrument housing independent of the position of the wiper contact.
5. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B68-10175

(continued overleaf)

Patent status:

This is the invention of a NASA employee, and U.S. Patent No. 2,844,776 has been issued to him. Inquiries about obtaining license rights for its commercial development should be addressed to the inventor, Mr. John Dimeff, at Ames Research Center, Moffett Field, California 94035.

Source: John Dimeff
(ARC-10060)