# Meetings

## Electromagnetic Relays

Suppression of inductive transients generated by de-energizing coils and the possible reduction in radio frequency interference have long been problems in the development of control systems. Unsuppressed 28-volt inductive devices, such as relays, can easily produce transient voltages in excess of 1000 volts. This type of electromagnetic interference was a major topic of discussion at the 13th annual National Relay Conference. The conference was held jointly with the second International Conference on Electromagnetic Relays held at Oklahoma State University, 27–29 April 1965.

New to the discussion this year on possible suppression techniques was the use of bifilar-wound (both conductors wound together) coils in which one winding is short circuited. When the same wire size is used for both shorted and working windings, the voltage transient is reduced to at least the original value of the applied voltage. Smaller sizes of wire are not as effective as the larger sizes in suppressing the transient voltage. R. M. Acker (George C. Marshall Space Flight Center, NASA) indicated that using wire two sizes smaller still results in reducing the transient voltage to 40 volts for a 28-volt unit.

An initial comparison of the bifilar form of suppression to the conventional diode (the resistor-capacitor and zener diode forms of suppression) indicates that the bifilar form could be competitive with respect to cost, is possibly more reliable than, and is not as susceptible to radiation as the diodes. F. M. Blatt (Sigma Instruments, South Braintree, Mass.) indicated that the bifilar form of suppression has some disadvantages, such as increased operate and release times, slower contact opening, and increased coil volumes.

Another form of radio-frequency suppression for miniaturized components was discussed by A. L. Albin and E. Busch (Fairchild Space and Defense Systems, Syosset, N.Y.). This type involves a transistor driver circuit for use on low-current circuits to 1 ampere. Also, the series type R-C contact suppressor was effective if the series R could be tolerated in the contact circuit.

R. S. Gomez (I.B.M., Burlington) discussed contact arc suppression for miniature reed switches. Leading off with a discussion of the type of arcing phenomena that contributes to contact degradation, which includes bridge transfer, arcing on break, arcing on make, and glow discharge, Gomez concludes that R-C suppression can considerably extend the contact life if certain criteria are followed. These criteria, as stated by Gomez, are: (i) "In order to suppress bounce the R-C time constant should be kept as low as possible. A 30-microsecond time constant is fast enough to suppress 75 percent of the bounce period and will greatly increase contact life; (ii) The initial contact voltage at break should be kept as low as possible and, for optimum design, should be kept below 14 volts (the minimum arcing voltage); (iii) The inrush current should be kept as low as possible to insure that the contact is not damaged on make."

Experimental results on 48-volt, 100- and 300-milliampere loads indicate that contact life can be increased approximately ten times by the proper R-C suppression.

Contact arcing phenomena were the subjects of major discussions. Hans O. Karlström (Swedish Telecommunications Administration, Farsta, Sweden) reported on testing two contact materials, palladium and copper silver, under laboratory and normal conditions. The amount of contact erosion with the number of operations for different surrounding air conditions was his main interest. The observations were for contacts, subject mainly to short arcs. The amount of hydrocarbon vapor in the air surrounding the contacts influences the contact erosion, causing greater erosion with larger amounts of hydrocarbons. However, even contacts operating under "fixed" conditions will at different times be subject to erosion of varying types and extent.

Y. Ohki (Nippon Electric Co., Ltd., Tokyo) presented results of investigating the use of multilayer, diffused contacts for reed switches. The reeds of the reed switch must serve the triple function of contacts, magnetic poles, and magnetic path. His results indicate that the best overall results are obtained with "52 alloy" (Ni, 52 percent; Fe, 48 percent) with a nickel-gold diffused contact. However, treatment of the reed is very critical. The iron should not be diffused toward the contact surface in excess of the limit in which iron can constitute a solid solution with gold alloy at room temperature. The contact metal should be covered with oxide film (chemisorbed oxygen), which is not easily pierced in contact closure but which assumes a low contact resistance by tunnel effect.

M. J. Price (University College of Swansea, University of Wales) describes the results obtained with high-speed photography in analyses of how molten metal bridges rupture and the relation between rupture, the microplasma, and the subsequent transfer of material.

M. R. Hopkins, a colleague of Price's, described results of using radioactive-tracer techniques to determine the migration and transfer of metal between electrodes of electrical contacts. The two physical processes which are important in the study of migration and transfer are the formation and rupture of the molten metal bridge. This bridge forms between the electrodes as they separate. Hopkins described the initiation and maintenance, for a short time, of the micro-arc which forms as the bridge breaks. His results indicate the micro-arc, rather than bridge thermal asymmetry, is mainly responsible for metal transfer.

More than one-third of the 34 papers presented during the conference were concerned with various aspects of arc suppression, radio interference, and arcing phenomena. Other papers covered testing, production, design, and specification of military and industrial types of relays.

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