# SECTION M—Discussion: Systems for Control and Analysis

*Note: A participant's full name and address are given with the first contribution to the Discussion. Authors' full names and addresses are given with the title of each paper. For subsequent entries the addresses are omitted.*

*Paper M-1:* Quenching Spark Gaps as Trigger Elements in High-Speed Cinematography, *Frank Früngel and Walter Thorwart*, Dr.-Ing. Frank Früngel GmbH., Sülldorfer Landstrasse 400, Hamburg-Rissen (24a), Germany.

*Dr. Gustav Thomer (Institut Franco-Allemand de Recherches, St.-Louis, France):* Could you tell me whether you have always used copper electrodes, or have you also tested other electrode materials?

*Dr. F. Früngel:* We first used brass, aluminum and tungsten; later, copper; and finally, an alloy of tungsten and copper. This last electrode material has four times the life of the copper electrodes.

*Paper M-2:* Precision Speed Control for a High-Speed Camera, *David A. Cahlander*, Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Massachusetts.

*John G. G. Hempson (Ricardo & Company Ltd., Shoreham-by-Sea, Sussex, England):* I note that all the figures given for this speed control apply to comparatively low framing rates of about 2,000 frames/sec, maximum. Has the author had any experience of this equipment near the maximum speed of the camera in the region of 8,000 to 10,000 frames/sec?

*D. A. Cahlander:* There is no reason why the speed of the acmera could not be controlled at maximum or near maximum speed. You would need, of course, more acceleration voltage than the 120-v a-c that I apply to the motors. You would probably need to use larger thyratrons than are used in this control to handle the current at the elevated acceleration rates. I don't use the camera at rates higher than 768 frames/sec; so I did not need to apply elevated voltages for acceleration.

*Paper M-7:* A Method for Analyzing High-Speed Films, *Franz Topfer*, Comité National Belge d'Optique, 15, Rue Sohet, Liège, Belgium.

*Claude Véret (Office National d'Etudes et de Recherches Aéronautiques, 29-39 Av. de la Division-Leclerc, Châtillon-sous-Bagneux (Seine), France):* In your apparatus, does not the length of the teeth around the measuring wheel cause some error in the rate of movement of the paper with respect to the graduated disc?

*F. Topfer:* The wheel shown on the projected slide was provided with longer and bigger teeth than those really used (for the latter would not be visible on the projection screen). Actually, the teeth are about 0.25 mm long. They penetrate right through the paper, which is thus tangent to the rim of the wheel. The engagement of the paper is perfectly regular and free from slip.

*Howard S. Weisbrod (Air Force Flight Test Center, Edwards Air Force Base, Lancaster, California):* Have you considered including your rotating calibration dial internally within the high-speed camera for long-range applications?

*F. Topfer:* I have in fact contacted the camera manufacturers, who are examining the possibility of incorporating the synchronous clock in the camera. That would obviously be the best solution.

*J. S. McVeagh (Armament Research and Development Establishment, Fort Halstead, Sevenoaks, Kent, England):* What kind of motor is used to rotate your timing disc?

*F. Topfer:* We use a synchronous motor fed from the mains. The frequency of the mains seems sufficiently precise and constant. Obviously, one could just as well supply the motor from a constant frequency generator.