Comments on Light Sources

By HAROLD E. EDGERTON

My assignment from Chairman Beard was to report briefly in Chicago on the papers that concerned light sources, and their relationship to high-speed photography.

An unscheduled paper by Dr. Immanuel Marshak of the Lamp Works, Moscow, U.S.S.R., was to me one of the most interesting of the session. He showed data from continuous xenon lamps that were operated without ballast resistors from an a-c line. The loading was up to 5,000 watts per centimeter for tubes of less than a centimeter in diameter. The lumen per watt output information that he presented in slides showed that the efficiency increased almost directly with watts per centimeter. He reported on a 100-kilowatt lamp and mentioned that larger ones (more than ten times) had been tried. The use of high-powered efficient xenon-filled lamps, for producing bright light for high-speed motion pictures, seems interesting. There also may be other uses for efficient continuous lamps of power in the hundreds of kilowatts.*

Presented on October 24, 1962, at the Society's Convention in Chicago by Harold E. Edgerton, Dept. of Electrical Engineering, Massachusetts Institute of Technology, Cambridge 39, Mass. (This paper was received on January 18, 1963.)

* Dr. Marshak's paper appears in the *Proceedings of the Sixth International Congress on High-Speed Photography*, pp. 134–142.

Dr. Frank Früngel from Hamburg, Germany, continues his intense interest in high-speed photography. There were five papers for which he or an associate was on the platform at the Congress. One of his papers, with H. G. Patzke, considered the laser as a high-speed light source. A few examples were shown which utilized the intermittent short flashes from the ruby laser. Various methods of control were mentioned which no doubt will be elaborated in the final paper.

L. Frommhold and H. Raether presented an informative paper on a spark ultraviolet light source of 0.01-microsecond duration to the half intensity points. The gap operated with ether vapor of 400-mm pressure using a Kerr cell to cut off the tail of the light.

The noisiest light source at the Congress was an open gap across a semiconductor which sounded like a 12-gage shot gun in the exhibition hall whenever it was flashed. A concentric arrangement of capacitors totaling 100 watt-seconds of stored energy formed a low-inductance circuit for producing the flash across a semiconductor disc of titanium dioxide. J. Moden, G. Reece and S. Pooley presented technical information on the light output and duration of the light source as well as the current and voltage variations with time. The authors had not devised a trigger circuit for their source at the time of the meeting.

Further refinements of the Fischer "line" type of nanosecond gap flash-lamps were reported in a paper by H. Fischer, C. Gallagher and P. Tandy. Both an increase in capacity and a decrease in residual inductance were obtained by the precision control of the thickness of the insulating sheet of the capacitor and the current path. The shortest light pulses to date have a rise time of 1.1 and a half width of about 5 nanoseconds. The Früngel exhibit (Impulsphysik) displayed a Fischer gap.

The limits of operation of the quartz xenon electronic flash-lamp was the subject of a talk by J. Goncz. He, with coauthors P. Jameson and H. Edgerton, presented experimentally obtained data on a series of actual flashlamps.

A specific type of tube reaches its load limit for three conditions such as (1) physical explosion of the quartz walls; (2) loss of light due to evaporated electrode metal that is redeposited on the walls; and (3) vaporization of the quartz walls.

The life of a specific type of flashlamp can be increased if the peak current is reduced by the use of an inductance.

D. Elle showed a Cranz-Schardin multiple-spark source with an optical arrangement of prisms and light guides to reduce the parallax.

Cameras and Techniques for Shock Waves and Explosions

By B. E. DRIMMER

In the research fields of shock waves and explosives, as in other fields of research, there are no substitutes for well-considered theory and equally well-designed experiment. A most important element of a well-designed experiment lies in the use of observational techniques that match the requirements of the desired measurements. Obviously then, rapidly changing phenomena need observational systems having rapid, and if possible, repetitive responses. Shock waves and detonations are such rapidly changing phenomena; therefore, we who do research in these fields are intensely interested in all phases of high-speed photography.

Presented on October 25, 1962, at the Society's Convention at Chicago, by B. E. Drimmer, then at the U.S. Naval Ordnance Laboratory. The author is now at the Navy Bureau of Weapons, Code RRRE-6, Washington 25 D. C
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At the Sixth International Congress on High-Speed Photography, quite a number of papers were presented which dealt with photography as applied to, or which originated in, the fields of shock waves and explosions. Several of these were on the general topic of photography of shock waves in wind tunnels and shock tubes.

R. J. North of England reported on his measurements of the relative sensitivities of different optical systems.[1] (By sensitivity here is meant the minimum initial gas density that would permit visualization of the desired phenomenon.) He found that for shock waves the most sensitive system was the schlieren system, which detected shocks in gases at initial densities 1/13 the minimum density (of the same gas) usable in a simple shadowgraph system. Schlieren interferometer and normal interferometer systems were intermediate in sensitivity. He also found that non-shock phenomena such as wake eddies require initial densities some 10 times as high as is needed for visualization of shocks. What is new here is not so much that