A Review of the Seventh International Congress on High-Speed Photography

Zurich, Switzerland, September 12–18, 1965

By MAX BEARD

In 1948, John Waddell organized a small group of people into the first high-speed photography committee of the SMPE. Little did anyone, including myself as a member of that first group, realize the ultimate importance of the committee's growth. Starting with occasional sessions on high-speed photography at the Society's semiannual meetings, the need for international participation soon became apparent. In 1952, John Waddell, under the Society's sponsorship as part of its 72d Semiannual Convention Technical Program, organized an International Symposium on High-Speed Photography. It had seven full papers sessions, with representatives from five countries. Subsequent congresses were held in Paris (1954), London (1956), Cologne (1958), Washington, D.C. (1960), The Hague (1962), and at the Kongresshaus, Zurich, September 12–18, 1965.

The importance and significance of these meetings are evidenced by the continuous high participation, the full programs, and the attraction for persons from nearly every phase of science. The Proceedings of the various congresses will reveal to the uninitiated the great range of basic sciences and applications covered, the influence of high-speed photography in research, development and engineering, and, most of all, the thoroughness with which the congresses delve into the subject.

The congresses were held biennially until the 7th Congress. Austria, the scheduled host country for the 1964 meeting, was unable to serve as sponsor, and the Swiss volunteered to host the Congress if it were postponed one year to 1965. With a late start, this was a large undertaking, since the Swiss had to concentrate their planning and organizing in a relatively short period of time. There was no single organization in Switzerland, such as SMPTE, that could sponsor an international meeting, which includes the underwriting of financial obligations during the pre-congress period. After accepting the Congress, their bringing it to a successful conclusion in such a relatively short time was an accomplishment worthy of praise and a great credit to the people involved.

A paper to be presented during the Society's 99th Conference in Washington, D. C., May 1–6, 1966, by Max Beard, U. S. National Delegate, 10703 E. Nolcrest Dr., Silver Spring, Md. 20903. (This paper was received on March 8, 1966.)

Organization and Operation of the Congress

Without an overall sponsoring group, each country must provide its own sponsors and organization. The only continuing group of the congresses is the International Committee, made up of National Delegates from each participating country (Addendum I). This group, of course, does not have the responsibility for any one congress. It is interesting to note, however, that since the Congress, a Swiss High-Speed Photography Foundation is being planned.

Supported by Swiss industry, sponsors for the 7th Congress were: The Swiss Commission of Optics; The Physical Society of Switzerland; The Photographic Institute of the Swiss; The Federal Institute of Technology.

The President of the Congress, Prof. Dr. John Eggert, and the Congress Vice-President, Prof. Dr. W. F. Berg, carried the formal responsibility of organizing, planning, and financing the Congress. Everyone is especially indebted to Klaus Pfister, Secretary of the Congress, for his endless hours of devoted effort in coordinating all phases of the Congress, which made the meeting such a huge success. These three people are all from the Photographic Department of the Federal Institute of Technology. Full listing of the organizing committee is not included herein, but will appear in the Proceedings of the Congress.

A note of sadness must be injected here. Prof. Dr. Hubert Schardin of Germany suffered a sudden stroke during the Congress and died several days later. Prof. Schardin was known widely for his many accomplishments and he had received many awards and honors. He was the National Delegate to the congresses from Germany and as such had been an active assistant to Mr. Pfister for the 7th Congress. His obituary appeared in the *Journal*, December, 1965, p. 1146.

As has always been the case, congress attendance was again one attuned to the balanced program which was of interest to persons in all fields of science, with the common core of interest in high-speed photography. In evaluating each congress, one must bear in mind that the program is diversified in subject matter to meet the requirements of a wide scientific public. A congress should not be evaluated solely on the basis of the presentation of scientific breakthroughs or completely new techniques. The educational value to new scientific groups being introduced for the first time to high-speed photography as a tool should be considered. On this basis, as well as by the standard of research and new techniques reported and demonstrated, the Zurich Congress was outstanding. Probably more educators were present and educational institutions represented than at any previous congress.

The SMPTE Instrumentation and High-Speed Photography Committee performed a notable service for which the Congress organizers stated their appreciation. Efforts were made to have each paper from the United States reviewed by at least six different reviewers for constructive criticism. These comments were summarized and forwarded to the technical program committee prior to acceptance. In turn, the comments were also forwarded to each author for re-evaluating his own paper. This was a large task, but was very helpful to the Swiss. It appears desirable to use this procedure in the future. The list of reviewers is included with this report (Addendum II).

Attendance and Organization

Twenty countries were represented, with the Peoples' Republic of China participating for the first time. All persons on a mailing list of 5,500 were canvassed; of these, 1,350 responded. At the Congress there were 520 persons registered; and about 100 unregistered guests. Twenty-four exhibits, representing seven countries, displayed a wide variety of high-speed cameras, x-ray, electronic, and other accessory equipment. All exhibitors expressed extreme satisfaction in the strong interest shown by those attending the Congress. About 100 technical papers were presented, each running ten minutes, followed by five-minute discussion periods (Addendum III). Although the discussion periods were relatively modest, table facilities outside the lecture hall for small group discussions were amply available and lengthy discussions with authors were numerous. Interchange between people with different high-speed photographic specialities was obvious in these discussions of overlapping problems, as were opportunities to cement international friendships.

Twenty-five papers were presented by United States participants.

The author had the privilege of arranging for the motion pictures which were used as session openers. A group of films gathered by a subcommittee of the SMPTE Instrumentation and High-Speed Committee was the starting point for the final selections. An unscheduled evening period was devoted to re-showing several of the films for an audience of about 400. Appreciation for the use of these films has been expressed to the producers and distributors (Addendum IV).

Although the European weather was not the best for enjoying the beauty of Switzerland, a number of tours were available as a choice for a free afternoon. Boat trips on Lake Zurich and Lake Lucerne, Alpine flights, museums, and art galleries all gave visitors a good opportunity to see some of the historic and scenic beauties of Switzerland. A farewell party was held at ancient Lenzburg Castle which is set high on a hill in a typical Swiss urban setting. To everyone's pleasure, a Swiss yodelling choir performed, singing folk music.

Technical Program

The full report of the Congress Technical Program will be published as the Proceedings of the Congress, by Verlag Dr. Othmar Helwich, Hoffmannstrasse 59, 61 Darmstadt, Germany.

To give a brief overall view of the Congress, however, several United States participants were selected to report the program to the Society. Although simultaneous interpretation was available for the three official languages — French, German and English — technical interpretations are difficult, and considerable effort was expended by our reporters in selecting the highlights or new aspects of papers.

The reporters have grouped the papers by basic subject wherever possible, and utilized their experience in content evaluation. The reporters and their respective subjects are: J. P. Barbour, *X-Ray Techniques;* Dr. Francis D. Harrington, *Several Light Sources and a Framing Drum Spectrograph;* Dr. Paul D. Flynn, *Dynamic Photoelasticity and Fracture;* P. L. Clemens, *Hypervelocity Impacts;* Morton Sultanoff, *Russian Papers;* Dr. J. S. Courtney-Pratt, *Lasers;* Bernard Drimmer, *Explosion Phenomena;* William G. Chace, *Miscellaneous Selections;* William G. Hyzer, *Surveys and Applications.* Appreciation is expressed to these reporters for their excellent work in analyzing these papers and preparing the reports. These reports will be given orally with slides and informal discussion during sessions of the 99th SMPTE Conference in Washington, May 2–6. The written reports of Messrs. Barbour, Harrington, Flynn, Clemens, Drimmer and Hyzer appear in this issue of the *Journal.*

Future Congresses

The International Committee for these congresses met during Congress week and locations for the 8th and 9th Congresses were approved. The invitation of Sweden for June 1968 was accepted. This meeting will be held in Stockholm or Uppsala, an old university town 44 miles north of Stockholm. The spring of the year was selected in order to utilize university facilities as well as to be able to see Sweden during its most beautiful season.

The Swedish National Delegate, Tryggve Ramqvist, has requested that we again review papers to assist in their technical program. Also, we have again been requested to select films for session openers. It is possible that the 8th Congress program will not have simultaneous interpretation, since it is believed most papers will be in English.

The 9th Congress will be held in the United States. Although the date has not been selected, the Board of Governors of SMPTE has approved inviting the Congress back to the United States either for the Fall of 1970 or the Spring of 1971. Present plans call for either the fall meeting on the east coast or the spring meeting on the west coast. All factors will be considered before the location of the meeting is finally determined.

As the United States National Delegate, the author wishes to express appreciation for the valuable and extensive help given by individuals who assisted the Swiss in their excellent Congress; authors of papers, paper reviewers, reporters of the Congress, the SMPTE Board of Governors, the editorial staff of the *Journal,* and the Instrumentation and High-Speed Photography Committee of the Society. This was a group effort, and every contribution was appreciated.

Many persons who contributed to the success of the Zurich Congress are shown in the composite photograph on the opposite page.

1: **Prof. Dr. J. Eggert,** President of the Congress and Professor Emeritus of the Swiss Federal Institute of Technology, is handed the microphone by student assistant Miss B. Funk for the official opening of the 7th Congress.

2: **Dr. E. Landolt,** President of the Council of the City of Zurich, welcomes the Congress members to the city during the opening ceremonies.

3: **Prof. Dr. W. F. Berg** (left), Vice-President of the Congress, and Mr. K. Pfister, Secretary, were constantly active throughout the entire week of technical papers and auxiliary events. Dr. Berg is Director of the Photographic Department of the Swiss Federal Institute of Technology.

4: **Prof. Dr. W. Traupel,** Rector of the Swiss Federal Institute of Technology, spoke on behalf of the Institute's President during the opening ceremonies.

5: **Max Beard,** National Delegate from the United States, during the formal opening, expresses thanks to the Swiss for inviting all nations to the Congress.

6: **Dr. H. E. Edgerton** opened the Technical Program with an invited lecture on Applications of Xenon Flash.

7: **Prof. Dr. H. Schardin,** giving his one-hour invited lecture. This photograph was taken shortly before he left the Congress and the last one taken of him before his death on September 25, 1965.

8: **General P. Fayolle,** National Delegate of France, addresses the Congress during its formal opening. Flags of all participating nations are on display behind the speakers' head table.

9: **Engineer Tryggve Ramqvist,** National Delegate from Sweden, who will be the Chairman of the 8th Congress in Stockholm or Uppsala, Sweden, June 1968.

10: **K. Pfister (left),** Congress Secretary, during one of his less rigorous moments, talks with Professor T. Tsutsui of Tokyo, Japan.

11: **Dr. R. E. Kutterer,** Director of the French-German Research Laboratories, St. Louis, France, sits next to the late Dr. Schardin, former Director of the Laboratories, during the opening ceremonies of the Congress. Dr. B. Koch, of St. Louis, is at the right.

12: **Dr. A. S. Dubovik,** National Delegate from Russia, presented several lectures as author or co-author as well as other papers of Russian authors not present.

13: **Dr. Berg** greets the delegation from the Peoples Republic of China, which was represented for the first time. Prof. Kung Tsu-Tung, their National Delegate, is on extreme right.

14: **Morton Sultanoff,** U.S.A., during his invited lecture on Techniques and Applications of High-Speed Photographic Instrumentation in Physical Research.

15: **Dr. T. Bán,** National Delegate from Hungary, discusses a problem with P. Tegelaar, of the Netherlands, co-editor of the Proceedings of the 6th Congress, held in the Hague.

16: **Congress members from all nations** listen to the technical papers. Head sets were used for simultaneous interpretation of the three official languages —French, German, and English.

17: **A group of Americans** relax at one of the tables set up outside the lecture hall between sessions. (Left to right: E. E. Soehngen; W. Chace; Fritz Mantey; M. A. Persechino; and Dr. L. Zernow.)

18: **A rousing** and closely packed group attended the farewell party. Congress participants from all nations kept up a continuous buzz of conversation in all languages spoken in the twenty different countries.


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Obtain

ADDENDUM I — National Delegates and Participants at International Committee Meeting

Austria
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Arcueil (Seine)

Germany
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DR. F. FRÜNGEL (Acting)
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ADDENDUM II — Reviewers of Papers Submitted by United States Authors

DAVID ABERNATHY
U.S. Naval Weapons Laboratory

THURE ANDERSON
Lawrence Radiation Laboratory

MYRON B. BALDWIN
Beckman & Whitley, Inc.

BERLYN BRIXNER
Los Alamos Scientific Laboratory

P. L. CLEMENS
ARO, Inc.

PAUL H. CORDS, Jr.
U.S. Naval Ordnance Laboratory

J. S. COURTNEY-PRATT
Bell Telephone Laboratories, Inc.

EDWARD L. CRISCUOLO
U.S. Naval Ordnance Laboratory

JOHN K. CROSBY
Stanford Research Institute

LeROY M. DEARING
Consultant

BERNARD DRIMMER
Department of the Navy

WALTER P. DYKE
Field Emission Corporation

FRED M. EMENS
Revere-Wollensak Div., 3M

ALLEN M. ERICKSON
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MALCOLM S. FERGUSON
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PAUL D. FLYNN
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R. C. GOETTELMAN
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THEODORE H. HARDING
E. I. du Pont de Nemours & Co., Inc.

STUART HAUSER
Applied Physics Corp.

WILLIAM G. HYZER
Consulting Engineer

SIGMUND J. JACOBS
U.S. Naval Ordnance Laboratory

THOMAS P. LIDDIARD, Jr.
U.S. Naval Ordnance Laboratory

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Philco Corporation

JOHN H. NIEMEYER
Eastman Kodak Co.

RICHARD O. PAINTER
General Motors Proving Ground

A. EARLE QUINN
Eastman Kodak Co.

DONALD S. RANDALL
Stanford Research Institute

RAYMOND F. SAXE
North Carolina State University

ROBERT D. SHOBERG
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PROF. WILLIAM S. SHOEMAKER
Rochester Institute of Technology

DONALD J. SOUTHARD
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MORTON SULTANOFF
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LARRY W. TEEPLE, Jr.
Beckman & Whitley, Inc.

PROF. HOLLIS TODD
Rochester Institute of Technology

JOHN H. WADDELL
Douglas Aircraft Company

DEANE R. WHITE
E. I. du Pont de Nemours & Co.

CHARLES W. WYCKOFF
Edgerton, Germeshausen & Grier, Inc.

RICHARD YOUSO
LogEtronics

ADDENDUM III — Program of Papers Presented at 7th International Congress on High-Speed Photography

SESSION 1 Chairmen: P. L. Clemens (United States)
K. Vollrath (Germany)
Vice-Chairmen: G. H. Lunn (United Kingdom)
O. Sesini (Italy)

LIGHT SOURCES

General Lecture: Prof. Dr. H. E. Edgerton (United States), *Applications of Xenon Flash*

1 W. Thorwart, J. F. Suarez, H. G. Patzke (Germany), *Eine Cranz-Schardin-Anordnung kontinuierlich einstellbarer Funkenfrequenz mit zwei auswechselbaren Funkenköpfen*

2 F. Früngel, G. Röder (Germany), *Regenerierbare Hochdruck-Blitzlampen für 10–1000 Joule, Schaltungs- und Anwendungsbeispiele*

3 R. M. H. Wyatt, E. L. Kendren (United Kingdom), *Special Detonators for Photographic Use.*

Film

SESSION II Chairmen: P. Fayolle (France)
E. F. Topfer (Belgium)

LIGHT SOURCES

4 H. Conrads, P. Bogen (Germany), *Ein getriggerter Gleitfunken hoher Intensität*

5 H. E. Edgerton, U. E. MacRoberts (United States), *Multiflash Strobe*

CAMERAS

6 H. Herbrich (Germany), *Die getriebelose Hochfrequenzkamera—eine Möglichkeit zur Verbesserung der Aufnahmequalität*

7 H. Fiedler (German Democratic Republic), *Drehspiegelkamera mit einer Bildfrequenz von 1 6 × 10^6 Bildern/s und 10^4 Einzelbildern*

8 Cancelled

9 B. S. Brown (United Kingdom), *Optical Systems for an Integrated Ultra-Violet Image Tube Camera*

10 E. A. Huston (United Kingdom), *A Multiple-Frame Image Tube Camera*

11 E. A. Huston (United Kingdom), *Streak and Multi-Channel Photography using Image Tubes*

Interval

SESSION II (cont'd) Chairmen: J. S. Courtney-Pratt (United States)
J. Rieck (Germany)

12 W. A. Waller (United Kingdom), *Framing Spectrograph*

13 T. E. Holland, J. K. Landre (United States), *Ultra High-Speed Laser Camera*

14 J. K. Landre (United States), *An Exceptionally High-Aperture Streak Camera*

15 A. D. Berg, J. D. McGee, R. W. Smith (United Kingdom), *A High-Speed Electron Image Intensifier Framing Camera*

16 S. Majumdar, D. J. Bradley (United Kingdom), *An Electron-Optical Multiple-Beam Image Tube for Time Resolved Laser and Plasma Spectroscopy*

17 A. Persson (Sweden), *A Multiple Kerr-Cell Camera with a Wide Range of Application*

Film

SESSION III Chairmen: M. Sultanoff (United States)
B. Koch (Germany)

EXPLOSIONS, SHOCK WAVES, PLASMA PHYSICS

General Lecture: Prof. Dr. H. Schardin (Germany), *Untersuchung instationärer gasdynamischer Vorgänge als Beispiel für den zweckmassigen Einsatz der Hochfrequenz-Kinematographie*

Interval

18 E. Mazzucato, S. Martellucci (Italy), *Schlieren Photography of a Theta-Pinch (Cariddi) at the First and Second Harmonics of Ruby Laser Light*

19 R. H. Christie (United Kingdom), *Photographic Radar*

20 J. van Montfoort, F. Herlach, H. Knoepfel, D. Nencini (Italy), *High-Speed Photography in Applied Explosive Experiments*

21 Y. Mizushima, M. Kusakabe (Japan), *High-Speed Photography of Large Scale Explosion*

Interval

22 M. P. McOnie (United Kingdom), *The Initiation and Growth of Explosion in Liquids*

23 F. E. van Wely, J. D. van Leeuwen (Netherlands), *High-Speed Cinematography of Explosive Forming*

24 K. K. Neumann, Mrs. E. C. Cassidy (United States), *Photographic and Spectrographic Studies of Exploding Wires in a Sealed Vessel*

25 H. Reichenbach (Germany), *Funkenkinematographische und interferometrische Untersuchungen von Stosswellenphänomenen in abgewinkelten Kanälen*

26 H. Oertel (Germany), *Anwendungen der Kurzzeitphotographie in der Hyperschallforschung*

Film

SESSION IV Chairmen: K. R. Coleman (United Kingdom)
W. F. Berg (Switzerland)

PHYSICAL PHENOMENA

27 C. Kramer, A. Naumann (Germany), *Hochfrequenzkinematographische Untersuchung von Wirbelstrassen im Transonikbereich*

28 F. Eisfeld (Germany), *Untersuchung des Aufbaues und der Bewegungsvorgänge in der Dampfschicht über einem Flüssigkeitsfilm mit Hilfe der Hochfrequenzkinematographie und der Kurzzeitphotographie. Ein Vergleich über den Aussagewert verschiedener Methoden*

29 R. H. Christie (United Kingdom), *Recording the Surface Condition of an Exploding Wire by External Illumination, using a Ruby Laser*

30 T. Bán (Hungary), *Schnell veränderliche Temperatur-Gradient-Messung*

31 M. Giraud, B. Koch, G. Simon (France), *Etude aérodynamique de maquettes en vol libre par photographies susccessives déclenchées et synchronisées par radar*

32 Cancelled

33 I. Overington, D. J. Williams, A. M. Newton (United Kingdom), *On the Use of Cine and Streak Photography for the Quantitative Study of Time and Space Variable Brightness Phenomena*

Interval

SESSION IV (cont'd) Chairmen: F. Früngel (Germany)
J. Varossieau (Netherlands)

34 J. Ch. Viénot, J. Bulabois, J. Pasteur (France), *Interférométrie en cinématographie ultra-rapide; application à l'étude de l'émission laser*

35 R. B. Mesler, N. B. Hospeti (United States), *High-Speed Photography of Nucleate Boiling of Water Showing the Effect of Surface Temperature on Bubble Shapes*

36 M. Benedini (Italy), *L'emploie de la cinématographie à grande vitesse dans l'observation des bulles de cavitation*

MEDICINE AND BIOLOGY

37 N. M. Ohlsson, H. M. Stauffer, A. Bove (Sweden), *High-Speed Cinefluorography (270 and 540 frames/s) in Cardio-Vascular Research*

38 R. Beltrame, A. Berbenni, G. Galassi (Italy), *Contribution to the Studies on the Movements of the Eyeball during Optical Perception by Means of High-Speed Motion Picture Photography*

39 M. E. J. Holwill (United Kingdom), *High-Speed Cinephotography of Microscopic Organisms*

Film

SESSION V Chairmen: H. E. Edgerton (United States)
G. Thomer (Germany)

X-RAYS

General Lecture: M. Sultanoff (United States), *Techniques and Applications of High-Speed Photo-Instrumentation in Physical Research*

Interval

40 S. K. Handel, J. Bergfeldt (Sweden), *Some Phenomena in a Flash*

41 W. P. Dyke, J. P. Barbour, F. J. Grundhauser, F. M. Charbonnier (United States), *High-Speed Photography with a Pulsed Electron Beam*

42 W. P. Dyke, F. J. Grundhauser, J. P. Barbour, J. P. Brewster, F. M. Charbonnier (United States), *A New Two Million Volt Flash X-Ray Machine*

43 W. P. Dyke, J. P. Barbour, F. J. Grundhauser (United States), *Cineradiography at 10^8 Frames/s—with a Single X-Ray Tube*

Interval

44 W. G. Chace, M. A. Levine, C. V. Fish (United States), *Nanosecond X-Ray Studies of Exploding Wires: Techniques and Results*

45 W. Schaaffs (Germany), *Die Durchleuchtung des Schaltvorganges in Hochleistungsschaltern mit Hilfe von Röntgenblitzen*

46 D. D. Abernathy (United States), *The Application of Ultra-High-Speed Photography to the Investigation of Detonation Wave Interactions*

Film

SESSION VI Chairmen: R. J. North (United Kingdom), F. Frungel (Germany)

TECHNOLOGY

General Lecture: Dr. U. Ascoli-Bartoli (Italy), *Plasma Diagnostics by Means of Laser Light*

Interval

47 S. M. Belotserkovsky, V. S. Sukhorokikh, V. S. Tatarenchik (Russia), *The Investigation of Three-Dimensional Gasdynamic Flows by Optical Methods*

48 D. Hall, J. Davis, J. Dehnel (United States), *Measurement of Millimeter Particles at Orbital Velocities by Streak Camera Techniques*

49 D. Hall (United States), *Time and Space Instrumentation in Orthogonal Cineradiography for Hypervelocity Impact Studies*

50 Cancelled

Interval

51 M. P. W. Wilson, J. H. Brunton (United Kingdom), *The High-Speed Photography of Some Deformation Processes in Metals*

52 Cancelled

53 J. K. Kilham, E. G. Jackson (United Kingdom), *Flow Visualization in Combustion Research*

54 F. Kerkhof (Germany), *Fraktographische Untersuchung von mechanischen Impulsen in Platten*

55 P. D. Flynn (United States), *Dynamic Photoelasticity Using a Dual-Beam Polariscope and Ultra-High-Speed Photography*

Film

SESSION VII Chairmen: T. Ramquist (Sweden), W. F. Berg (Switzerland)

TECHNOLOGY

56 L. Pirodda, A. Berbenni (Italy), *Experimental Analysis of Transient Stress and Strain in Structural Metallic Models Under Dynamic Loads*

57 S. W. Gehring (United States), *Experimental Techniques Used to Observe Hypervelocity Impact Phenomena*

58 Ch. V. Dunski (Belgium), *La camera à haute fréquence dans les recherches sur le four à arc*

59 W. Diamant (France), *Etude photomicrographique de la pulvérisation des combustibles par méthode strioscopique*

60 H. Pujols (France), *Application de la cinématographie ultra-rapide et de la radiographie éclair à l'étude des phénomènes de jets et de fragmentation de plaques métalliques projetées au moyen d'explosifs puissants*

61 A. D. Heyes, S. E. Field (United Kingdom), *The Fracture of Materials of High Elastic Moduli*

62 P. Grassmann, A. Reinhart (Switzerland), *Untersuchung der Form und Grösse fallender Tropfen verschiedener Flüssigkeiten*

63 Cancelled

Interval

SESSION VII (cont'd) Chairmen: L. Zernow (United States), K. H. Kwee (Holland)

64 D. H. C. Taylor (United Kingdom), *The Application of a Double Pass Schlieren System to a Small High-Speed Diesel Engine*

65 H. J. Wittwer (Germany), *Hochfrequenzkinematographische Analyse des Zerreissvorganges von schlagartig belasteten Zugproben*

66 B. Vrillon (France), *Cinématographie ultra-rapide d'un éclatement par autodéclenchement*

67 M. Wössner (Germany), *Kurzzeitphotographie und Kurzzeitmessung bei uhrentechnischen Untersuchungen*

68 Cancelled

69 T. Bán, P. Greguss (Hungary), *Einige Anwendungen der Hochfrequenz-Kinematographie zur Klärung des Wirkungsmechanismus von Ultraschall-Erscheinungen*

Film

SESSION VIII Chairmen: P. Clemens (United States), K. Weedon (Norway)

AUXILIARY EQUIPMENT

General Lecture: Prof. Dr. W. F. Berg (Switzerland), *Photographic Aspects of High-Speed Photography*

Interval

70 C. D. Reid (United Kingdom), *Curved Field Optics for Use in Image Tube Cameras*

71 Cancelled

72 G. Nomarski (France), *Sur un nouveau montage interférométrique dit "a référence ponctuelle" applicable en soufflerie*

73 G. H. Lunn, E. G. Baker, D. Bowley-Booth, G. F. Hinton (United Kingdom), *The Application of a Zone-Plate in High-Speed Cinephotography*

74 W. Hopmann (Germany), *Das Image-Orthicon als Kurzzeitverschluss*

Interval

SESSION VIII (cont'd)

75 L. F. Guyot, B. Driard, P. Balaskovic (France), *Tubes intensificateurs d'image pour observation de phénomènes peu lumineux rapidement évolutifs*

76 D. L. Emberson (United Kingdom), *Image Intensifier Developments at 20th Century Electronics Ltd. and Their Application as High-Speed Electronic Shutters*

77 E. Hermanns (Germany), *Funkenentladungskreise mit Eigenfrequenzen von 2,5 und 1 MHz, elektrischen Energien swischen 5-200 Wattsekunden und rasch abklingendem Strom*

78 J. W. Corcoran (United States), *Applications of the Isodensitracer in High-Speed Photography*

79 J. Plant, W. L. Murray, D. W. Godwin, L. P. Barbero (United Kingdom), *A Shutter Arrangement for Preventing Multiple Exposure in Ultra-High-Speed Rotating-Mirror Cameras*

SESSION IX Chairmen: Max Beard (United States), T. Bán (Hungary)

AUXILIARY EQUIPMENT

80 A. I. Churbakov (Russia) (presented by Prof. Dr. A. Dubovik), *High-Speed Shutter, Type "Sultan"*

81 L. G. Gvozdeva, O. A. Predvoditeleva, M. P. Sistchikova (Russia), *Application of Optical Research Methods in Shock Tubes*

MISCELLANEOUS TECHNIQUES AND APPLICATIONS

82 H. J. Raterink (Netherlands), *Accurate Measurement of Small Displacements, Using an Optical Alignment Method with a Laser and a High-Speed Camera*

83 M. R. Nagel (United States), *Asymmetric Motion Blur in the Photographic Image of Fast-Moving Objects*

84 W. G. Hyzer (United States), *Survey of High-Speed Photography in the U.S.A.*

85 J. G. A. de Graaf (Netherlands), *Application of High-Speed Photography in the Study of Traffic Safety Problems*

86 L. S. Thickett (United Kingdom), *The Application of High-Speed Photography in the Steel Industry*

87 J. S. Courtney-Pratt (United States), *Miniaturization in High-Speed Photography*

SESSION X Chairmen: J. G. A. de Graaf (Netherlands), G. H. Lunn (United Kingdom)

MISCELLANEOUS TECHNIQUES AND APPLICATIONS

88 J. W. Taylor, D. S. Hughes (United States), *Quantitative Reduction of Data from High-Speed Stereoscopic Photographs*

89 A. De Volpi (United States), Speaker: H. Schneider (Switzerland), *High-Speed, Multi-Channel Data Recording for Nuclear Physics Experiments Using Fast-Framing Cameras*

90 Chr. Spuida, H. Schwieger (Germany), *Die Äquidensitometrie in der Kurzzeitphotographie am Beispiel des elastischen Randstosses auf eine Kreisringscheibe*

91 G. I. Belinskaya, M. S. Guskova (Russia), *Short Exposure Time Effect of Photographic Image Sharpness and Contrast Transfer Functions of Films*

92 T. H. Healey, H. M. Owren (United States), *Quantitative Data Acquisition with Image Converter Camera Systems*

93 P. R. Lord (United Kingdom), *High-Speed Photography and Photo-Elasticity*

94 J. R. Crosnier (France), *Etudes de couples thermoélectriques soumis a des ondes de choc en milieu métallique*

95 D. Ebeling (Germany), *Monochromatische High-Speed Photographie mit modulierten Impuls-Lasern*

ADDITIONAL PAPERS PRESENTED

96 Cancelled

97 H. Tannert (United States), *A 16mm High-Speed Intermittent Camera— the "Monitor" 600 Camera System*

98 A. S. Dubovik, V. V. Garnov, N. M. Sitsinskaya (Russia), *High-Speed Image Dissector Twin-Disk Camera*

99 A. S. Dubovik, V. V. Garnov, N. M. Sitsinskaya (Russia), *Stereoscopic Photography with High-Speed Image Dissector Cameras*

100 G. I. Mishin, U. A. Dunayev, V. G. Maslennikov, M. P. Sistchikova, G. K. Tumakayev (Russia), *Application of Optical Research Methods at Ballistic Ranges and in Shock Tubes*

R. S. Dennen, A. V. Appel, E. P. Stridde, J. Gershon (United States), *High-Speed Schlieren-Cine Photography of Electrically Generated Imploding Shock Waves*

T. Rogers (United Kingdom), *The Control and Synchronisation of a Rotating Mirror Camera*

ADDENDUM IV — Films Shown at the Congress

The Priceless Laboratory; Eclipse of the Quiet Sun, Douglas Aircraft Co., Marketing Communications, Film Production, Santa Monica, Calif. 94720.

Food, the Color of Life, Reid H. Ray Film Industries, Inc., 2269 Ford Parkway, St. Paul, Minn. 55116.

Fish, Moon and Tides—The Grunion Story, Academy Films, 748 N. Seward St., Hollywood, Calif. 90038.

To Catch a Porpoise, Burton Clark, General Manager, Miami Seaquarium, Rickenbacker Causeway, Miami, Fla. 33149.

Flow Visualization; Surface Tension in Fluid Mechanics, Educational Services, Inc., 47 Galen St., Watertown 72, Mass.

Molecular Spectroscopy, David W. Ridgway, Director of Film Activities, Chemical Education Material Study, Lawrence Hall of Science, University of California, Berkeley, Calif. 94720.

Step Into Space; U.S. Manned Lunar Expedition; The Four Days of Gemini IV, Andrew M. Sea, Chief, Audio Visual Services, Public Affairs Office, AP2, NASA Manned Spacecraft Center, Houston, Texas 77058.

The Dolphins That Joined the Navy, Produced by the U.S. Navy.

Summaries of Papers on Several Light Sources and a Framing Drum Spectrograph

By FRANCIS D. HARRINGTON

THE general lecture of Professor H. E. Edgerton, four papers on light sources and one paper on a framing drum spectrograph are reported.* The authors were kind enough to send transcripts of their papers together with appropriate illustrations; the latter are incorporated herein. Appreciation and thanks are expressed to these authors for their generosity. The following is this reporter's interpretation of the assignment.

In his general lecture on "Applications of Xenon Flash" Professor H. E. Edgerton† stated "the object of the paper is to review briefly the theory of the xenon flashlamp and to help those who have applications." It is impossible in this even briefer review to do justice to the fine presentation and the reader will appreciate this when the full paper is published in the *Proceedings* of the 7th Congress. A sizable bibliography is contained in the paper.

The classical theory of electrical breakdown, the inconsistencies occurring in self-breakdown, and the merits of external triggering of xenon lamps were discussed. Figure 1 shows the phenomenon which occurs in the initial phase in the development of the discharge when external triggering is used. Figure 2 sketches the physical setup and the type of oscilloscope traces derived from this type of triggering. The "kink" observed in the oscilloscope traces is believed to be associated with the onset of ionization. The development of the xenon arc with respect to time was illustrated by rapid framing photography.

Major characteristics of these lamps, such as, arc resistance, flashlamp life and spectral output and efficiencies from 0.35 to 1.1 μ were discussed.

Applications of xenon lamp, briefly reported here, were described in some detail for variable stroboscopic motion study photography, single flash for normal photography, motion-picture and multiflash photography, underwater photography, flashing beacons for aircraft and satellites as well as lighthouses, laser optical pumps, and flash photography used in medical research.

W. Thorwart, J. F. Suarez and H. G. Patzke (1) described a multi-sequenced light source in an improved compact design of a Cranz-Schardin arrangement. It consists of eight triggered spark gaps spaced 9 mm apart in a 63-mm high vertical row, the arrangement placed close to the side of the camera head fixture. The parallax inherent in the original arrangement of Cranz-Schardin is hardly noticeable in this design because of the compact array of gaps. Each spark gap is triggered from a controlled third electrode onto the main electrode of the gap. A single lens is used for all eight gaps and eight adjustable prism systems in the camera head orient the frames in a still camera focal plane. The framing rate for a transient optical event is at a rate up to 10^6 frames/s. Figure 3 illustrates the arrangement of the spark gaps and

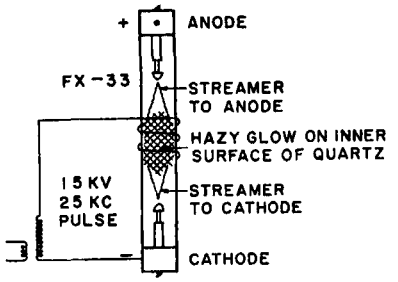

Fig. 1. The initial phase in discharge development when external triggering is used.

A paper to be presented during the Society's 99th Conference in Washington, D.C., May 1–6, 1966, by Francis D. Harrington, Radiometry Branch, Optical Physics Div., U.S. Naval Research Laboratory, Washington, D.C. 20390 (This paper was received on March 8, 1966.)

* Numbers in parentheses refer to the papers' numbers in the Congress Program as listed on pp. 353–355. The papers will appear in the *Proceedings of the Seventh International Congress on High-Speed Photography*, to be published by Verlag Dr. Othmar Helwich, D-61 Darmstadt, Hoffmannstr. 59, Germany.

† General Lecture, Session 1, Congress Program, p. 353.