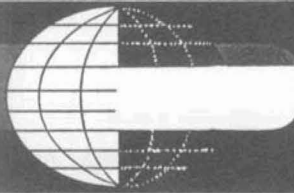


## ABSTRACTS OF PAPERS FROM OTHER JOURNALS



Abstracts of papers appearing in other journals chosen for their importance and possible value to researchers, as well as those of timely interest, are published in the *Journal* from time to time. Many translations of abstracts from foreign journals, chiefly those of the USSR, are made available to the *Journal* by the Research Laboratories of the Eastman Kodak Company. As a rule, translations are made of the abstracts and not of the papers. The journals in which the papers appear can be consulted at some libraries. Current issues of *Tekhnika Kino i Televideniya* can be consulted at, or borrowed from the Society's Headquarters Office.

The subject areas are grouped below:

- Cameras
- Cinematography
- Data Recording and Processing
- Film and Its Properties
- General
- High-Speed Photography and Instrumentation
- Holography
- Lasers
- Light Sources
- Optics
- Photographic Theory and Materials
- Projectors and Projection
- Sound
- Television

### CAMERAS

The new Panaflex camera makes its production debut, Herb A. Lightman,

*Am. Cinemat.*, 54: 564-567, 598-599, 611-620.

The first production model of the new Panaflex camera was used on the Zanuck/Brown production for Universal, *The Sugarland Express*. This production was chosen because of some unusual photographic problems involved, including 360° pans from inside a moving car with two traveling vehicles involved. The new Panaflex looks almost like a toy beside the Panavision R-200 camera, but it functions like the incredibly sophisticated electronic instrument that it is. Everyone who worked on the production seemed delighted with its performance.

**Aerial camera mount for 70mm stereo,** Floyd F. Sabins, Jr., *Photogrammetric Eng.*, 36: 579-582, June 1973.

For many applications which do not involve large survey areas 70mm aerial stereophotography is valuable. Specifications are given for a rugged and versatile camera mount which provides leveling and aircraft crab adjustments. A reticle is described that converts the camera reflex viewfinder for two purposes: (1) a drift sight to correct for aircraft crab and (2) an intervalometer to determine time between exposures for correct overlap of successive frames. This equipment has been used to produce mosaics of areas as large as 100 square miles.

**A gyroscopic suppressor for the angular**

vibrations of a motion-picture camera, (in Russian), V. A. Kolesnikov, V. A. Pavlov, Yu. N. Sokolov and N. S. Savin, *Tekh. Kino i Televideniya*, 36-39, Dec. 1972.

A device based on the use of a gyroscope is described for the damping of angular vibrations in a hand held motion-picture camera. — S.C.G.

### CINEMATOGRAPHY

**Problems and apparatus in cinematographic analysis** (in Czech), J. Hampl. *Jemná Mech. a Opt.*, 159-166, No. 6, 1972; *Ref. Zh., Fotokinetikhnika*, Abstract No. 9.46.213, 1972.

The analysis of phenomena recorded on motion-picture film has a qualitative and a quantitative aspect. Apparatus available on the international market for these two kinds of analysis is described. — S.C.G. (Abridged from *Ref. Zh., Fotokinetikhnika*)

**A characteristic of the interaction between visual and aural perception under the conditions of cinematography** (in Russian), V. S. Man'kovskii. *Trudy Leningr. Inst. Kinoizh.*, 185-193, No. 18, 1972; *Ref. Zh., Fotokinetikhnika*, Abstract No. 10.46.184, 1972.

An analysis has been made of the interaction between visual and aural perception which takes place under conditions of stereophonic wide-screen cinema performances. — S.C.G. (Translated from *Ref. Zh., Fotokinetikhnika*)

**An electronic time-lapse device for narrow-gage cameras** (German) G. Glück. *Radio-Fernsehen-Elektron.* 21: 238-239 (No. 7, 1972); *Ref. Zh., Fotokinetikhnika*, Abstract No. 9.46.172, 1972.

A description is given of a portable unit which allows cinematography to be carried out with a speed reduction of 1:100 to 1:15,000. This means that 8 hours photography corresponds to a projection time of 5 min to 2 s with a projection frequency of 16 frames/s. The necessary conditions for the use of the unit are a socket for a cable release, and, if possible, the provision for frame-by-frame photography. The main element of the unit is a generator of timing impulse, the source of which is an unstable asymmetric multivibrator in the generator. An external view and the main electronic circuit are given, together with the working principles of the impulses generator and technical data for the electromagnet of the release mechanism on which the impulses operate. Practical recommendations are given for mounting the electromagnet and the cable release on cameras of the given type and for the electrical connections of the impulse generator and the electromagnet. It is pointed out that it is possible to use a gas-discharge electronic flash lamp with time-lapse cinematography by designing additional equipment controlled by the electronic unit described here.

**A high-speed cinematographic study of hydrodynamic processes in the breakdown of small gaps in a liquid** (in Russian), G. A. Volkova, A. S. Zingerman and Yu. M. Kruglov, *Trudy Leningr. Inst. Kinoizh.*, 3-10 No. 18, 1972; *Ref. Zh.*

## Biographical Note



**John A. Pistor**

John A. Pistor retired 1 February 1974 from Eastman Kodak Co. as Director Sales Development, Motion Picture and Television Markets, in the Motion Picture and Audio-Visual Markets Div. of the U.S. and Canadian Photographic Division. Born in 1915 in Montclair, N.J., he was graduated from Cornell University in 1938 with the B.S. degree in administrative engineering. That same year, on July 5, he joined Eastman Kodak Co. as a trainee.

His first appointment was in the physics division of Kodak Research Laboratories. A few months later he was transferred to

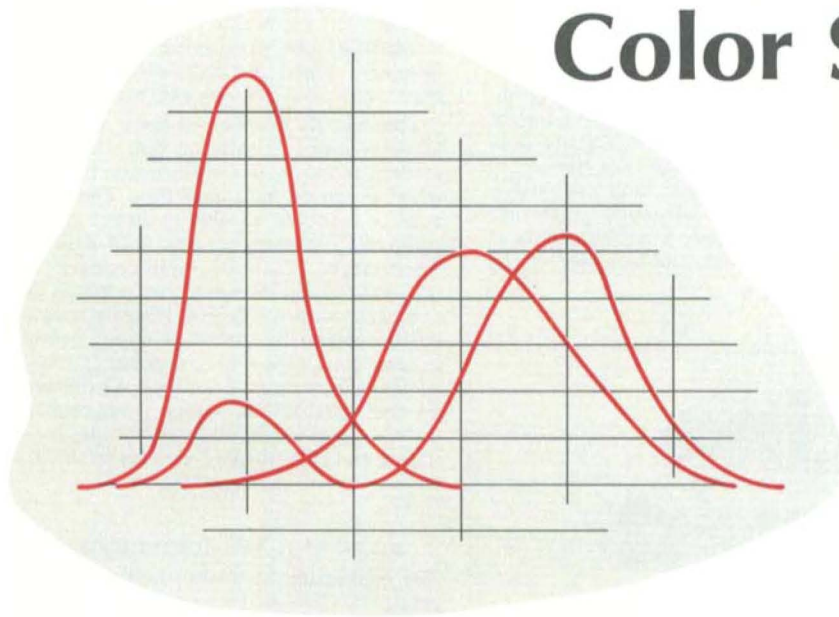
the finished film department and in October 1946 he transferred to the motion-picture sales department at the Kodak Office, 343 State St., Rochester, N.Y. On 23 July 1956 he was granted a leave of absence from Kodak to join W. J. German, Inc., on the west coast, in an executive capacity. On 16 December 1963 he returned to Kodak as General Manager of the East Coast Division, Motion Picture Products Sales Department. In March 1965 he was made Director, Motion Picture Trade Relations, Motion Picture and Education Markets and in September 1969 he was appointed Director, Sales Development, Television Broadcast Markets, a position he held until his retirement.

Mr. Pistor has been a member of the Society since 1953. He was made a Fellow in 1965. Other professional organizations of which he is a member include the American Society of Cinematographers, National Press Photographers Association, the Academy of Motion Picture Arts and Sciences, British Kinematograph, Sound and Television Society, Radio and Television News Director Association and the International Radio and Television Society. He is also a member of Tau Beta Pi, an engineering honor society — *Glenn E. Matthews*

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## CONTENTS

- 1 Introduction
  - 2 Fundamentals of Sensitometry
  - 3 Sensitometric Exposures
  - 4 The Processing of Sensitometric Tests
  - 5 Quantitative Evaluation of Image Density
  - 6 Densitometer Design Principles
  - 7 Interpretation of Sensitometric Results
  - 8 Statistical Aspects of Color Sensitometry
- Appendix: Transformations Between Spectral and Analytical Densities
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Apparatus is described in use for the high-speed cinematographic study of hydrodynamic processes when an electric discharge is passed through a liquid. The investigation gave the possibility of establishing the character of the motion of the liquid and the relation of its velocity to the energy of the discharge and its power and duration, and to the properties of the liquid itself, the nature of the solid particles in the liquid, its velocity in relation to mass and size of the particles and the properties of the liquid. It is noted that the results obtained were used for raising the productivity of the electro-erosion

treatment of metals. — S.C.G. (Translated from *Ref. Zh., Fotokinetekhnika.*)

#### DATA RECORDING AND PROCESSING

Computer analysis of imagery, James D. Turinetti and Olin W. Mintzer, *Photogrammetric, Eng. 36:* 501-506, May 1973.

An investigation was conducted to determine computer analysis procedures applied to gray-tone data from day and night thermal-infrared imagery to classify land uses. A computer program was devised to identify three choices of land use: water, vegetation and construction materials (soil, asphalt, steel, etc.). As the quality of the model improved, the accuracy of the

identification also improved, the image interpreter's tasks were reduced, allowing him to concentrate on the identifications of the more complex land uses. Over 40 per cent of the targets were uniquely and correctly identified based on thermal-infrared density information alone.

Recording and processing thermal IR imagery, Floyd F. Sabins, Jr., *Photogrammetric, Eng. 36:* 839-844, Aug. 1973.

Thermal IR scanner imagery was formerly recorded directly on film, but most modern scanners record on magnetic tape which is played back onto film. The tapes may be replayed to obtain correct image scale and optimum contrast and density. The imagery may be rectilinearized to eliminate marginal distortion inherent in scanner recording. Typical imagery irregularities caused by aircraft motion, weather, electronic noise and processing problems are illustrated along with suggestions for their prevention. Image enhancement methods such as digitized gray scale, level slicing and color display are aids to the interpreter.

#### FILM AND ITS PROPERTIES

The evaluation of image quality of film prints by subjective expertise (in Russian), S. M. Koslovski and B. V. Trofimov, *Tekh. Kino i Televideniya, 16:* 20-27, Nov., 1972.

A system of psychophysical and mathematical methods is proposed for solving the problem of the choice of the optimum values of the photographic variables of motion-picture prints. On the basis of this system optimum values are found for the making of 8mm prints of educational films. — S.C.G. (Translated from *Tekh. Kino Televideniya.*)

Measurement of the shrinkage of motion-picture film (in Polish), W. Dubczyński, *Pomiary. Automat. Kontrola, 18:* 203-205, No. 5, 1972; *Ref. Zh., Fotokinetekhnika, Abstract No. 9.46.181, 1972.*

The causes of alterations in the pitch of the perforations of motion-picture film, both in the course of time and during manufacture, are discussed. The construction and working principles of two pieces of apparatus allowing the continuous measurement of deviations from the perforation pitch are described. — S.C.G. (Translated from *Ref. Zh., Fotokinetekhnika.*)

The extension of the method of determining film speed numbers to motion-picture stock (in Russian), I. B. Gutina and A. L. Kuznetsova, *Tekh. Kino i Televideniya, 16:* 10-13, July, 1972.

It is shown that speeds of black-and-white negative motion-picture films for professional cinematography can be determined by a method similar to that proposed by ISO for continuous-tone black-and-white films for general purposes. — S.C.G. (Translated from *Tekh. Kino Televideniya.*)

Dye stability of motion picture film, R. K. Schafer, *Brit. Kinemat. Sound and TV, 54:* 286-287, 296, No. 10, 1971.

The types of dye-fading common in motion-picture films, and their causes, are

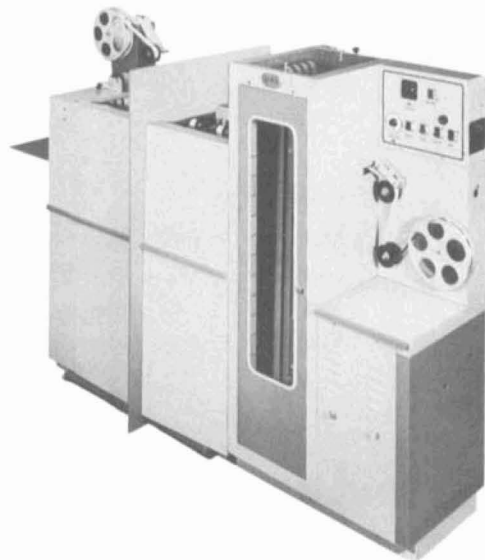
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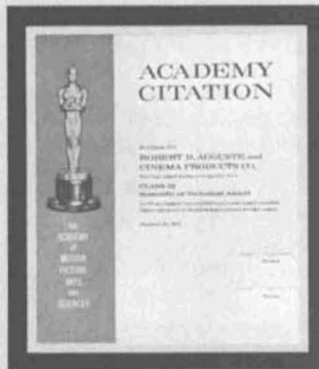
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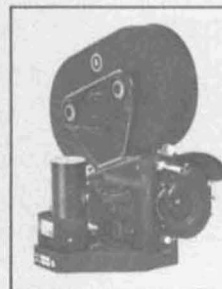
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described. Practical steps to combat fading, from manufacture of the film onwards, are suggested, and the trend towards greater stability is outlined. — A.P.W.

## GENERAL

**Report from the UCLA filmmakers**, Tom Birns, *Am. Cinemat.*, 54: 434-436, 447, 468-469, Apr. 1973.

Graduate students of the University of California Los Angeles reveal (in interviews) changing trends in their productions, their future plans and their attitudes toward Hollywood.

**Home video systems: a revolution?** Cliff Christians, *Jour. Broadcasting*, 223-234, Spring 1973.

Periodically, technology develops what is touted as a new medium which makes all other obsolete. Television was going to erase radio; tape was going to do away with disc recordings; and quadrasonic sound will do away with stereo which, in turn, replaced monaural recording methods. Getting the most attention on these lines at present is cable television and the competing methods of home video recording — cartridges, cassettes, videodiscs, etc. This paper suggests that the so-called home video "revolution" is really nothing of the kind — but rather more of the same content and controlling interests merely wrapped in different garb.

## HIGH-SPEED PHOTOGRAPHY AND INSTRUMENTATION

**An optical method of estimating shrinkage with the aid of cinematography** (in Russian), V. K. Senchikhin and V. I. Tret'yakov. *Zavod. Lab.*, 37: 1478-1479, No. 12, 1971; *Ref. Zh., Fotokinotekhnika*, Abstract No. 4.46.242, 1972.

A method is proposed for estimating the shrinkage of metaloceramic materials during firing, by an optical method with the use of framing cinematography. This is carried out through a quartz glass tube with a Kiev 16-S3 16mm camera. The time interval between frames ( $\geq 1$  s) is given by means of an electromagnetic relay. The method eliminates faults present in the dilatometric method. — S.C.G. (Translated from *Ref. Zh., Fotokinotekhnika*.)

**A photographic method for studying the motion of dust particles in electrostatic filters**, E. Dytkowski and W. Kuzniar, *Pr. Inst. Masz. Przepl. PAN*, 285-292, No. 54-55, 1971; *Ref. Zh., Fotokinotekhnika*, Abstract No. 3.46.245, 1972.

A description is given of apparatus for the photographic recording of the motion of dust particles in an electrostatic field. The illuminant is a high-pressure mercury lamp. With the aid of an optical system the light flux from the lamp is formed into a flat parallel beam, directed along the axis of the model electrostatic filter, and perpendicular to the direction of photography. The lamp is fed with a pulsed current with a frequency of 150 Hz, so providing stroboscopic illumination for the photography. The results show the possibility of photographically recording particles of diameter  $\sim 3 \mu\text{m}$ , moving at a speed of  $\sim 1$

m/s, with the use of a Tessar  $f/2.8$ , 50 mm and 20° DIN film. — S.C.G. (Translated from *Ref. Zh. Fotokinotekhnika*.)

## HOLOGRAPHY

**An introduction to holography by shadow casting**, H. J. Caulfield, and A. D. Williams, *SPIE Jour.*, 12: 3-7, Jan./Feb. 1973.

Holography by shadow casting is a non-interferometric means for recording a hologram. Like ordinary (interferometric) holography, it leads to three-dimensional images of the object. Unlike ordinary holography, it works best at short wavelengths ( $\gamma$ -rays and x-rays). The history, techniques, and prospects of shadow holography are reviewed.

## LASERS

**Prospects for x-ray lasers**, J. M. Forsyth, *Image*, 4: 2-3, Spring 1973.

This article briefly describes the current work at Rochester on the controversial subject of the prospects for constructing x-ray lasers and discusses the kinds of difficulties that exist. The author concludes that there are good prospects for lasers with wavelengths in the 100 Å range but that lasers in the 1 Å range are much more difficult.

## LIGHT SOURCES

**Radiometry and Photometry I**, 1972 Annual Meeting, Optical Soc. of America.

**ThF15. The reproducibility of gas-filled tungsten lamps**, Edward F. Zalewski, *Jour. Optical Soc. Am.*, 62: 1372, Nov. 1972.

The reproducibility of the output of visible radiation from several types of commercially available gas-filled tungsten incandescent lamps has been studied as part of a program to realize a new standard luminous intensity. The several groups of lamps studied can be classed according to filament type and filling gas. The filaments were either C-13 (single coil, seven or nine supports), C-8 (single coil, two supports), or CC-8 (coiled coil, two or three supports) and the filling gas was either an inert gas or a halogen-inert gas mixture. The lamps were studied at color temperatures ranging from 2800 to 3200 K. The discussion includes the measurement of the repeatability of relighting these lamps in place, the measurement of drift over long periods of operation, and the possible correlation of lamp characteristics and reproducibility. A new socket design for medium bi-post base lamps is described and the results of the measurement of the reproducibility of repositioning and relighting the lamps in this socket are discussed.

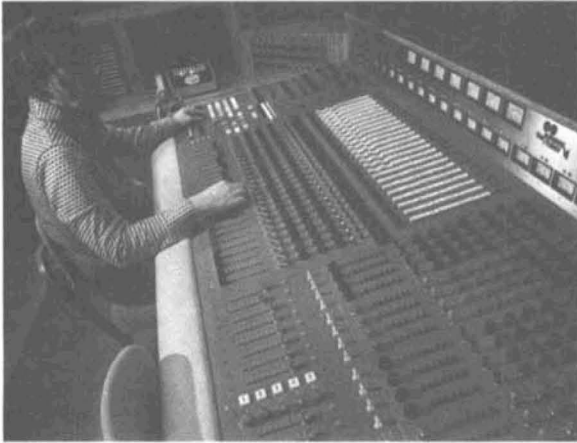
**A universal thyristor rectifier for light sources for motion-picture projectors** (in Russian), A. K. Mamsurov, L. I. Sazhin, V. V. Trofimov and B. Z. Yudovskii, *Tekh. Kino i Televideniya*, 16: 28-35, Dec., 1972.

A discussion is given of the design of a thyristor rectifier for the power supply of 3-kW xenon arcs and high-intensity carbon arcs for motion-picture work. — S.C.G.



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## OPTICS

**Modulation transfer function and resolving power of photographic objectives** (in Russian), G. V. Kreopalova and V. M. Kakhnovskii, *Trudy Moskov. Vyssh. Tekh. Uchil. im N. E. Baumana*, 156-165, No. 143, 1971; *Ref. Zh., Fotokinetekhnika*, Abstract No. 4.46.66, 1972.

Different criteria are discussed for estimating the image quality of objectives, expressed by means of the MTF and the resolving power. Their advantages and disadvantages are noted. It is shown that at present there is no clear opinion concerning the advantages of any one numerical criterion. — S.C.G. (Translated from *Ref. Zh., Fotokinetekhnika*.)

**Deforming-light-path ring-laser experiments**, K. P. Kovacs, *Jour. Optical Soc. Am.*, 62: 1264-1267, Nov. 1972.

Based on a thought experiment of Von Laue, a deforming-light-path ring-laser experiment is proposed. The thought experiment of Von Laue provides not only a well-founded explanation of rotating-mirror experiments with nondeforming light paths, but is also applicable to the problems of deforming light-path devices. Von Laue's experiment in its original form, can probably be performed only as a deforming-closed-light-path experiment. Von Laue's straight movable device may be used as an inseparable part of a ring interferometer or ring laser. In another possible form of a deforming-light-path experiment, the closed deforming light path is a

fiber and beat frequencies are caused by the light-path-directed motion of the fiber.

**Normal objectives with increased rear focal lengths** (in Russian), A. V. Dyagileva, *Trudy Moskov. Vyssh. Tekh. Uchil. im N. E. Baumana*, 95-102, No. 143, 1971; *Ref. Zh., Fotokinetekhnika*, Abstract No. 4.46.71, 1972.

An analysis is given of the geometrical variables of normal objectives with the aim of designing fast objectives with increased rear focal lengths. — S.C.G. (Translated from *Ref. Zh., Fotokinetekhnika*.)

**Modulation transfer function and efficiency of transparent luminescing materials**, J. Gaspar, *Jour. Optical Soc. Am.*, 63: 714-720, June 1973.

Transparent luminescing screens can be used as image transducers in radiographic and image-intensifier systems. The modulation transfer function (MTF) and efficiency of these screens when used in conjunction with a receiver or recording medium are obtained from the derivation of the point spread function of the screen-receiver system. The derivation accounts for all optical paths and attenuations of the luminescent energy producing the spread function. Both the theoretical MTFs and energy-transducing efficiencies of several screen-receiver systems are presented for various system parameters. The MTF of an actual (ZnS) screen-film system computed from this derivation was found to be in excellent agreement with the MTF of

the system determined by photographic photometry.

**Three-component variable-focus optical systems with a given law of motion of the components** (in Russian), I. I. Pakhomov and A. V. Shikut' *Trudy Moskov. Vyssh. Tekh. Uchil. im N. E. Baumana*, 80-87, No. 143, 1971; *Ref. Zh., Fotokinetekhnika*, Abstract No. 4.46.80, 1972.

A method is given for calculating the parameters of a three-component variable-focus system with a given kinematic relation between the motions of the components  $i_n = i_{no} \cdot m$  ( $m$  is the variable parameter characterizing the displacement of the  $n$ -th component). A study has been made of the possibility of constructing a system with variable-focus change of magnification with rigidly connected components. It is shown that in this case a smaller displacement of the image plane must be achieved than with 4-, 5-, or 6-component systems with a linear relation between the moveable components. — S.C.G. (Translated from *Ref. Zh., Fotokinetekhnika*.)

**A method of calculating the MTFs of photographic objectives** (in Russian), V. K. Apryatkin, *Trudy Moskov. Inst. Geod., Aerofotos'emki i Kartogr.*, 181-187, No. 58, 1971; *Ref. Zh., Fotokinetekhnika*, Abstract No. 3.46.73, 1972.

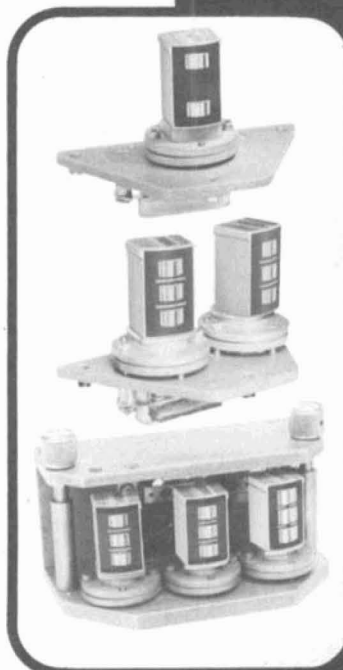
Calculation of the MTFs of objectives requires a large amount of work and in practice cannot be carried out without the help of a computer, except for the case of very low frequencies. For the special case of the calculation of the MTF of an optical system at a point on the axis in the region of low spatial frequencies, formulas are suggested which considerably simplify the calculation procedure and give a visible picture of the efficiency of different zones on the exit pupil. — S.C.G. (Translated from *Ref. Zh., Fotokinetekhnika*.)

**Lens Design I**, 1972 Annual Meeting, Optical Soc. of America.

**WK15. A Faster LASL Lens Design System**, Berlyn Brixner, *Jour. Optical Soc. Am.*, 62: 1349, Nov. 1972.

Recent improvements in my 13-year old lens-design system, increase the speed perhaps 100 times, maintain the calculation accuracy of the original version and at the same time make the program easier to use. These improvements are (1) a technique that combines damping the parameter increment vectors with a search procedure for obtaining optimum damping, (2) analytic differentiation of the observed errors with respect to the variable parameters, (3) simultaneous design on all variables, (4) reliable convergence criteria for terminating calculation, (5) vignette control by forming biased violation error components, (6) provision for bounding the variables, (7) an enlarged weighting procedure that improves control of troublesome image defects, (8) greater calculation accuracy through a rectangular least-squares linear system solver, and (9) FORTRAN coding. Although this faster program does not have quite as much versatility as the original program, it can solve many ordinary lens-design problems in a few 10-s runs on the CDC-7600 computer. A sample lens-design problem is described. The designing system continues to optimize the sizes and

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The Arrivox-Tandberg is a non-compromising, professional 1/4" tape-recorder designed especially for the motion picture industry. It provides filmmakers with the ideal sound package in quality, compactness and lightweight, at a low price.

#### SPECIFICATIONS:

**Measurements:** 13" x 4" x 10" **Weight** (less batteries): 10.5 lbs. **Reel Diameter:** 5" reels with cover closed 7" reels with cover open **Tape speeds:** 7 1/2 ips and 3 3/4 ips **Wow and flutter:** .1% for 7 1/2 ips; .2% for 3 3/4 ips **Temperature range:** -4°F to +140°F (-2°C to + 60°C) **Inputs:** Two balanced microphone inputs for dynamic microphone, 50 to 200 Ohm impedance, switchable to built-in power supplies for condenser microphones. One line input with control range from .775 to 7.5 V. Each input has separate gain controls and individual, switchable automatic limiters.

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positions of many-ray image spots without considering the classical aberrations.

**Lens Design I**, 1972 Annual Meeting, Optical Soc. of America.

**WK16. Automatic Desensitizing of Lens Designs**, Jerome G. Kenney, *Jour. Optical Soc. Am.*, 62: 1349, Nov. 1972.

Automatic lens design programs produce excellent, highly corrected optical systems. A few of these optical designs, however, prove to be virtually unmanufacturable because, while exhibiting excellent correction at nominal design values the systems are highly sensitive to normal manufacturing tolerances. A model to automatically desensitize these systems in the design stage combines the optimal allocation properties of a linear program and the third-, fifth-, and seventh-order aberrational differences between the nominal design and the design with the parameters at unit tolerance limits. The model optimizes the selection of the limits on tolerances for various lens parameters. Some of these are: index of refraction, element spacing, element thickness, and radius of curvature. A further application of the model allows the optical engineer to apply consistent manufacturing controls to existing lens designs through the automatic allocation of manufacturing tolerance specifications.

#### PHOTOGRAPHIC THEORY AND MATERIALS

Color gamuts of additive and subtractive

**color-reproduction systems**, F. R. Clapper, R. G. Gendron and S. A. Brownstein, *Jour. Optical Soc. Am.*, 63: 625-629, May 1973.

The classical representations of color gamuts that can be displayed by both additive (TV) and subtractive (photography) systems show the latter to be restricted in its ability to produce saturated colors at high lightness levels. This is attributed to the unwanted absorptions of the real dyes used in color photography. When realistic mechanisms associated with the photographic system are taken into account, calculations show the color gamuts of additive and subtractive systems to be closely matched.

**Response functions for color densitometry**, George H. Dawson and William F. Vogelsong, *Phot. Sci. Eng.*, 17: 461-468, Sept./Oct. 1973.

Interinstrument variability can be minimized by adjusting the unfiltered response of the individual densitometers to a standard set of values and fitting the densitometer with carefully matched filters. An analysis of the sensitometric system and compilation of data on the present population of densitometers provides a basis for the specification of standard response functions. With these functions, the design responsibility for the filters and instrument may be separated and better control techniques determined. A standard unfiltered response is proposed, test methods are outlined, and filter curves are speci-

fied. Using a technique outlined for trimming individual instruments, the interinstrument variability of a group of commercial densitometers was reduced over 60 per cent.

**Partial restoration of images from aerial photographs using experimentally derived Fourier filters**, William H. Carter, *Phot. Sci. Eng.*, 17: 50-56, Jan./Feb. 1973.

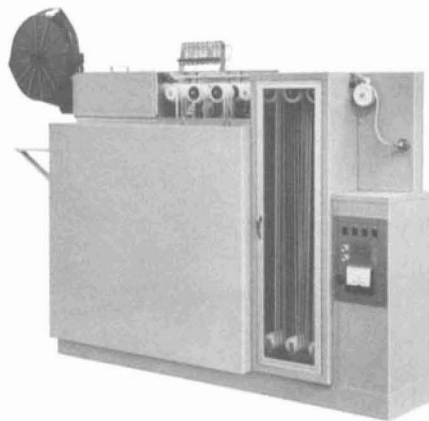
An experiment is reported in which clear quantitative improvements were made in images from conventional aerial photographs using linear processing with experimentally derived Fourier filters. These filters are found from the images produced by known two-tone objects such as symbols painted on flat uniform surfaces. A sequence of noise suppression and linear filtering steps has been developed and implemented using a computer for calculating a processing filter and for using that filter to improve digitized images. Comparison of images before and after processing indicates that well-defined improvements are made.

**Image evaluation as an aid to photographic emulsion design**, R. Shaw, *Phot. Sci. Eng.* 16: 395-405, Nov./Dec. 1972.

In spite of the infusion of new techniques into the field of photographic image evaluation over the past twenty years, the outstanding problems remain numerous. However, as a link between the assessment of existing photographic emulsions and research targets for improved emulsions, image evaluation is proving a powerful aid, especially when linked with analytical models of the photographic process. The features of some models, and the photographic parameters they include, are discussed. It is indicated how, in this way, image properties such as characteristic curve, speed, MTF, Wiener spectrum of noise and DQE can be viewed as a set of closely-related input/output variables rather than diverse and specialized image properties. A series of computed examples is presented which illustrate the relationship between characteristic curve, noise, and DQE, and their dependence on grain size and sensitivity properties. A strategy is given for the improvement of image properties, and the significance of the nature of grain sensitivity in this respect is indicated.

**The color gamut obtainable by the combination of subtractive color dyes. II. Actual dyes in color prints. (2) Optimum spectral characteristics of absorption bands**, Noboru Ohta, *Phot. Sci. Eng.*, 17: Mar./Apr. 1973.

A computer simulation has been carried out relating to spectral characteristics of cyan, magenta, and yellow dyes in color prints. The studies included evaluation of the effect of elimination of the unwanted secondary absorption peaks, the stability of gray balance, and the dependence of the optimum values upon color temperature of illuminants. Methods similar to those outlined in earlier papers have been applied in this study. In general, the results obtained are similar to those reported for color films, although we have found that: (1) The effects of unwanted secondary absorption peaks are greater on color reproduction in color prints than in color films.



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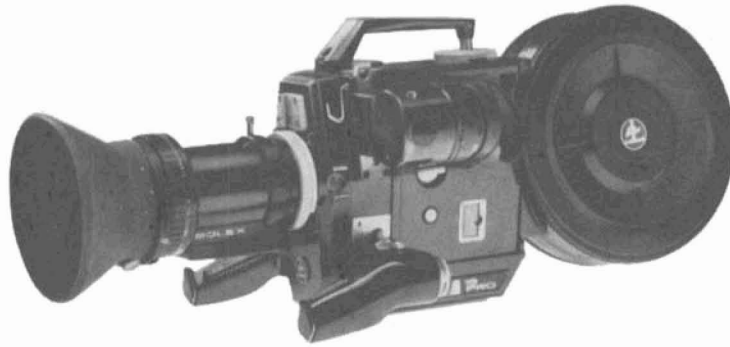
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(2) More stable selective grays are obtainable in color prints than in color films even when the same dyes were used. (3) The influence of illuminant color temperature is less in color prints than in color films.

**Routine analysis of silver in photographic products**, D. W. LaPalme, G. H. Klinger and J. J. Hawley, *Phot. Sci. Eng.*, 17: 400-404, July/Aug. 1973.

Reproducibility of the classical volumetric method of Bush for the determination of silver is dependent upon: electrode response, silver ion to silver ion solvent concentration and ratio; titrator response, and the reaction rate of thioacetamide with the silver ion complex. Employing a novel titrator assembly and experimental conditions that increase the reaction rate of thioacetamide, an improved procedure was developed. A teleprocessing computer program which transforms the digital titration information into silver content and system calibration data is also described.

**Image formation using self-imaging techniques**, Olof Bryngdahl, *Jour. Opt. Soc. Am.*, 63: 416-419, April 1973.

Two situations in which self-imaging techniques can be applied to advantage are presented: the pinhole-array camera and transmission through an optical fiber. The experimental procedure and results are presented for the case of a pinhole array illuminated with an extended incoherent object distribution. In the Fresnel-image planes, more images are formed than there are pinholes in the array, which is in contrast to the case of the pinhole-array camera. An optical fiber or thin film working in the kaleidoscope mode may form an image, provided that its length fulfills the self-imaging condition.

**Alternating renewal model of photographic granularity**, P. E. Castro, J. H. B. Kemperman and E. A. Trabka, *Jour. Optical Soc. Am.*, 63: 820-825, July 1973.

A crowded-monolayer emulsion is viewed in one dimension as an alternating renewal process. The model presented is sufficiently general to include the effects of arbitrary distributions of halide grain sizes and gap sizes and further arbitrary dependence of developability of the grains on grain size and exposure. In an example, we calculate the increase of granularity that accompanies the increased exposure latitude obtained by broadening the size distribution of maximally sensitized grains.

**Chemical mixtures for combination cinematography** (in Russian), B. T. Travkin, *Tekh. Kino i Televideniya*, 16: 14-19, No. 11, 1972.

Chemical mixtures can be used to give interesting effects which can be used as backgrounds, etc. in combination cinematography. The production of some of these special effects is discussed. — S.C.G.

**Systematization of criteria of the quality of images obtained by means of reproduction** (in Czech), Anon. *Jemná Mech. a Opt.*, 16: 332-333, No. 12, 1971; *Ref. Zh., Fotokinetika*, Abstract No. 4.46.12., 1972.

Criteria are proposed for determining the similarity of the image with the origi-

nal. These criteria are divided into three groups. The first group includes criteria for evaluating similarity of content. The second includes psycho-physiological criteria according to which similarity is evaluated by methods approximating to perception by the eye. The third group consists of technical criteria, which are the most objective and should take into account the peculiarities of visual perception, e.g., the spectral sensitivity of the eye. The third group of criteria is discussed in more detail. Among the purely objective criteria of evaluation of reproduction are image shape, spatial relations, color, and brightness. Other criteria in this group serve for the evaluation of reproduction starting from the conditions of observations, e.g. spatial perception of stereoscopic images. The degree to which the individual criteria have been studied is discussed. There has been relatively little study of the optimal conditions of observation and up till now there has been no complex evaluation of quality. Evaluation of information transfer in bits is recommended as an up-to-date and relatively general means of evaluation. — S.C.G. (Translated from *Ref. Zh., Fotokinetika*.)

**The vanadometric determination of Metol and hydroquinone in developers** (in Russian), P. K. Norkus, M. V. Pelyakene and D. A. Norkene, *Tekh. Kino i Televideniya*, 16: 40-42, Dec., 1972.

A study has been made of an earlier proposed method for determining Metol and hydroquinone in developers by titration with an ammonium vanadate solution with ferrocene as indicator. The method gave satisfactory results over a range of conditions and is recommended for the control of developer solutions in motion-picture processing. — S.C.G.

**PROJECTORS AND PROJECTION Radiometry and Photometry II**, C. L. Sanders, 1972 Annual Meeting. *Optical Society of America*.

ThQ16. **Color-Rendering Index for Photographic Viewing Illuminants**, F. Grum and L. DeMarsh, *Jour. Opt. Soc. of America*, 62: 1384, Nov. 1972.

It is rather unfortunate that sources which deviate far from the blackbody locus are classified according to their color temperature. For example, if one would say that a given projector has a color temperature of 3200 K, this would mean that its light appears to the average human eye to be the same color as an incandescent lamp having a color temperature of 3200 K. This, however, does not mean that it would produce the same effect when used to project a color film. A newer concept, color-rendering index, may give a more appropriate evaluation of color properties; however, this concept has not yet been worked out for projection illumination and there has been no correlation of the value of the index obtained with such illumination with the quality of projected pictures. We have evaluated the absolute color quality of a group of color transparencies under several illuminants having different color-rendering indices. The results of this psychophysical study show a very poor correlation between the visual appraisals of picture quality and conventional color-

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#### FEATURES

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rendering indices. A modification of color-rendering index appropriate to photographic projection illuminants is proposed that correlates well with visual judgments.

**Modern methods of determining the instability of images in motion-picture projection** (in Czech), J. Koluch, *Jemná Mech. Opt.*, 17: 126-129, No. 5, 1972.

Methods of determining image instability in motion-picture projection are classified in three groups: (1) methods giving a physiologically subjective evaluation; (2) objective measurement methods; and (3) absolute measurement methods with correction of the results from the point of view of the physiological properties of the observer. A review is given of the known methods in all three groups and they are compared one with another. A general fault of all the known methods is that they measure the overall instability, although there is a definite interest in explaining the influence of the individual units and parts of the projector, for example, the Maltese cross. — S.C.G. (Translated from *Tekh. Kino i Televideniya*.)

**The light-conductor in the optical sound block of a motion-picture projector** (in Czech), Z. Lonicek and V. Venzarova, *Jemná Mech. Opt.* 17: 88-90, No. 4, 1972.

In many designs of the optical sound blocks for ensuring equality of illumination of the lightstreak, light conductors in the form of glass parallelepipeds are used. A method of calculating the paths of light rays in the light conductor are given and

also the principles of a qualitative and quantitative analysis, based on these calculations, of the distribution of illumination over the length and breadth of the lightstreak. Such an analysis was tested practically in the design of a new sound block for the MEO IV motion-picture projector. As a result it was found that the light streak should be lengthened by 3 mm and the distance between it and the condenser correspondingly decreased. This allowed the optimum input parameters to be given to the micro-objective and high factors to be obtained for the whole optical system of the sound block together. — S.C.G. (Translated from *Tekh. Kino i Televideniya*.)

#### SOUND

**Multitrack audio in video production**, Eugene M. Nothaft and Tom W. Irby, *Jour Audio Eng. Soc.*, 21: 172-176, Apr. 1973.

A synchronizer system is discussed which should enhance the use of multitrack audio machines in video productions. It uses the newly adopted SMPTE time code to phase lock the audio machine to any source of master code, including video recorders. The use of the time code opens up new avenues of handling the audio tape in the postproduction phase.

**A new automatic noise-reduction system (ANRS)**, Masami Yamazaki and Isao Masuda, *Jour. Audio Eng. Soc.*, 21: 445-449, July/Aug. 1973.

A new noise-reduction system, suitable for use with high-quality cassette tape recorders is described. The signals of low level are compressed in the recording process and expanded in a complementary way during playback in order to reduce noise without altering the tonal quality of the original sound. In this process, however, the hissing noise inherent in tape recording in the region of 5 kHz, is reduced by approximately 10 dB.

**Dolby B-type noise reduction for FM broadcasts**, D. P. Robinson, *Jour. Audio Eng. Soc.*, 21: 351-362, June 1973.

FM broadcasting (as originally conceived) is capable of producing very high quality audio performance. Unfortunately, stereo transmissions degrade the signal-to-noise ratio by more than 20 dB. Under noisy reception conditions, this results in demodulated signals which do not compare favorably with other home entertainment sources. It is shown that the use of Dolby B-type noise reduction in FM transmission allows the signal-to-noise ratio to be improved significantly. Experimental results are presented, and a brief outline is given of the results of full-time broadcasting in New York.

**The "thunder-effect"—a problem of the sound film**, H. Orlich, *Brit. Kinemat. Sound and TV*, 55: 48-50, Feb. 1973.

This article surveys the history of systematic assessment of the operating conditions in photographic sound recording be-

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fore 1945 and suggests that the work should be resumed in order to relate the old results to more recent insights. Since there is no unique English term to describe the audible effect of image spread in a photographic soundtrack the descriptive German term "thunder-effect" has been retained.

**An improved system for theatrical reproduction of 35mm optical sound,** Robert Orban and John Delantoni, *Brit. Kinetemat. Sound and TV*, Vol. 55: 124-125, May 1973.

Modern advances in magnetic recording and microphone technology are employed nowadays in the sound-recording process in film production. Original recordings often contain information up to 15 kHz. The final optical track commonly goes up to 9 or 10 kHz. Recorded sound quality is better than it appears to be when judged by listening tests in commercial theaters, due to the use of the Academy curve for playback. A technique based on "dynamic noise reduction circuitry" is described. The bandwidth of the standard optical soundtrack is extended up to 10 kHz in reproduction, without objectionable film noise. Also introduced is a dynamic high-frequency energy limiter. As an option, the monaural signal can be processed into a stereophonic signal pair, adding "depth effect." In motion-picture-production use the channel available is expanded by an additional octave, providing better reproduction. There is no compatibility prob-

lem, and old prints can be reproduced with improved quality.

**Magnetic video-sound recording for motion-picture films** (in Russian), M. Z. Vyotskiĭ, *Tekh. Kino i Televideniya*, 16: 14-17, July, 1972.

Possible methods of using magnetic video recording as well as magnetic sound recording in filmmaking are discussed. The methods used in the English Pine-wood Studios are described. — S.C.G.

#### TELEVISION

**1972 Annual Meeting, Optical Soc. of America.**

**WM17. Correction for Residual Image Effects in Mariner-9 Television Images.** Paul L. Jepsen and Arnold A. Schwartz, *Jour. Opt. Soc. Am.*, 62: 1351, Nov. 1972.

The Mariner-9 television subsystem consisted of two camera systems that incorporated vidicon tubes as the active sensor. An image recorded on a vidicon surface is difficult to erase completely, and the next recorded image will contain some portion of previous images when it is scanned. The Mariner-9 camera system was designed to minimize residual image; however, a low percentage of each image was still due to previous exposures. Evaluation of the Martian environment and surface features requires quantitative measurements using television imagery, and the stringent photometric and image differencing requirements of the experiment

required development of a method for correcting for the effects of residual image. An extensive set of calibration data was recorded and analyzed, and an empirical model describing residual image behavior was developed. The model determined the residue in an image as a function of position on the vidicon surface, wavelength of the incident light, intensity of both the image being recorded and preceding images, and camera temperature. This paper describes the method used to measure residual image effects, the algorithm developed to correct for the residue in an image, and the success of the approach.

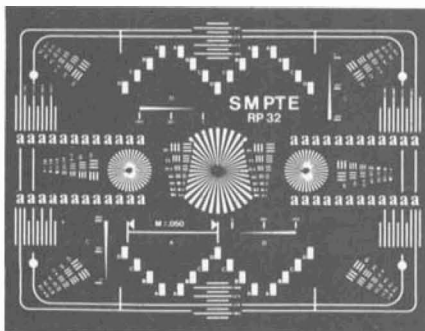
**1972 Annual Meeting, Optical Soc. of America. Information Processing I**

**WB12. Display Signal-to-noise ratio requirements for image detection,** Frederick A. Rosell and Robert H. Wilson, *Jour. Optical Soc. Am.*, 62: 1337, Nov. 1972.

Analytical models are developed for the detection of televised aperiodic and periodic images by human observers based on signal-to-noise considerations. These models include the effects of the sensor generated noises and the sensor's optical transfer functions. Through psychophysical experimentation, the observer's requirements are determined in the form of signal-to-noise ratio thresholds for given probabilities of detection under various viewing conditions. With the thresholds determined, sensory system resolution can be predicted including the observer as an integral part of the sensory system.

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designed to measure and adjust aperture size and position, jump, weave, travel ghost, lens focus, and film buckling.

The second type is for Super 8 Magnetic Sound. There are four all together, each of which was recorded on full-coat magnetic stock with a Super 8mm .1667-in pitch, and contains a 24-mil record in the edge track position.

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- 1. Azimuth Alignment Test Film** (50 ft) which is used to align the azimuth position of the recording and reproducing heads on magnetic sound equipment.
- 2. Flutter Test Film** (50 ft) to measure flutter introduced by sound reproducers, contains an original recording with extremely low flutter content.
- 3. Signal Level Test Film** (50 ft) helps measure and balance the power level output from motion picture sound reproducers. The recorded level does not in itself indicate a program level, but provides a reproducible reference from which a recommended program level can be determined.
- 4. Multifrequency Test Film** (100 ft) is used for testing and adjusting motion picture sound reproducers and projectors. It is calibrated, and correction factors are supplied with each film.

SMPTE Test Films provide simple equipment performance checks without

the use of expensive, complicated test equipment. The films can be used when adjusting the equipment to determine when the equipment is again within specifications, and with the sound films, you can tell when the projector and sound system are operating properly.

For further information, please mail the coupon immediately.

## SMPTE Test Films

Society of Motion Picture and Television Engineers	J1
Test Film Dept.	
862 Scarsdale Ave.	
Scarsdale, NY 10583	
Please send me information on:	
<input type="checkbox"/> Registration Test Film	
<input type="checkbox"/> Flutter Test Film	<input type="checkbox"/> Azimuth Alignment
<input type="checkbox"/> Multifrequency	<input type="checkbox"/> Signal Level
Name _____	
Co. or organization _____	
Address _____	
City _____	
State _____	Zip _____