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book its character as an important reference work.

The authors have helped to prepare the Code, and are therefore qualified to interpret it in the *Handbook*.

Changes in the 1965 Code are identified by marginal rules. The publishers note that there are over 250 changes. There are new sections for mobile homes, trailers, deicing and snow melting. The section on projection booth practices has not changed; it is current and timely for nitrate film.—*Bernard D. Plakun*, Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn. 06902

### Soviet Cine Camera Equipment

By I. B. Gordychuk. Published (1966) by Isskusstvo, Moscow, USSR. 320 pp.

Instead of a review, some descriptive notes about this book follow:

The bibliography contains 56 references to Russian publications in the field.

The first chapter, "Principles of Construction and Performance of Basic Elements of Cine Camera Equipment,"

discusses many of the unitary elements present in any motion-picture camera.

The second chapter presents detail of the several models which are expected to be found in use under a variety of conditions, producing conventional and wide-screen pictures on 35mm film. In all, twelve models are identified.

The third chapter takes up equipment for photography of wide-format and panoramic films. Three camera models are identified for wide format photography. Two models are shown for panoramic photography. The type of camera assembly used for full circular panoramic photography is also shown.

The fourth and final chapter, "Methods and Instruments for Checking Cine Camera Equipment," treats a wide range of mechanical and optical tests to show the performance of the cameras.

An Appendix (18 pages) presents a lengthy tabulation of detailed information concerning cameras and lenses available in the USSR.—*Deane R. White*, Photo Products Dept., E. I. du Pont de Nemours & Co., Parlin, N.J. 08859.



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.

Those requiring definitive and thorough searches of current literature and patents are referred to *Abstracts of Photographic Science & Engineering Literature (APSE)*, produced by the Engineering Index, Inc., 345 E. 47 St., New York, N.Y. 10017, with the editorial cooperation of the Society of Photographic Scientists & Engineers. The subject areas are grouped below:

- Cameras
- Cinematography
- Color
- Data Recording and Processing
- Film and Its Properties
- General
- Laboratory Practice
- Lasers
- Lens Systems
- Photographic Theory and Materials
- Projection
- Sound Recording and Reproduction
- Television

### CAMERAS

**The RKS-2M ultra-high-speed lenticular-plate motion-picture equipment** (in Russian), V. P. Gusev, O. F. Grebennikov, S. M. Provornov, B. I. Shablevich, and A. G. Medvedev. *Zh. Nauch. i Prikl. Fot. i Kinemat.*, 12: 45-53, No. 1, Jan./Feb. 1967.

The RKS-2M ultra-high-speed lenticular-plate motion-picture equipment has been designed in the Leningrad Institute of Motion-Picture Engineers for filming rapid events at a frequency of 500 million frames/s. The camera can be used for the filming of processes the beginning of which can control the delivery of a synchronized pulse to the camera. Test runs with the camera have shown it to work reliably and the pictures obtained with it to be of sufficiently good quality.—S.C.G. (Translation of authors' abstract.)

### CINEMATOGRAPHY

**Cinematography from the kinescope screen without exposure correcting pulses** (in Russian), V. I. Til'kin, *Tekhn. Kino i Televideniya*, 11: 62-66, Feb. 1967.

A method of recording television programs on motion-picture film with apparatus using the afterglow of the luminophore, but with phase change and without intensifying pulses, is rational and its introduction into practice gives good results. Using the method described and carrying out the recommendations, any television studio, until such time as suitable apparatus is produced in quantity, can construct with its

# "MAGAZINE" *story*



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own resources temporary apparatus for recording television programs on film.—S.C.G. (Translation of authors' abstract.)

**Recording and determination of image instability on motion-picture film** (in Czech), M. Večeřa, *Jemná mech. a opt.*, 11: 290-293, No. 10, 1966; *Ref. Zh., Fotokino-tekhnika*, Abstract No. 2.46.180, 1967.

An objective method is proposed for recording and determining the magnitude of image instability on motion-picture film, which may also be used for the measurement of the inaccuracy of perforation in the forward and transverse directions. The method consists in filming with a single exposure a scale and a vernier placed so that the distances between their images in the plane of the film is equal to the magnitude of the forward motion of the film for one frame. In the filming of each following frame the image of the vernier is superimposed on the image of the scale, the film gate of the camera having been suitably enlarged. A mathematical basis is derived for the objectivity of the proposed method, and also a draft of experimental tables which allow the study of the influence of the camera itself and of perforation inaccuracies on image instability by the double exposure method and by the new method to be compared.—S.C.G. (Translated from *Ref. Zh., Fotokino-tekhnika*.)

**Stabilization of camera position relative to the subject** (in Russian), V. Yu. Torochkov, *Tekh. Kino i Televideniya*, 11: 23-24, Feb. 1967.

A kinematic system for stabilizing a motion-picture camera on a moving base makes use of a receiver and motor drive system which keeps the camera in a fixed orientation relative to a light source in the subject plane.—S.C.G.

**Light meter for high-speed cinemicrographic studies**, D. F. Shernoy, T. J. Fitzgerald and R. C. Kintner, *Phot. Sci. Eng.*, 11: 124-125, Mar.-Apr. 1967.

A light-measuring device suitable for use in high-speed cinemicrography is described. It has three scales, two of which are linear and one asymptotic, with incident light. Good exposures were obtained for framing speeds from 16 to 3000 pictures/s.

## COLOR

**The stereoscopic effect of color**, Abraham Anson, *Jour. Amer. Soc. Photogrammetry*, 33: 371-376, Apr. 1967.

During a study for the development of objective color sensors, experiments were performed at the U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency in order to determine the quantitative stereoscopic effect obtained from exaggerating the differential refraction of light frequencies in the visible spectrum. This exaggeration was obtained by the attachment of optical wedges to standard photographic cameras. This approach employs the physical property of the differential refraction of light frequencies in a pair of prisms to cause a

visual stereo image in which the spectral elements are displayed in a relative parallax, apparent as Z-coordinates. The exposure of a group of color chips was projected through an optical wedge with the base toward the right side, then the wedge was rotated for the second exposure with the wedge base toward the left. The resulting dispersion of the spectra in opposite directions created normal and color parallax from a single (monocular) camera position.

## DATA RECORDING AND PROCESSING

**Foundations of the case for natural-language programing**, Mark Halpern, *IEEE Spectrum*, 4: 140-149, Mar. 1967.

Misconceptions and conflict have long impeded useful discussion on the question of the suitability of natural language for programing. This article sharpens the issues and argues the case for natural language.

**Data compression by redundancy reduction**, C. M. Kortman, *IEEE Spectrum*, 4: 133-149, Mar. 1967.

Great strides in improving data communication efficiency are being made through the recent development of several techniques for eliminating large amounts of redundant data from the streams of information being transmitted.

## FILM AND ITS PROPERTIES

**Dimensions of sprockets for 8mm perforated film**, Anon., *BSI News.*, 4157, 20, Apr. 1967.

Relates to 12- to 32-tooth feed, combination, and holdback sprockets. Specifies the tooth form and essential dimensions for accurate engagements with standard 8mm film.—(BSI Publication).

**Electron microprobe examination of aging blemishes in microfilm**, Deane R. White and Norman E. Weston, *Phot. Sci. Eng.*, 11: 107-114, Mar./Apr. 1967.

Electron microprobe examination of blemishes from six selected samples of microfilms impaired by the occurrence of Type 1 blemishes and one by Type 4 blemishes showed (a) that the ring structure visible on microscopic examination of Type 1 blemishes could be correlated in many, but not all, cases with nonuniform silver distribution; (b) that in many cases the silver concentration is lower toward the center of a blemish area than in the surround; and (c) that high or uneven sulfur concentration was not necessary to the occurrence of blemishes. Microprobe techniques first used were destructive of the sample, but new techniques developed during the course of this work gave the later results without destruction of the sample and in a display form relatively easy to comprehend.

## GENERAL

**The development and improvement of the technique of narrow-gage cinematography** (in Russian), V. G. Komar and N. D. Bernshteyn, *Tekh. Kino i Televideniya*, 11: 25-29, Feb. 1967.

A discussion of the use and development of 16mm equipment in the Soviet cinema

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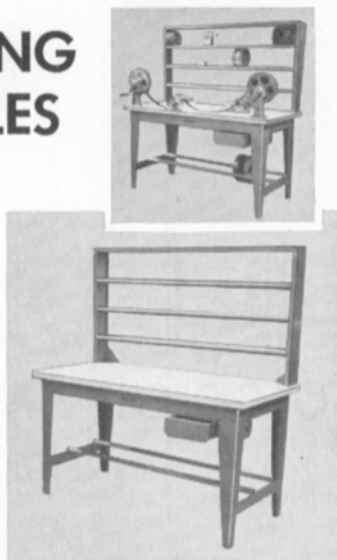
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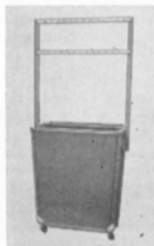
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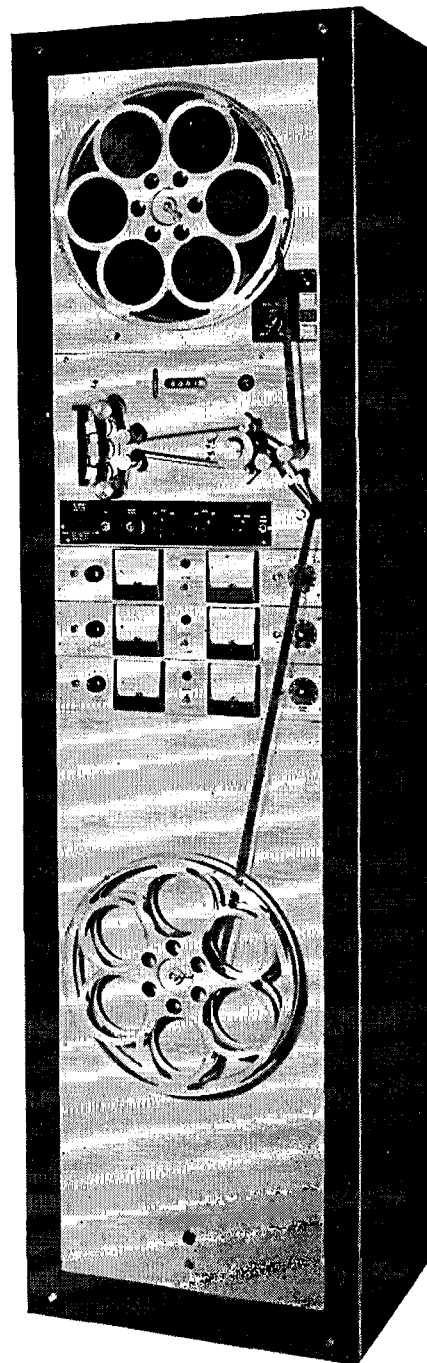
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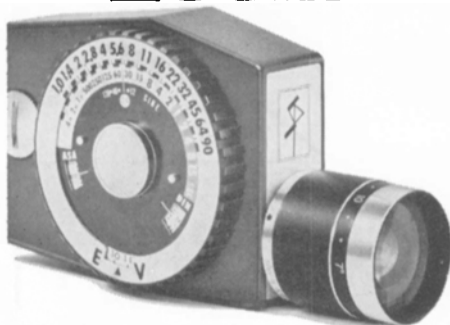
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## SPOTRON PENTAVIEW ZOOM



network, particularly in the country districts, conducted in *Tekhnika Kino i Televideniya*, is summarized by the authors of the paper which initiated the controversy.—S.C.G.

**Interaction between light and sound**, Robert Adler, *IEEE Spectrum*, 4: 42-59, May 1967.

Because of the development of the laser and new acoustic techniques, the interaction between light and sound, first observed more than 30 years ago, has led to applications of great promise and practical utility.

**Dilemmas of engineering education**, Harvey Brooks, *IEEE Spectrum*, 4: 89-91, Feb. 1967.

The values and attitudes true of the specialist are not always compatible with the values and needs of the professional, and therein lies a fundamental dilemma of engineering education today. Modern technology has posed a special dilemma for today's professional, who is confronted by rapid change in both the body of knowledge he must use and the needs and expectations of the society that he must serve. The resulting problem for professional education—to ascertain the proper balance between science and art in training for a profession—is considered in this article.

**Time-delay units for sound reinforcement systems**, David L. Klepper, *Jour. Audio Eng. Soc.*, 15: 176-179, April 1967.

This paper discusses the uses of time-delay units in sound reinforcement systems and the different types of commercially available units. The use of time delay for increasing intelligibility and to improve the naturalness of amplified sound is considered.

**Optical transfer of the three-dimensional object**, B. Roy Frieden, *J. Opt. Soc. Am.*, 57: 56-66, No. 1, Jan. 1967.

A transfer theory is developed that determines the image space, and three-dimensional image spectrum, of a 3-D object. For both incoherent and coherent illumination, the image is found to obey convolution, transfer, and sampling theorems that resemble the familiar results of ordinary 2-D theory. A 3-D transfer function is related to the pupil function of the image-forming optical system. One result of the theory is that with incoherent illumination, the object image space contains no more than  $1/(\lambda^2/\text{no.}^4)$  degrees of freedom/unit volume, where  $\lambda$  is the wavelength of light. The transfer theory is based on the existence of volumes of stationarity, termed "isotomes," into which the object must be partitioned. Isotomicity is shown to be approximated, over sufficiently small volumes, in the diffraction-limited case.

### LABORATORY PRACTICE

**Black-and-white developers for the separate processing of soundtracks on color prints** (in Russian), A. P. Strel'nikova and A. E. Ziskis, *Tekh. Kino i Televideniya*, 11: 18-25, Mar., 1967.

The NIKFI research laboratories devised a method of separately processing soundtracks on color motion-picture positives in which the tracks were subjected to two black-and-white developments. Phenidone-

hydroquinone developers have now been formulated for both developments. The first developer also contains 1-phenyl-5-mercaptotetrazole, which not only suppresses fog, but retards the subsequent color development of the track and improves the final densities towards the photocells of the sound reproducing unit. It also lessens the possibility of the formation of color halo in the soundtracks. These properties of 1-phenyl-5-mercaptotetrazole may also have some application in the processing of reversal film. In the second black-and-white developer ethylene diamine can be replaced by the cheaper potassium thiocyanate. Laboratory and production tests on the new developers are described.—S.C.G.

**An optical printer** (in Russian), G. A. Bondarenko, *Tekh. Kino i Televideniya*, 11: 75, Mar., 1967.

A brief description is given of a unit for printing onto 16mm film with a magnetic soundtrack, made by combining a Ukrainian projector and a Pentaflex-16 camera.—S.C.G.

**Automatic light-control film printer**, Haruo Sakata, Teichi Taneda and Hidehiko Kasama, *NKH Technical Monograph*, 7: 3-26, Feb. 1966.

To print positive film from a negative film with a conventional film printer an operator must first determine the printing exposure value; then he must manually adjust the printer to this setting. NHK Technical Research Laboratories has developed an automatic light-control film printer to detect the negative film density and automatically adjust the printer to this correct exposure value by means of a servomechanism. A specially constructed CdSe cell is used in the detector for picking up the approximately maximum density of the negative film. In this manner the positive film minimum density remains nearly constant.

Two control systems have been developed: one for continuous light control of each and every frame; the other, a step system to control every cut. The majority of NHK's film programs have been made employing this newly developed automatic light-control film printing system.

### LASERS

**High-power lasers—their performance, limitations, and future**, F. P. Burns, *IEEE Spectrum*, 4: 115-120, Mar. 1967.

Many new, imaginative applications have led to the development of lasers with power outputs exceeding the ability of the laser materials to withstand damage for more than a few shots. The apparent necessary remedial steps would be to learn how to increase damage threshold and to determine how to improve laser parameters that will not degrade life. This article discusses how high power is attained in a laser system and it reviews the data on laser performance to establish the principal causes of failure and to determine how to rectify them. An integral part of the analysis is a detailed treatment of the measurement and interpretation of luminance.

### LENS SYSTEMS

**Modern motion-picture camera optics**

and prospects for their development (in Russian), F. S. Novik, A. I. Gan, and M. M. Shcheglov, *Tekh. Kino i Televideniya*, 11: 8-19, Feb. 1967.

The optical characteristics of a number of lenses made for motion-picture cameras in the USSR are discussed. These include: camera objectives for standard 35mm film; objectives for 16mm cameras; and variable-focus lenses. It is concluded that while most lenses reach the level of performance of imported lenses, and in some cases surpass it, a few types are not as good as the best of the imported lenses of the same type and must be improved.—S.C.G.

#### PHOTOGRAPHIC THEORY AND MATERIALS

**Restoration of turbulence-degraded images**, Benjamin L. McGlamery, *J. Opt. Soc. Am.*, 57: 293-303, March 1967.

Turbulence-degraded images have been processed to obtain an improvement of their visual image quality. The initial objects were photographed through laboratory-generated turbulence. The resulting transparencies of the degraded images were digitized by a photoelectric scanner and processed on a digital computer. The processing consisted of applying corrections to the amplitude and phase coefficients of the two-dimensional Fourier series representing the degraded images. The correction factors were obtained from the optical transfer function of the turbulence measured at the time the images were photographed. The experiment was done for 5-ms and 1-min exposure times. The processed data were used to generate photographs. The processed images were found to have significantly more visual detail than the original degraded images; the 5-ms-exposure restorations were superior to the 1-min-exposure restorations.

**An automated technique for deriving MTF's from edge traces**, Robert A. Jones, *Phot. Sci. Eng.*, 11: 102-106, Mar./Apr. 1967.

An automatic edge-gradient technique has been developed for fast, accurate determinations of the modulation transfer functions (MTF) of photographic systems. Photographic edges resulting from brightness step edges in the object plane are obtained from either laboratory exposures or normal operational exposures. A digitized microdensitometer is used to scan the edges and sensitometric exposures. A computer program directs a high-speed computer to accept the edge-scan data, produce the proper microdensitometer correction, perform the nonlinear sensitometric conversion, obtain the smooth spread function, and determine the MTF. The technique has been tested using both artificial and experimental edges and found to operate reliably.

#### PROJECTION

**Characteristics of lighting systems for motion-picture and still projection** (in Russian), V. G. Pcll', *Tekh. Kino i Televideniya*, 11: 76-83, Mar., 1967.

Western information on the characteristics of lighting systems for projectors is reviewed. The fundamental calculations

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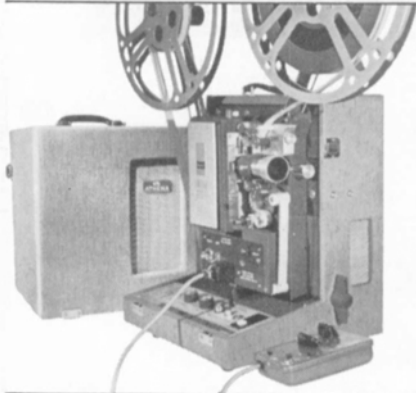
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arc explained and data for different light sources are compiled.—S.C.G.

## SOUND RECORDING AND REPRODUCTION

**Comparison of directional localization with monaural and binaural hearing,** R. Condamines, *E.B.U. Rev.*, 96: 64-66, Apr. 1966.

An attempt was made to ascertain whether the incident direction of sounds can be determined with monaural listening. Statistical experiments have shown that, in general, directional localization is very often confused with monaural listening, the results being much more dispersed than with binaural listening. Nevertheless, there is certainly some directional sensation with monaural listening, and it can, under certain conditions, be relatively precise. Conclusions are drawn regarding the explanation of the stereophonic effect.

**Apparatus for synchronized sound on 16mm motion-picture film (in Russian),** Yu. S. Leont'ev, *Tekhn. Kino i Televideniya*, 11: 70-73, Mar., 1967.

The use of 16mm films with synchronized sound under the conditions prevailing in Soviet television studios is discussed, with particular attention to the apparatus available.—S.C.G.

**A low-noise two-wire condenser microphone preamplifier,** Mead C. Killion, *Jour. Audio Eng. Soc.*, 15: 163-168, April 1967.

Vacuum tube preamplifiers for use with dc-biased condenser microphones have two drawbacks: they require multiwire cables and they are usually noisy. Using the high voltage transistors available today, a two-wire cathode follower type of preamplifier is practical. If a low leakage FET is used at the input, bias resistors of 1000 MΩ or more become practical, substantially reducing the input noise level. The design of such a preamplifier, with its associated power supply, is discussed.

**Some aspects of binaural sound,** Charles J. Hirsch, *IEEE Spectrum*, 4: 80-85, Feb. 1967.

In binaural listenings, the human ear can hear two normally dissonant sounds without subjectively experiencing dissonance. Among other things, this finding suggests that with the human listener, harmony and melody obey different rules.

## TELEVISION

**The influence of scene lighting on the transmission characteristic of an electronic color camera,** F. J. In der Smitten and R. Lehmann, *E.B.U. Rev.*, 96: 52-63, Apr. 1966.

The translation of colored scenes into electrical color signals by means of an electronic camera is considerably influenced by the spectral characteristic of the scene lighting used. Tests and measurements have been carried out for the purpose of determining this influence qualitatively and quantitatively. Based on the color-mix curves of a camera, which were obtained experimentally, the signal changes to be

expected were determined, by varying the color temperature of a studio light source over the range between 2700 K and 3500 K. The resulting changes in the nature of the color are discussed by means of defined test colors. On the basis of the evaluation of these results, it is possible to indicate the use of lighting-control installations in color television studios. How the light output and the spectral distribution of energy of some currently-used studio light sources change as a function of the supply voltage is shown by means of measurement results.

Additional tests were made in order to determine more closely the production of color signals when using light sources similar to daylight (in the region of about 6500 K) as well as light sources with a decidedly spectral-line character (gas-discharge lamps of modern design). In this connection, mention is made of the use of mixed light with different color temperatures.

**Distribution of monophonic and stereophonic audio-frequency signals on television links,** H. J. van der Heide and J. J. Geluk, *E.B.U. Rev.*, 96: 46-51, Apr. 1966.

A description is given of a system which provides for the simultaneous distribution of three monophonic programs and three multiplex stereophonic programs by means of modern television radio-relay links. The audio-frequency signals are retransmitted in the video-frequency band by means of six subcarriers. For the monophonic programs, use is made of amplitude modulation with a suppressed sub-carrier, and for stereophony the multiplex signal of the pilot-tone system frequency modulates the corresponding sub-carrier with a deviation of 8%.

**A color film camera with 1½-inch vidicon,** K. Ulyett, *Internat. Broadcast Engr.*, 88-90, 92, No. 18, 1966; *Ref. Zh., Fotokinetikhnika*, Abstract No. 9.46.215, 1966.

A detailed description is given of RCA's type TK-27 telecine camera. The camera uses four normal 1½-in. vidicons, Type 8480, with electrostatic focusing and electromagnetic beam deflection. A feature of the camera is the special oscillographic control in the form of a single specially formed signal instead of control by signals from all four tubes. This method allows the simultaneous control of the extreme values of all the signals. Optimal parameters of the signals, when the density of the image on the motion-picture film is altered, are obtained not by a control in each channel, which could lead to colorimetric errors, but by the automatic simultaneous control of the signals of all the camera channels. The optical system of the camera uses, instead of dichroic mirrors, prisms to ensure a smaller loss of light and a more rigid construction.—S.C.G. (Translated from *Ref. Zh., Fotokinetikhnika*).

**Servo controls on zoom lenses,** J. D. Barr, *Brit. Kinemat.*, 49: 6-17, Jan., 1967.

Television places greater demands on the use of zoom lenses than cinematography and high-performance servo systems have been developed by Rank Taylor Hobson in order to give smooth and accurate mechanical control with minimum effort. Systems of zoom and focus control are described, and an ac-

count is given of the design of the servos which they control. The RTH iris servo is then briefly described and finally some of the combinations of Varotal lenses and Sental servo control systems for various cameras are mentioned.—S.C.G.

**Sound broadcasting and "Pye range 70,"** Charles Taylor, *Internat. Broadcast Eng.*, No. 29, 42-46, Feb. 1967.

In September, the Pye group produced the first video and broadcast facilities in an entirely new range of equipment known internationally as "Range 70." Additions have been made and this article deals with audio and sound broadcast equipment.

**Application of redundancy reduction to television bandwidth compression,** D. Hochman, H. Katzman and D. R. Weber, *Proc. of the IEEE.*, 55: 263-266, Mar. 1967.

Redundancy reduction processes have proven highly effective in compressing the bandwidth of pictorial data. Compression is achieved by approximating the video time function with polynomial sequences.

This paper presents experimental results obtained by computer simulation, demonstrating the effectiveness of redundancy reduction when applied to different examples of pictorial material. Some of the practical considerations in implementing bandwidth compression systems for both black-and-white and color television are also discussed.

Based upon these simulation results and laboratory investigations, it is estimated that video bandwidth reductions from two to four can be accomplished with the present state-of-the-art.

**The improvement of the film recording systems: Analyses of film recording transmission systems** (In English), Iwamura Soichi and Sugiura Yukio, *NHK Tech. Monogr.*, 8-32, 70, No. 8, 1966; *Ref. Zh., Fotokinetikhnika*, Abstract No. 10.46.170, 1966.

The results are given of a study of the characteristics of the elements entering into television systems for transmitting an image from motion-picture film. All the units of the system have been studied, beginning with the input signal from the recording device into the television motion-picture camera up to the reproduction of the output video signal on a special projector for comparison with a standard for the transmission of brightness gradation. In order to obtain the required contrast coefficient characteristic ( $\gamma$ -correcting characteristic) of each system, a  $\gamma$ -correcting circuit has been based on the use of an exponential signal for the calibration of nonlinear amplifiers. The frequency characteristics of nonlinear conversion systems, the general characteristics of the electron tube, the motion-picture film, the vidicon, and the film recording unit were measured by the method of imposing a sinusoidal signal of small amplitude on a stepped signal. At the same time a value for distortion of their output signal was obtained. A study has been made of the influence of alteration of the brightness of the cathode-ray tube screen on the transmission of the finished image, the graini-

ness of the film, changes in the sensitivity of the vidicon target, and noise in the pre-amplifier. The principles of  $\gamma$ -correction of the image of different conversion systems are discussed. Circuit diagrams of the systems considered are given, together with the results of measurements and examples of numerical calculation.—S.C.G. (Translated from *Ref. Zh., Fotokinetikhnika*)

**Characteristics and applications of vidicon scan converters,** Robert P. Moore, Charles A. Hawthorne and Charles A. Ashwood, *SPIE Jour.*, 5: 58-62, Dec. 1966/Jan. 1967.


This paper discusses the use of a vidicon storage tube in scan converter operations. It outlines the design considerations and pertinent characteristics of devices employing the storage vidicon in scan converter applications. It discusses optics, transfer characteristics and sensitivity considerations. It discusses the significant factors in choosing tube type, sweep circuits, and other associated electronics when assembling a special purpose instrument. It outlines modifications and operating techniques when utilizing an ordinary TV camera. Instruments designed and built by NOLC, both a general purpose laboratory instrument and an airborne unit, are described. The paper concludes by giving a number of example applications.

**The PAL color television system,** B. J. Rogers, *Radio and Electronic Eng.*, 33: 147-159, Mar. 1967.

The PAL system and its relationship to the NTSC system is described. The effects of phase distortion and sideband limitation separately and in combination are analyzed. The attributes of various decoding arrangements are compared and the action of the delay line discussed. The possibility of error correction prior to transmission is outlined and finally the consequences following the use of systems with a line sequential component are described.

**The development of a pay-television system and equipment,** G. L. Hamburger, *Radio and Electronic Eng.*, 33: 241-256, Apr. 1967.

The system described applies to wired-broadcasting networks of the multipair variety. The pay-television user establishes credit by the insertion of one or more coins into a special subscriber's unit. The established credit will be consumed at a faster rate for an expensive program, and vice versa. On the other hand, the subscriber can at any time switch off, and preserve the remaining credit for some future occasion. If the credit is exhausted, the unit switches off, and no pay-television program can be received until more money is inserted. Means are provided in the central station from which the pay-television programs emanate and from which the price is controlled to display numerically and to print out, minute by minute, how much money has been collected from viewing subscribers since the start of a particular program. This is achieved by digital techniques combined with data transmission, and it constitutes a complete, automatic and instant accountability system.



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