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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 Televidinya* 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:

Film and Its Properties
General
Holography
Lasers
Light Sources
Photogrammetry
Photographic Theory and Materials
Sound Recording and Reproduction
Special Applications
Television

FILM AND ITS PROPERTIES

Preservation of cinematograph film in the National Film Archive, Ernest H. Lindgren, *Brit. Kinemat. Sound and Telev.*, 50: 290-293, October 1968.

Previous treatments of the film preservation problem have tended to concentrate on special aspects in isolation. This paper stresses the importance of a total procedural pattern, involving selection, acquisition, storage, testing, cataloging and the safeguarding of preservation masters, and describes the work of the British National Film Archive in putting such a pattern into practice.

GENERAL

A half century of photographic standardization in the United States, C. S. McCamy, *Phot. Sci. and Eng.*, 12: 308-312, Nov./Dec. 1968.

Over the past 50 years, photography and cinematography have reached a high level of standardization in the United States of America. This has been accomplished through cooperative efforts of the photographic industry, interested consumers, and the government. These efforts have been organized by societies such as the Society of Motion Picture and Television Engineers, and by the United States of America Standards Institute and its predecessors. The

USA program is coordinated with those of other nations by the International Organization for Standardization. Besides the documentary standards which record the consensus of interested parties with regard to specifications and test methods, there are physical standards, from various sources, which serve as the basis of measurement.

Milestones in motion pictures production, Baynham Honri, *Brit. Kinemat. Sound and Telev.*, 51: 94-107, Apr. 1969.

On December 4, 1968, a Vintage Film Night was held at which Arthur Kingston, Ernest Lindgren, and Baynham Honri illustrated with British Films of 1900-1910, how they were made, their studios and equipment.

Color separation process, *Indus. Phot.*, 18: 31, 86-92, May 1969.

To simplify the usually expensive and difficult procedures for obtaining color electron microprobe images, NBS uses a color-separation process. Color filters, an ordinary copying camera, and rapid-access film give color composites that can be readily interpreted and produced routinely.

Metrication in kinematography, W. J. Raymont, *Brit. Kinemat. Sound and Telev.*, 51: 71-73, Mar. 1969.

The United Kingdom is changing to the metric system coincident with the adoption internationally of a rationalized system of metric units of measurement, the *Système International d'Unités* to be known by the abbreviation S.I. Units.

A program of implementation has been laid down and much work has already been done. All new British Standards are being issued with metric sizes and in many industries and professions advisory panels are being set up to consider the implications and to assist in making the changeover meet the program and to avoid the pitfalls before they occur.

HOLOGRAPHY

Longitudinally reversed shearing interferometry, Olof Bryngdahl, *Jour. Opt. Soc. Am.*, 59: 142-146, Feb. 1969.

A type of shearing interferometry is presented in which the interferogram is formed by the object wave front and its replica folded in the longitudinal direction. Holography has been applied to achieve this: an off-axis hologram of the object under test is made and, in reconstruction, the two required wavefronts are formed and superposed by using two separate illumination waves. The longitudinally reversed shear interferogram shows the double phase variation of the object and only one image of the object. Experiments show that the technique is simple and versatile. Methods by which the phase variation can be redoubled several times are also given.

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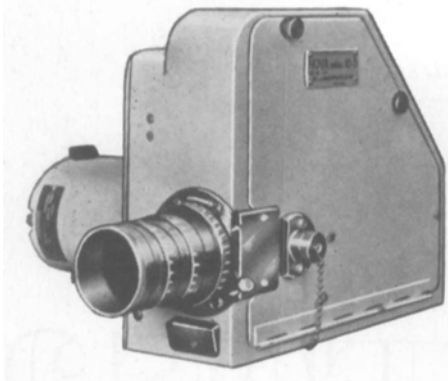


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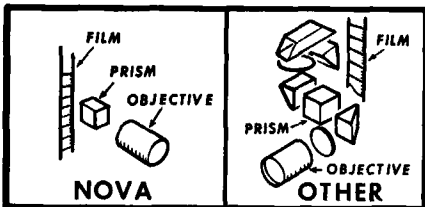
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Fourier-transform holograms by Fresnel zone-plate achromatic-fringe interferometer, Makoto Kato and Tatsuro Suzuki, *Jour. Opt. Soc. Am.*, 59: 303-307, Mar. 1969.

Fourier-transform holograms are produced by using achromatic-fringe interferometer arrangements in which the beam splitting is achieved by offset Fresnel zone plates. The effects of the size and the spectral bandwidth of the spatially incoherent source are discussed. Coherence requirements of the source are the same as those for in-line holograms. Experimental examples with object transparencies and a high-pressure mercury-arc lamp are given.

Holographic imaging with ultrasound, Frederick L. Thurstone, *Jour. Acoustical Soc. Am.*, 45: 895-899, Apr. 1969.

The use of holographic imaging techniques with acoustical investigating fields offers the possibility of presenting three-dimensional visual images of optically opaque structures. The fundamental limitations on such an imaging technique are presented, and the methods that have been used together with the basic requirements for this imaging process are discussed. Several techniques are presented for the reduction of the image distortion associated with the wavelength ratio of acoustical energy to electromagnetic energy in the visible spectrum including a nonlinear holographic technique that produces equal lateral and longitudinal image magnification.

Theory of holographic interferometry, G. M. Brown, R. M. Grant and G. W. Stroke, *Jour. Acoustical Soc. Am.*, 45: 1166-1179, May 1969.

A simple theory of three forms of holographic interferometry—"time-average," multiple-exposure, and "real-time" (live) interferometry—is presented, based on a new development in holographic "image synthesis" (complex amplitude addition and subtraction), introduced in 1965 by D. Gabor, G. W. Stroke, et al. They demonstrated the remarkable property of holography: interference can occur between two or more light beams that are not superimposed either in time or in space, if the holographic intensities corresponding to the beams are obtained with the aid of a coherent reference-background beam of the same spatial shape and if these intensities are successively added in the same hologram. Following the independent discovery of holographic interferometry, in 1965, by J. M. Burch; by R. L. Powell and K. A. Stetson; and by L. O. Heflinger, R. F. Wuerker and R. E. Brooks, among others, it was found that two or more successive photographic additions of the hologram intensities (corresponding to two or more sequential positions or shapes of a given object) would thus indeed permit one to "synthesize," in the form of an interferogram, the complex sum of the spatial-electric-field vectors, corresponding to each object-point position, as if the different object-point positions had all existed simultaneously rather than sequentially, as they do during the hologram recording (for instance in the case of multiple holographic-image recording of a vibrating object). The rigorous equations we present, notably in vector form, for the general cases

of practical interest bear out the equations previously derived by a number of authors, for some special cases, frequently in heuristic form.

Atmospheric degradation of holographic images, Jack D. Gaskill, *Jour. Opt. Soc. Am.*, 59: 308-318, Mar. 1969.

The resolution of images formed from turbulence-degraded lensless Fourier-transform holograms is analyzed for gaussian and exponential refractive-index structure function models, first by a geometrical-optics method and then by Schmeltzer's series-expansion method, under the assumption that the random log-amplitude and phase perturbations across the entrance pupil of the recording apparatus are locally stationary processes with gaussian statistics. Both long and short exposures are treated.

The resolution of turbulence-degraded holographic images is governed primarily by a function $m^2(r_1)$, for which analytical expressions are derived and results of experimental measurements are given. The analytical results obtained for $m^2(r_1)$ by the geometrical-optics method are identical with those obtained by Schmeltzer's series-expansion method. The measurements were made by an interferometric technique for horizontal atmospheric propagation paths of 86 and 542 m. In addition, holographic images of an extended object were obtained for the 86-m path.

Vibration analysis by holographic interferometry, Michael A. Monahan and Keith Bromley, *Jour. Acoustical Soc. Am.*, 44: 1225-1231, Nov. 1968.

Optical holographic interferometry is used to study the vibrational characteristics of a sonar transducer. Experimental methods are described, and photographs of 13 resultant hologram images are included. Each is an interferometric fringe pattern from which the peak-to-peak amplitude of every point on the vibrating surface can be computed. The result of an exact theoretical analysis is stated; the solution for a simplified model is derived; and numerical results are compared.

LASERS

Laser display technology, Charles E. Baker, *IEEE Spectrum*, 5: 39-50, Dec. 1968.

The promise of producing a cathode-ray-tube type of display with essentially unlimited screen size accounts for much of the current interest in laser displays. The first display that used a laser light source to generate a television image was operated in late 1964. Since that time, a number of experimental laser display systems have been demonstrated, including versions capable of reproducing color television images and displaying computer-generated information. Adequate light modulation and scanning techniques are presently available, but the design of broadly applicable equipment still awaits the development of more efficient multicolor lasers.

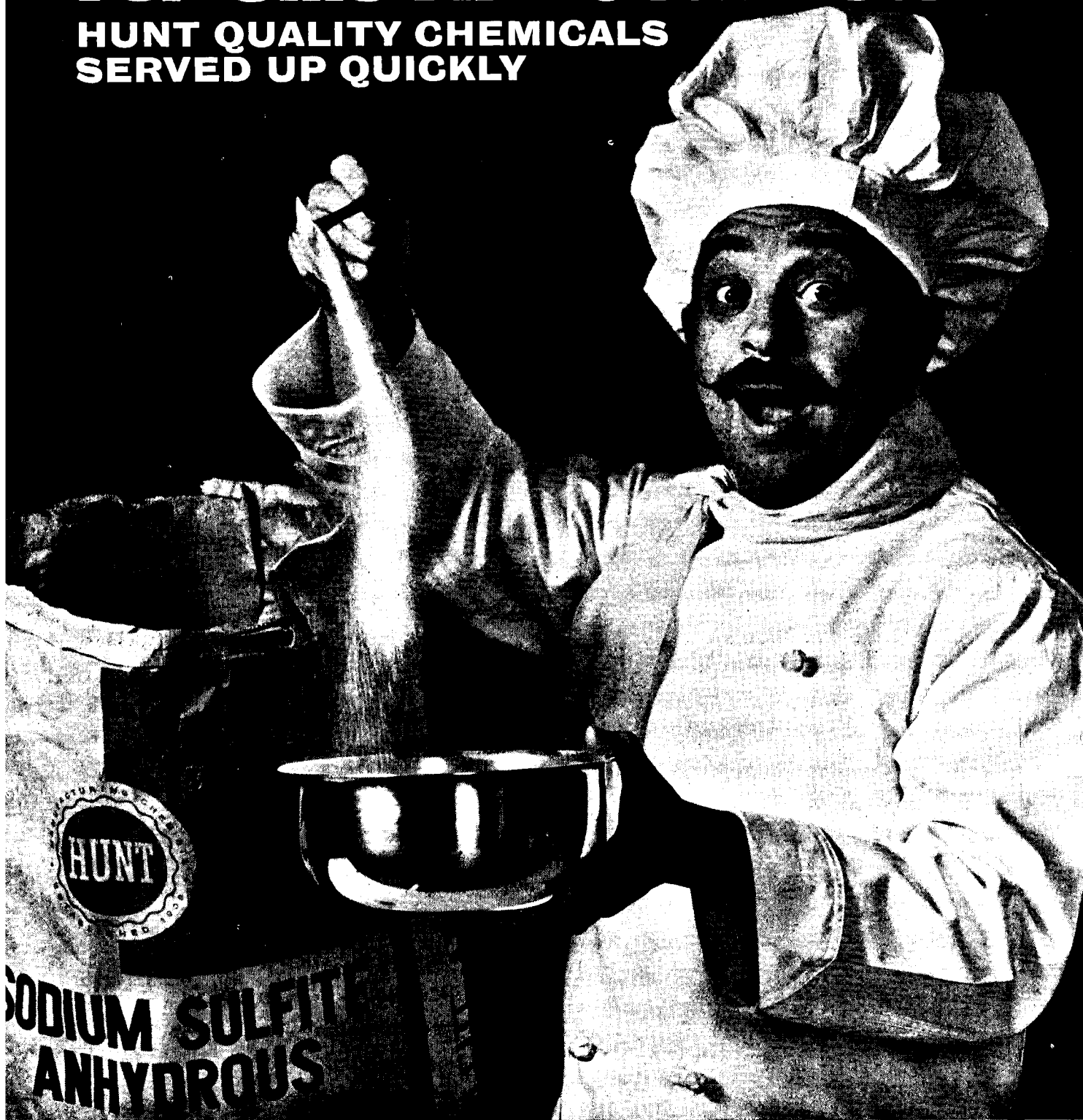
LIGHT SOURCES

Sensitometric simulation of the spectral emission of standard phosphors, David A. Cree, *Phot. Sci. and Eng.*, 13: 18-23, Jan./Feb. 1969.

A method is described for simulating the spectral emission of standard registered

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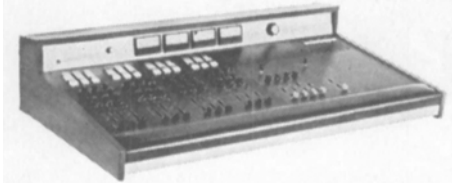
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phosphors and other light sources using subtractive or simultaneous additive filter sets combined with sensitometric light sources. An objective selection criterion and associated computer program are described which determine from spectrophotometric curves of available commercial filter set components, the optimum filter set(s) for simulating a given single- or double-peaked phosphor. Subtractive filter set simulations are given for the P-1, P-11, P-12, P-22B, and P-24 phosphors using tungsten light. Results are also given for the P-11, P-16, P-22B, and P-24 phosphors for use with xenon flashtube sources. Simultaneous additive filter set simulations are given for the P-4, P-15, and P-31 phosphors using a linear Edgerton, Germeshausen, and Grier FX-1 xenon flashtube as the source.

PHOTOGRAMMETRY

Problems of two-medium photogrammetry, Karl Rinner, *Photogrammetric Eng.* 35: 275-282, Mar. 1969.

Two-media photogrammetry applies in instances involving the depth of water, bubble chamber work and satellite geodesy. Several references have treated the subject superficially if not incorrectly with specific reference to corrections to be applied to observed water depths and to the subject of y-parallax. The equations that are derived represent fundamentals for orientation and plotting procedures for two-medium surveys. They concern both the analytical methods and the stepwise reduction of the conventional procedures of single-medium photogrammetry.

PHOTOGRAPHIC THEORY AND MATERIALS

Investigation of image simulation procedures, Robert A. Jones, *Phot. Sci. and Eng.*, 73: 24-28, Jan./Feb. 1969.

The simulation of aerial images is important for image evaluation, psychophysical studies, and training programs. Presently, techniques are being used for the production of photographic images with specified modulation transfer function granularity, contrast, exposure, scale factor, and scene content. It was desired to extend the simulation procedures. Therefore, an investigation into possible methods for altering the modulation transfer function of the final image was conducted. However, production of higher spatial frequencies is difficult due to finite distance limitations and the resulting Fresnel diffraction. The best arrangement for a modified copy system-use of a mask to alter the lens pupil function was tested and determined to be feasible for high spatial frequency simulations.

A review of current image-evaluation techniques, G. C. Brock, *Jour. Phot. Sci.*, 16: 241-249, Nov./Dec. 1968.

The characteristics of image-evaluation techniques are reviewed in relation to their use in the design and testing of photographic systems. Each technique has advantages and limitations; no one technique can serve all purposes. Resolving power takes account of many factors that affect image quality, hence it can be a significant measure of system performance; for the same reason it

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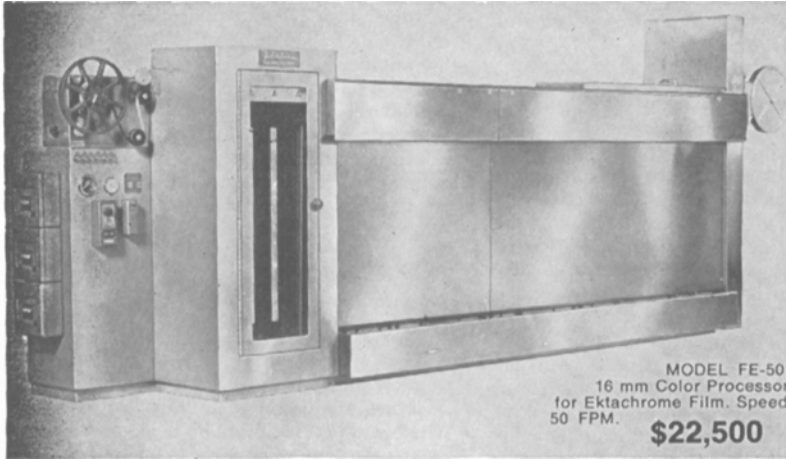
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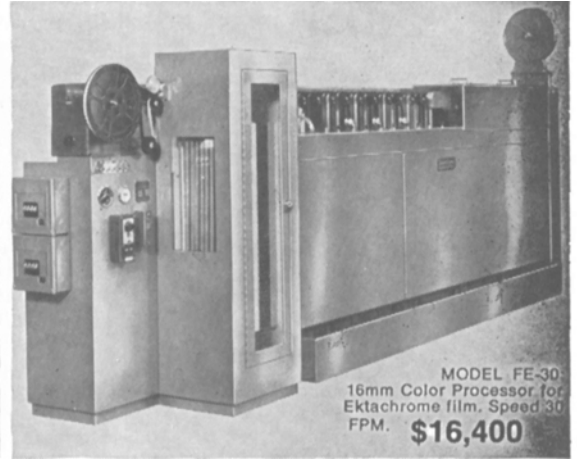
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is inaccurate and inherently unsuitable for measuring the performance of lenses. The MTF is potentially more accurate than resolving power, but by itself lacks significance because it omits important factors in the system. Nevertheless the MTF is an invaluable aid in design and analysis as well as in research. The importance of adequate calibration of MTF equipment and of standardization of resolving power targets is stressed. The possibilities of a calculated resolving power based on the MTF and a signal to noise ratio are mentioned. Problems of evaluating the MTF in practically significant ways, and the advantages of the single bar target for interpreting it in spatial terms, are discussed.

A new method of thermoplastic image recording based on orientation of colloidal particles, B. Kazan, D. P. Foote and D. G. Marlow, *Phot. Sci. and Eng.*, 12: 274-282, Nov./Dec. 1968.

A new method has been developed for recording halftone images using a thermoplastic film containing opaque colloidal particles which are platelike in shape. Such images are produced by establishing a charge pattern on the surface of the film and softening it by heat to allow orientation of the particles by the local electric fields. After cooling, the orientation of the particles remains fixed, resulting in a pattern of varying light transmission. By using a photo-conductive layer in contact with the thermoplastic film to control its charging, an input optical image can be recorded as an orientation pattern which can then be viewed directly or by means of conventional projection optics. If reflecting particles are used, in addition to the image seen in transmitted light, an image of opposite polarity is also produced by reflected light. With present photoconductor-thermoplastic layer combinations, image details of about 0.1 mm can be resolved, corresponding roughly to the combined thickness of the layers. Such images exhibit 9 halftone steps and have a contrast ratio as high as 40:1. In addition to the optical effects resulting from particle orientation, local variations in capacitance and resistance are produced which are of potential use for direct electrical readout.

An optical heterodyne ultrasonic image converter, G. A. Massey, *Proc. IEEE*, 56: 2157-2161, Dec. 1968.

The theory and preliminary experimental results for a new type of ultrasonic image converter system are presented. The method uses a scanning laser transmitter and receiver, operating as an optical heterodyne system, to sense the vibration amplitude distribution on a reflective resonant diaphragm placed in the liquid acoustic medium. The output of the optical heterodyne receiver is displayed as an optical image on a cathode ray tube. If an acoustic image is formed on the diaphragm, either by means of acoustic lenses or by shadow imaging, the corresponding pattern will be present in the visible display. Sensitivity to low sound levels is comparable to the best alternate methods for much of the frequency spectrum of interest in this work. Acoustic holograms also can be recorded by this technique, which should be practical with very large acoustic apertures.

SOUND RECORDING AND REPRODUCTION

Stochastic approach to the noise in magnetic tape, F. T. S. Yu, *Jour. Acoustical Soc. Am.*, 44: 1442-1450, Nov. 1968.

The noise in magnetic tape is approached by viewing it as a stochastic process. A conditional probability distribution of the unmagnetized particles (as well as the magnetized particles), defined under the effective recording gapwidth, is derived. The corresponding mean and variance are also calculated. The general application to a typical magnetic tape is given. The signal-to-noise ratio and the dynamic range of the tape are defined. A procedure for determining the information capacity of a given magnetic tape is also discussed. It is found that the information capacity of a multi-channel tape should increase compared with that of a single channel; however, this advantage is somewhat reduced by the physical separation of the channels. Finally, a conclusion is drawn that the noise in the magnetic tape is a discrete, nonadditive, nonstationary random process, which is in contrast with the usual assumption that it is an additive stationary gaussian process.

SPECIAL APPLICATIONS

Systems approach, Mal Wolfe, *Indus. Phot.*, 17: 19-21, Oct. 1968.

The underwater photographer of tomorrow must be proficient in using and selecting the type of life-support system which will best facilitate his assignment and meet the pressing demands of visual communication quality and expertise.

Environmental design requirements, Dimitri Rebikoff, *Indus. Phot.*, 17: 22-24, 57-64, Oct. 1968.

The underwater environment demands proper engineering and design of photographic equipment to protect the diver and obtain optimum results.

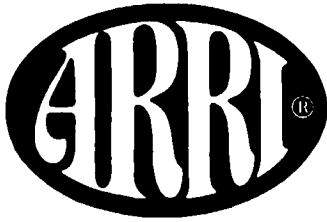
TELEVISION

Color television studio equipment and problems, F. G. Parker, *Radio and Electronic Eng.*, 36: 225-239, Oct. 1968.

The paper outlines the nature of a studio complex and the problems which arise from the introduction of color television beginning with those associated with the color separation signals. Special reference is made to the problems arising from the use of four-tube color cameras particularly from the point of view of monitoring their outputs as well as the methods of coding to ensure accurate color reproduction on commercial receivers. In a studio using the PAL system of color television certain extra pulses are required for use with the coders and the generation and distribution of these pulses is discussed.

The interchange of time and frequency in television displays, Adrianus Korpel, Seymour N. Lotsoff and Robert L. Whitman, *Proc. IEE*, 57: 160-170, Feb. 1969.

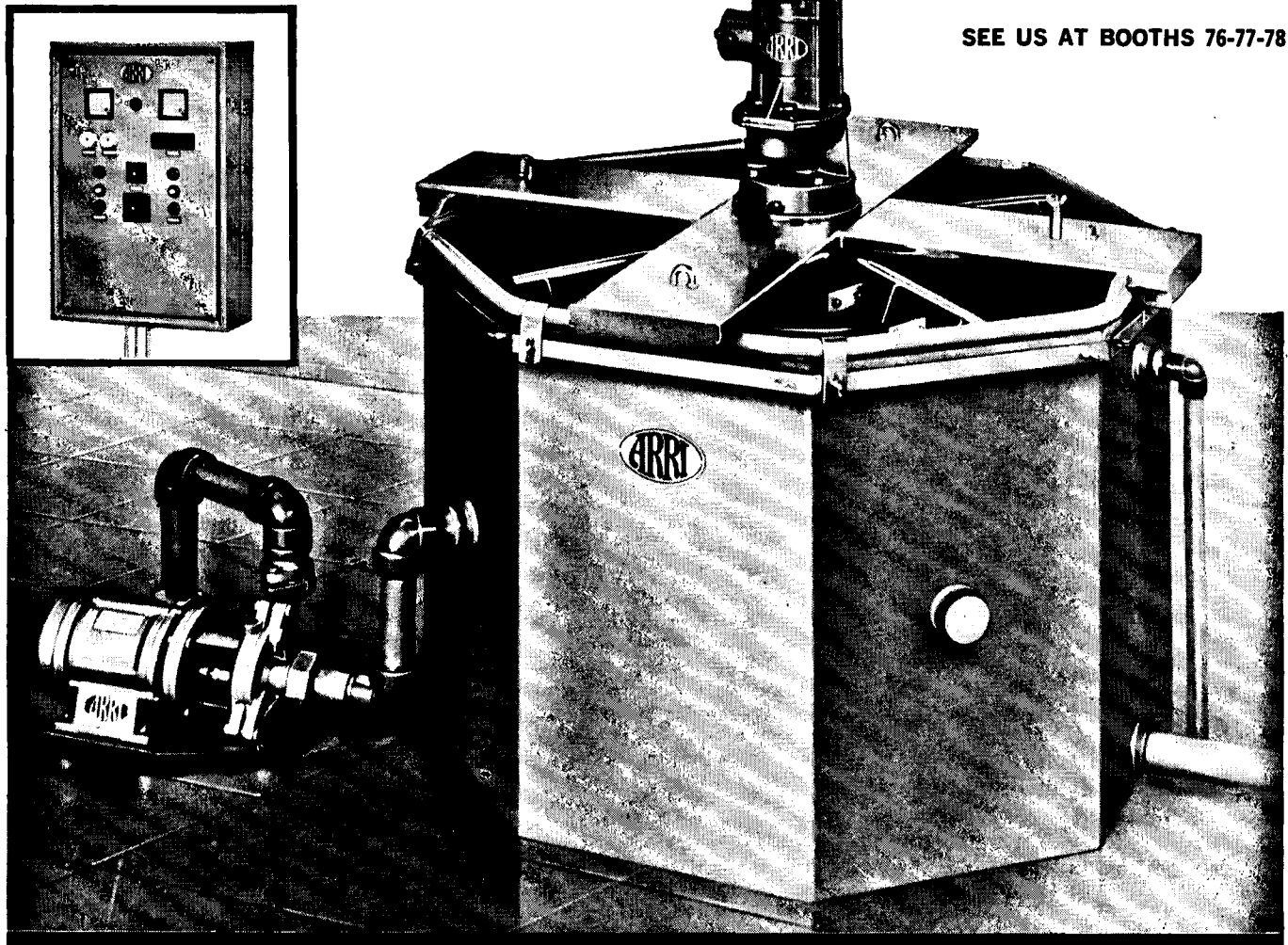
The paper discusses the properties of display systems using frequency rather than time coding of the individual image elements. Various coding techniques, all making use of a dispersive delay line, are com-



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50	50	2	21¾" 21¾"	27½" 15¾"	2943 sq. in.	13 sq. ft.	500 liters
100	100	2	25½" 25½"	35¾" 21¾"	4586 sq. in.	22 sq. ft.	1,000 liters

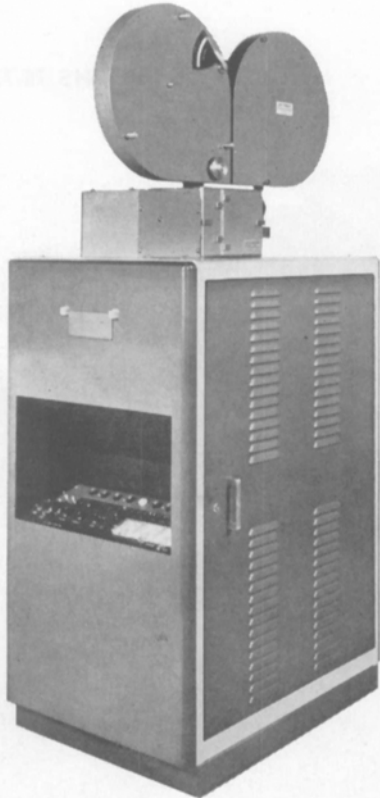
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pared by means of time-frequency diagrams showing the nature of the coding operation. A detailed analysis is given of one such technique used in conjunction with an acoustic light diffraction cell as the display device. Experimental results for this system are presented in the form of measured modulation transfer functions and photographs of standard television test patterns displayed with this technique.

Closed circuit in action, *Film User*, 22: 7-13, Dec. 1968.

Charles Rigby gives an in-depth description of some of the CCTV equipment currently in use in industry and business.

Summarized matrix system for making colorimetric calculations for color TV, S. V. Novakovsky, *Brit. Kinemat. Sound and Telev.*, 50: 286-289, Oct. 1968.

Color television is international and despite the differences between the NTSC, SECAM and PAL systems, much of the technology of modern television is applicable to all systems; this is particularly true of the color relationship between the responses of the color camera and the colors of red, green and blue phosphors used in shadow mask tubes. Although physicists have developed sophisticated color measurement systems for specifying colors, such as the international XYZ system of the CIE, such systems are not immediately applicable to the Red, Green and Blue system of color reproduction used in television. This paper sets out in an elegant mathematical form the steps in the calculations which are necessary to convert from the colorimetric systems of the physicist to the color signal system of the television engineer.

Ionospheric interference to television in Great Britain, L. W. Barclay, *Marconi Rev.*, 27: 254-264, Fourth Quarter 1968.

Long distance VHF propagation, and interference to British television services by distant stations, is possible via the ionosphere. Three possible modes are discussed in detail; these modes are supported by temperate latitude sporadic E ionization (E_s), auroral E_s , and F2 ionization. Of these, temperate latitude E_s , occurring during the day and evening in summer, is the most important. Auroral E_s occurs most often in the afternoon and at midnight during equinoctial months in the years of high sunspot number. Dense F2 ionization also occurs during these years. Although ionospheric considerations show that interference should be worst on Channel 1 and should decrease with increasing frequency, an analysis of reception reports indicates that Channel 3 is the worst affected because of the distribution of high powered stations in Europe.

Television bandwidth compression by contour approximation scheme, Nobuo Imai and Yoshikatsu Nakamura, *Jour. Radio Research Lab.*, 15: 165-185, May 1968.

In the television bandwidth compression system by contour approximation scheme, edge points are extracted from an original picture and then approximated by linear contour lines. This paper reports on the

computer simulation experiment carried out to investigate the bandwidth compression effect and the reproduced picture quality of the scheme.

The disturbing effect of the noise contained in an original picture was also investigated. The methods were examined in suppressing the noise disturbance, and subjective evaluation tests were performed to assess the quality of reproduced pictures.

Tolerances for PAL color television, R. D. A. Maurice, *Royal TV Soc. Jour.*, 12: 86-93, Winter 1968.

If color television is to be a success, some administrative means of guaranteeing satisfactory picture quality may have to be established. It is the purpose of this paper to suggest the basic engineering lines upon which an administrative superstructure could be built.

Adequate technical information is still lacking, but the major distortions that are introduced by equipment in the color television chain are known and the amounts that are tolerable are likewise known. Thus it is possible to establish overall tolerances which must not be exceeded if color picture quality is not to fall below a given subjective criterion. Having established overall tolerances, the next problem is to divide each overall tolerance among the various portions of the television chain. When this is done it becomes evident that various sections of the television chain would be restricted to tolerances which they cannot maintain. In other words, the arithmetic sums of the performance figures for the individual parts of the chain exceed the permissible overall tolerances. This means that either color television is impossible or one must admit that the overall tolerances will be exceeded from time to time.

It is fortunate that the errors in the parameters most likely to cause distortion of the color television picture vary statistically in a positive and a negative direction. Thus the arithmetic sum of all positive errors or of all negative errors is a statistically rare event and convolution of the errors contributed by the various parts of a television chain shows that overall tolerances will be exceeded for only small percentages of the time.

This paper gives some examples of a possible subdivision of the color television chain and of the results of convolution of errors.

Resolution limitations of electromagnetically focused image-intensifier tubes, I. P. Csorba, *RCA Rev.*, 30: 36-52, Mar. 1969.

The four major factors that limit resolution in electromagnetically focused cascaded image-intensifier tubes are electron-optical aberrations, the thickness of the interstage separator sheet, the phosphor screens, and (at low illumination levels) electron-fluctuation noise. For an image tube that has homogeneous axial magnetic and electric fields, the resolution of the electron image varies directly as the voltage and inversely as the distance between the phosphor screen and the photocathode. The thin phosphor-photocathode separator sheet, usually mica, and the phosphor screen also have resolution limits inversely proportional

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