magnetic recording and is the author of *Handbook of Magnetic Recording* and several technical papers. Additional information on the course is available from Danvik, 1201 Bel Air Dr., Santa Barbara, CA 93105.

Eastman Kodak Co. has opened a film and video marketing and technology center in Hollywood, Calif. The $3 million facility houses Kodak's sales and technical staff, and contains state-of-the-art analytical, densitometry, and sensitometry film laboratories and modern videotape testing equipment. There is also a 44-seat motion-picture screening room in the facility, along with a technical library and two auditorium-style seminar rooms.

According to spokesman William A. Koch, the new center preserves the historic building first purchased by George Eastman in 1927 to house the technical staff he sent from Rochester to deal with problems arising from the rapid shift from silent to sound motion pictures during the late 1920s. The marketing and technology center was literally constructed around this corporate landmark, Koch said.

Auditronics, Inc., a manufacturer of professional audio equipment, has acquired Tapecaster. The acquisition makes it possible for Auditronics to add Tapecaster's tape cartridge machine to its product base. The entire manufacturing operation of Tapecaster, originally based in Silver Spring, Md., was moved to a facility adjacent to the Auditronics headquarters in Memphis, Tenn.

Samuelson Group, Inc., a supplier of film, video, and AV production equipment, has recently acquired Victor Duncan, Inc., Irving, Tex., a firm with a similar product line. The acquisition represents an effort on the part of the Samuelson Group to expand its operations in the U.S. Samuelson Group, Inc., is located in Los Angeles, while the Victor Duncan management and staff will remain intact in Irving.

Fred Austin and Tom Johnston have been promoted, respectively, to executive vice-president, operations, and vice-president, production, Deluxe Laboratories, Inc., Hollywood, Calif. In his new position, Austin assumes responsibility over all phases of laboratory production at the firm. He joined Deluxe in 1959, and served as senior vice-president, operations, prior to the promotion. Johnston will supervise in the production area, reporting directly to Austin. Johnston joined Deluxe in 1955, and was formerly assistant vice-president, television.

Dennis Boxall has been elected president of the British Kinematograph, Sound and Television Society (BKSTS), headquartered in London, England. Boxall comes to the BKSTS from the education sector, currently serving as an assistant dean at Harrow College of Higher Education. Previously, he was head of the Photography and Film Unit of the Biological Research Dept. at Glaxo Laboratories. Boxall, who received a BKSTS Fellowship in 1970, has been instrumental in shaping the Society's education and training policy.

Charles P. Ginsburg, the former Ampex Corp. executive who in the 1950s headed an engineering team that developed the first commercially practical videotape recorder, has joined the consulting firm, AVP Communication, as a technical planning consultant. In his new association with AVP, Ginsburg will work with the firm's founder and managing partner, Bob Paulson, in providing technical advisory services to current and new manufacturer and end user clients. AVP is located in Westborough, Mass.

Book Review

Television Engineering Handbook

K. Blair Benson, editor-in-chief. McGraw-Hill Publishing Co., New York, N.Y., 1985. Illus., 1478 pp., hardcover, $89.50.

This long awaited updating of the familiar 1957 "Fink" version of the *Television Engineering Handbook* comprises the efforts of some 70 authors who have contributed their expertise, coordinated by Editor-in-Chief K. Blair Benson. This review examines the Handbook's evolution: the changes it has undergone in spanning the intervening years' technological advances while continuing to serve as a basic reference on the many branches of television's supporting sciences, arts, standards, and recommended practices.

The advances in television technology may be graphically symbolized by noting that eight new chapters, largely on specific advances in television hardware since 1957, have been added, while four subjects of a more fundamental nature are no longer given specific chapter coverage by title. That the new edition is half again as thick as its forerunner, even though the vacuum tubes in the illustrations have been replaced by transistors and integrated circuits, could be said to further symbolize the magnitude of these advances.

The new chapter titles are Cable and Satellite Home Distribution Systems, Broadcast Production Equipment Systems and Services, Video Tape Recording, Video Disc Recording and Reproduction, Film Transmission Systems and Equipment, Digital Television, Digital Video Effects, and Electronic Editing. The subjects losing chapter status are synchronization of scanning and color coding, video amplification and dc restoration, wideband RF and IF amplification, and wideband modulation and demodulation. They are adequately treated, however, mainly in chapters on receivers and broadcast equipment.

All other subjects in both editions fit roughly under 12 broad categories, all of which are updated and some of which are covered by several of the same authors (including, of course, Donald G. Fink) and variously grouped co-authors. The broad subject groups are properties of light, vision, photometry, color representation and reproduction, and optics; monochrome and color visual information transmission; video waveforms and spectra; wave propagation, radiation, and absorption; television transmitters and auxiliary equipment; transmitting antennas, transmission lines, and radiators; electron optics, scanning, deflection, and color registration; photosensitive camera tubes and devices, camera chains, and color terminal equipment; cathode-ray devices, monochrome and color image displays; television receivers; television standards and recommended practices; and reference data, numbers, equations, and definitions.

Cable and Satellite Home Distribution Systems

The first of the new technology chapters, Cable and Satellite Home Distribution Systems, was written by D. Stevens McVoy, Coaxial Communication Corp., and Joseph L. Stern, Stern Telecommunications Corp., with contributions from others. It reports on an industry that had its beginning as the first edition of the Handbook was being written in the early 1950s, and which in 1986 is serving over 45 million subscribers, or 52% of television households.

The elements of CATV systems (head ends, trunk systems, neighborhood distribution systems, and subscriber drops) are covered in depth as is subscriber-premises equipment (converters and descramblers). Bidirectional systems and regional interconnections for cost-effective sharing of services via microwave amplitude-modulated links (AML) are de-

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scribed. The chapter concludes with a technical discussion of parameters affecting the carrier-to-noise ratio and other picture-quality-determining factors in home reception of direct-broadcast satellite (DBS) transmissions.

Broadcast Production Equipment and Services

The eight sections on relatively new technology do not deal just with advanced "high tech" items — optical videodisc recording, digital video effects, electronic editing, and the like. For example, the chapter on broadcast production equipment and services contains expanded sections that deal with behind-the-scenes items that, all too often, are not assessed at their true relative importance.

These include communications systems without which a successful broadcast operation, involving split-second coordination of events among scores of technical and production people, would be totally unable to function. Control room design and layout is, likewise, considered *sine qua non* in a television production facility, and a section is devoted to the personnel requirements and layout considerations that allow the director, audio operator, technical director, and production assistants to intercommunicate.

Architectural aspects of noise control, room illumination, air conditioning, room acoustics, and control room windows are considered, relative to the primary function of a control room and interrelated adjunct control rooms — announce booths, edit rooms, video control rooms, audio control rooms, and master control rooms. This chapter was authored by consultant Blair Benson; Bruce Rayner, Grass Valley Group; Frederick M. Remley, University of Michigan; and Joseph Roizen, Telegen, with contributions by 11 other authorities.

Videotape Recording

Videotape recording, then in its infancy, did not make it to press in Fink's 1957 Handbook. This new and sizeable chapter in the Benson edition, as expected, gives a thorough and practical treatment of the technology, starting with the principles of the recording process itself and bringing in the theoretical aspects of magnetism and interrelationship of units downstream in the chapter — a natural presentation that is easier to relate to than the academic treatises prevailing in college texts during magnetic video recording's coming of age. A team of authorities, headed by Charles P. Ginsburg, Ampex Corp., discusses the respective subsets of the video recording art, each according to his expertise.

The chapter thoroughly treats the recording and reproduction process, magnetic materials and tapes, head design, recording formats (including cassette recorders), FM signal processing, time-base

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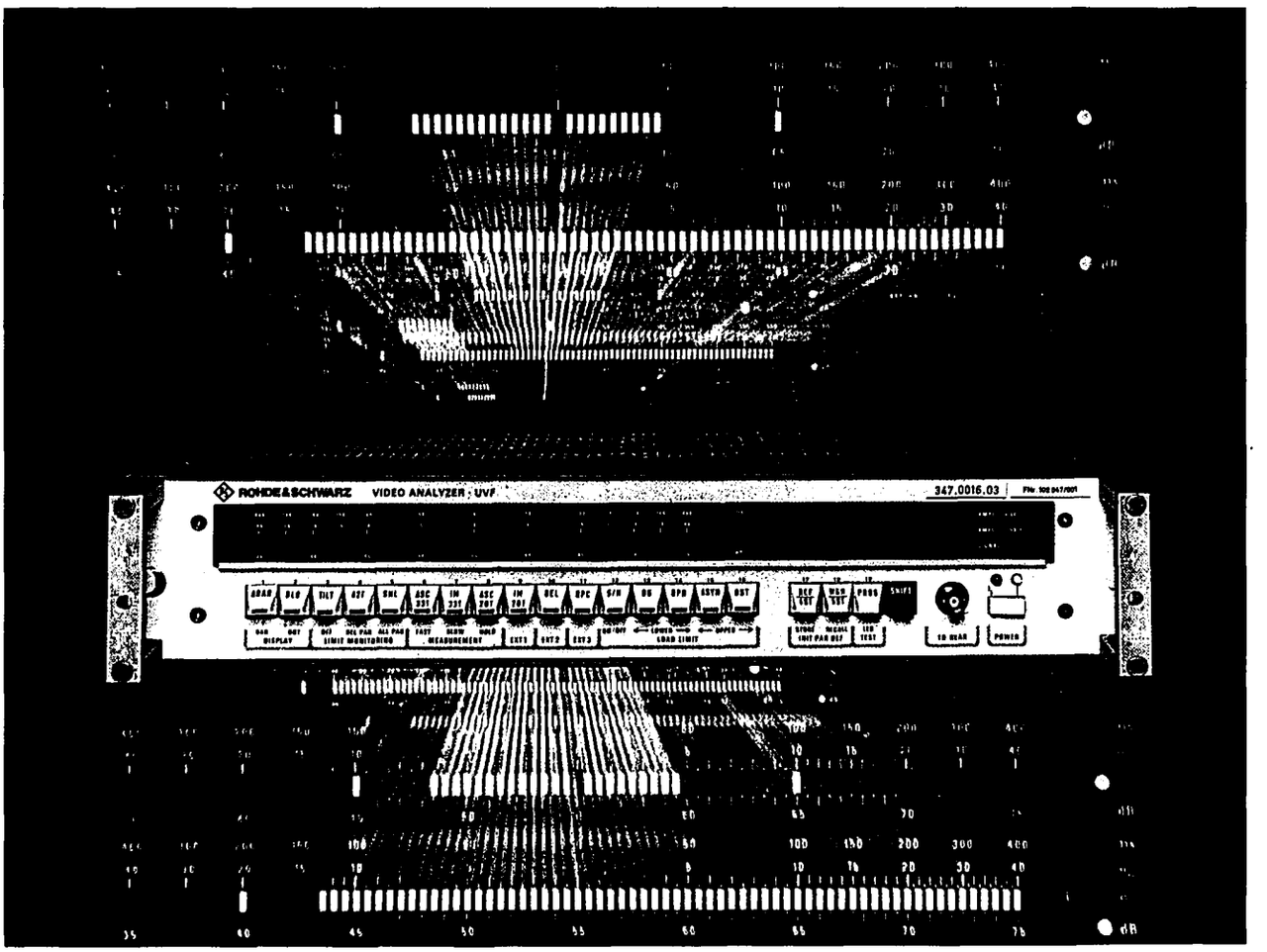

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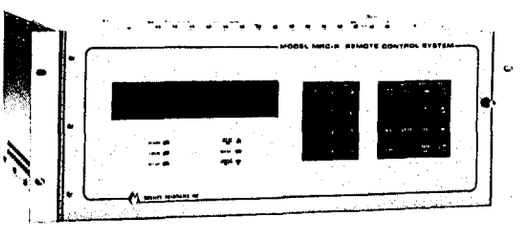

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and velocity-error correction, and dropout compensation. On the mechanical end, there are scanners and servo systems of all types, including dynamic tracking for nonstandard playback speeds. Audio formats, equalization, and distortions are given their due, along with electronic and time-code editing methods.

Videodisc Technology

Videodisc technology is covered in the next new chapter, by Robert A. Castrignano, CBS Technology Center. It treats various photographic, mechanical stylus-and-groove, and capacitive stylus-and-groove (also stylus-and-grooveless) systems historically, along with the optical-reflective or transmissive systems that are enjoying increasing success in the burgeoning computer and data storage industries, but as yet are in relative infancy in television. The magnetic disc devices, presently used by broadcasters for slow-motion and instant replay of sports events, and usually limited to 30 sec, are not included.

The chapter surveys recording methods, including laser and electron-beam techniques, and replicating methods of the many disc technologies. The direct-read-after-write (DRAW) types are described, along with developmental work on erasable and rerecordable discs.

Film Transmission Systems

The new chapter on time-honored film transmission systems is introduced by Anthony H. Lind, now retired from RCA. The systems are presented all in one chapter, rather than in various locations according to the type of electronic pickup, as in the Fink edition. The three presently used film scanners — projector-camera, flying-spot scanner, and charge-coupled device (CCD) scanner — are given separate sections after classical dissertations on the intricacies of 2-3 pulldown in intermittent-motion film transports and jump-scan techniques for continuous-motion transports, often used with flying-spot scanners.

The inverse process, television film recording, is stated by Benson and Kenneth G. Lisk, Eastman Kodak Co. (retired), to have been a growing activity despite the now ubiquitous videotape media in both broadcast and home video systems. The continuing need for film records has increased because of the convenience of direct viewing by optical projection and television viewability on any transmission standard without requiring scan conversion.

Again, historical efforts are traced, from a beginning in 1927, when a process called Phonovision was developed to record a crude 30-line television picture at 12.5 frames/sec on a mechanical phonograph disc, to the kinescope recordings that were used commercially in the early days of monochrome television. These were supplanted by videotape methods before the use of trinoscope recordings on color film could become widespread.

The kine recording mechanism is described, whereby every fifth half-field of the television picture is deleted in concept, if not practice, by a 72°, 1440-rpm shutter during film pulldown, giving rise to the familiar midframe image-splice problem in alternate film frame.

Laser-beam and electron-beam film recording systems are described, in addition to the well-known CRT methods. The laser beam is mechanically deflected, vertically by a recording mirror galvanometer and horizontally by a poly-faceted mirror. Acousto-optic light modulators separately modulate the *R*, *G*, and *B* recording beams.

The electron-beam film recorder, requiring that the film be enclosed in a vacuum chamber, could achieve remarkably high resolution. One such 4000-line system was used for producing video-generated special effects by sequentially recording *RGB* color separation images on black-and-white film from a video processing converter in off-line operation. The three color-sequential separation

master frames were then sequentially step-printed onto corresponding single frames of a color film for release.

The film system chapter concludes with a section on exposure and sensitometric consideration of films for television.

Digital Television

Ernest J. Tarnai, Bell-Northern Research, Ltd., author of the digital television chapter, covers the fundamentals of analog-to-digital and digital-to-analog conversion, error management, and coding schemes. An introduction to components of digital television systems is presented, treating items such as digital filtering, transform theory (with references to further mathematical works), and high-speed semiconductor hardware suitable for digital video. A final section gives well-known applications of digital technology — digital video sources such as test-signal generators, time-base correctors, frame synchronizers, special effects generators, and standards converters. Digital videotape and videodisc developments by various engineering and standards groups are referenced.

Digital Video Effects

The field of digital video effects is sufficiently well developed that a separate chapter, by Alistair Cockburn, IBM, and Carl Ellison, Evans and Sutherland, has been included. It provides a practical, hardware-oriented expansion on the basics of digital effects generators (frame and line buffer stores, color mapping, gamma correction) and introduces concepts of boundary and area systems.

Boundary systems work with the outlines of objects, for which image planes, animation, and use of equipment such as character generators are discussed. Area systems, on the other hand, are concerned with coloring and texturing within a shape. Examples are paint systems, squeeze and zoom generators, and digital frame-manipulating systems.

An excellent tutorial section on filtering and aliasing provides a helpful way of looking at the resolution limits and aliasing problems posed by the sampling operation (line structure) in the spatial domain vertically, and also in the time domain, by the television raster process. It explains the Whittaker-Shannon sampling theorem, involving the well-known Nyquist limit, which when exceeded, is a cause of the spurious aliasing so often noticeable in fine-detailed camera signals.

I would suggest that such information-theory approaches obviate the need for the Kell factor discussion in another chapter, which becomes involved in definitions of such things as resolution element widths, raster pitch distances, and ultimate resolution elements. The new edition duly updates a chart on resolution elements to show the comparative number (730,000) for the provisional HDTV standard versus the NTSC resolution elements per raster (150,000), retaining the discussion on this approach for those who may find it useful or, perhaps, of historical interest.

The chapter continues with a section on input signal-processing techniques, mentioning two classes of inputs. The first, valuators, includes transducers of various types, which may be one-dimensional: slides, levers, or potentiometers; two-dimensional: track balls, joysticks, or light pens; or *n*-dimensional (usually limited to three): using pressure-sensitive or rotation-responding devices mounted on two-dimensional valuators. The representations of input quantities (position, speed, time, color, for example) are endless.

The other input involves analog time-domain signals, as from a camera. In preparation for effects work, the input signal is digitized and processed to reduce noise and dropouts and to facilitate rotation and scaling. Camera compensation is used by inputting a blank white field from which a multiplying factor is stored for each sample point in the grid, thereby neutralizing camera blemishes or shading defects. Edge enhancement is applied, by subtracting the Laplacian, or second derivative, of the signal in the X and Y directions from the main signal. Noise reduc-

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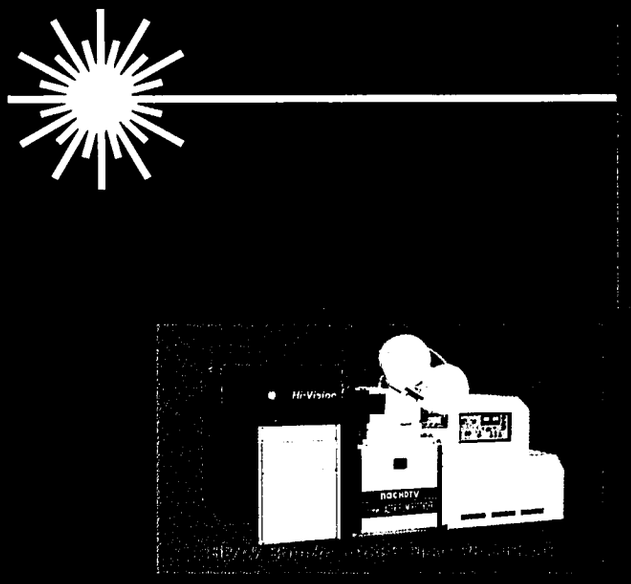

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tion is accomplished by sampling to greater precision than required in the output signal, and limiting the output range to those corresponding values between floor and ceiling levels of the input signal, established by clipping.

The final section on digital video effects describes the spatial and temporal data-reduction techniques that are used to process edges in a real-time frame buffer. Techniques of run length and area encoding, vertex coordinate storage, and adjacent pixel direction encoding according to the most probable extension of a boundary are described, along with techniques such as Huffman encoding for accomplishing them.

Temporal data reduction takes advantage of the great redundancy between frames where relatively few parts of the picture are in motion. Various schemes, some using valuator-related data, are discussed.

Electronic Editing

Electronic Editing is the final chapter not having a counterpart in the Fink edition. Written by Richard J. Caldwell, TVC Video, Inc., its nine sections cover evolution of videotape editing, SMPTE/ANSI time code, computer technology, tape and switcher equipment control, editing programs, displays and controls, edit decision lists, assembly techniques, and editing trends.

The section on editing trends describes a novel approach to the problem of tracking the visible frame numbers on 24 frame/sec motion-picture film with the electrically recorded 30 frame/sec videotape time code. Known as Datakode magnetic control surface, the process magnetically records editing time code, edge numbers, and other cueing information on an essentially transparent (optical density = 0.15) gamma ferric oxide layer only 8 μm thick. With this process, a fixed relationship exists between the film numbers and the time code, whether the time code is precoded or recorded during exposure of the film.

Standards and Recommended Practices

Even the very limited sampling of items used in writing this review could not properly omit the chapter on standards and recommended practices, compiled and written by Dalton H. Pritchard, RCA Laboratories. It provides a working reference for both broadcasters and television engineers.

Broadcasters will find a useful chart listing all U.S. cities to which any of television Channels 2 through 69 have been assigned. Another chart lists the broadcast standards used in various countries worldwide.

Engineers are given ready references to signal generating, transmission, and performance standards, synchronizing waveforms for NTSC color transmissions, and the associated EIA tentative standard RS170A, which details the four differing color fields that comprise one color frame. Details of the PAL and SECAM standards are given, with a discussion of their similarities to and differences from NTSC. SMPTE color bar, multi-burst, VITS, and VIR signals are detailed. Five well-known EIA camera alignment charts are described, plus three relatively new additions: a multi-burst chart, for indicating the square-wave MTF of a camera chain; a white pulse chart, for adjusting enhancement equipment; and a color calibration chart, containing the NTSC primaries *R, G,* and *B* and their complements *Cy, Mg,* and *Yl,* which fall within the tolerance boxes of a vectorscope display for a properly adjusted camera system.

Equipment standards are given for visual and aural transmitters, and receiver radiation allowances in accordance with FCC regulations. Important examples of CCIR, EIA, JEDEC, SMPTE, and EBU standards and publications are also listed.

Reference Data and Equations

A final chapter, edited by Donald Fink, on reference data and equations, completes this engineer's bible, with sections on radio frequency, video frequency, and visual data.

— Raymond Hallows