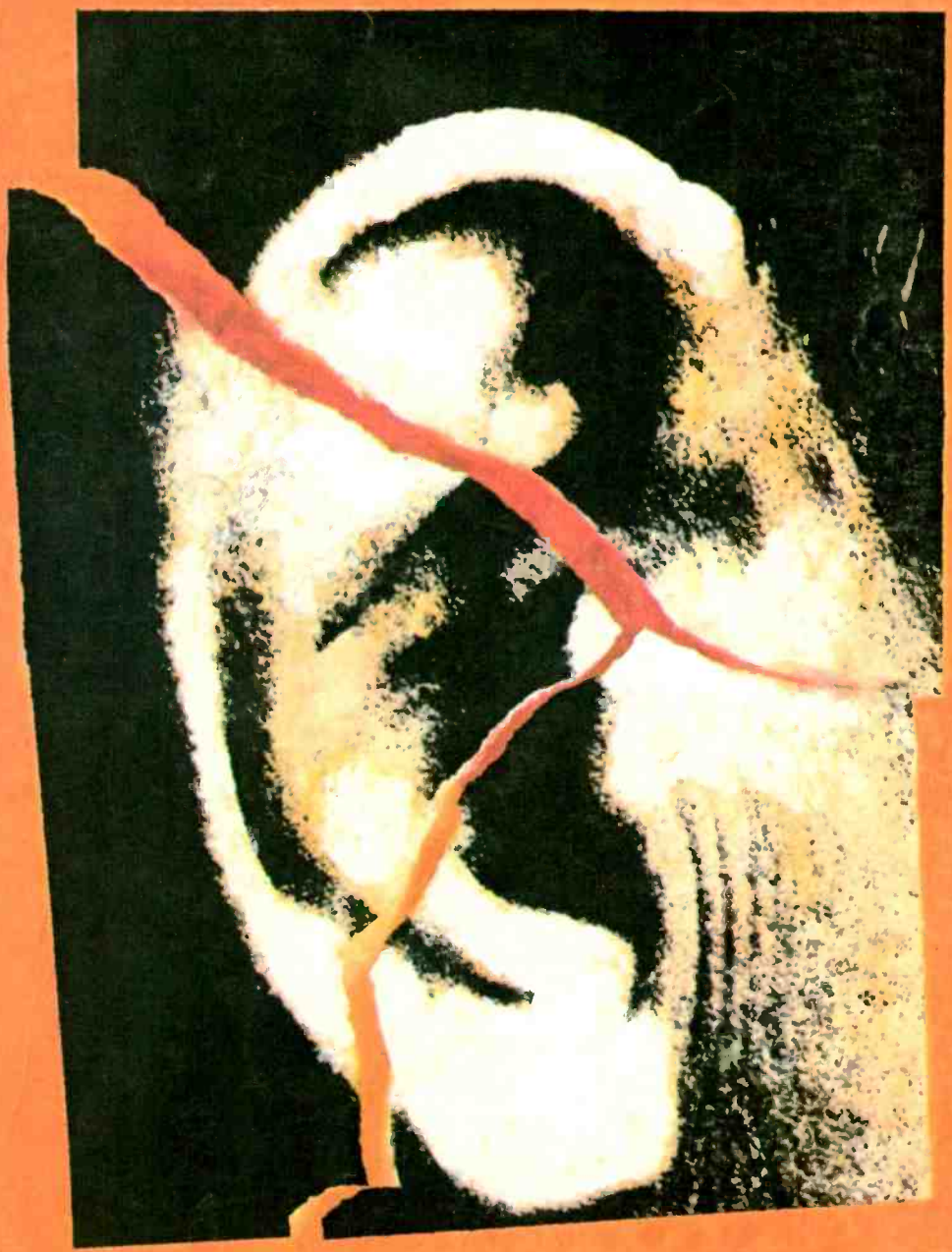
OCTOBER 1975

BM/E

BROADCAST MANAGEMENT/ENGINEERING



Don't turn off listeners with fractured sound.

The whole point of ENG is the point of the Sony U-matic format.

Fast, easy, economical *news gathering.*
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That's the whole point of Sony's ¾" U-matic® videocassette equipment.

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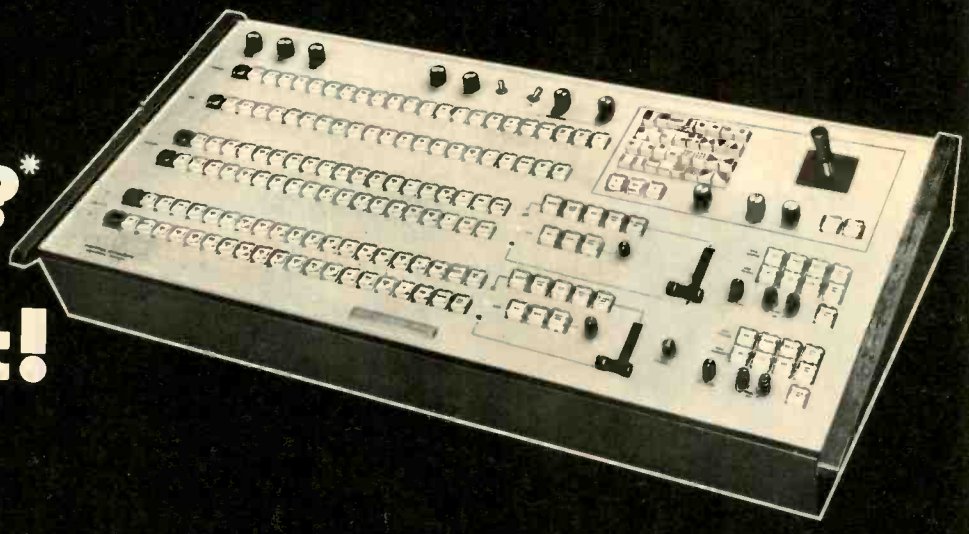

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When you need a "Big" Video Production Switcher there are only a few manufacturers who make them. You've been accustomed to a "Big" delivery (6 months and longer), and at a "Big" price.

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Here's how it is NOW!

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BM/E
BROADCAST MANAGEMENT/ENGINEERING

You can sound louder but is that what you want? It's easy to distort your signal and drive listeners away, as Riley and Klein explain on page 28.

BROADBAND INFORMATION SERVICES, INC.
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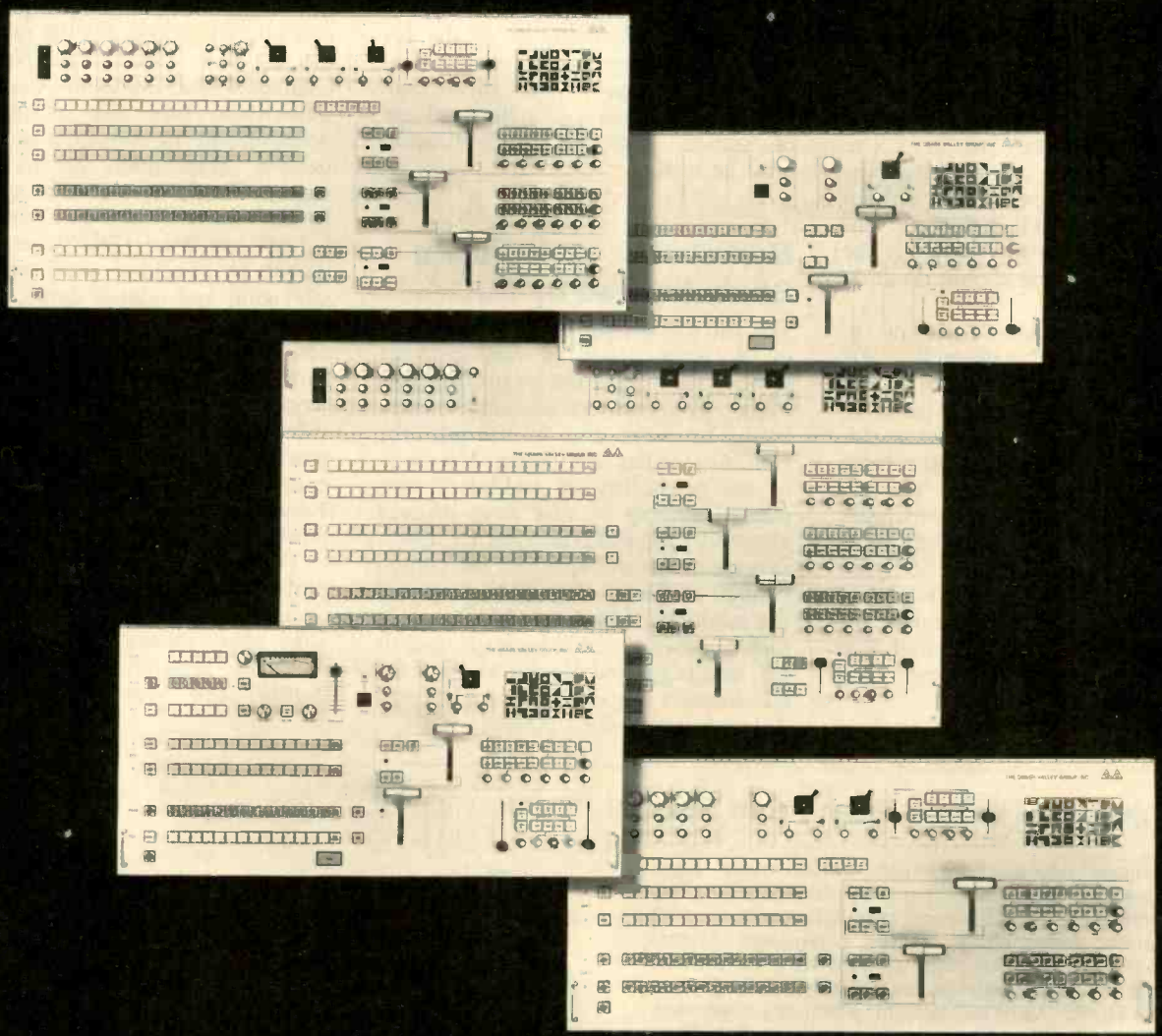

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BROADCAST INDUSTRY NEWS

FCC Issues Rules For Sponsor Identification

Recent changes in the law covering the requirements for identification of commercial broadcasts and cablecasts are reflected in a comprehensive set of rules issued by the FCC in a Public Notice dated September 3rd, 1975. The notice was sent to all broadcast licensees. Any broadcaster who did not get his copy should ask for one immediately; and if he did not study the notice thoroughly, he should do so at his first opportunity.

The relevant sections of the law are quoted, including the new section 508 which requires disclosure to the station management of any payments (or gifts) to an *employee* of a station to secure broadcast of any material (a direct blow at "payola" in all its forms). The station would then have the responsibility of disclosing the "consideration" to its listeners. The notice includes 36 hypothetical cases which attempt to clarify the situations in which a sponsor announcement is, or is not, required. It is dangerous to summarize these; they must be studied in detail.

Two broad principles that emerge, however, are that the giving of a product for normal use in a broadcast (a refrigerator at the back of a kitchen scene) will not require an announcement; but if the qualities of the refrigerator are emphasized in the program; or if the manufacturer gives *four* refrigerators, three for the personal use of station personnel, identification must be made.

Markets For VHF Drop-In Study Defined by FCC

The 100 markets the FCC will consider in its current study of VHF drop-ins (Docket 20418) are the 100 top markets of the 1974 American Research Bureau listing by prime-time households, the Commission has announced. The study of the possibility of making a substantial number of VHF drop-ins was opened by the FCC on April 15, 1975, in response to an inquiry by the United Church of Christ. The UCC proposed the addition of as many VHF assignments as were technologically practical, and suggested careful study of the 62 channels proposed by the Office of Telecommunications Policy.

TV Academy Expands Educational Program

Entering its fourth year of presenting educational courses for the public and the television industry, the New York Chapter of the National Academy of Television Arts and Sciences announced late in August a greatly expanded "curriculum" for the 1975-76 season. The 33 courses to be sponsored by the Academy at New York's New School, on West 12th Street, will be taught by working professionals in television and related fields. Subjects range from television production crafts and directing, through writing, performing, post-production, camera work, news, children's programs, videotape post-production, network production, and many others. Many courses include "hands-on" practice in New York television stations and video production houses.

There will also be six courses given at the Academy itself on such subjects as auditioning for TV commercials, soap opera techniques, etc. Inquiries about the program should go to Jeff Satkin, 110 West 57th St., NYC

continued on page 8

Projection TV Gets Push From Several Firms

Projection television receivers, which have been around for a long time, primarily as classroom aids, are beginning to invade the consumer market as a result of expanded sales efforts of two companies. Muntz-Markoff Theatrevision, Inc., opened New York showrooms and offices for large-scale distribution in the East of the Muntz "Mark 50" system, which has been sold, mainly on the West Coast, for about a year. The "Mark 50" uses a special Trinitron tube, plus a within-the-cabinet optical system to put the picture on a 50-inch wide screen. Retail prices are from $1695 to $1895.

The Advent Corporation of Cambridge, Mass., makers of a system that beams the picture across the room to a screen about 5' by 4', is reported to be selling its entire current production of about 60 units a week. Advent recently appointed Cramer Electronics as its first franchised dealer in the Boston area. "Suggested" retail prices of the Advent system are $3695 for the consumer model and $3995 for the commercial model, which has remote control.

Sony, which has an industrial projection system the VPP 2000, will soon replace that model with a KPKV 4000, a unit designed for the home market. As we go to press, Projection Systems Inc. announced that it will reveal a new system suitable for the home market in late September.

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Delivers Top-Level Broadcast Technology At A Surprisingly Affordable Price

To find another color studio camera as good as our FP1212, you'd have to go into a much higher price class.

We know that's a big claim. But who else offers you a professional color camera with three 1" Plumbicon tubes for **less than $20,000**?

Who but HITACHI?

The FP1212 features all the built-in refinements you'd normally expect in cameras costing nearly twice as much:

- Bias light on all three tubes for low lag.
- Electronic color temperature control.
- Rotary neutral density filter wheel in camera head.
- High gain switch. (6dB)
- Full I & Q encoder.
- Horizontal Aperture Correction (External vertical aperture correction optional for $1,400 extra.)
- RS-170 Sync.
- Color bar generator.
- Remote and local registration with switchable negative green.
- Cable Compensation Length (up to 900 feet.)
- 5" electronic viewfinder with hood.
- Standard lens in an f/2.5 Fujinon zoom lens (16-160mm), featuring rear cable control and auto iris with manual override at CCU. Optional F/1.8 E.B.C. lens also available, as well as f/1.8 14:1 zoom lens (29.5 to 415mm).

There are over 1200 Hitachi Shibaden color cameras performing in video installations throughout the country today. For more information or a demonstration, please write to us or contact your local authorized Hitachi Shibaden dealer.

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10019, tel. 212-765-2450.

SMPTE, USC & West Coast Academy Plan Fall Seminar

On the West Coast the Hollywood chapter of the National Academy of Television Arts and Sciences is working jointly with the Society of Motion Picture and Television Engineers and the University of Southern California to present a fall seminar with the general title "Electronic Photography Today: Techniques and Technology."

The classes will be held every Wednesday night from September 17, 1975 through January 21, 1976. The sessions will have such topics as: New Developments in Video Cameras; Tour of a Contemporary Facility; Newest in Broadcast Videotape Recorders; Film and Helical to Quad Transfers; Electronic Animation; Electronic Journalism; Tape-to-Film Conversion; and many more. Lecturers will be industry executives—nearly 100 had signed up by mid-August to teach in the course. For information: call 213-746-2235 (USC).

RCA, CVS, Angenieux Aid US-Soviet Space Show

Television coverage of the Apollo-Soyuz link-up was boosted by equipment and services from a number of American broadcast equipment makers and communications services.

RCA provided the US portion of all overseas television links; and also handled the international portions of television between the Johnson Space Center, in Houston, and Moscow, used by the Soviet television broadcasters. Voice commentary travelled from the recovery ship to New York via RCA Globcom's domestic satellite service.

Angenieux TV lenses were in both the Apollo and the Soyuz spacecraft. And four Consolidated Video Systems Model 600 synchronizers speeded the live television coverage and TV recording of transmissions from Apollo and from Russia, via satellite.

AES Sets Full Program For Fall NY Meeting

In an enlarged program of technical sessions, the Audio Engineering Society will cover just about every aspect of current audio technology during the 52nd Convention, at the Waldorf-Astoria Hotel, New York, October 31-November 3. Disc recording, magnetic recording, instrumentation, electronic music, sound reinforcement, video disc systems, architectural acoustics, are some of the topics that will get extended treatment. Especially interesting to broadcasters should be sessions on signal processing (Oct. 31, 2 pm), audio in broadcasting, with BM/E's editor, James A. Lippke, as moderator (Oct. 31, 7 pm), electronic music (Nov. 1, 2 pm) and compressors/expanders, (Nov. 1, 9 am).

Also attractive is the promise of a special session, November 1 at 7 and 9:30 pm, titled "Those Magnificent Men and Their Music Machines," billed as an audio/visual tour through the history of electronic music.

The advance sale of exhibit space, the Society says, indicates that a number of new exhibitors will be added to the old for the largest product show in the Society's history.

Report Says CATV Industry Making Recovery

A recent report called "New Trends in Cable Television" claims that the cable television industry is making a strong recovery after facing high interest costs, inflation, regulatory delays, and increased competition for the con-

continued on page 10

INNOVATIONS in coaxial cables

guarantees mechanical and electrical performance.

The choice is yours at Cablewave Systems . . . 0.180" to 3⅛" outer conductors of smooth wall aluminum or corrugated copper; dielectric insulators of air (extruded spiral polyethylene or special helix designs), foam polyethylene center, conductors of copper or copper clad aluminum . . . each engineered to excel in its area of application whether it be phasing lines for broadcasting, microwave antenna feeders, or delay line applications and each with a full range of connectors and accessories.

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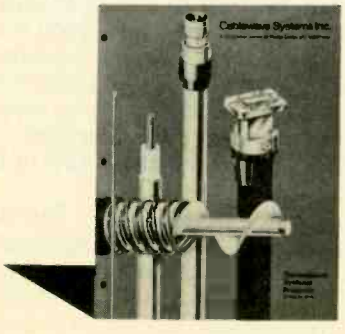

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Cablewave Systems Inc.

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NEWS

sumer's dollar. New growth, however, will be in selected areas, and under the direction of more judicious marketing and management, thus producing a ''leaner, but more healthy'' industry.

Issued by ComQuest Corp., an independent information services firm that specializes in the field of communications, the report provides a comprehensive assessment of the current status of the industry and future trends.

According to the report, most CATV operators have increased both subscriber density (subscribers per mile of cable) and revenues. More than $6 billion in construction is planned by the industry in the next decade and by 1984 core construction of CATV systems in most U.S. cities will be completed.

The report is available for $375. For more information, contact ComQuest Corp., 1000 Elwell Court, Palo Alto, CA 94303; 415-969-4040.

TV, Pay Cable, Nearing Big Use of Domestic Satellites

Activity leading to wide use of satellites for domestic transmission of both broadcast TV and pay cable is expanding rapidly, with the first actual use by broadcast TV occurring early last August. This premier ''domsat'' TV hop carried a Milwaukee Brewers-Texas Rangers baseball game, played in Milwaukee County Stadium, to viewers in the Dallas-Ft. Worth area via KXAS-TV, Ft. Worth. To get from Milwaukee to Ft. Worth the signals went by microwave relay (Midwestern Relay Co.) to Chicago, were there beamed by Western Union to the Westar satellite, came back to earth at the WU ground station in Dallas, and then went by AT&T to KXAS.

Plans for pay cable's use of satellites on a large scale advanced with agreements between TelePrompTer and Home Box Office, and between TelePrompTer and Scientific-Atlanta. The first is for HBO's supplying its subscription programs to TPT in 20 states. The second is for the construction of 24 earth stations for TPT by Scientific-Atlanta. When all the earth stations are installed, TPT will be able to supply HBO programs, via satellite, to 870,000 subscribers, about 82% of the total.

In another development, Scientific-Atlanta announced an agreement with Transcommunications Corp., of Greenwich, Conn., under which TCC will give advisory services to Scientific-Atlanta on the application of satel-

continued on page 12

AKAI RELIEVES BACK PAIN.

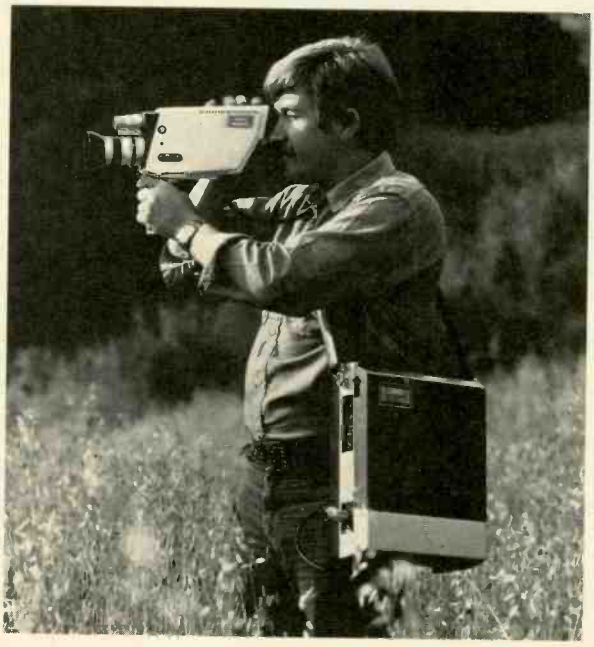
One of the common discomforts due to excessive videotaping is back pain.

Lugging around those 35 and 40 pound VTRs through crowds, down stairways, up stairways, up hills, steep hills.

Well, no more. Akai has a remedy—our new VTS-150B we call the Hustler.

The Hustler doesn't weigh 35 or 40 pounds like other recording units. It doesn't weigh half that.

In fact, it doesn't even need to go on your back.



The Hustler is a 16 pound color videotape recorder you sling over your shoulder, and a 6 pound color camera you can carry in one hand.

No wonder 63 TV stations are now using our little Hustler.

The lightweight, two-piece, one-man operation that isn't a pain in the back—or anyplace else.

AKAI™

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lite earth station transmitters, receivers, and related equipment for cable systems.

RCA announced awarding of contracts totalling about $9.7 million for earth station equipment in the RCA Satcom system, which will supply domestic satellite service nationwide. The first of RCA's satellites will go up this coming winter.

On the non-profit front, the Public Service Satellite Consortium, an alliance of organizations in health care, education and other public service areas, is expanding personnel and facilities for its push to foster direct communication, via satellite, to rural and urban schools, hospitals and community centers. PSSC Chairman H. Rex Lee, former FCC Commissioner, announced several new assignments to the board of directors.

The advance of satellites stirred one warning voice: the National Association of Broadcasters said that direct satellite-to-home broadcasts would be likely to destroy "the world's best system of localized service." Besides the loss of local news, weather, political discussion, advertising, etc., there would be the threat of central control of communications, the NAB said.

New Video Company Formed

Video-Optics, Inc., a new company organized to develop and manufacture video and electro-optic hardware, has been founded by R.R. Madison and James K. Fadely. Video-Optics first video product is a monochrome TV camera designed to fill a special need in the low light level camera field.

Video-Optics is located at 1916 Old Middlefield Wy., Mountain View, CA 94043; tel. 415-965-4298.

Cetec To Acquire Schafer Electronics

Cetec Corporation recently announced an agreement in principle for the outright purchase of Schafer Electronics Corporation of Santa Barbara, Calif.

With the acquisition of Schafer, Cetec will have five divisions or subsidiaries serving the broadcast and communications markets. Cetec's other holdings are Sparta Electronics, Jampro Antenna and Vega Electronics.

James M. Cunningham, president and general manager of Schafer at the time of the announcement, will retire from both positions but will continue to serve Schafer in a consulting capacity. No other changes in Schafer management positions are anticipated.

Spectra Data Forms New Division

Spectra Data, Inc., Northridge, Calif., a manufacturer of high speed signal processing computers, systems and peripheral equipment, has entered the automated computer controlled broadcast systems industry, through the formation of the Spectra Automation Division.

The Spectra Data broadcast system will utilize software and instant programming techniques similar to the Cybrix computer controlled system. In addition, the new Spectra hardware has been designed to be field compatible with the Cybrix system.

Harris Wins Largest Radio Order Ever

The Republic of Indonesia has signed a $20 million agreement with Harris Corporation for a nationwide radio broadcasting system, which the company believes to be the largest order for radio equipment ever placed with any manufacturer.

The contract calls for Harris to supply transmitters, antenna towers

and related equipment at 36 separate sites along Indonesia's 3,000 island chain, which includes Java, Sumatra and portions of Borneo and New Guinea. The transmitters will be standard Harris 50,000 and 10,000-watt units that are already widely used in the U.S. and overseas.

"Hands Across US" Bicent Idea Aired On WBBM

A novel idea for making millions of Americans participants in the Bicentennial celebration got its first public exposure recently on Chicago's WBBM. Under the heading "Hands Across the Nation," Chicago attorney Marvin J. Rosenblum proposed that there be a line of people stretching from coast to coast, who on a signal would join hands for 10 or 15 minutes.

Rosenblum has figured that it would take four to five million people, standing about four feet apart, and would require an enormous organizational effort. But Rosenblum says it could be done. The idea was quickly picked up by TV and radio network news programs and newspaper columnists in Chicago and elsewhere.

HEW Gives $12 Million To Educational Broadcasters

The Department of Health, Education and Welfare recently has made 62 grants, totalling $12 million, to noncommercial organizations to build or improve radio or television stations, according to an HEW announcement.

Made under the Educational Broadcasters Facilities Program, the grants bring the total to 556 grants, and $106 million, since the inception of the program in 1962.

The full list of the latest grants is available from HEW, Office of Education, Wash. D.C.; tel. 202-245-8084.

NAB Asks Kissinger To Aid In Canadian Dispute

The top officials of the National Association of Broadcasters have asked the U.S. Secretary of State to help American advertisers resolve problems in reaching Canadians through American radio and television stations with signals crossing the border. In a letter to Kissinger, Board Chairman Wilson C. Wearn and President Vincent Wasilewski point out that Canadian cable systems, with the encouragement of the Government, are deleting American ads from American programs they pick up and are substituting Canadian ads.

In addition, there is Canadian legislation proposed that would deny business deductions for Canadian firms that advertise through American stations.

continued on page 15

HARRIS LEADS THE WAY . . . AGAIN

THE WORLD'S FIRST FCC TYPE ACCEPTED 100% SOLID-STATE AM BROADCAST TRANSMITTER!

over 60 sold since '75 NAB

From the power amplifier/modulator to the oscillator and audio driver, the one-kilowatt MW-1 is *totally transistorized*, for the ultimate in performance and reliability!!

Another first—the Progressive Series Modulator (PSM)* is brand new, combining the operating simplicity of conventional series modulation with greatly increased modulator efficiency. Overall transmitter efficiency is greater than 50%!

Add to this a 125% positive peak modulation capability, and you have the most exciting, broadcaster-oriented AM transmitter to be introduced in many years.

MW-1, from Harris—the pioneers with Direct Carrier Frequency Modulation, with the Pulse Duration Modulator, with IF Modulation . . . and now with total solid-state design and PSM.

For more information write Harris Corporation, Broadcast Products Division, 123 Hampshire Street, Quincy, Illinois 62301.

*Patent Pending

HARRIS

COMMUNICATIONS AND INFORMATION HANDLING

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Calling these activities "grossly unfair," Wearn and Waslewski have asked the Secretary of State to intervene with the Canadian government.

NCTA, NAB Exchange Fire Over Leapfrog Rules

In another heavy skirmish of the broadcast-vs-cable campaign, the National Association of Broadcasters and the National Cable Television Association issued drastically opposed statements on the FCC's "leapfrogging" rules. These rules put restrictions on the distant signals a cable operator may "import," in particular, requiring that if he chooses a program from an independent station in one of the 25 top markets, he must take it from one or both of the two nearest of the 25 top markets.

NCTA's statement argues that this has been strongly counter-productive in restricting or stopping the development of cable television in certain areas, with new cable systems being concentrated in areas which have clear access to independent stations which can be received from one microwave direction. NCTA presented a map in support of this contention, and made a strong plea that the leapfrogging rules should be eliminated entirely.

NAB says, directly counter to this, that abandonment of all restrictions on leapfrogging would lead to the dominance of the national cable scene by a few "super-stations" in large centers, with loss of the diverse, locally-oriented programming whose preservation is a main objective of FCC policy. NAB called NCTA's arguments for the abandonment of leapfrogging restrictions "literally incredible . . . rife with fallacious reasoning."

The FCC said recently that at least for the immediate future there would be no change in the leapfrogging rules.

NAB Briefs

The NAB has petitioned the U.S. Court of Appeals to review the new FCC **rules on movies and sports programs for cable television** on the ground that the rules "contain the seeds" of serious siphoning of programs, the issue on which the NAB is resisting cable most strenuously . . . In another petition to the FCC, the NAB has asked that cable operators who provide aural origination to subscribers be **required to carry all local radio stations,** if cable input prevents over-the-air reception of the sta-

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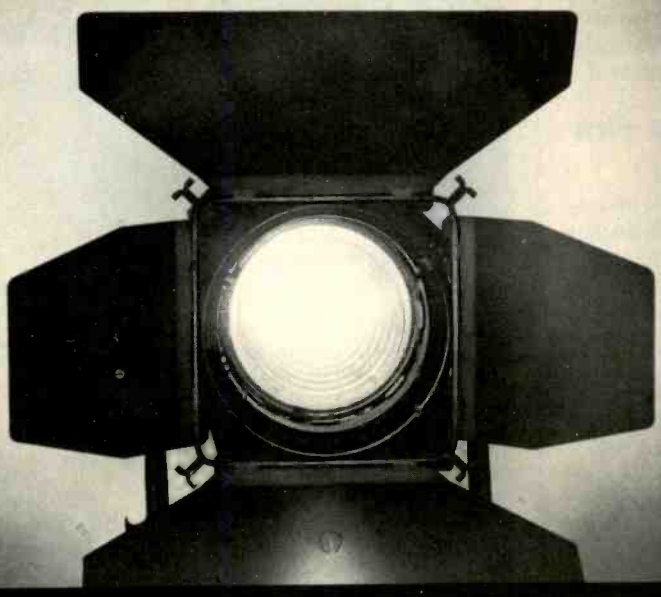

Introducing the dawn of a new era. Flicker-free HMI daylight.

Our new flicker-free Quartzcolor daylight spotlights are now available in 575W, 1200W, 2500W and 4000W models. Each unit is complete with lamp, cable and the special flicker-free ballast.

What's more, Quartzcolor radiates very little heat, uses power very sparingly (85 - 102 lumens per watt), and produces light like tomorrow's dawn.

The output efficiency of our 2500W model at 5600° K is equal to that of a 10,000W incandescent unit corrected to daylight. And that's a lot of light. In a system that doesn't weigh a ton or cost a fortune to operate.

That's Ianiro Quartzcolor. The dawn of a new era in lighting.

For details, write Ed Gallagher, National Director of Television/ Motion Picture Sales.

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STRAND CENTURY INC
A COMPANY WITHIN THE RANK ORGANISATION

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NEWS

tions . . . The NAB attacked proposed rulings of the Federal Trade Commission which would require **food advertisements to carry full nutrient information;** NAB said this would be impossible in short ad spots (30 seconds, for example) and would probably cause many food advertisers to abandon radio and television . . . In another blow at the cable "threat," the NAB warned that a scheme by KTV Spot Sales, **to substitute local commercials for the TV ads on cable programs,** could have a "disastrous impact" on the ability of local radio to continue to serve local needs.

MEETINGS

Society of Broadcast Engineers

The Society of Broadcast Engineers Chapters 1, 2, and 22 are sponsoring their third annual regional convention and equipment exhibition October 17 at the Northway Inn, Syracuse, NY. This convention of SBE Chapters from central New York, the Binghamton-Elmira area, and northeastern Pennsylvania is the original regional convention. The Northway is situated at the intersection of Interstate 90 (the N.Y. State Thruway) and Interstate 81.

For further information contact Paul Barron, convention chairperson, WCNY-TV, Syracuse, 315-446-4780.

NAB-RAB Joint Radio Conventions

This fall the National Association of Broadcasters and the Radio Advertising Bureau have combined their conventions to offer a new concept of six regional seminars that will cover every aspect of day-to-day radio station operations. Planned are separate sessions on sales, programming, publicity and promotion, legal problems, government relations, engineering and a 2½ hour meeting with an FCC commissioner and top FCC staffers.

The series opens in Atlanta, Oct. 13-14; New Orleans, Nov. 10-11; Chicago, Nov. 17-18; and San Francisco, Nov. 20-21.

The regional conventions, coupled with NAB-sponsored seminars for radio program directors, are designed to provide station managers with a broad spectrum of operational information under one roof.

For further information contact the NAB at 1771 N St., N.W., Washington, D.C. 20036; 202-293-3500.

continued on page 18

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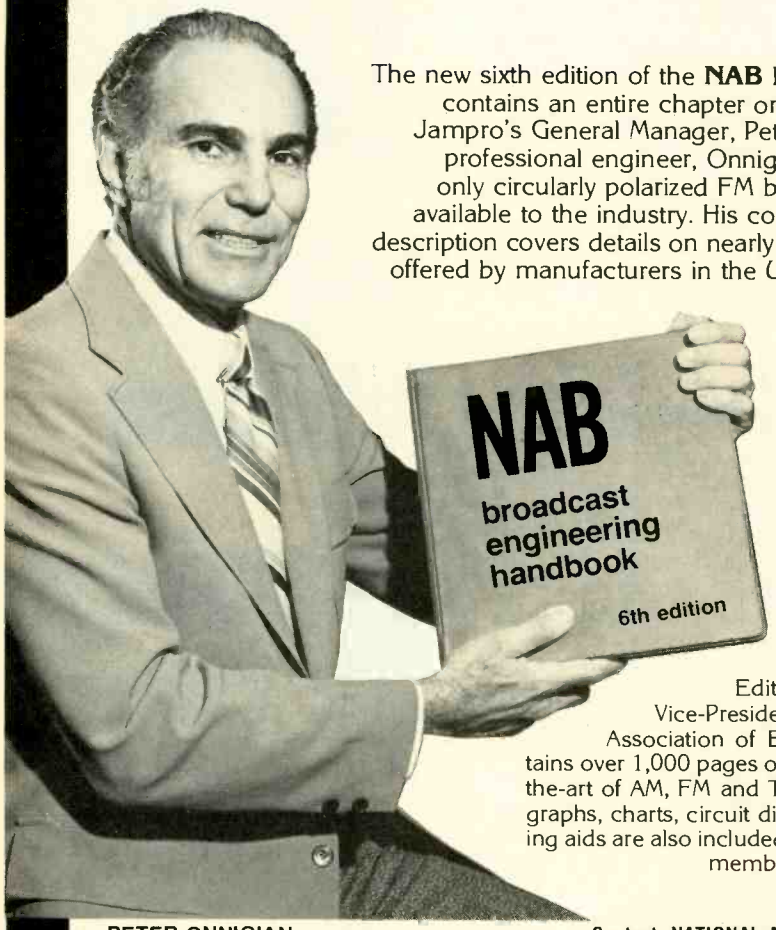

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Edited by George W. Bartlett, Vice-President of Engineering, National Association of Broadcasters, the book contains over 1,000 pages of information on the state-of-the-art of AM, FM and TV. Many illustrations, photographs, charts, circuit diagrams, and other engineering aids are also included. The price is $45.00 to non-members and $30.00 to members.

PETER ONNIGIAN
General Manager, Jampro Antenna Co.

Contact: NATIONAL ASSOCIATION OF BROADCASTERS
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NEWS

More Meetings

The Western Cable Show, which will emphasive how to run a profitable operation, will be held at the Disneyland Hotel Nov. 11-15.

The third annual Midwest Seminar on Videotape and Film will be held in Chicago, Oct. 17-18. For reservations or further information contact Midwest Seminar on Videotape and Film, PO Box 11376, Chicago, Ill. 60611 . . . The Practising Law Institute will hold a seminar Nov. 6-7 in the Los Angeles Century Plaza Hotel and a seminar Nov. 13-14 in the New York Sheraton Hotel to cover developing legal and policy issues in media. Guests will include Senators Birch Bayh and Alan Cranston. For further information contact the Practising Law Institute, 810 Seventh Ave., N.Y., NY 10019 or call Ernest Wilkerson, Program Director, 212-765-5700.

News Briefs

Scientific-Atlanta, Inc. has received two contracts totalling $1.05 million for satellite earth station equipment for use with the RCA domestic satellite program. Two antenna systems and associated ground communications electronics will be furnished to RCA Alaska Communications, Inc. and ground communication electronics for two RCA Global Communications, Inc. earth stations to be located in the continental U.S. will be provided . . . . **The Broadcast Products Division of Harris Corp.** will supply two 100 kilowatt short wave transmitters and a 10 kilowatt AM transmitter to stations KTWG and KTWR, two new radio stations in Guam . . . . Six IVC-7000 Broadcast Television Cameras have been delivered to WUNC-TV, Chapel Hill, N.C. by **International Video Corp.**

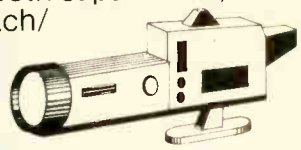
CBS Television Network, N.Y., has taken delivery of the 1,000th **Consolidated Video Systems** time base corrector . . . . WPIX-TV, Channel 11, N.Y., has taken delivery of the 10,000th Repromaster Mark 3, manufactured by **Agfa-Gevaert, Inc.** . . . . KOVR-TV, KXTV-TV and KCRA-TV, the three VHF TV stations in Sacramento, Calif., all are currently installing **RCA** transmitting systems, with a combined value of approximately $1 million, to replace existing equipment . . . . The CBS Network has placed a $180,000 order for a BT-25L, 25 kilowatt low band TV transmitter, and related accessories,

continued on page 21

HOW TO GET A SECOND CAMERA WITHOUT PAYING FOR IT.

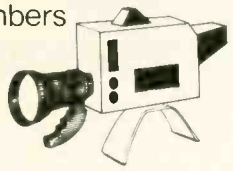
Economic realities being what they are, improving your camera setup often boils down to a battle of program quality versus pocketbook: For some assignments, you want the mobility and compactness of a hand-held camera. For others, the long focal length and high zoom ratio of a first-rate mobile. And sometimes, of course, the virtues of both. But what can you do on a one-camera budget?

Logical question. For which we have a logical—and economical—answer: Canon Versatility Packages. A family of two-lens systems which give you both capabilities, plus a quick, positive attach/detach system that's the closest thing to two cameras for the price of one.



Take our Plumbicon* Package, for instance. When you need compactness and high mobility, there's the PV10x12B—the world's most popular electronic news gathering lens. Featuring an 18" minimum object distance and a 55.4° wide angle, it's the lightest professional 10:1 around. One of the smallest of its type, the PV10x12B features remote CCU iris control with manual override, and fully-motorized variable-speed zoom.

Where applications require a longer focal length, there's the other half of the Package: our PV34x24B-DZ for 25mm and the P34x32 for 30mm. A mouthful of numbers which add up to the most versatile remote lenses available today. The basic lens is a 24-400mm automatic iris f/1.8 with built-in double zoom that yields a long, long 800mm. Thanks to its continuous, stepless magnification, you can operate at maximum light efficiency while tailoring the focal length precisely to your needs. Vary field of view from 29.8° to 0.9°controlled by the cameraman on the air, with no blanking periods or cumbersome supplementary lens insertions. And work to a minimum object distance of just 1.8 meters. Mounted on a rugged, lightweight camera base plate with a universal head fitting, either lens is easily attached and detached from the camera.



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NEWS

for its O&O Station WCBS-TV (Ch. 2), New York City, with the **Broadcast Products Division of Harris Corp.**

The Fernseh Group of the Robert Bosch Corp. has signed a contract with "Television Centre-Las Vegas" for delivery of the only Standard Converter in North America, which will allow all broadcasters and production houses to convert to any standard in the world instantly for satellite transmission or convert programs for distribution to all countries . . . . **Ampex Corp.** recently delivered three AVR-1 videotape recorders, totalling $350,000, to Auburn University, Auburn, Ala., for use in its teleproduction facility . . . . Post-Newsweek Stations, Inc. has taken delivery of four TCP-1624 cartridge film projectors, an automated device for streamlining TV broadcasts of commercials and other short film clips from **RCA Broadcast Systems** . . . **The Broadcast Products Division of Harris Corp.** has announced a recent order from the Iowa Educational Broadcasting Network of $735,000 for two BT-55U, 55 kilowatt UHF television transmitters, and related accessories, and the installation of a BT-25H1, 25 kilowatt TV transmitter at WCHS-TV. Charleston, W.V.

Marconi Communication Systems Ltd., a GEC-Marconi Electronics Co., has signed the first of a series of contracts which will total slightly more than $10 million to supply equipment to bring British color TV programs to U.K. forces stationed in West Germany . . . . **RCA** has signed a $8,750,000 contract to design and install a wide range of telecommunications facilities for a major new winter resort under construction on Kish Island in the Persian Gulf which will include a CATV program distribution designed to serve 3,500 color receivers . . . . **FRL, Inc.,** Cohu's subsidiary in Belmont, Calif. is currently constructing an internal communication system for the South African Broadcast Corp. television studio complex in Johannesburg under a contract in excess of $400,000.

CCA Electronics Corp. has signed a contract to construct an FM stereo radio station in Riyadh, the capital of Saudi Arabia . . . . **Telemet** will supply a specially modified 7930 C1 Audio-Video Routing Switcher to Sound Systems, Inc., a Philadelphia-based communications company, installing what is believed to be the first private video telephone system in the nation (outside the Federal Govt.), for the Philadelphia Police Dept.

INTERPRETING THE

FCC RULES & REGULATIONS

Lottery Information Broadcasts

By Frederick W. Ford and Lee G. Lovett
Pittman, Lovett, Ford and Hennessey, Washington, D.C.

More and more states are instituting state-run public lotteries. The promise of instant riches (the top individual award in a number of states is $1 million) has motivated innumerable people to become regular participants in weekly and monthly state lottery drawings. As the number of lottery participants rises, so does the public interest in drawing results. Newspapers regularly carry lottery drawing results. Big winners, especially the occasional $1 million winner, get their pictures and stories displayed on the front page. The winner's name is big news—or is it?

The Commission apparently did not think so.

The Commission's Declaratory Ruling

A Wildwood, New Jersey, broadcaster sought a declaratory ruling from the Commission as to whether airing the winning New Jersey State Lottery number in a normally scheduled news broadcast was "news" and, therefore, permissible, or was a violation of a federal statute[1] prohibiting the broadcast of lottery information.

The Commission made two separate rulings on the matter. First, it said that the winning lottery announcement would violate the federal lottery information broadcast law as well as Commission interpretive rules. Second, the Commission squarely faced the question of whether a lottery-related news item would likewise be prohibited. The Commission answered this issue in the affirmative, basing its ruling upon the federal statute which prohibited the broadcast of ". . . any . . . information concerning any lottery . . ."

Despite the weekly interest of 2,750,000 New Jersey State Lottery ticket holders, the Commission ruled that a broadcaster could not make the following statement on the air:

> "The winning state lottery number drawn today is (and then recite the winning number)."

In light of the federal prohibitory statute, the Commission could ostensibly do little else.

Federal Appeals Court

The New Jersey Lottery Commission appealed the Commission's Declaratory Ruling to the U.S. Court of Appeals for the 3rd Circuit. It argued that the winning weekly lottery number is a bona fide item of news; that it is of interest to several million ticket holders, not only in New Jersey, but also in surrounding states where ticket holders resided who could receive New Jersey stations on their radios.

The 3rd Circuit permitted the states of New Hampshire and Pennsylvania to join the New Jersey State Lottery Commission in appealing the Commission decision. Both states held lotteries similar in nature to that of New Jersey; hence, they had standing before the Court because the Commission could apply the Declaratory Ruling to them.

The contentions advanced in favor of broadcasting winning lottery numbers were fundamental and constitutionally based.

First, it was argued that the Commission is prohibited by Section 326 of the Communications Act of 1934, as amended, from exercising control over editorial decisions of broadcast journalists. Thus, the Commission could not make its own determination of what is "news" and whether that news would best serve the listening public.

Second, irrespective of Congressional legislation (i.e., the Communications Act) and agency regulations (the Commission's Rules), the First Amendment prohibits its imposition of any "prior restraint" (a long standing constitutional parameter) upon "dissemination of information of interest" to the public.

The Commission backed away from its ruling that the winning lottery number was not news and therefore not entitled to First Amendment protection. Even if the winning number "had some news value to some persons," reasoned the Commission, its broadcast "would directly promote a lottery and could therefore be prohibited by the FCC."

The 3rd Circuit ruled in favor of the New Jersey State Lottery Commission and held that:[2]

(1) The FCC must enforce the federal law prohibiting broadcast of lottery information within the parameters of the First Amendment's free speech guarantee;
(2) The Communications Act of 1934 does not permit the FCC to exercise any control over the editorial decisions of broadcast journalists;
(3) The FCC's Declaratory Ruling amounted to an unreasonable and, hence, an unconstitutional prior restraint upon free speech; and
(4) The winning New Jersey lottery number is news, at least on the day that it is drawn.

The 3rd Circuit stated that the only remaining constitutional restraints upon dissemination of information related to *1* libel[3] (very generally defined as: false statements made with malice—in "public figure" cases; false statements made in reckless disregard as to truth or falsity—in "private figure" cases) and *2* obscenity.[4] Thus, except for these two situations which do *not* come within the First Amendment's protective scope, the

continued on page 24

[1] 18 U.S.C. 1304.

[2] *New Jersey State Lottery Commission v. U.S.*, 29 RR 2d 157 (CA 3d, 1974).
[3] *New York Times Co. v. Sullivan*, 376 US 254 (1964) and succeeding cases.
[4] *Miller v. California*, 413 US 15 (1973) and succeeding cases.

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Commission cannot regulate the content of broadcast journalism.

Supreme Court and Remand

The U.S. Supreme Court soon thereafter agreed to hear the case. Before oral argument, Congress passed an amendment to the federal lottery information broadcasting law which exempted the "broadcast by a radio or television station licensed to a location in that state or an adjacent state which conducts a lottery" of an "advertisement, list of prizes, or information concerning a lottery conducted by a state acting under the authority of state law." The Commission claimed that the Supreme Court case was, therefore, moot. The Supreme Court remanded the case to the 3rd Circuit to determine whether the federal law amendment mooted the case.

In what will hopefully lay the case to rest, the 3rd Circuit held that the case was not moot and affirmed its original ruling.

The Court's rationale was that the Commission's Declaratory Ruling could be applied to states which do not conduct lotteries, but which are adjacent to states which do (i.e., the aforementioned federal lottery information broadcast law exemption applies specifically to *1* stations in states having lotteries and *2* stations in adjacent states which also have lotteries). Thus, the Commission could apply the Declaratory Ruling against a Vermont station (no state lottery) for broadcasting the results of the New Hampshire State Lottery. The 3rd Circuit action in affirming the case effectively prevented this course of action by the Commission.

As a general rule, a licensee cannot broadcast an advertisement (or any information) regarding a lottery.[5] The Commission characterizes a "lottery" as ". . . offering prizes dependent in whole or in part upon lot or chance . . ." But, whether a particular program is deemed a lottery will be determined on a case by case basis by the Commission.

A broadcast program will be considered a lottery when a valuable prize is awarded to a person chosen at random or by lot *if,* as a *precondition* to winning the prize, the person must:

(1) furnish money or an item of value; or
(2) maintain in his/her possession "any product sold manufactured, furnished or distributed by a sponsor of a program broadcast on the station."

As noted above, Congress legislated an exemption from the lottery information broadcast law which allows the broadcast of advertisements about (or information concerning) state lotteries by stations within *1* that state or *2* an adjacent state which also has a state lottery.

The Commission enacted a Rule identical in nature,[6] leaving the same danger to broadcasters (i.e., a broadcaster in adjacent state X, which has no lottery of its own, would be in violation of Commission Rules by airing any information concerning state Y's lottery).

Finally, the Commission has delineated a special definition of "lottery" for the lottery information broadcast exemption:

> . . . 'lottery' means the pooling of proceeds derived from the sale of tickets or chances and allotting those proceeds or parts thereof by chance to one or more chance takers or ticket purchasers. It does not include the placing or accepting of bets or wages on sporting events or contests.

Note that this definition excludes wagering or sporting events. Thus, the names of off-track betting ticket winners cannot be aired.

The Commission has taken steps to conform its lottery information broadcast rules to newly enacted Congressional legislation and recent court decisions. It has yet to specifically authorize lottery information broadcasts by an "out of state" station whose state does not also run a lottery. It is possible that the Commission may move to amend its Rules, accordingly, before this article goes to print. In any event, broadcasters should thoroughly review the Rules before broadcasting lottery information. **BM/E**

[5]Section 73.1211 of the Commission's Rules.

[6]Section 73:1211(c) of the Commission's Rules.

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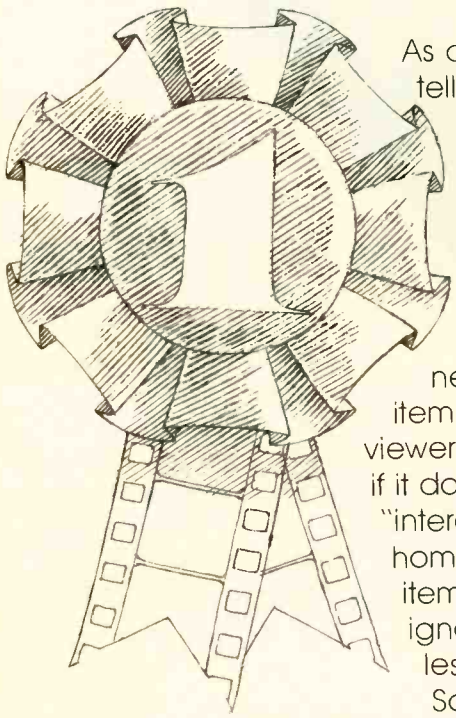

As any pro will tell you, it's not so much what you shoot with, but what you shoot at, that makes for a newsworthy item. But as any viewer will tell you, if it doesn't look "interesting" on the home screen, an item may be ignored, regardless of its content. So when we say film is the basic medium, we think it supports what's basic to good reporting. Film's fine image quality lets it function as the backbone of quality reporting. And its versatility helps you get the depth that every major story needs.

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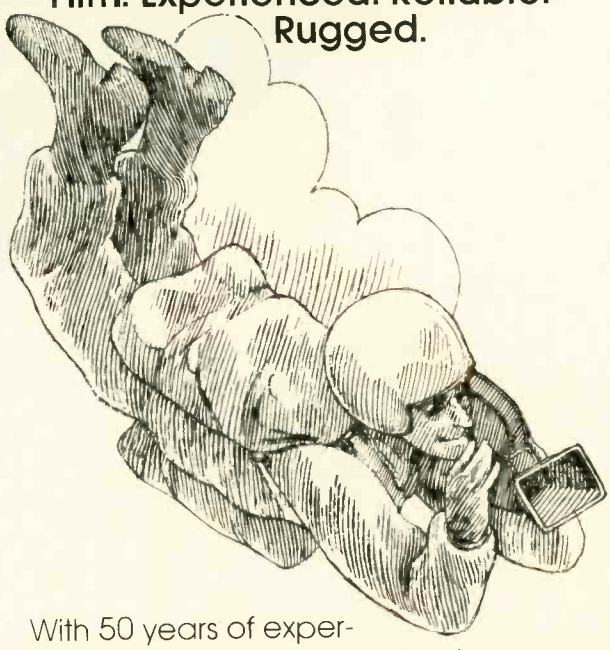

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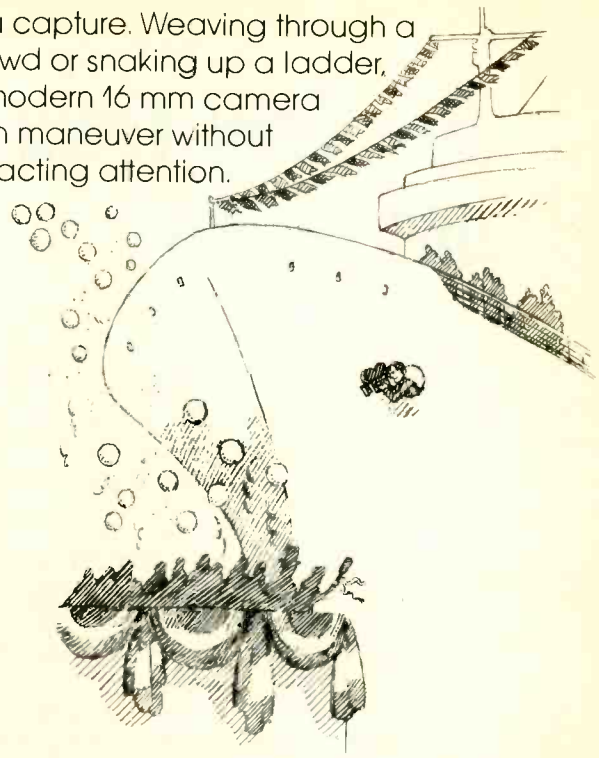
Film. For every angle.

Talking heads provide useful news, but TV is the visual medium. Movement. Action. The unexpected. That's what film can help you capture. Weaving through a crowd or snaking up a ladder, a modern 16 mm camera can maneuver without attracting attention.



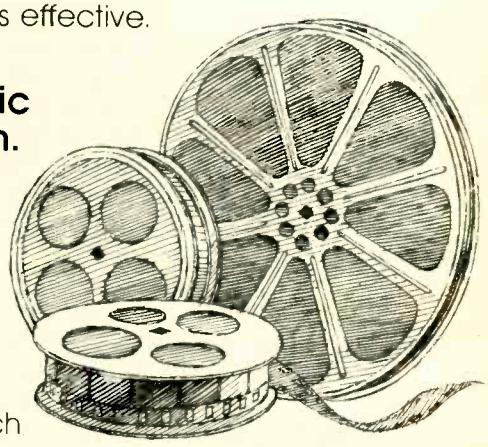
Film. The processing time is also good news.

For last-minute news just before air time, or bulletins as they happen, videotape makes a valuable addition to film. But even film is far from slow. The average 16 mm film can be processed quickly, and simply edited—all in less than 30 minutes.

So, if you're a film person with more than a few minutes to air time, just aim your camera and roll it. Very basic.

But no less effective.

Film. The basic medium.



All of which brings us to the final point. Film doesn't get its impact from sophisticated, expensive electronics. Or bright lights. Or gimmicky special effects. Film gets its impact from you.

Kodak

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The Only True Route to High-Grade AM Audio

by J. Fred Riley and Harrison J. Klein

You have to start at the antenna and work back carefully through the transmitter as described in detail in this article, to get AM audio that wins listeners. Use extensive audio processing only if you need it to beat the competition; use it with great care (as described) to avoid making your sound worse rather than better.

This article was written in an attempt to shed some light on the complex subject of audio processing, and to quash the impression that good audio comes out of some miracle gadget in the audio line. Audio processing starts at the antenna system—not at the studio.

We herein define processing as the synthetic alteration of the apparent fidelity, dynamic range, and waveform nature of the audio before the listener hears it. We process for several reasons; among these reasons are loudness increases, increased intelligibility, and to deliver consistent "apparent" fidelity.

No single technique is applicable to all formats, and not every station needs to process their audio extensively; but the techniques of processing—especially the preliminary work—also provide insight into the general methodology of clearer audio.

First of all, extensive processing is expensive. There should be a clear-cut justification for the expenditures necessary. Who needs it? Better yet, who doesn't need it? A friend of mine once answered this best when he said, "I identify the competition and beat them at their own game."

Understand that you must put from your mind the notion that higher modulation levels and processing will significantly improve coverage *outside* your normal contour. You are not going to change your 25 mV contour! Within your contour, you *can* increase the apparent signal-to-noise ratio significantly. The station should examine the antenna system and, importantly, the ground system if extending the signal strength contour is the point in question.

So first, identify the competition. Do you have any? A louder signal is not going to greatly help if your format is wrong; neither will it significantly increase revenue in a single station market where no real competition is present. Conservatism may be the key to success, depending, of course, on the market.

Here is where the engineer's ego can get in the way. Remember that as an engineer your responsibility is to help increase the station's profitability. You want a loud, clean signal you can be proud of, but you should make the equipment dependable before you make it loud. Remember too that you can't take the philosophy of audio (presented later in this article) and apply it before you do the preliminary work as outlined below. If you try it in reverse order you won't reach your objectives.

So again we say, before deciding on processing, identify the competition. Who is taking your ratings—and why? If it boils down to a fight between two similarly programmed stations, then processing is indeed worthwhile. And if you decide to use processing, chances are you will need to clean up your audio first, of course. Any station's audio, whether processing is employed or not, should be clean; but if processing is to be used, the transmitted audio has to be first made *more* than clean—it must be absolutely immaculate.

For that kind of audio clean up, you have to work in the following order:

STEP #1—The antenna must load symmetrically

You must, of necessity, start at the antenna system. Readers are first referred to a paper by Bill McCaren (of CBS) that was delivered to the Society of Broadcast Engineers. McCaren, in his paper, explains the necessity and shows the results of presenting a symmetrical load at both the upper and lower sideband frequencies to the tube plate. In his paper, he deals with a fairly simple antenna problem—one that was corrected without a great deal of parts or money.

With McCaren's permission, I've included the results of his work. On the Smith Chart (Fig. 1) the impedance at the tube plate is plotted as Curve A. Note that the impedance is significantly different at the upper and lower sideband frequencies. The theoretical calculations are given in Fig. 2 and 3 for the power distribution in the sidebands. Curve B was considered but rejected because of the sideband power levels. Curve C was selected and achieved by installing a 45° delay T network. The results of this rotation can be seen in the distortion performance of the transmitter (Fig. 4). The basic nature of the load has not been changed. The transmitter simply sees a symmetrical sideband load. The impedance measurements were made at the plate of the RF output stage. Unless the delay through your transmitter's output network is known, you must measure at the tube plate.

We feel here that we should stop and explain that this requirement for antenna system performance is *not* something new that has arisen with new modulation processes. Whether one is using a Western Electric Doherty, a conventional plate modulated system (as in the above example), or the newest systems, you simply

Mr. Riley is Field Service Engineer, Harris Broadcast Products; Mr. Klein is Chief Engineer, KING radio, Seattle.

cannot achieve optimum performance from your transmitter unless it looks at a good load. Remember that if we limit the upper modulating frequency on AM to 10 kHz, which is hardly ever done, the transmitter sees an entirely different load at carrier ±10 kHz, unless the load is a non-reactive dummy. The key rule in AM service then is: Fix the antenna system first—get a good ground, get the antenna "Q" down, and make sure the sideband frequencies present a symmetrical load to the tube plate.

If you have a tight antenna problem, call in the experts. They are skilled in making systems work. You should demand that your system be made to perform as it should. Most of a directional engineer's time is spent worrying about monitoring points instead of common point excursions. Here is where you have to have both. The resistance/reactance curve of your system should look flat. Years ago Doherty published an article that dealt with the problems of a limited-bandwidth antenna system[1]. Strange, isn't it, that we are repeating, in 1975, something that engineers were cognizant of in the 1930's[2].

The load at the tube plate is usually too high for direct measurement by the usual G-R bridge available to most engineers. A Wayne-Kerr susceptance bridge is ideal for these measurements, but it is rare in this country. The G-R bridge *can* be used to measure impedances outside its normal range by techniques explained in the bridge operating manual. Although a fairly boring mathematical exercise is involved in this technique, it is not too hard considering the end objectives.

Measurements should be taken every 1 kHz out to 15 kHz either side of the carrier frequency and then the results normalized and plotted on a Smith Chart. Usually a simple "T" network can be used to optimize the antenna system if a single antenna is involved.

When a directional system is involved, the problem of providing a limited excursion of impedance over the modulation range may not be so easy; but, it is necessary and forms the first steps. What you are really doing is insuring that modulation monitors (and car radios) are seeing the same sideband power and modulation levels out in the antenna field as those present at the transmitter output—a key point. *Only* when this is done do we move back the line to the transmitter.

STEP #2—Transmitter distortion must be minimal

Each transmitter has its own sound. Now that is a horrifying statement to make! Let us explain. It is not hard to get most any transmitter to have less than 2% harmonic distortion across the spectrum; and, we know from psychoacoustic research that the trained ear cannot hear harmonic distortion below about 1%—most people can't hear 2%. So, if we are keeping the distortion below 2% (and frequency response is hardly a problem today), and still have to admit that different transmitters sound different, we must as a consequence admit that we really don't measure all the important parameters of a trans-

continued on page 30

[1]W.H. Doherty, "*Operation of Radio Transmitters Into Sharply Tuned Antenna Systems*," Proceedings of the IRE, Vol. 37, Pgs. 729-734 (July, 1949)

[2]C.G. Mayo and H. Page, "*Amplitude Modulated Transmitter Class-C Output Stage*," The Institution of Electrical Engineers, Paper No. 2724R (November, 1958)

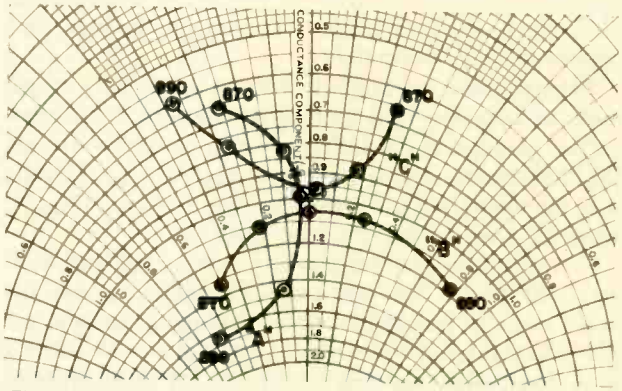


Fig. 1. Plots on Smith Chart show impedance-frequency curves of antenna. Curve A, the original, shows considerable variation at upper and lower sidebands. Curve B is a 45° advance; Curve C, which was chosen, a 45° delay,

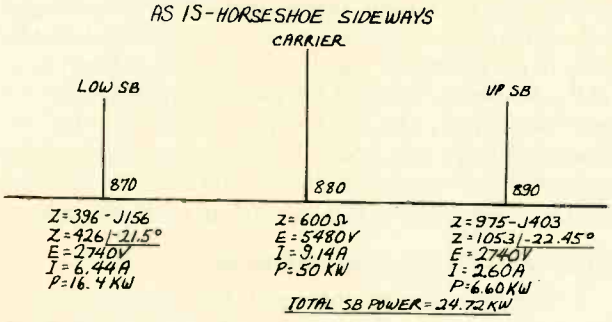
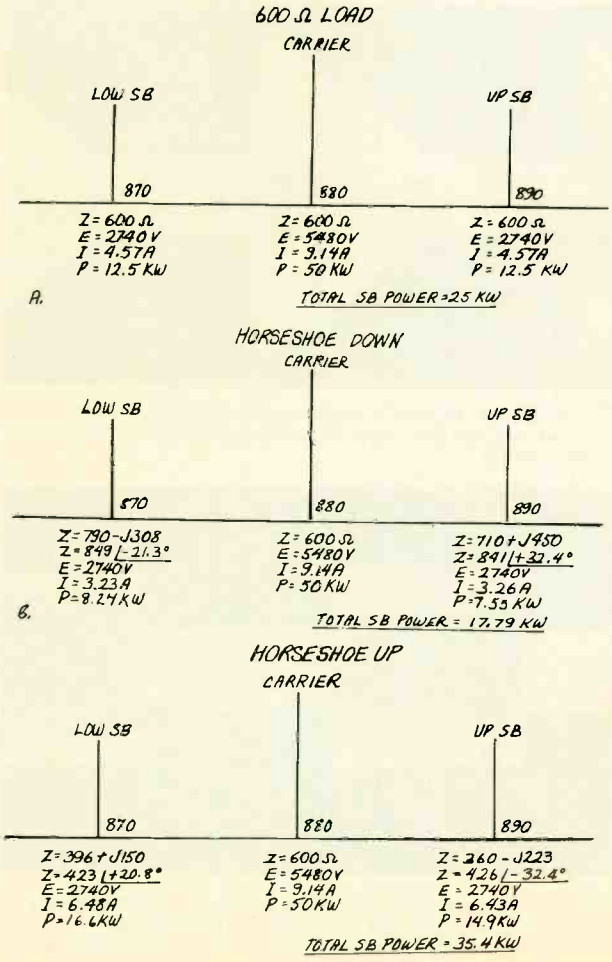


Fig. 2. Calculations show large variation in impedance between upper and lower sidebands of original Curve "A". Fig. 3A (top right). Power and impedance distribution with 600 ohm load, showing even upper and lower sidebands. Fig. 3B (center right). Power and impedance with adjustment to Curve "B" shown on chart. Fig. 3C (bottom right). Calculations for Curve "C", which was produced by a 45° delay network.



mitter in the annual proof.

We never have (and probably never will) because few measurement devices are available to the average engineer to measure such things as inter-modulation distortion; transient inter-modulation distortion; transient

Delay Net Out 90% Modulation

Audio Freq.	Response	% Distortion
1000Hz	0	1.1
5000Hz	−1¼ db	1.8
7500Hz	−1½ db	4.5
10000Hz	†	†

†IT WAS NOT POSSIBLE TO KEEP TRANSMITTER ON AIR LONG ENOUGH TO MAKE MEASUREMENTS, DUE TO P.A. OVERLOADS.

Delay Net In 95% Modulation

Audio Freq.	Response	% Distortion
1000Hz	0	1.4
5000Hz	−0.7	1.4
7500Hz	−0.2	1.7
10000Hz	−1.8	2.0

Fig. 4. The top table shows frequency response and distortion measured before delay network was added to make antenna impedance symmetrical; second table, measurements made with the delay network added to "straighten" antenna impedance. Frequency response is flatter and distortion has dropped, even at higher modulation.

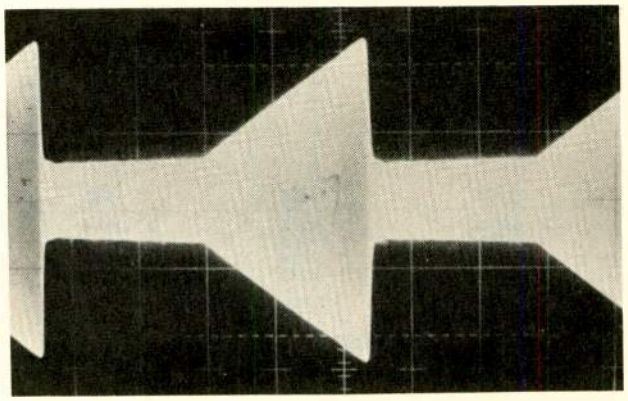


Fig. 5. Ramp waveform, pushing modulation to 135% positive, checks the upper limit of linear positive modulation of transmitter.

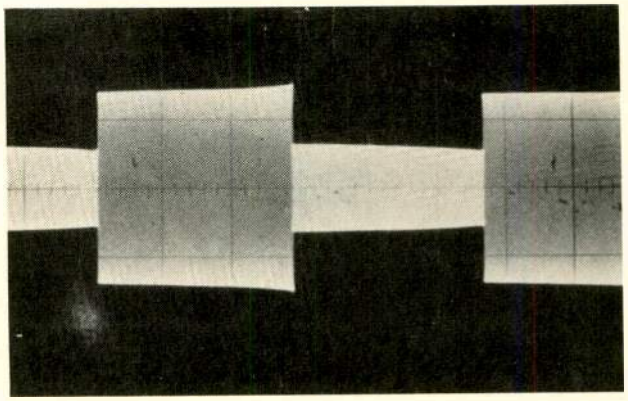


Fig. 6. Square wave at 20 Hz is check for low-frequency phase shift which might preclude clipping at low frequencies. In test illustrated, response is good down to dc.

response and modulator/power supply/feedback bounce. So, before we can have above-average audio, we have to become *above-average engineers* with *above-average test equipment*.

Consider inter-modulation distortion first: What is it? Where does it come from? How do we measure it? How do we control it? Suppose that we modulate a transmitter with two frequencies at the same time (remember, with complex audio we usually have many more than two). Pick 4000 hz and 60 hz as an example. Now if our transmitter *and detector* are linear we will detect only 4000 hz and 60 hz. If either is not linear, the non-linearity will result in the generation of frequencies at 4060 hz and 3940 hz. These frequencies are the result of non-linearities in the modulating stages, the modulated stage, and/or in the detector—remember a detector diode can also be non-linear.

I (Riley) encountered a vivid confirmation of this often overlooked fact recently. In conversation with a chief engineer I pointed out the particularly low IM distortion of our new series of transmitters. He countered that he had measured an IM level of over 10%. After my suggestion that he closely re-examine his test set-up, he repeated his checks using another modulation monitor. This time the results were well below 2%. His problem had simply been a non-linear detector diode in the modulation monitor first used.

The reader is referred to *Care and Feeding of Power Grid Tubes*[3] by Bill Sutherland of Eimac. Therein he discusses the 3/2 power law that tubes obey (more or less) and the generation of inter-modulation distortion products by amplifying stages. We also refer the reader to *Radio Transmitters*[4], by V.O. Stokes, for a discussion of methods used to lower IM products in high and medium power transmitters.

Briefly, these books point out that amplifying stages must be operated well within their ratings and within certain parameters the authors discuss before the lowest IM level can be achieved. Several instruments are available for measuring IM distortion. For example, Crown, Heathkit, and Hewlett-Packard make them.

It *is usual* for audio equipment to have IM distortion about 1% higher than harmonic distortion. It *is not unusual* to see a transmitter with harmonic distortion less than 2% that has IM distortion greater than 6-8%. Don't loose heart when you make your first IM measurements on an older transmitter—they will probably be high—but know that you have to get the IM down to the 2-5% range before the transmitter will sound really clean.

When the IM is high, suspect bad tubes, bad tuning or bad iron-core components (if used). You should also be wary of the HV power supply—it has to be stable *dynamically*. Remember too that the plate voltage/plate current ratio determines the modulating impedance that the modulator stage acts upon. This ratio is usually critical and some improvement in IM may be achieved by varying the loading of the P.A. to find an optimum ratio.

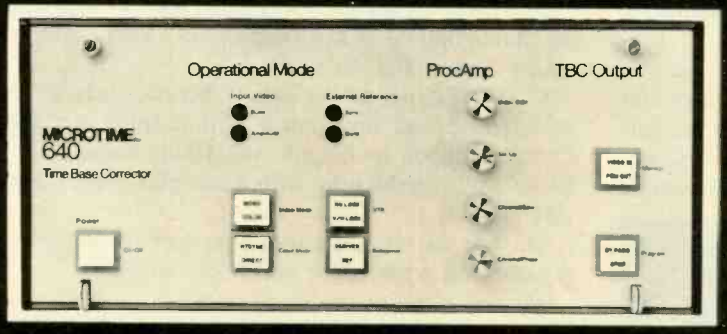
STEP #3—Transmitter efficiency

Efficiency has to be optimized. Every wasted watt in the P.A. has to be modulated at the expense of many factors. Never, at radio frequencies, trust an RF Am-

continued on page 32

[3]Robert I. Sutherland, *Care and Feeding of Power-Grid Tubes*, Eimac-Division of Varian (1967)
[4]V.O. Stokes, *Radio Transmitters*, Van Nostrand Reinhold Company (1970)

640 Series Digital TBC



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meter. When the transmitter efficiency is abnormally high or low, verify the antenna or common point measurement. Then verify the RF ammeter by substitution with devices calibrated *at the operating frequency*. For high modulation and optimum efficiency, grid current must be up to or above normal and neutralization must be properly adjusted.

Let's review up to here. First, we have to have a transmitter operating at optimum efficiency which has IM distortion below 5%, and operating into an antenna system that allows it to be modulated by audio frequencies at 10 kHz or above. Frequency response should be within ±1 dB over the spectrum and harmonic distortion above 50 hz should be less than 2%.

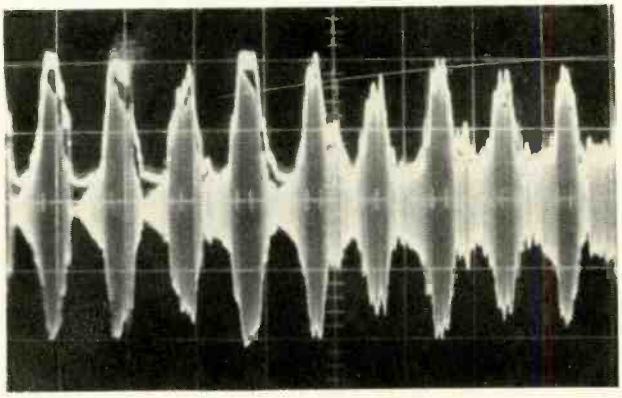


Fig. 7A. To check power supply bounce, and its limit on modulation, compare input and output waveforms of a complex audio signal. Test above shows considerable tilt and overshoot of 20-30%.

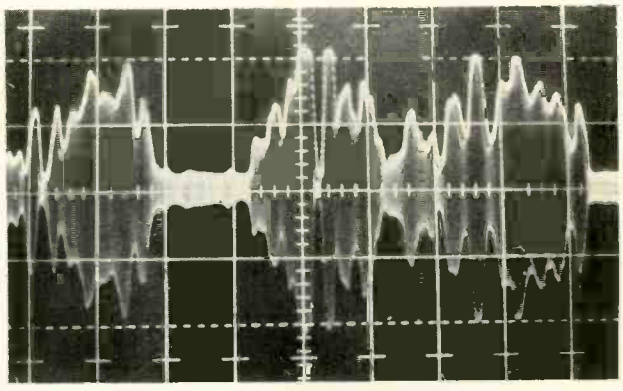


Fig. 7B. In this example of the input-output test, the pattern shows good tracking between the two waves, indicating a stable power supply.

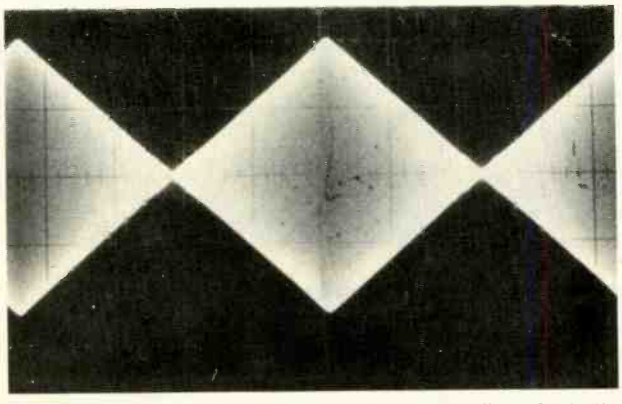


Fig. 8. A triangular waveform checks for non-linearity in the cross-over region, which can add significantly to distortion. In the example shown, the cross-over was found to be highly linear.

STEP #4—Finding the modulation limits

We are now ready for some final determinations of the limits of your transmitter. We need to know:

A. What is the upper limit of linear positive modulation? Use a ramp test to find out. (Fig. 5)

B. Is low frequency phase shift present which would preclude clipping at low frequencies? Check this with a square wave. (Fig. 6)

C. How much power supply bounce does the transmitter have and how much will it limit modulation? Compare input to output waveforms on a dual-trace scope while modulating with a complex wave. (Fig. 7A and 7B)

D. Are any non-linearities present in the crossover region? Use a triangular waveform. (Fig. 8)

E. For what average modulation level was your transmitter designed and are component failures likely if you push it?

F. How good are the HV wiring and RF components? Remember that 100% modulation doubles the dc voltage and that 125% brings it to a 2¼ times carrier voltage level.

The reader is referred to *Enhanced AM Signal Coverage Through Improved Modulation Techniques*[5] by C.B. Cox (available at no charge from Harris) for discussions of items A, B, C, and D. Brian has been able to identify many of the reasons different transmitters sound different. We heartily recommend this paper as a reference text, no matter what type of transmitter is being optimized.

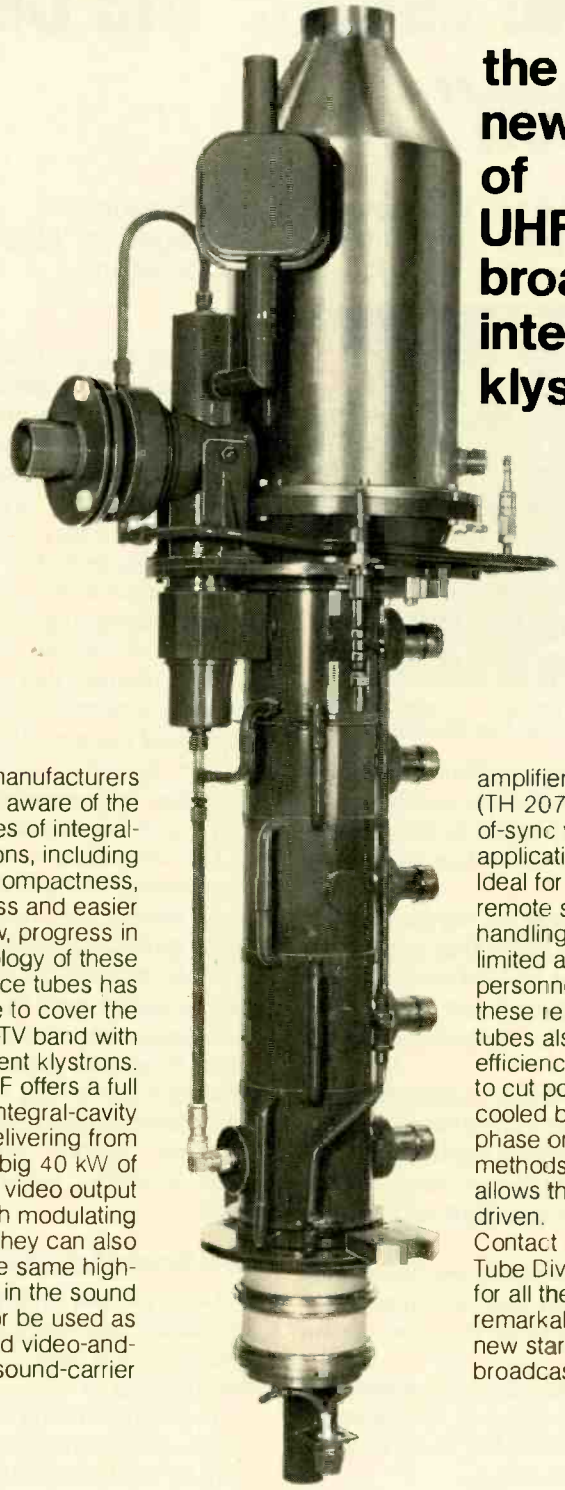
Know now that highly processed clipped audio can approach the equivalent in heating to the transmitter of 70-90% continuous sine-wave modulation. Most older transmitters were designed for 30% continuous sine-wave modulation—which was the right idea when they were designed. The benefits of higher average modulation levels will be *lost entirely* if you lose air time due to multiple component failures brought on by insufficient attention to the transmitter's limits.

You may have been modulating to only 90% before you started with the IM checks; if you now push it up to 115-130%, will the transmitter's components take it? Are the antenna feeder system components capable of handling the increased RF voltages? You may start pushing marginal guy insulators to the flash-over point.

You should, by now, be familiar with the transmitter's limitations and capabilities. If questions arise about the transmitter's capabilities or design limitations, the transmitter manufacturer's service deparment can be of assistance. No modifications to the transmitter should be attempted until you have checked the rules and regulations to insure that type-acceptance is not voided. Any planned changes should be discussed with the manufacturer's technical representative to avoid any unforeseen consequences.

When you are satisfied that the transmitter and antenna system are really optimized, you can move on to consider the audio line. But that is the subject of **Part II of "The True Route," which will appear next month.**

[5]C. Brian Cox, "*Enhancing AM Signal Coverage Through Improved Modulation Techniques.*" Harris Corporation/Broadcast Equipment Division (1974)



the new stars of UHF-TV broadcasting: integral-cavity klystrons

TV-transmitter manufacturers have long been aware of the real advantages of integral-cavity klystrons, including their compactness, sturdiness and easier handling. Now, progress in the technology of these high-performance tubes has made it possible to cover the whole UHF-TV band with only three different klystrons. THOMSON-CSF offers a full line of these integral-cavity TV klystrons, delivering from 10 up to a big 40 kW of peak-of-sync video output power. Fitted with modulating anodes, they can also operate from the same high-voltage supply in the sound socket, or be used as combined video-and-sound-carrier amplifiers, with up to 16 kW (TH 2070 series) of peak-of-sync video output in that application.

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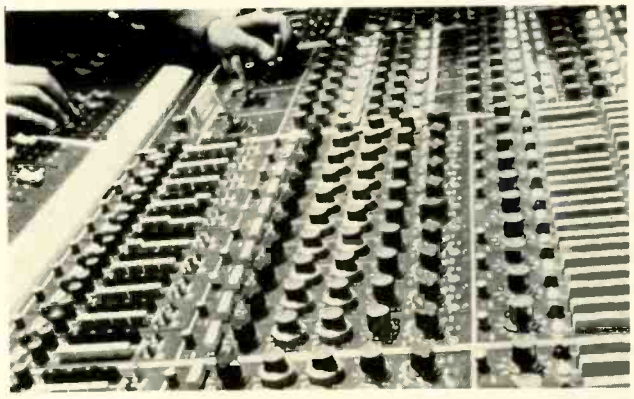
"Audio Is No Longer the Cinderella of Television"

(The following is adapted from a paper, "Audio in Broadcast Television," given at the NAB Convention in Las Vegas by Alastair M. Heaslett, staff engineer, Ampex A/V Systems Division.)



New console at WSM-TV, "Grand Ole Opry House," typifies sophisticated audio technology moving into television.

Can it be that audio is no longer the Cinderella of the television broadcasting industry? What is certain is that more and more of the advanced audio techniques developed in the recording and radio industries are moving into regular use in television.

The difference in quality between the superb video of the modern quad VTR and the audio that used to be commonly available in television was, of course, nothing short of embarrassing. But there are some more pragmatic reasons for a swing to sophisticated audio technology in television.

Economics. Modern multiple-channel audio recording can save large amounts of money in television production, by freeing quad VTR's from post-production work, and by sharply reducing lost time and errors in the making of complex shows, especially high-cost musical shows.

Control of quality. Producers and artists have long liked the close control of quality that advanced video techniques give. Now they are getting the same control of the audio quality.

Consumer sophistication. The increased sophistication of both video and audio production techniques is most timely—the consumer is *demanding* more sophistication, more finish, in television shows.

And even though the gain is impossible to evaluate in strict economic terms, the fact that audio quality *is* improving with the new technology is undoubtedly a plus for the industry. Set makers might gain against their competition by matching the better over-the-air audio with better audio sections in receivers. The European television industry has long worked hard at better audio.

How recording techniques are used in television

The *multichannel audio mixing console* is becoming common in the larger TV stations, with its biggest impact on live television shows. Having twenty or thirty inputs lets the producer, for example, close-mike the orchestra, getting good aural balance in what might otherwise be a very poor environment. The ability to preset groups of microphones eliminates frantic repatching and rebalancing from shot to shot.

Major recording artists feel better about television shows because they know their "sound," often created largely in the recording studio, can be well preserved by multi-channel technology. An artist may even bring his favorite mixing engineer to TV shows, and that engineer does his job through a multi-channel console.

Multi-channel pickup lets the producer control the minutest segment of the audio, with far greater flexibility in physical placement of artists and musicians. Important in this flexibility and control is the hyper-cardioid, "shotgun" microphone, which has helped greatly in the keeping of mikes out of wide-angle shots.

The *multi-channel recording machine*, now a fixture of recording-studio technology with its 16 or 24 or even more tracks, adds its own great contribution to better audio production in television. The ability to lay down separate tracks at different times makes recording studio production far more flexible and efficient, and also greatly increases the artistic, creative possibilities. It has the same virtues for audio production in television, as TV producers are finding out. Furthermore, as discussed in detail later in this article, use of an audio machine in a "double" system, with the audio machine doing the audio recording, can greatly improve the quality of TV audio.

Synchronization, key to better TV audio

Low-cost and highly reliable integrated-circuit logic, by making practical the synchronization of unsprocketed machines, has been the most important single factor in the marriage of advanced audio and video technology.

There are several sync methods in wide use. The oldest is recording on the audio tape a control signal derived from part of the video signal, such as the vertical interval rate. In playback, the control signal is picked up, applied to a phase-lock servo system, or "resolver," where it is compared with a signal derived directly from the video playback. The error signal is used to correct the audio machine speed, through a servoed capstan drive.

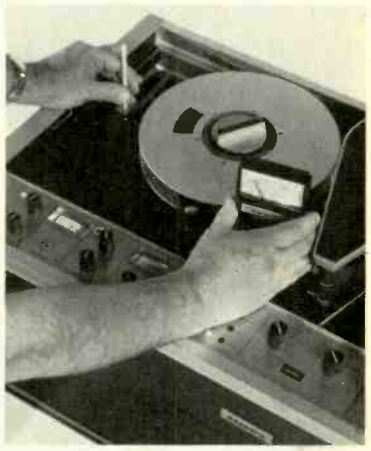
This system is adequate for many programs, but it does not easily provide exact lip sync. The SMPTE time and control code overcame that difficulty. Most readers will be familiar with this absolute time-of-day code which allows identification of any part of the recorded signal by a unique address. The SMPTE code has had

continued on page 36

Now the world's best one-inch VTR has a new name to go with the new features: Ampex VPR-7900A

We've made so many significant improvements on the basic model this past year that we feel justified in calling it the VPR-7900A. It still uses the reliable VPR-7900 transport and signal electronics, but we've made it easier to use, easier to adjust and align, and easier to maintain.

Easier to use
The many benefits of time base correctors have become an important consideration lately. Now the VPR-7900A has a built-in interface for the optional Ampex TBC-800 Digital Time Base Corrector. Plug the TBC-800 into the video output line, and you'll have a picture that is even more stable than FCC broadcast specs call for. (For older VPR-7900s, there's a TBC interface kit available from the factory.)
Editing is made easier on the new VPR-7900A with the addition of an optional digital tape counter with a Power-off-Memory. The large readout will guide you in finding segments, cueing drop-ins, and gauging time remaining.



Easier to adjust
Remove a small access plate atop the VPR-7900A transport, and you'll be looking directly at the shuttle adjustments. It's easier than ever to touch up transport operation now, and once adjusted, it will stay adjusted longer than ever before.
Easier to Maintain
The entire transport chassis tilts up and away from the cabinet for the most convenient service access you've ever had to a professional one-inch VPR. You can operate the VPR-7900A while the transport is tipped up, and you can observe the effect of adjustments and service operations immediately. That saves time and false moves when making minor repairs.

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tremendous impact on video editing systems, allowing precise control of every video frame in automatic and semi-automatic editing.

Audio and video machines, in any combination, can be sychronized by slaving two or more machines to a single SMPTE address-code source, or by using one machine as "master" and another as slave. An example of equipment for the first system is the Ampex RA-4000 Random Access Controller; and for the second, the Ampex Synchronizer System, which is built on a compact synchronizer unit.

For either system, and whatever sync equipment is used, the video and audio machines must have servo-controlled capstans, and remoteable transport control—with those features, true automatic synchronous operation is possible. If the system also has selectable frame offset between machines, it becomes a highly flexible editing system.

Using the SMPTE code for television audio

There are many ways in which SMPTE-synched audio/video combinations can be used in television. Here are a few major possibilities:

Video of a live production goes onto one or more VTR's, with SMPTE code in the main audio tracks. Audio goes separately onto a multichannel audio machine, with the SMPTE code on one track. If the audio is on several tracks, a rough single-channel mix can be transferred, if the producer wants, to the cue tracks on the video. Or he can wait for the final audio mix.

With the video edited onto one tape, the time code can be transferred to the cue track, and the final audio mix simultaneously transferred to the audio track of the video tape, maintaining absolute lip sync.

If the video is edited with a system using the SMPTE code to define the edit points, it is better practice to put the time code originally on the cue tracks, and rough audio mix on the audio track. The final audio mix can still be transferred at a later time, with absolute lip sync.

With this system, sweetening can be added to the audio totally independent of the video; or a dub of the video put on a low-cost VTR for evaluating the overall effect of sweetening.

An alternate scenario: the video and dialog track are recorded and edited in quad format. Time code is recorded on the quad cue track, and on the audio II track of a helical machine, while simultaneously transferring the video to the helical machine, and recording the audio from the quad, and again the time code, on the multichannel audio machine.

The quad is now released for other work, the audio sweetening can be carried out as wanted without it, and the final move requires only a single pass of the edited video tape, which by now represents a considerable investment. The final audio can be mixed onto a spare track on the audio machine, using the Sel Sync mode, and transferred back to the master video tape in the final pass. Alternatively, a secondary audio tape can be created for the mixing and sweetening.

Video layback heads

Today it is even possible to have a special head as-

sembly with full audio-for-video format, on a second multichannel audio machine. This "video layback head" eliminates the use of the quad VTR for the final audio dub.

For example, the Ampex video layback head assembly for the MM-1100 mastering recorder has the normal audio record/playback, audio erase, cue erase, and cue record/playback heads, but also an additional narrow-gap reproduce head for both audio and cue tracks, in position to read the audio and cue signals from a video tape. These heads, plus the recorder electronics, have better frequency response and signal-to-noise ratios than the normal audio record/playback system on a VTR.

If this assembly is used even for the initial transfer between the video tape and the audio machine before sweetening, the transfer can be made away from the relatively hostile audio environment of a quad VTR. This adds to the gain in signal quality from using the layback assembly in subsequent transfers.

Why double-system video: the VTR's audio limitations

The foregoing suggests a couple of reasons—better frequency response and S/N ratio—for the superiority of the double system in recording audio for video. We can examine the audio limitations of the VTR in some detail for a fuller picture of these and other factors.

As to S/N ratio and dynamic range, the audio track on a VTR suffers from the transverse orientation of the tape oxide. This is optimum for video, but for a longitudinal signal there is a drop of 6 to 10 dB for a given level of distortion.

Unfortunately the tape noise does not follow suit, so the dynamic range is reduced some 6 to 10 dB. Helical machines use longitudinally-oriented tape, but the usually narrower tracks and the thin oxide coats of the tape make their own substantial reduction in signal-to-noise ratio.

A second major drawback of the VTR is the frequency modulation of the audio signal by the very large variations in longitudinal tape velocity; these motion variations are cause by the rotary heads, as they contact the tape at a 960 Hz rate. If an audio recording is reproduced on the same VTR, the frequency modulation is effectively cancelled; but any change in tape path, as in shifting from one transport to another, will allow the modulation sidebands to become evident.

This serious degradation of audio quality is unfortunately not disclosed by normal flutter measurements and the effect, in fact, is not perceived as flutter, but as a "blurring" of the signal. Over several generations the modulation sidebands will themselves cause additional inter-modulation products, and the final result can become very objectionable.

A third problem with VTR-machine audio is the use of a combined record/playback head. The gap has to be a compromise between the short gap that is best for high-frequency playback and the longer gap that is optimum for recording. Typical overall performance of the audio channel might approach 56 to 57 dB S/N ratio, computed from the 3% of third harmonic distortion level; and a bandwidth of 50 HZ to 15 kHz, ±1 dB from a midband reference.

As the foregoing suggests, the improvement in S/N ratio comes mainly from the orientation of the oxide for

continued on page 38

longitudinal recording; and the bandwidth improvement from the use of separate record and playback heads, with optimized gaps.

These differences between single-system and double-system audio for video show why four or five generations from an original video tape may show very little degradation of the video signal, but are likely to reduce S/N ratio at least 6 dB for noise alone, and by 12 dB for any coherent signals, such as horizontal rate or power line components. Thus a 120 Hz component, buried under tape noise in the original, can become very obvious by the fourth generation.

If the audio track, however, started its life on an audio machine, the final fourth-generation release on the video tape may have a signal-to-noise loss of only 3 dB, compared with the original. The gain this represents stands out sharply when we consider that the 46 to 48 dB S/N of a VTR audio track after four or five generations is just about equal to the S/N of a high quality home cassette recording, running at only ⅛ the speed, with tracks less than ⅓ the width!

The introduction of dual audio tracks on the VTR format has increased the flexibility of the system, including the addition of stereo capability. However, cutting the track width to accommodate the two tracks causes a loss of 3 to 4 dB in signal to noise, compared with full track audio. This puts even more pressure on double-system recording. And as to frequency response, the audio-only machine not only starts out better, but can more easily minimize the loss over several generations because it is more readily adjusted for optimum flatness.

Noise reduction

It might be argued that the VTR audio track could be restored to top usefulness by applying one or another of the noise reduction systems that are now so prominent on the audio scene. But this ignores all the production flexibility and economy of the double system, pointed out in the foregoing. And the noise reduction systems can be, and are, applied to the audio machines—we can make excellent use of the resulting gains in signal-to-noise, even though the audio machines start from a higher level than the VTR.

The main noise reduction systems in wide use are well known—Dolby "A" and, more recently, DBX. Each has its advantages and disadvantages. The main problem with both is that the recorder channel gain accuracy and amplitude flatness must be maintained within closer limits than is usual, for satisfactory behavior over more than two or three generations.

With careful use the possible coloration introduced by the noise-reduction systems can be minimized, and substantial subjective improvements in dynamic range and signal-to-noise ratio will be realized. These gains are highly welcome in the production of audio for television.

Compressors and limiters

Compressors and limiters have been brought to their present high state of development by the television and

continued on page 40

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radio industries, so their use is familiar to television engineers. The logic of compressor/limiter use for the audio in teleivision will be similar in most respects to that of use in radio broadcasting, discussed in many publications recently. (Editor's note: See the article on another page in this issue, "The True Route to Good AM Audio," for a discussion of audio processing in AM broadcasting; and the article on FM limiting without distortion, for a new approach to limiting in FM.)

With the advances that have been made all along the audio line in recent years, some engineers are now saying we should eliminate artificial limiting and compression entirely, in the interest of audio "purity." And it is true that one can still hear, in far too many cases, the characteristic noise "pumping" of a signal far into compression both on television and radio. But probably most will agree that some form of limiting is a must in broadcasting as it is now constituted. The problem therefore is to design proper compressor/limiters and use them properly. There are a number of good ones available that can do a quiet, smooth job if used in the right manner.

Dynamic noise filters

These devices, of which the line manufactured by Burwen are probably the best known, can recover an intelligible signal on very noisy telephone lines, and reduce heterodyne and adjacent channel interference on poor radio telephone and short wave links. High-frequency bands are automatically filtered out when there is no signal component in them. The resulting reduction in noise and interference can be put to good use on many kinds of "remotes," often transforming such feeds from unusable to usable.

The future

A very strong influence on our thinking about the future is the great proliferation of systems using digital processing for both audio and video. The British Broadcasting Corporation, for example, is now using digital techniques to carry a full audio signal in digital form embedded in the normal video signal. There are a number of obvious advantages in being able to transmit, switch, and route both audio and video over a single video baseband microwave link. Of course, this particular format is no good for production work, for the very reasons that make it excellent for center-to-center transmission.

In this country many schemes are being considered for using digital techniques in transmitting both video and audio. Probably it won't be long before broadcast audio and video are routinely sent along microwave and satellite pathways in digital form. The economics of these systems look better all the time. But signal processing in analog form will also continue to develop. In audio specifically, automated mix-down consoles will soon bring the day when the audio signal can be manipulated as flexibly as the video is now.

Economics will continue to be the major force, but the present and future trends discussed here mean that the drive for better audio quality in television will have high power too. **BM/E**

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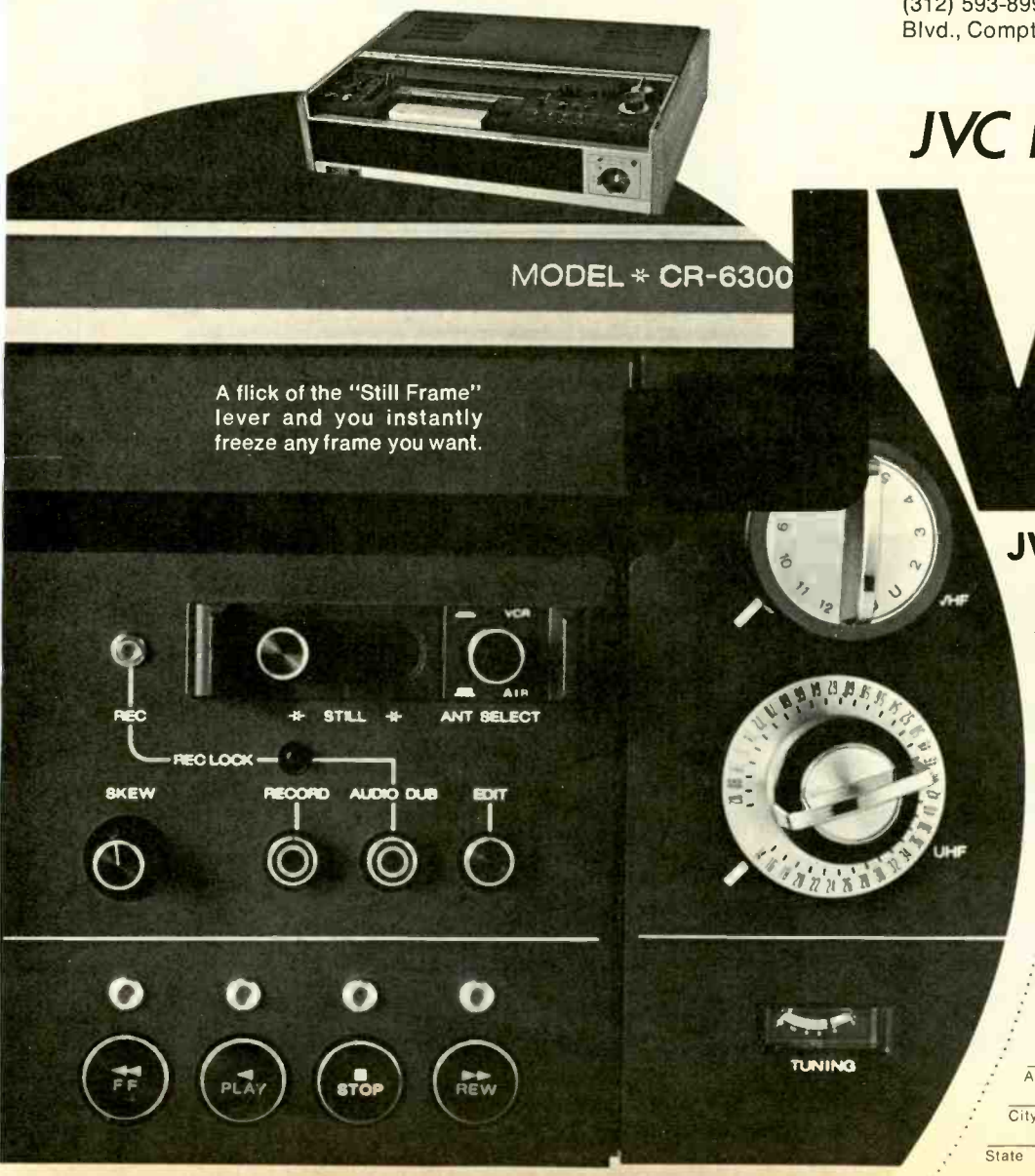

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An Audio Super-console Brings High Flexibility To TV Production At The "Grand Ole Opry," WSM-TV

In the accompanying story, Author Heaslett describes how multi-channel audio consoles are providing great economy and flexibility in production, as well as higher quality, in audio for television.

An outstanding example is a Neve master control console installed last year in the "Grand Ole Opry," which is in effect the main studio complex of WSM-TV and WSM radio, in Nashville.

The construction of a new $15-million opera-house-plus-recording-complex was the occasion for the installation of the new console. As described in a preliminary story in the May, 1974 BM/E, the new building includes not only a 4,000-seat auditorium for every kind of music production, but elaborate radio and TV production facilities and recording studios, as well as feeds to the television and radio transmitters.

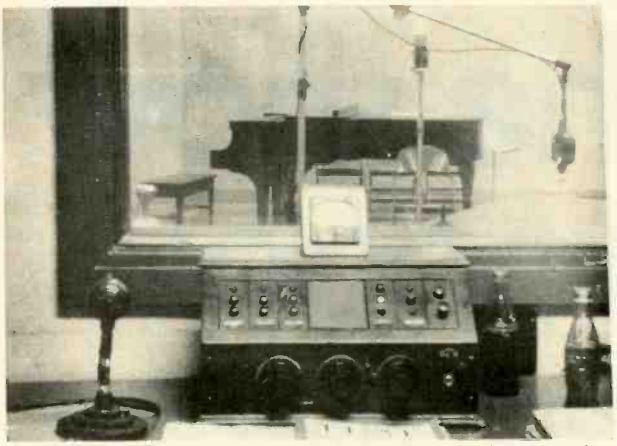
There are 40 microphone positions on the stage of the auditorium. The Neve console can mix these in any combination to 24 outputs, distribute them to any or all of the following: video recording; audio recording; fold-back to the performers; radio broadcast; TV broadcast.

In its first year of use the master console has proven to be immensely flexible and responsive to the concert, broadcasting, and recording needs of the WSM operation, which includes not only the Grand Ole Opry itself but also a long roster of country-music productions and recordings, travelling road shows, and many other music activities.

And the console, as well as the new building and new recording facilities, are splendid culminations for the career of Aaron C. Shelton, for many years Technical Director of WSM, who retired in May. Shelton's career as an engineer at WSM goes back to the 1940's. While carrying out his duties in radio, Shelton was one of the prime movers in establishing Nashville as a center for recording a wide variety of popular music.

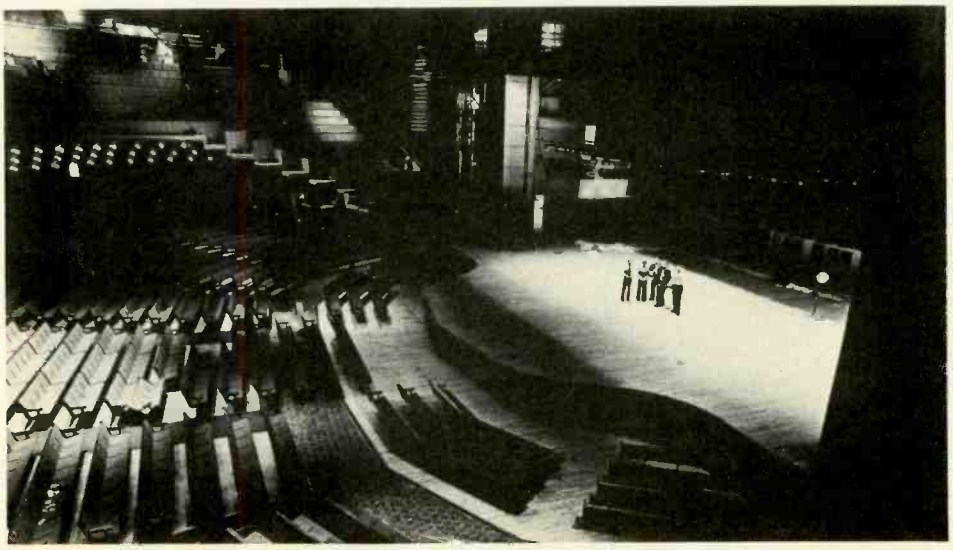
With two other engineers Shelton started the old Castle Recording Studios, Nashville's first, in 1947, and quickly built a reputation for expert discing of popular music, including, of course, the country music that was already flowing into Nashville seeking a "national" hearing via radio.

Shelton's mixing then used three inputs feeding one output (see photo), and the recording engineer had to use his own ears, tuned to the "live" sound, to get the right balance then and there; "post-production" had not yet been heard of. As the maestro of innumerable recording sessions of that variety, Shelton probably has a kind of Cloud Nine feeling as he sits in front of the intricate array of buttons and switches on the new Neve console (photo). The whole new installation at WSM reflects his skill and far-sightedness.



Small cabinet holding three faders, feeding one line, was the "control console" of the old Castle Recording Studios in Nashville, Aaron Shelton of WSM and associates.

Mr. Shelton, who recently retired from his long-term post of Technical Director of WSM, sits at board of the new Neve audio console installed in the Grand Ole Opry House, which feeds the WSM recording, radio, and television studios.



Auditorium in new Grand Ole Opry House seats 4000, has 40 microphone positions on stage, each feeding a separately-controlled input on the audio console.

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Combining High Signal Quality With High Modulation Levels in FM

by Eric Small and Robert Orban

The filtering in many current FM limiters produces ringing and large overshoot, at high modulation levels, with consequent serious distortion. Combining the broadband limiter, high frequency limiter, pre-emphasis, low pass filter and stereo generator in one integrated system, the unit described here reduces these effects greatly and allows FM modulation to be set very high without audible distortion. The article that follows is based on a paper presented at the 1975 NAB Convention.

It is clear from practical experience that all current devices purporting to prevent FM overmodulation actually don't.

One result of this is that it is impossible to set up FM modulation using tone; instead, it must be done with program material—usually one of the station's "difficult" records which inexplicably causes the new type-approved stereo monitor to go wild. Most broadcast engineers tend to somehow blame their limiters. Yet observing the output of any of these devices reveals peak levels very tightly controlled. Plainly, something is happening between the output of the limiter and the RF modulator to cause this unpredictable overmodulation.

A brief review of the peculiarities of the stereo FM system is in order. The FM stereo "pilot tone" system used in the U.S. transmits the sum of the two channels (L+R) on the main channel, which modulates the transmitter up to 15,000 kHz. It transmits the difference (L−R) on a double-sideband suppressed-carrier AM subchannel centered at 38 kHz. A 19 kHz pilot tone at 8-10% modulation is utilized to provide a phase reference to regenerate the 38 kHz carrier for purposes of demodulation. In addition, both left and right channels are pre-emphasized at 75 microseconds.

The result is that the left and right channels must be lowpass filtered at 15 kHz. Otherwise, high-frequency components could leak into the subchannel, and vice-versa (a phenomenon known in communication theory as aliasing.) The filters required are rather high-performance types, as they must be essentially flat to 15 kHz and down 50-60 dB at 19 kHz. In order to achieve this performance with reasonable economy, the sophisticated "elliptic function" filter is used in most stereo generators.

Unfortunately, the elliptic function filter has an extremely non-linear time delay close to its cutoff frequency. The result is that it introduces phase shift and ringing. By changing the phase relationship between the various harmonics in a complex wave, the filter also changes the peak level, thus introducing the possibility of over-modulation. Further phase shift and ringing can be caused by the input transformers, and mismatches between the transmitter pre-emphasis network and the de-emphasis network in the limiter.

Some samples of filter-caused overmodulation

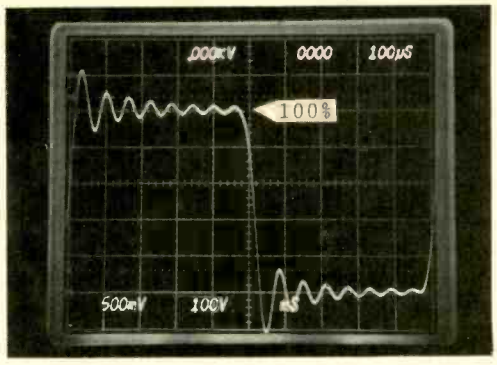
Figure 1 shows a photograph of the response of a highly regarded modern stereo generator/exciter to a 1 kHz square wave. The ringing introduced by the lowpass filter is equivalent to instantaneous overmodulation of roughly 144%. Figure 2 shows the frequency response of the filter. It should be noted that it is extremely steep, with cutoff occurring at roughly 17 kHz.

Figure 3 shows the overall frequency response of another modern exciter. It has a much gentler frequency cutoff, and its ringing; Figure 4, although much less, still corresponds to 122% modulation.

Another potential cause of overmodulation is more subtle, but nevertheless significant. In order to be effective, all currently manufactured FM limiters must use some form of clipping or instantaneous limiting at the output. In some cases, this is used as the sole mechanism to control overmodulation due to preemphasis; in other cases, its purpose is to control overshoots due to the relatively slow attack time of the broadband and/or high-frequency limiting sections.

The result in either case is the same. For some period

Mr. Small is a Broadcast Audio Consultant; Mr. Orban is president, Orban Associates.



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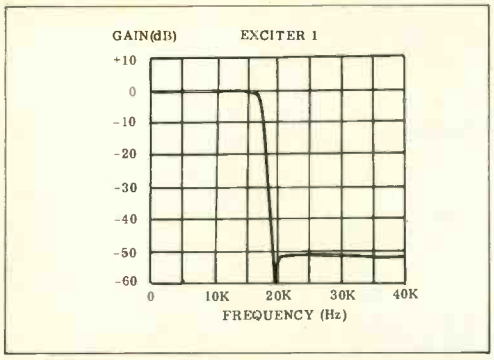
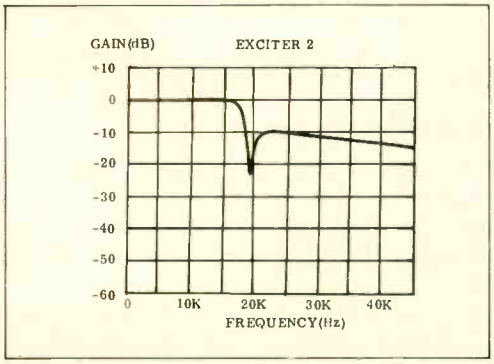


2.

1. A modern stereo generator/exciter produces serious ringing in response to 1 kHz square wave, amounting to over-modulation of roughly 144%.

2. Cause of ringing in unit of Fig. 1 is extremely steep cut-off of low pass filter, shown here. Note knee at 17 kHz.



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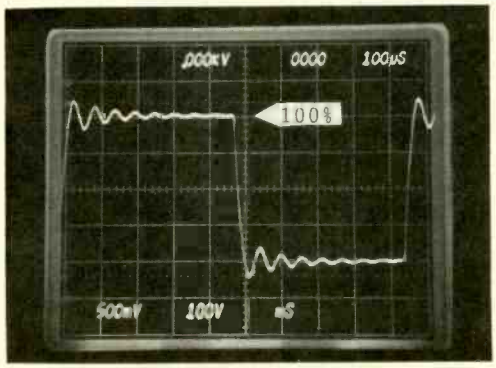
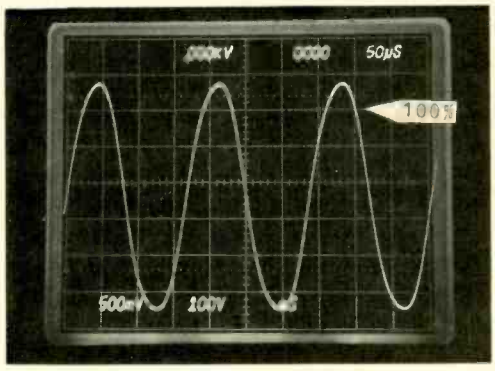


4.

3. Another modern exciter has overall frequency response less sharply cut than that of Fig. 1.

4. Ringing in second exciter, though less than that of Fig. 1, still corresponds to 122% modulation.



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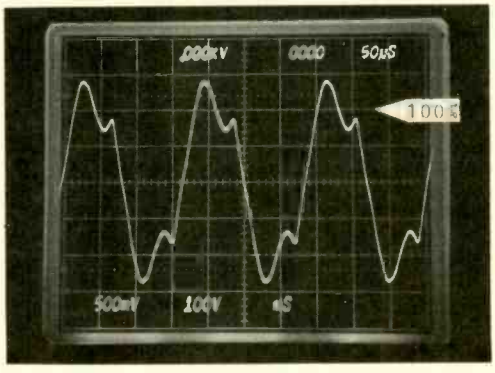
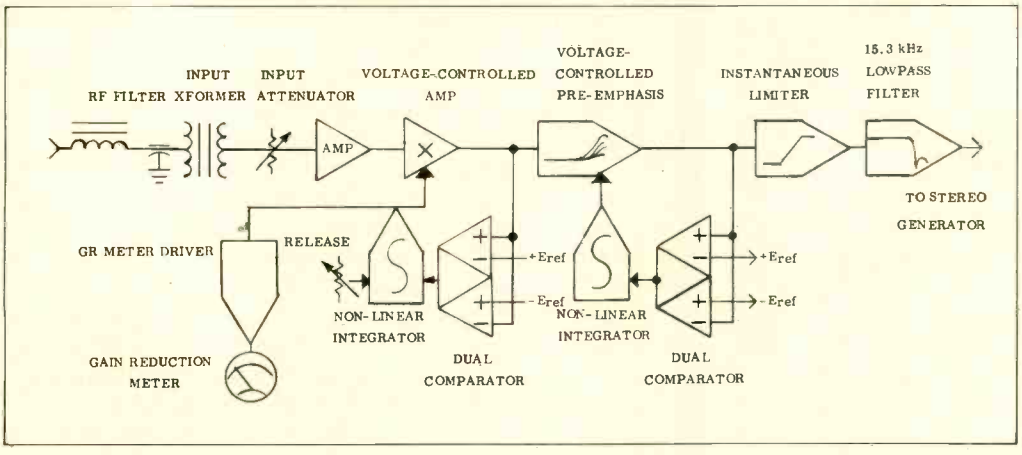


6.

5. First exciter, after clipping, has high frequency components added, enough of which can get through low-pass filter to add with fundamental to 132% modulation, as shown here.

6. Second exciter's gentler cut-off allows considerable third harmonic through; phase shift around 15 kHz has changed harmonic's phase in relation to fundamental, raised peak to 143% modulation.



7.

7. Block diagram of integrated broadband limiter, pre-emphasizer, high frequency limiter, instantaneous limiter, lowpass filter and stereo generator which reduces the overmodulation from filtering and clipping.

of time, the clipped waveform resembles a square wave. This means that the clipping has introduced high-frequency components which were not present in the original program material. Often, these components extend far above 15 kHz, and are therefore removed by the lowpass filter in the stereo generator.

Figures 5 and 6 show the respective responses of the first and second exciter to 5.7 kHz square waves of the same amplitude as the 1 kHz square waves shown in Figures 2 and 4. The sharp cutoff of exciter 1's lowpass filter results in almost all the harmonics' being removed. However, the remaining harmonics plus the fundamental reach 132% modulation.

The gentler cutoff of the second exciter's lowpass filter permits substantial amounts of third harmonic to remain. In addition, the phase shift in the region of 15 kHz (where the third harmonic is) has changed its phase relationship to the fundamental and increased the peak level to 143% modulation.

When we apply Fourier analysis to a square wave, we

find that the peak level of the fundamental is 2.1 dB *above* the peak level of the square wave as a whole. This means that even if we could filter out all the harmonics introduced with an ideal filter having no phase shift or ringing, the level of the output of the filter would still exceed the level of the input by 2.1 dB—equivalent to 127% modulation. When we deal with a real filter, the situation becomes much worse because of the phase shift/ringing problems described above.

In view of all of this, it is small wonder that the modulation monitor's peak light seems to flash at unreasonable levels and at unpredictable times!

The solution: an integrated system

Fortunately, there is a solution to this dilemma. It involves a radical departure from the old way of doing things. However, its justification is its dramatic effectiveness in bringing the peak overmodulation problem under control.

A solution is this: The broadband limiter, preemphasis, high-frequency limiter, instantaneous limiter, lowpass filter, and stereo generator may be engineered as a single system, in a single package, so that the interface between the various processing stages can be consistently defined, and sophisitcated corrective techniques can be employed in a precisely controlled manner. This is what we have done.

The broadband limiter

Figure 7 shows a block diagram of the audio processing section of the system. The basic system logic can be seen to be similiar to conventional systems. Following RF interference filtering and the input transformer, the signal is applied to a voltage-controlled amplifier, realized with a junction FET functioning as a voltage-controlled resistor. The output of the VCA is applied to a dual comparator. If the positive or negative peak value of the output attempts to rise above the level of the reference voltage, the comparator turns on and charges the integrator until the overload disappears.

The integrator determines the basic "sound" of the unit, and great effort has been expended in its development. It incorporates four distinct time constants, which have been carefully arranged so that "pumping" is totally absent. In essence, the unit establishes an average level, and permits approximately 2 dB of very fast limiting above that level, with a release time in the order of 70 ms. If the average level of the input changes, the integrator will release very slowly, on the order of 2 dB/second. A large, sudden increase in input level will cause the release time of the circuit to decrease for a short time, and then recover to its steady-state value. In addition, a time delay occurs between the onset of an input peak and the onset of release. In this way, low-frequency distortion is eliminated.

The range of gain reduction has been purposely limited to 15 dB. Extensive listening tests with all sorts of modern recordings, ranging from classical to hard rock, have revealed that the ideal amount of compression of low-level passages in the music is 8-10 dB. This increases the perceived signal-to-noise ratio at the receiver, but does not simultaneously damage musical

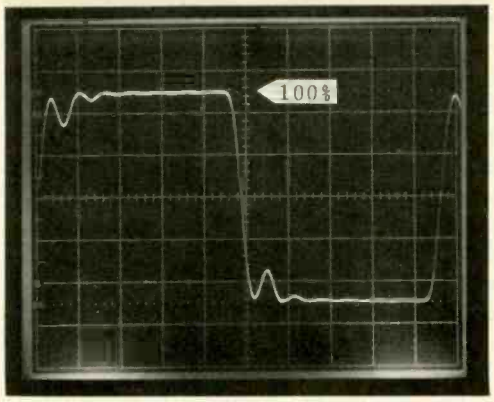


Fig. 8 Response of low-pass filter in new combination unit to 1 kHz square wave shows greatly reduced ringing as compared with other two units; most of ringing is undershoot.

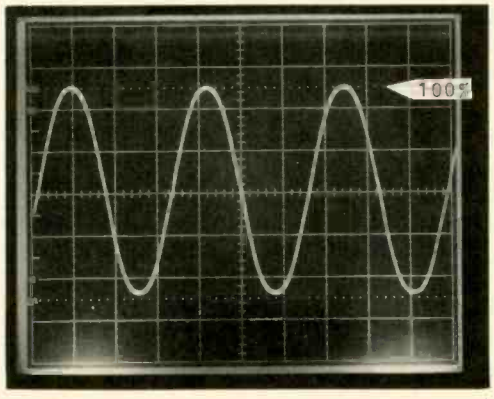


Fig. 9 The response of the filter to a 5.7 kHz square wave shows it reaching precisely 100% modulation, with all harmonics removed.

values because of the nature of the release time constants. In particular, the medium-speed release time which causes pumping and listener fatigue has been totally eliminated.

Thus, if the average amount of compression is 8-10 dB, some 6 dB is left over for "headroom" for fast limiting, operator error, etc. Attempts to increase the compression to greater than 15 dB will result in severe audible distortion, although no overmodulation.

An additional advantage of using 8-10 dB compression is that gating is not required for musical programs. A station with a talk format would probably wish to use an "intelligent compressor" ahead of the limiter, and use the limiter for peak limiting only. However, for music formats, further compression will only degrade quality.

A new kind of high-frequency limiter

While the basic "sound" of the limiter is determined by the broadband section, it is largely the design of the high-frequency limiter that determines whether the audio quality will be grossly degraded by the need to control potential overmodulation due to high-frequency preemphasis. Our high-frequency limiter uses a new principle, whereby the preemphasis filter itself is voltage-controlled by the feedback signal from a comparator. This maximizes the accuracy of the operation, and also permits a tailoring of the filter curves under high-frequency reduction to match the typical spectral distribution of music. Thus small overloads in one part of

continued on page 48

the spectrum will not force gross filtering of another part of the spectrum, with the attendant coloration familiar to all contemporary FM listeners.

The high-frequency limiter is followed by an instantaneous limiter in order to control overshoots due to the moderate attack times of both the broadband and high-frequency limiters. The spurious harmonics produced by this process are dealt with in the lowpass filter, so they do not cause overshoots.

The typical harmonic distortion through the broadband and high-frequency limiters at any frequency and any degree of gain reduction does not exceed 0.2%. De-emphasized noise in the 15,000 kHz bandwidth is better than 80 dB below 100% modulation. Stereo coupling of the two limiters is achieved by using one comparator per limiter per channel, wire "or'ing" corresponding comparators, and using the integrator output to drive matched FET's. In this way, gain reduction in both channels tracks whichever channel requires the most gain reduction at any instant.

The new anti-alias low pass filter: minimum overshoot and ringing

So far, the system merely consists of refinements of current techniques. However, the low pass filter deviates substantially from current design procedure in order to control the overshoot and ringing exhibited by typical exciter lowpass filters. Actual design details of the filter are extremely mathematical and beyond the scope of this paper. However, its performance can be described generally.

The filter is non-linear and non-minimum phase. Its frequency response is flat within +0, −0.6 dB from DC to 15.3 kHz. It is down approximately 60 dB at 19 kHz, and better than 45 dB from 23 to 53 kHz, reaching 70 dB in the SCA region. It is realized with resistors, capacitors, and operational amplifiers, thus eliminating spurious responses caused by stray capacitance associated with inductors. Theoretical overshoot is 3% maximum. Harmonic distortion is under 0.1%.

Figure 8 shows the 1 kHz square wave response of this filter, which should be compared with Figures 1 and 4. Note that the ringing is in the form of undershoot, and that overshoot is less than 103% of the steady-state value of the square wave.

Figure 9 shows the 5.7 kHz square wave response of the filter, and Figure 10 shows its frequency response. Note that the sharp cutoff at 15.3 kHz has removed essentially all of the harmonics from the wave, but the remaining fundamental reaches precisely 100% modulation.

The practical result of this filter, directly coupled to the stereo generator, is an almost complete absence of fast peak overmodulation. Therefore, the average modulation can be raised accordingly, and greater loudness is obtained with no degradation in audio quality whatever.

Two stereo generator designs compared

The stereo generator contains a number of novel design features worthy of comment. Historically, stereo

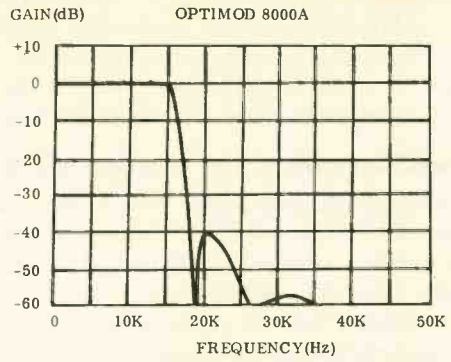


Fig. 10 Frequency response of the new low-pass filter shows the sharp cut-off at 15.3 kHz which removes practically all the harmonics, without causing serious ringing that would raise modulation level significantly above 100%.

generators which used the "time division" or switching technique to generate the stereo baseband signal have been popular. In the days of vacuum tubes or discrete semiconductors, the simplicity of this technique was extremely appealing. However, the fly in the ointment was the necessity of filtering the baseband signal above 53 kHz to remove the spectra around the odd-order harmonics of the 38 kHz square-wave switching signal, such as 114, and 190 kHz. If permitted to modulate the transmitter, these signals would cause interference to adjacent channels, due to these harmonics' high frequency.

Unfortunately, the design requirements of the 53 kHz lowpass filter are very stringent because of the necessity for low phase distortion. Such filters are very expensive to manufacture, and in addition cause mediocre high-frequency separation (40 dB or so.)

The direct technique of generating the baseband signal, using a balanced modulator for the L−R component, was compromised by the relatively low performance of transformer/diode balanced modulators. In addition, these balanced modulators were sufficiently slow to require phase correction in the L+R channel to compensate for the intrinsic phase delay of the modulator.

Improved performance of the Gilbert Modulator

Since the invention of the Gilbert principle of transconductance multiplication in 1968, the situation has reversed. The Gilbert multiplier permits construction of a fast, quiet, low-cost balanced modulator that requires no filtering of the baseband output, and no L+R phase correction. With certain circuit refinements, the Gilbert multiplier can be made outstandingly linear, yielding modulation linearities on the order of 0.01-0.02% harmonic distortion.

Figure 11 shows a block diagram of the stereo generator. In order to maintain the high performance capabilities of the basic modulator with time and temperature, the 19 kHz oscillator level, the 38 kHz level (and therefore the L−R gain,) and the 19 kHz/38 kHz phase relationship are all stabilized by feedback loops, using the very precisely regulated positive power supply as a reference.

The 19 kHz crystal oscillator is stabilized by a feedback loop using a comparator and integrator. The output of the oscillator contains about 0.1% harmonic dis-

continued on page 50

tortion, and therefore requires no additional filtering.

The 19 kHz output is fed through a voltage-controlled phase shifter to a doubler, which produces a 38 kHz square wave. This square wave passes through a voltage-controlled amplifier, and is then lowpass filtered to approximately 0.04% distortion. The output of the lowpass filter feeds a comparator/integrator which controls the VCA so as to stabilize the 38 kHz level at the output of the filter. The amplitude of the 38 kHz is adjusted by varying the reference voltage on the comparator. The filtered 38 kHz output is fed, along with the 19 kHz, into a phase detector. The output of the phase detector is integrated, and controls the voltage-controlled phase shifter, thus forming a phase-locked loop. Because of the integrator, steady-state phase error is theoretically zero.

The left and right outputs from the limiter lowpass filters are applied to a summing amplifier and differential amplifier to produce L+R and L−R respectively. The L−R signal is multiplied by the 38 kHz lowpass filtered signal to form the double-sideband amplitude-modulated supressed-carrier subcarrier. The subcarrier is summed with the L+R and the pilot in the output amplifier, which passes through an attenuator to the RF modulator of the station's exciter.

Performance of the new stereo generator

The stereo generator is capable of 60 dB separation at midfrequencies, reducing to approximately 47 dB at 15 kHz. Sub-main and main-sub crosstalk due to modulator non-linearities are below −70 dB. The 38 kHz supression is typically better than −55 dB. Supression of the 76 kHz exceeds −70 dB. The only major supurious output is 114 kHz at −57 dB, which is sufficiently low to be negligible. Noise and distortion are limited by the performance of the earlier audio processing chain.

Stereo/mono switching is accomplished by disabling the 19 kHz oscillator, which in turn removes the 38 kHz and eliminates the subcarrier. The stereo/mono control is interfaced to any remote control by means of opto-isolators for RF and ground loop supression. A simple set-reset flipflop provides latching for the stereo or mono mode, and is arranged so that the system always comes up stereo in the event of an AC power interruption.

Setup and alignment of new generator/limiter

The systems approach makes setup of the unit almost foolproof. The outputs of the left and right input amplifiers are metered, as is the output of the L−R amplifier in the stereo generator. Setting input levels is merely a matter of sending a mono audio signal from the studio, advancing the left input level control until the gain reduction meter reads the desired amount of compression, and then advancing the right input level control until the L−R metering nulls. Then the output level is advanced until 100% modulation is obtained- In a new installation, it is sometimes desirable to tweak the pilot phase and L−R gain controls to compensate for RF modulator quirks, particularly with older exciters.

Interfacing with RF modulators is most readily accomplished by means of the interface modules which all major manufacturers of exciters can provide to interface to composite STL receivers. The output of the stereo generator has been designed to look like the output of such a composite STL receiver electrically. However, we have had considerable success in interfacing the system to certain exciters directly, provided that the baseband output lead length is limited to less than twelve inches.

Results of tests on the air

A prototype of the system under discussion has been tested on the air at several stations. In general, the system has performed according to expectations. Subjectively, there is extremely little sense of limiting or compression, and no audible difference in high-frequency response between "air" and "program" for approximately 95% of all current recordings. Any high-frequency loss that does occur sounds perfectly natural, without timbre modulation or distortion common to other systems, and is detectable only in a direct A/B comparison with the original source. **BM/E**

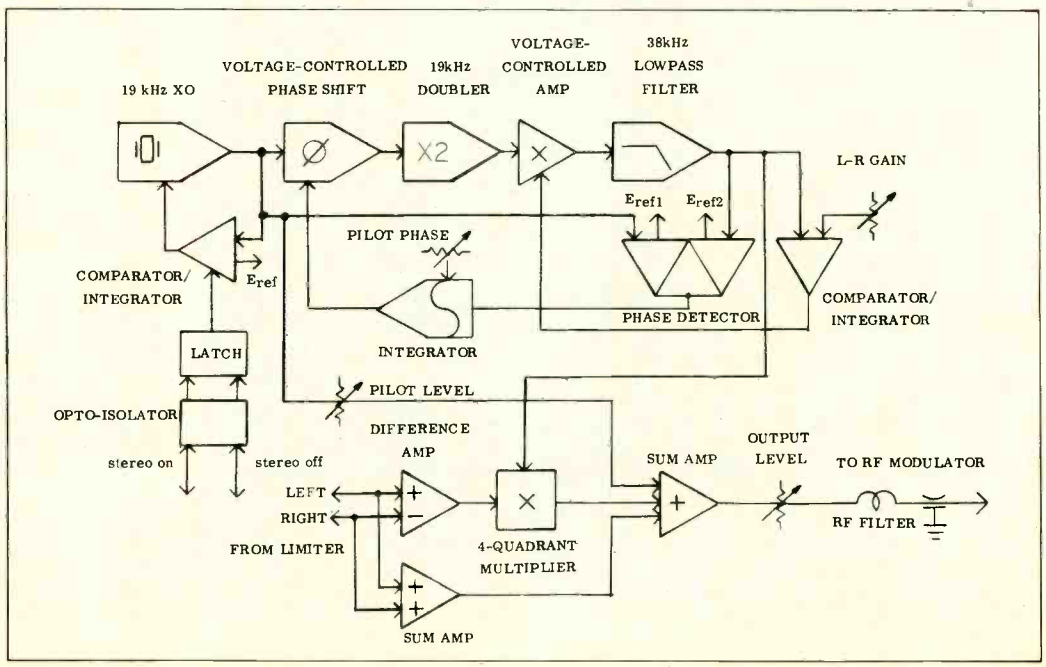
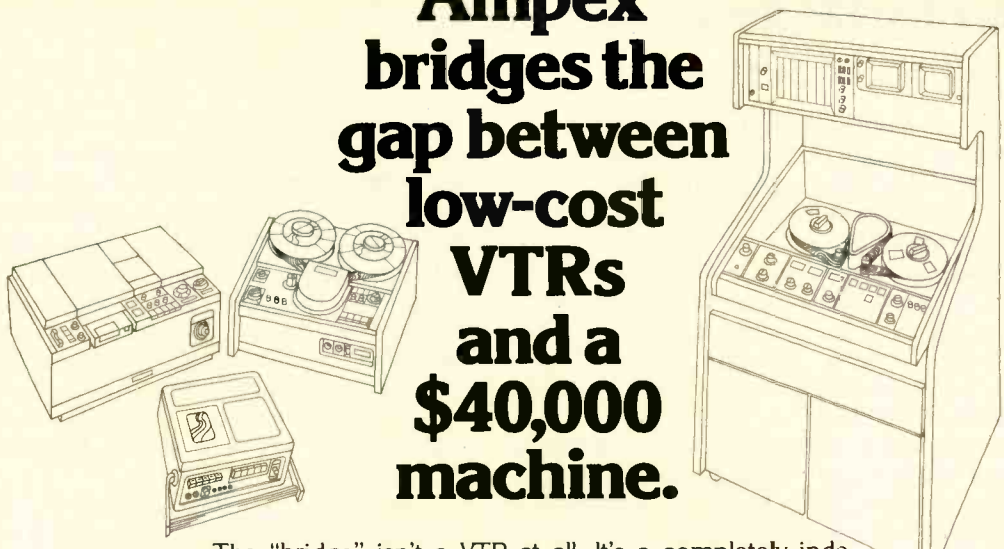


Fig. 11 Block diagram of stereo generator in new combination unit shows feedback loops used to stabilize pilot levels and phase relationships, and other features of design.

Ampex bridges the gap between low-cost VTRs and a $40,000 machine.



The "bridge" isn't a VTR at all. It's a completely independent piece of equipment called a Digital Time Base Corrector, the Ampex TBC-800.

By feeding the output of your helical VTR through our TBC-800, you'll achieve the same sort of time-base stability that Ampex builds into every broadcast-quality videotape recorder.

If you're using a low-cost VTR for Electronic News Gathering (ENG), you'll be able to play the tapes on the air without dubbing. Just connect an Ampex TBC-800 to the VTR output signal line, and picture stability will meet FCC broadcast standards.

If you're using a low-cost VTR for production work, you'll be able to produce finished programs with edits and insertions, and the final product will be clean, sharp and stable. And when you use the TBC-800 for dubs, you'll be able to get quite a few generations away from the original without significant loss of definition or clarity.

Nothing will make a low-cost VTR into a $40,000 model, but the TBC-800 will give many VTRs capabilities they would never have otherwise. If your helical VTR has a servoed capstan, it'll work with the Ampex TBC-800. If your color system employs heterodyne circuitry, there's a module for the TBC-800 to make it work with your machine. Dropout Compensator and Sync Generator are standard. Available options include stand-alone or rack-mount configuration, and a Velocity Compensator.

TBC-800. The Ampex product that bridges the gap between low-cost VTRs and a $40,000 machine.

AMPEX

Ampex Corporation, Audio Video Systems Division 401 Broadway, Redwood City, Calif. 94063 (415) 367-2011

Circle 162 on Reader Service Card

Antenna for Off-Air AM Monitoring

by Roy Trumbull, Technical Supervisor, KCBS, San Francisco

Amid the forest of high rise structures in San Francisco's financial district, picking out a clean signal for the air monitor can be tricky. While you would suppose that a commercial directional receiving antenna might be available, such is not the case.

The long wire antenna is the type most often used for air monitors. But if re-radiation from nearby structures is a problem, a directional antenna is called for. With our roof antenna farm up some 45 stories above the street, wind is also a problem. All these factors led us to use a compact tuned-loop antenna.

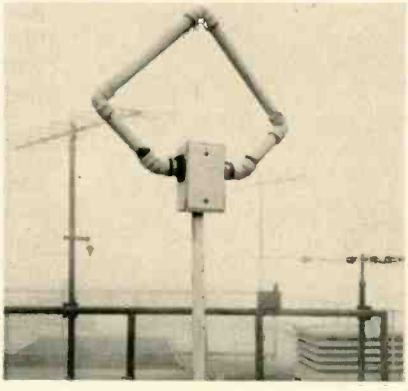
A tuned loop consists of at least 6 turns of #22 wire formed into a weather tight loop and resonated in combination with a tunable inductor at the desired frequency. Broadbanding is accomplished with a shunt resistor which lowers the Q of the circuit. The actual dimensions and geometry of the loop are unimportant. The loop or square should be at least 8 inches across for sufficient signal pickup.

If you have access to an electrician's shop with heat forming equipment for PVC plastic conduit, you can form a circle for your antenna. Otherwise you will have to make the antenna from short pieces of PVC formed into a square with 45° and 90° elbows (see photo). The circle or square is then mounted on an outdoor cast aluminum utility box with ports in the top, bottom, back, and sides. The cover fits on with a rubber gasket. If you make a square out of PVC pieces, it is best to lay out the component pieces and thread the wire through them before cementing them together with PVC cement.

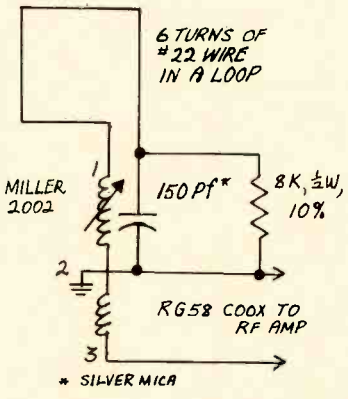
The resonating inductor placed in series with the loop is a Miller 2002 subminiature antenna with the free hanging wire clipped off. Connected to pins 1 to 2 are the many turns which go in series with the loop. Connected to pins 2 to 3 are the few turns that are used to feed the coax. Pin 2 is taken as ground. The function of the shunt resistor is to broadband the resonant circuit by ±10 kHz at the resonant frequency. The math for the resistor calculation may be found in the Radiotron Designer's Handbook.

The inductor is mounted on a piece of PVC and fixed in place with U bolts. It is directional in the edge plane. That is, the hole is 90° off axis from your transmitter site. The loop does have a front and a back with greater signal pickup in one direction than the other. The resonant point is fairly broad but sharp enough to note on a signal strength meter, associated with your RF amplifier, when tuning the inductor slug.

The reason the inductor is tuned rather than the capacitor is that moisture will effect a variable capacitor more. To reduce moisture effects, it is a good idea to use a heat gun to drive moisture out of the utility box before sealing it. If you have a desiccant to put in the box, so much the better. **BM/E**



Completed antenna built out of PVC.



Schematic of loop monitoring antenna. A general discussion of the loop antenna can be found in the ARRL antenna handbook

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Circle 137 on Reader Service Card

GREAT IDEA CONTEST

Another collection of valuable ideas. Look them over and then vote for those you think best on the Reader Service Card. Next month will be the wrap up of the 1975 contest.

29. Visual Indication Of Cart Status For Board Operator

James H. Young, Chief Engineer, KTAN-FM-AM, Sierra Vista, Arizona

Problem: Our Tapecaster cart machines are located to the right of the operator not readily visible when looking toward the live-copy book in front of him. Consequently there is some confusion as to which cart to start following a live announcement.

Solution: An SCR and an illuminated pushbutton remote start switch were added to each of our 3 Tapecaster X-700 cart playbacks. The switches are mounted immediately in front of the operator and are illuminated whenever a cart is loaded, ready to play, but are extinguished if there is no cart in the machine *or* if that cart has already been played.

The remote start button is not defeated, so the machine can be restarted for a donut spot if desired. However, this circuit could be adapted to absolutely prevent restarting.

The circuit has been used with Tapecaster equipment only, but it should be adaptable to other brands. The SCR is activated when 24 Volts

are applied to the anode as the cart is inserted into the machine. A pulse is coupled to the gate and the SCR latches on, turning on the lamp. A "start" command grounds the collector of TR-6, in the Tapecaster, which is also coupled by the diode to the SCR gate. The SCR turns off and lamp goes out, staying off until the next cart is inserted in the machine.

30. Alarm For Loss Of FM Carrier

Rockwell D. Smith, Chief Engineer, KBBK-FM, Boise, Idaho

Problem: With a remote controlled FM transmitter at a distant mountain top site, often plagued by momentary power outages or fluctuations, particularly during bad weather, it became obvious we needed a means to alert the operator to carrier failure on the FM. The operator is in charge of both our AM and FM simultaneously (both are automated) and often would not be monitoring the FM at the time of an outage. The FM is one of the top rated stations in our market, and it was extremely embarassing to have a listener call in to tell us we were off the air.

Solution: While a high-quality, off-air monitor is in operation most of the time, it was often set at fairly low level, and the operator may not immediately be aware of lack of audio, especially during week-end and nighttime hours, when, being the only person in the station, his attention might be directed either to the AM station, or he may be in production.

The particular FM stereo modulation monitor in use at KBBK (McMartin TBM 4500A) has a pilot monitor light that is operated by a relay. Six volts ac is used to show presence of the stereo pilot. Since KBBK is full time, with no mono programming as such, it was decided that we had the perfect "failure indicator" already. The leads to the stereo pilot indicator lamp were simply extended to another relay, which in turn triggers an alarm (we

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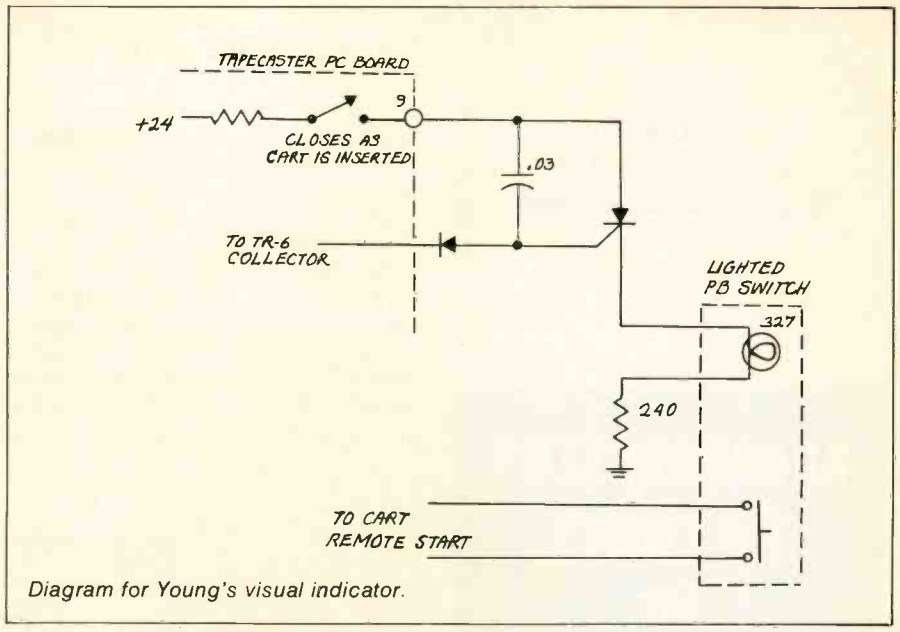


Diagram for Young's visual indicator.

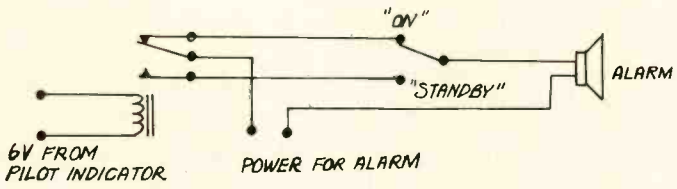
GREAT IDEAS

used a horn from a motorcycle, mainly because we had one lying around needing to be used for *something*).

The relay to drive the alarm is a "double throw" relay, with an s.p.d.t. switch between it and the alarm. The purpose of the switch is to turn the alarm off during an extended failure, but in such a way that the operator cannot leave the alarm "off." When turned "off," the alarm will sound upon PRESENCE of carrier, reminding the operator to return the switch to the proper position.

We have had no lengthy off-air periods due to inattention since the alarm was installed.

Note: Since the alarm is actuated by lack of stereo pilot (obviously lost if carrier is lost) it would also be triggered by failure of the stereo generator. Since this is a rather remote possibility compared to the loss of power momentarily, we find the reliability and simplicity of the whole thing very satisfactory.



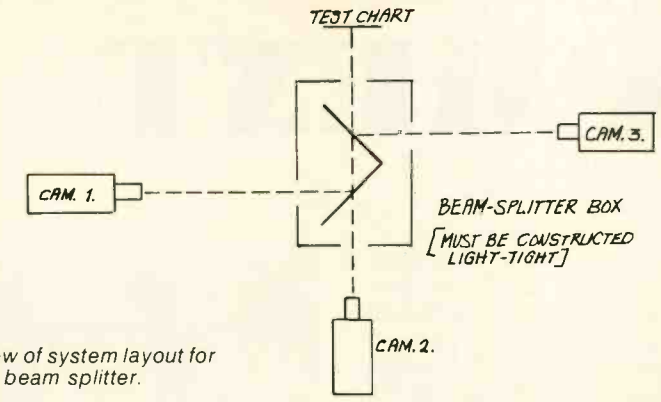
Off-air alarm in use at KBBK-FM.

31. Simple Beam-Splitter For Accurate Color Matching

Myles H. Marks, Engineer, WIIC-TV, Pittsburg, Pennsylvania

Problem: Matching color studio cameras using a logarithmic "chip-chart" is, at best, a very difficult and tedious task especially in small studios where the cameras are so close to the test chart that they pick-up the reflected light from completely different angles. Studio lighting as well as ordinary illumination transmits various degrees of color temperature. Therefore, the reflected light picked up by cameras at different angles "see" different color temperatures, depending upon which light is being reflected by the test chart into each camera lens. This makes a two or three camera match almost impossible.

Solution: We built a relatively simple beam-splitter box using optically transparent glass plates as the mirrors. Using this it is possible for as many as three cameras to "see" exactly the same reflected light at exactly the same angle and thus exactly the same color temperature. (See diagram) The dimensions of the beam-splitter box will depend on the distance between the test chart and the box: the shorter the distance, the larger the box must be. When all cameras "see" the same reflected light, a much better color match can be made than with normal side-by-side alignments and balances.



Top view of system layout for Marks' beam splitter.

32. Emergency Replacement For Dead Color Channel

William D. Gramling, TV Engineer, WRC-TV, Washington, D.C.

Problem: Occasionally one of the color channels of a live camera will quit due to a defective pre-amp, proc amp, etc., usually on a remote when all cameras are in use and few spare parts are on hand.

Solution: A tried and true method of quickly getting the camera back on the air is to obtain the three primary colors from the two working channels. Since blue represents the smallest portion of the monochrome signal, it is desirable to restore red or green by using the modules from the blue channel, should red or green be the dead channel.

The basis of the solution is to obtain a feed of green video from the green channel's proc amp, loop it through the input of a spare distribution amp (with a gain control for painting) then back to the green input to the colorplexer. The output of the DA is fed into the blue input of the colorplexer. The composite video can now be painted by using the DA's gain control for blue level adjustment.

It is true that the camera cannot produce pure blue or green but it can be painted to closely match the others and is now quite acceptable for air.

33. Signalling Which Call To Take On Phone Call-in Shows

Gene Rider, Chief Engineer, WIOD, WAIA-FM, Miami, Florida

Problem: Multi telephone line call-in talk shows usually require a telephone operator-production assistant to preview incoming calls prior to the talkmasters putting them on air via his second call director or PBX. With 12-15 lines flashing in the hold mode, it's a chore signalling digitally by upheld fingers to the talkmaster as to the next sequenced or priority call to take.

Solution: Build a stepping relay device for the operator whereby she can push a button lighting a numbered read-out light visible to the talkmaster to signal him which line to take next. We used this system for years.

A better solution is available if you have a CRT typewriter cartridge logging encoder in the same control room. Chances are the unit will drive a second CRT. Install this CRT on the talkmaster's desk. Then the telephone operator can type out which line to take and any other information pertinent to the on-the-air program for the talk show host to read as he broadcasts.

BROADCAST EQUIPMENT

For more information circle bold face numbers on reader service card.

Solid state AM tuner the AM5, is designed for studio/station monitoring. Selectivity is achieved with two eleven-element ceramic filters. A 10 kHz whistle filter is built in. Frequency response is 15 Hz to 10,000 Hz. Sensitivity is 3 μV. Companion (separate) ferrite antenna, the DA3, is shielded and directional with FET two-stage amplifier. It can be rotated and tilted to null out unwanted signals. McKAY DYMEK **300**

Image enhancers offer a signal-to-noise ratio of better than 60 dB. Models 834, 854, 877, and 470 also feature adjustable H/V enhancement ratio, front panel coring, and simplified construction. DYNASCIENCES VIDEO PRODUCTS **301**

AM transmitter, produced for foreign markets since 1967, is now for sale here since the June FCC ruling created a new 2.5 kW AM power classification. Model 703B will be furnished with optional power reduction to 1,000 or 500 watts for nighttime cutback. SPARTA **302**

Portable color camera equipped with a 1½-inch viewfinder, Model CTC-5X, features built-in automatic sensitivity control. It also has a front panel trigger switch for activation of portable VTR, an adjustable control for outdoor or indoor shooting and EIA RS-170 sync. $2,000. GBC CLOSED CIRCUIT TV CORP. **303**

Helical editing control system, the EA-5, interfaces with the Sony VO 2850 cassette recorder. System consists of an editing console plus an auxiliary console to accommodate and control the Sony interface. Some features are:

continued on page 60

Start Shooting with Our Versatile, Low-cost Portable Broadcast Color Camera

ASACA ACC-3000

The ASACA ACC-3000 is an extremely lowcost yet highly practical portable broadcast color camera developed for outdoor news gathering and use as an indoor studio sub-camera.

The ACC-3000 incorporates such features as 3-tube optical system (RGB), standard C-type lens mount, 4-position filter disc and three different field lenses which can be used for any type of C-mount zoom lenses. The camera head, VF, backpack and power control unit are all included as standard equipment, and the backpack output is an NTSC (PAL) signal. In addition, the 2/3-inch low-lag type chalnicon tubes have a sensitivity triple that of a plumbicon, not to mention their flat spectral characteristics and superior color reproduction. The deflection yoke incorporates electrostatic focus and electromagnetic deflection, so registration adjustment is simple and no time is lost in set-up. Finally, the cable between the camera head and the backpack can be up to 30 meters long, another great advantage.

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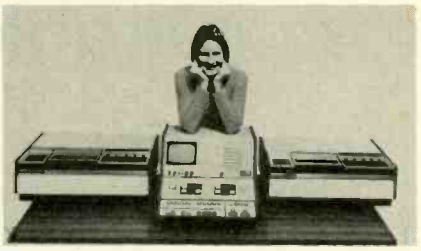
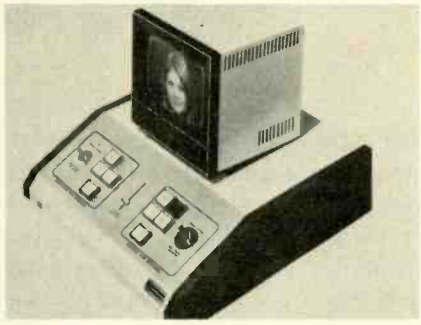
PRODUCTS



preview edits; editing-to-video or -audio cues; bidirectional search. $6,000. TELEVISION RESEARCH INTERNATIONAL **304**

Electronic editor, the ECS-1, works with the Sony VO 2850 cassette

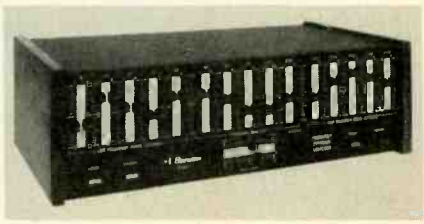


New Audio Processors

Here are a few of the many recent devices that give the broadcaster new or improved abilities to shape audio into more attractive form:

Half-Octave Graphic Equalizer. A new equalizer introduced by SAE (Scientific Audio Electronics) gives control over 20 different frequency bands, peaked a half-octave apart, from 20 Hz to 20 KHz. The vertical slide controls provide up to ±16 dB of equalization for each band. The unit has two complete channels, for stereo, and comes in a cabinet for home use (Model 27B) or in a rack mount (Model 2700B). IC-controlled power supplies for both sections are built in, as is a pink noise generator as a guide in overcoming room resonances and compensating for equipment deficiencies. Harmonic and intermodulation distortion are rated at less than 0.02%; output is 11 volts RMS into a 600 ohm load. 27B, $550; 2700B, $600. **326**

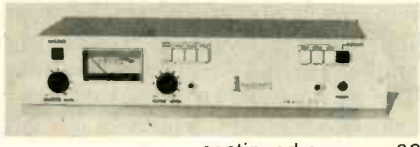
Frequency Extender-Equalizer. This unit, the EQ3200 from Burwen Laboratories, combines three non-interacting elements: five pairs of low-frequency peaking controls, at 16, 25, 40, 70, 150 Hz, with ±10 dB peaks;



recorder, as well as open-reel, 1-inch VTR's. Dual joysticks control bidirectional variable speed tape motion of both playback and record VTR's. Options include switchable cross-pulse to the video monitor and programmable end insert timer. $6,000. CONVERGENCE CORP. **305**

One-inch video tape recording system is offered in three versions: BCN 20—portable, battery-powered, offers 52 minutes of recording time; BCN 40—consists of tape deck and electronics unit and provides integrated electronic editing facilities; BCN 50—a processor-equipped BCN 40. This last model is equipped with either a black & white or color monitor, an oscilloscope and/or vectorscope. The BCN 20 will be marketed for about $30,000. The BCN 40 for $35,000, and the BCN 50 for $57,000. BOSCH/FERNSEH **306**

Replacement tape recorder electron-



continued on page 62

similar controls at 3.3, 6.5, 10, 15, and 24 KHz; and five controls that tilt the response up or down gradually with half-gain or loss points at 50, 200, 700, 2,000 and 8,000 Hz. The mid-band equalizers tilt the whole response above and below the "turning points" so that it is possible, for example, to add 5 dB at 16 Hz with the 700-Hz control, 10 dB with the 50 Hz control, and 10 dB with the 200 Hz control; plus the peaking control! The high end is similar. LED indicators warn of overload when the level is 3 dB below clipping; a variable input attenuator is included. Rated output is +21 dBm in 600 ohms; distortion, 0.2% maximum. $1145 in rack mount; $1095 in cabinet. **314**

"Auto flanger." The flanging effect, produced by feeding back a time-varying delayed repeat, is almost universally on tap in recording studios and is becoming popular in production for radio. It is often used for pseudo stereo. MXR Innovations of Rochester, NY, has introduced the "Auto Flanger" which allows setting the time delay (.2+2 Mg) and the sweep oscillator, (.05 to Hz) independently or in any ratio. Price is approximately $300. **327**

Instant Flanger. This unit, as reported in a previous BM/E, is made by Eventide Clockworks of New York. It provides delay variable from 200 microseconds to 10 ms, oscillator variable from .05 to 20 Hz, manual or remote control; it also has an envelope-follower mode, in which the input signal amplitude is used to control the flanging effect; and a "bounce" mode that simulate motor or servo "hunting." $625.00. **328**

PRODUCTS

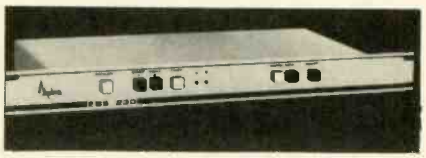
ics unit features remote control and three-speed equalization. The Model 375 plugs directly into most Ampex recorders, is adaptable to most other machines. $690. INOVONICS **307**

Film processor, Model ACM-E4/E6, is for converting Ektachrome type E4 to E6 process when required without the need for tank changes. The unit processes 110, 126 and 135 Ektachrome film with a film output of 5 fpm in the E4 configuration and 10 fpm in E6. TECHNOLOGY, INC., HF PHOTO SYSTEMS DIV. **308**

Ultra-low-noise microphone cable features two-conductor stranded copper wire (twisted) and helical screening using fine copper wires. Price of a 268 yard roll of Raab MK72 cable is $90. LAMB LABORATORIES **309**

Low-band TV broadcast antenna is for channel 2 through 6 stations. Turnstile II is a six-bay turnstile type and has omnidirectional standby capability. The antenna can be assembled at the site. RCA **310**

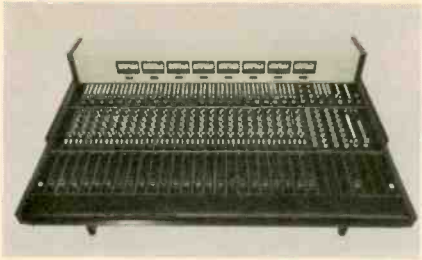
Emergency broadcast two-tone attention systems is used for monitoring and transmitting the new emergency broadcast signals required by the FCC



to go into effect on 15 January 1976. The EBS-230, pictured, combines the encoder and decoder units in a single, rack-mounted package measuring 1¾" high × 19" wide. It features program channel loop-through, front-panel adjustment controls for both tones, and a self-test circuit. $295. ALPHA ELECTRONIC SERVICES **311**

Electronic surveillance system reports malfunctions in film processor. Sensors detect breakdowns in the processor and announce the condition by flashing a light in a display window, and triggering an audio alarm. Called Photosense, the system monitors: temperature; film breaks and film speed; power; hypo flow; developer and water wash; hypo-, water-, developer-, and air-pressure. $3,000 to $10,000 for custom installation. PHOTO SYSTEMS **312**

Modular recording/remixing/on-air audio control console, Model 110-8, is for budget 8-track and 16-track recording/remixing and on-air work. Some features are metering, separate control room and studio monitoring, either 8- or 16-channel monitor matrix,



simultaneous stereo and 8-channel outputs. AUDITRONICS **313**

10 MHz analog-to-digital converter is offered in 11-, 12- and 13-bit models in both 5 MHz and 10 MHz word rates. The Series 9000 offers internal track and hold circuits with an aperature of 10 picoseconds. The units operate on system power. $8,200 to $13,980, depending on model. COMPUTER LABS **315**

Video tape for use with quadruplex high-band VTR's, VTC-1000, has a video signal-to-noise ratio of up to 50 dB, headwear of less than 7 μ in/hr. Single reels (64 minutes play time) are available for $168.50. VIDEO TAPE CO. **316**

Push-on coax connector is designed primarily for push-on modular equipment rack and panel applications. They are supplied in 75 ohms standard; 50-ohm versions are also available. TROMPETER ELECTRONICS **317**

Portable stereo mixing system is based on an 8-input mainframe and is expandable without recalibration. Each input channel includes XLR-type input, 5-position input attenuator,

pre-EQ foldback level, 3-frequency EQ. $1,600. RICHMOND SOUND DESIGN, LTD. **318**

Black & white VTR, the Model GV-212, provides an hour of recording and playback on ½-inch tape. Features include auto-manual level adjustment, stop action, and audio dubbing. GBC CLOSED CIRCUIT TV CORP. **319**

Constant power ballast and lamp ignition series includes models with power ratings of 200, 400, 575, 1,200, 2,500, and 4,000 watts. Prices of a 1,200 watt ballast and ignitor module are $532 and $90, respectively. TDC **320**

Wireless microphone transmits at 450 MHz. Dynamic or electret mics can be used. The transmitter will supply

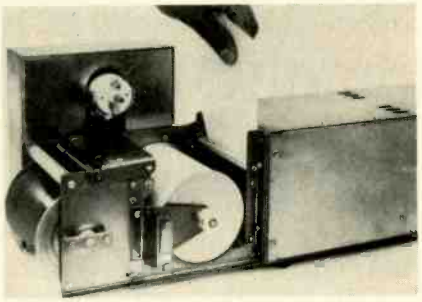
continued on page 64

PRODUCTS

power for several types of electret lavalier mics. The receiver is optionally line-or battery-powered and provides either line or mic level output. TELEVISION EQUIPMENT ASSOCIATES **321**

Video trimmer compensates for path length variations as a result of aging of discrete components. Delay time is infinitely variable from 3 to 9 ns. Model UN3/9 has 75-ohm impedance; loss is less than 0.1 dB at 100 kHz. $48. TELEVISION EQUIPMENT ASSOCIATES **322**

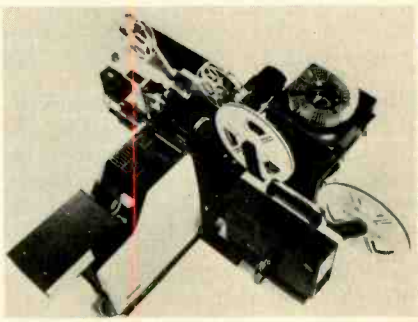
Prompter includes tilting. Model TP2 uses 4 × 6 index cards or adding-



machine roll paper. Black-on white or white-on-black display permissable. $2,350. ULTRA AUDIO PIXTEC. **323**

Colorbars and sync generators, the R/-series, are portable or available rackmounted. Sync-and-bars, driven bars, bars (standalone), and color sync generator-only ($595) are initial four versions. Sync generators include genlock, 2 sets of outputs. ULTRA AUDIO PIXTEC **324**

Compact video program origination/production center uses up to three film sources plus live video. LDH-16 color telecine system is capable of transferring Super 8 film, 16mm film and 35mm slides to standard TV format as well as picking up opaque displays, rear-screen projections and limited-action live scenes. Inputs are



optically combined via a prismatic quadraplexer. Genlock sync generator with horizontal delay and sub-carrier phase adjustments are built in, plus black and white R-G-B controls, color bar generator and test sawtooth generators. PHILIPS AUDIO VIDEO SYSTEMS **325**

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INDEX

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