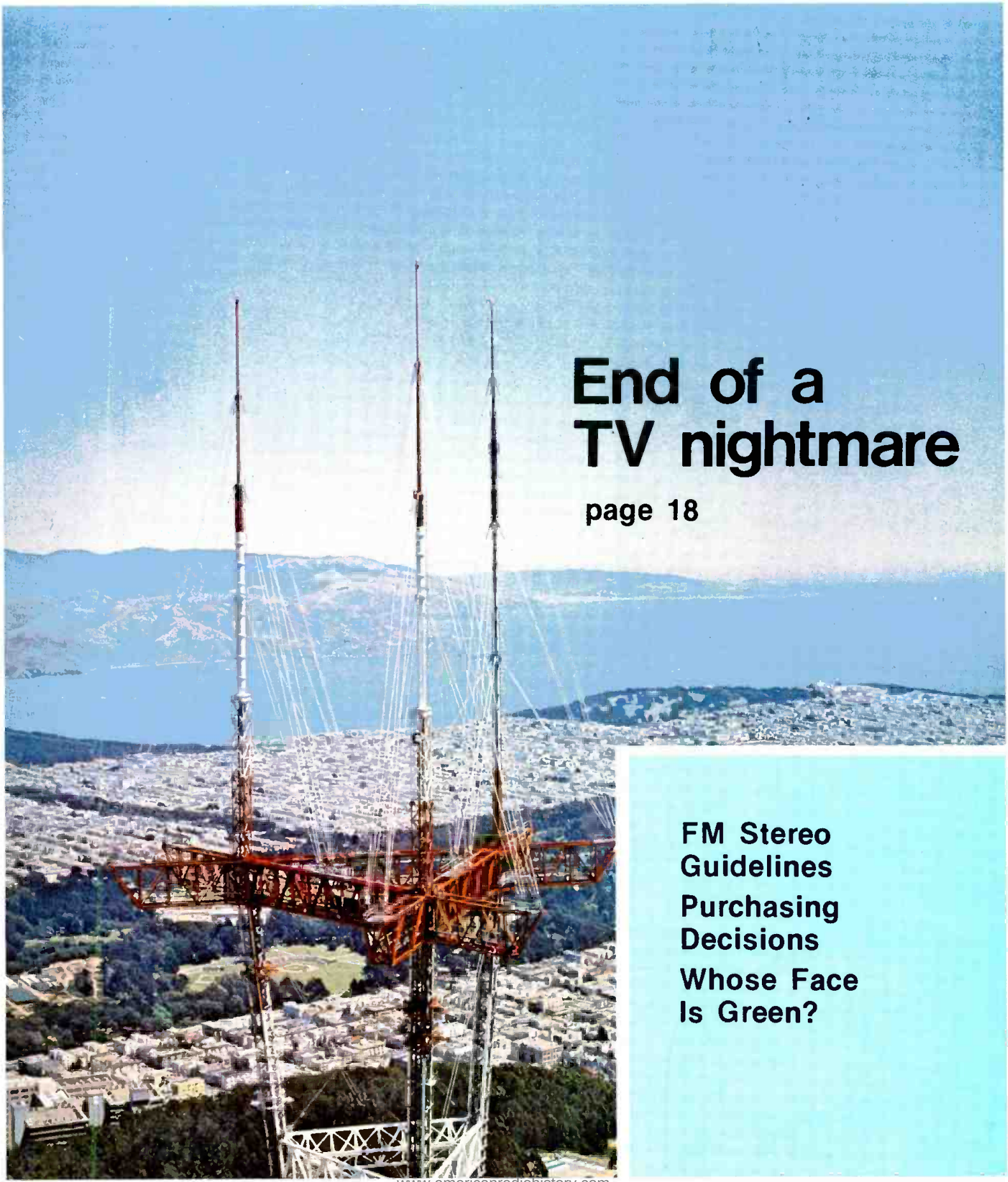
January, 1974/75 cents

BROADCAST engineering

the technical journal of the broadcast-communications industry



End of a TV nightmare

page 18

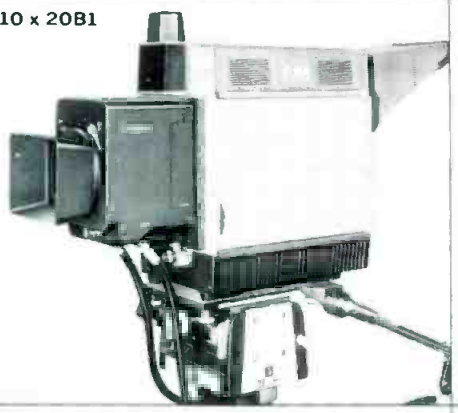
FM Stereo Guidelines

Purchasing Decisions

Whose Face Is Green?

Canon offers the perfect zoom lens for the camera of your choice

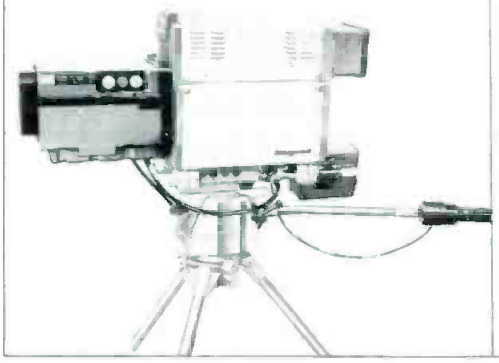
P10 x 20B1



P17 x 30B1

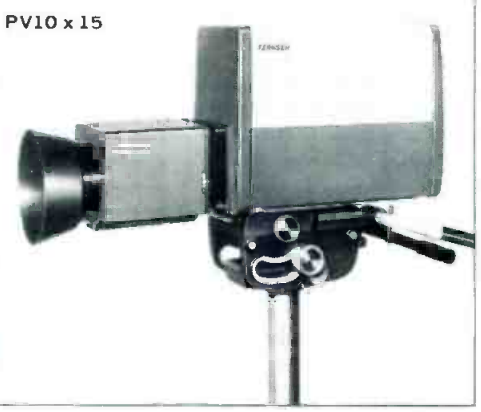
P17 x 30B2

PV10 x 16B



PV17 x 24

PV10 x 15



More and more people are discovering how significantly superior Canon Zoom Lenses are for TV broadcasting purposes. Their outstanding color characteristics, even in dim light, is one of the many reasons why Canon was chosen for telecasting the Munich Olympics.

Canon's wide range of excellent zoom lenses encompass three types of operation control—all-servorized, via flexible cables and by effortless push-pull rod control. And it can be attached to fit and operate with any make of TV camera.

Shown on this page are only a few examples of the quality lenses Canon has available to more than meet your particular demands. Specify Canon to stay ahead.

The following are Canon TV Zoom Lenses for the Plumbicon® color cameras currently available on the market:

Size of image tube	Lens	Image format covered
1¼" Plumbicon® color camera	P10 x 20B4 P17 x 30B1 P17 x 30B2	17.1 x 12.8mm (21.4mmø)
1" Plumbicon® color camera	PV10 x 16B1 PV10 x 15B2 PV17 x 24B1 PV 6 x 18B1	12.8 x 9.6mm (16mmø)

® Reg. TM N.V. Philips of Netherlands.

The Canon TV Lenses Naming System

P10 x 20B

- P — Glass Compensation for Beam Spliter
- 10 — Minimum Focal Length
- x — Zoom Ratio
- 20B — Application

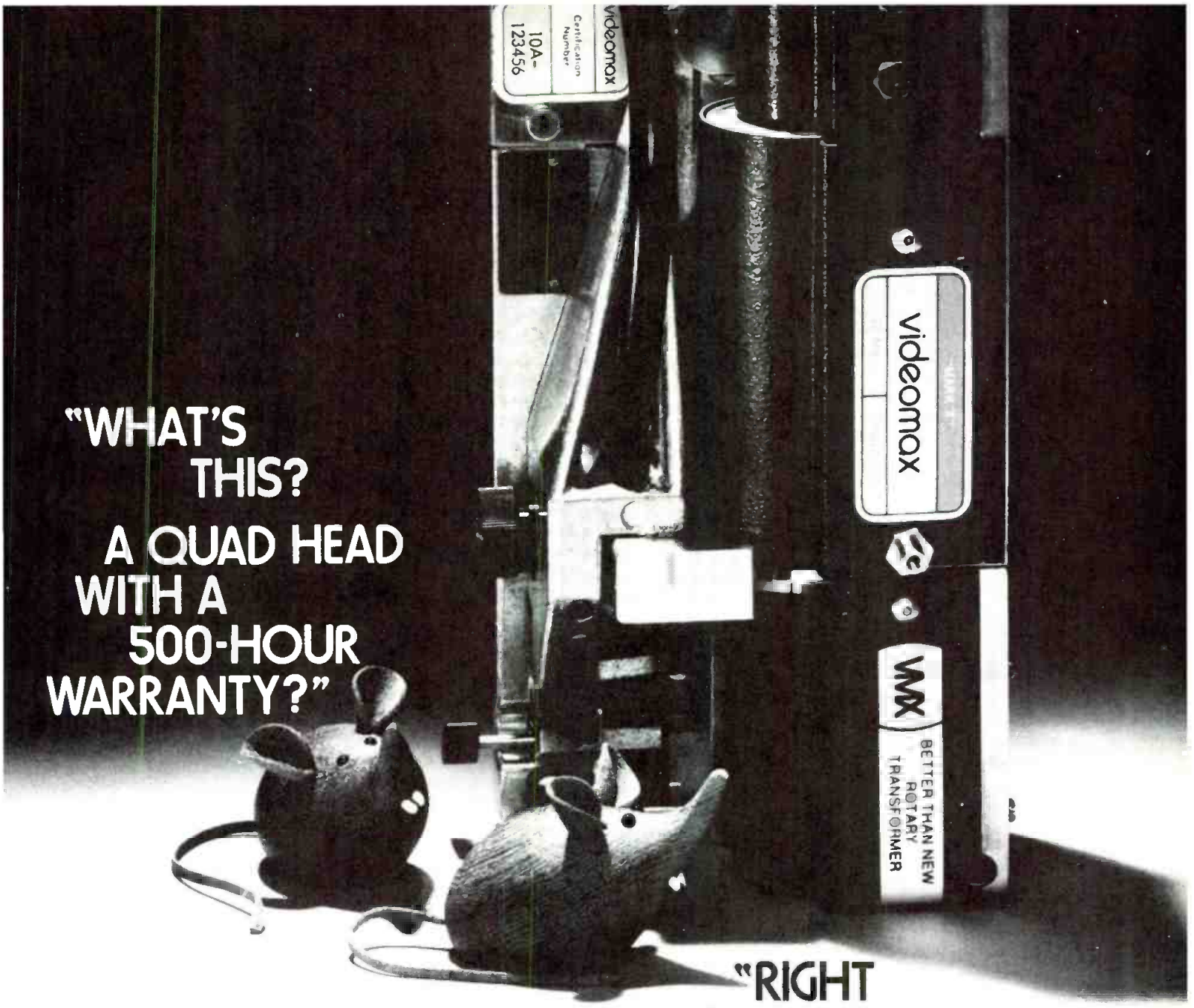
Applications	Image Format	Pick-up Tubes
P	21.4mmø	1¼" Plumbicon
PV	16mmø	1" Plumbicon

Apart from the above. Canon has available TV zoom lenses for 3" or 4-1/2" image orthicon cameras and can also build special lenses to fit your requirements.

Canon

● CANON INC.: 9-9, Ginza 5-chome, Chuo-ku, Tokyo 104, Japan ● CANON U.S.A., INC.: 10 Nevada Drive, Lake Success, Long Island, New York 11040, U.S.A. (Phone) 516-488-6700 ● CANON U.S.A., INC.: 457 Fullerton Ave., Elmhurst, Illinois 60126, U.S.A. (Phone) 312-833-3070 ● CANON OPTICS & BUSINESS MACHINES CO., INC.: 3113 Wilshire Blvd., Los Angeles, California 90005, U.S.A. ● CANON AMSTERDAM N.V.: Gebouw 70, Schiphol Oost, Holland ● CANON LATIN AMERICA, INC.: Apartado 7022, Panama 5, Panama

For More Details Circle (1) on Reply Card



"WHAT'S THIS? A QUAD HEAD WITH A 500-HOUR WARRANTY?"

"RIGHT AND BETTER THAN NEW!"

Welcome Max and Maxine. They've got a lot of good things to tell you about VIDEOMAX, the innovators.

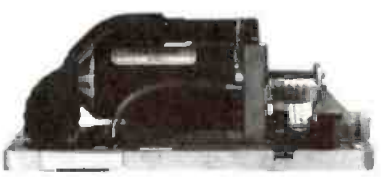
Broadcasters have asked for it. Now VIDEOMAX, the VTR quad head specialists, offers the "L" series refurbished head assembly, **better than new,** with a **500-hour warranty** at a price of only $950. How do we do it? Engineering innovation from the company whose only business is providing you with the finest quad heads available.

More good news. VIDEOMAX has also extended warranty on its current product now known as the "M" series from 150 to 200 hours at $800. This series is engineered for the most demanding, highly critical applications.

The choice is yours. Both the "L" and "M" series carry the same "no risk" trial offer. Both series are available in all Mark III and Mark X configurations. We'll continue the same fast service—ten working days or less—and we have the only field force dedicated to this business.

When you return a video head to us, it is completely refurbished from stem to stern. Every unit is then certified to meet or exceed the industry's highest standards, insuring total compatibility. It's only because we're the innovators that we can offer you these fantastic new warranties.

Careful Max and Maxine. We've built the better mousetrap.



VMX videomax™

For more information, write or call collect.

Videomax Corporation
Subsidiary of Orrox Corporation,
154 San Lazaro Avenue, Sunnyvale, California 94086.
Phone: (408) 739-5391

For More Details Circle (4) on Reply Card

January, 1974 • Volume 16, No. 1

BROADCAST engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

Sutro Tower, overlooking San Francisco Bay area. For the inside story of how and why Mt. Sutro was used, see article on page 18. Cover picture courtesy of RCA.

DEPARTMENTS

BROADCAST ENGINEERING is published monthly by Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105. Telephone: 913 888-4664.

BROADCAST ENGINEERING is mailed free to qualified persons engaged in commercial and educational radio and television broadcasting. Non-qualified subscriptions in the U.S. are $6.00 one year, $10.00 two years, $13.00 three years. Outside the USA add $1.00 per year to cover postage. Single copy rate 75 cents. Back issue rate $1.00. Adjustments necessitated by subscription termination at single copy rate.

Controlled Circulation postage paid at Indianapolis, Indiana.

Robert E. Hertel, Publisher

INTERTEC PUBLISHING CORP.
Subsidiary of HOWARD W. SAMS & CO., INC.

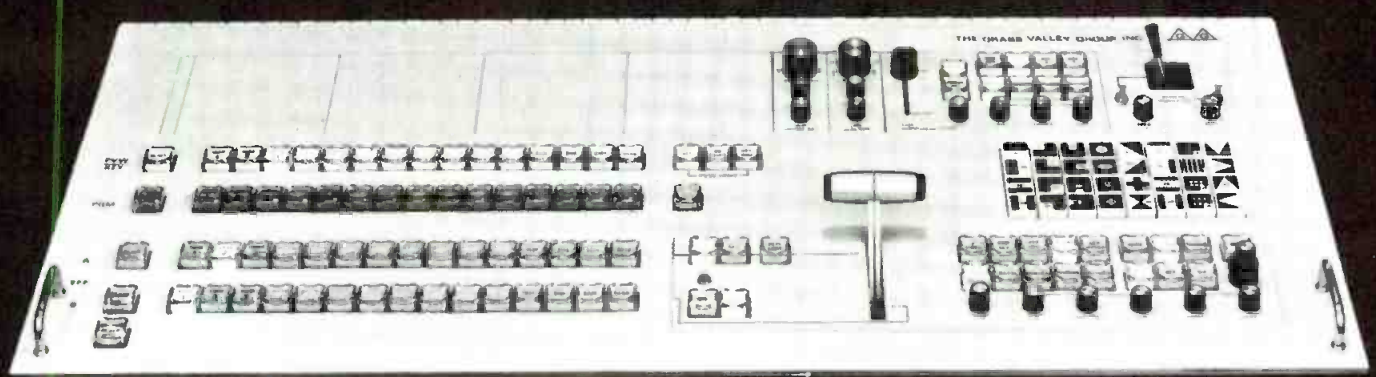
MODEL 1600-2A ----- A SWITCHER OF MODERATE SIZE AND PRICE PROVIDING STATE OF THE ART TELEVISION PRODUCTION TECHNIQUES SUCH AS *LINEAR KEYING, SOFT WIPE* AND *ELECTRONIC VIGNETTE.*

STANDARD FEATURES

- 16 VIDEO INPUTS
- 4 OUTPUT BUSES---MIX/EFFECTS A & B, PREVIEW/KEY, PROGRAM
- COLOR BLACK/COLOR BACKGROUND GENERATORS
- 32 WIPE PATTERNS
- JOYSTICK POSITIONER WITH MODULATION
- HORIZONTAL AND VERTICAL PATTERN LIMIT PRESETS
- ELECTRONIC SPOTLIGHT
- SOFT WIPE – ADJUSTABLY SOFT PATTERN EDGES
- BORDERED PATTERN EDGES – ADJUSTABLE COLOR AND WIDTH
- FOUR KEY MODES

OPTIONAL FEATURES

- CHROMA KEY SIGNAL GENERATOR
- DOWNSTREAM (PGM BUS) KEYER SYSTEM
- BORDERLINE GENERATORS FOR MIX/EFFECTS OR DOWNSTREAM KEYER
- CUTBAR SYSTEM
- RBG CHROMA KEY SWITCHER, 6 INPUT
- TECHNICAL PREVIEW BUS
- AUDIO FOLLOW VIDEO SYSTEM



THE GRASS VALLEY GROUP, INC.

SOLD EXCLUSIVELY BY GRAVCO SALES, INC.

6515 Sunset Blvd.	Station Plaza East	125 South Wilke Road	Redbird Airport	1644 Tullie Circle, N.E.
LOS ANGELES, CALIF.	GREAT NECK, N.Y.	ARLINGTON HEIGHTS, ILL.	DALLAS, TEXAS	ATLANTA, GEORGIA
(213) 462-6618	(516) 487-1311	(312) 394-1344	(214) 330-1245	(404) 634-0521

OVERSEAS - GRASS VALLEY INTERNATIONAL - BOX 1114, GRASS VALLEY, CA 95945 - USA

For More Details Circle (5) on Reply Card

DIRECT CURRENT FROM D. C.

January, 1974

by Howard T. Head

Commission Reorganizing Field Bureau

The Commission has begun the process of reorganizing its Field and Engineering Bureau (FEB). The new organization, known as the Field Operations Bureau (FOB), is headed by C. Phyll Horne, former engineering assistant to the FCC Chairman. Horne replaces Curtis B. Plummer, who retired in mid-1973 after 33 years of service with the FCC.

The principal effect of the new reorganization will be to group Bureau activities along functional lines. Station monitoring, for example, will be combined with inspection, reflecting the close relationship between these two activities. The FOB, in addition to its broadcast activity, also exercises supervision over many other areas. These include land mobile operations, where the Bureau is stepping up its mobile monitoring capabilities, and Citizens Band operations, which continue to be one of the most troublesome areas in the Bureau's enforcement activities. Field enforcement of the Commission's CATV regulations in both the technical and non-technical areas is expected to become an increasingly important activity.

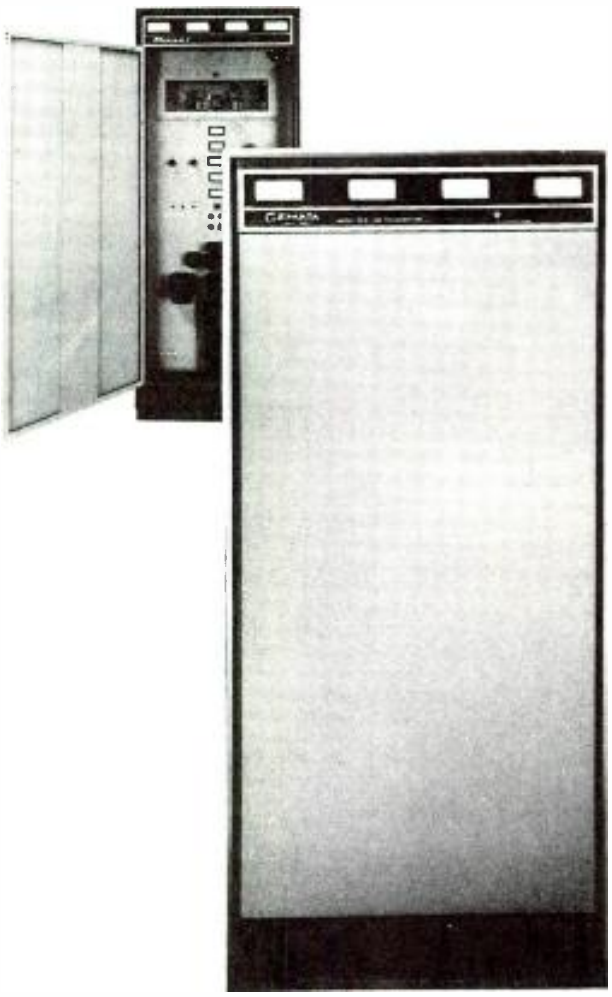
One of the more productive aspects of the Bureau's reorganization is a shift of non-engineering activity, such as the supervision of operator examinations, to non-engineering personnel, thus making the time of highly-skilled technical personnel more available for specialized tasks. However, the Bureau's workload continues to increase more rapidly than do staff increases to carry out the Bureau's responsibilities, and no expansion of the monitoring and inspection schedule appears likely in the near future. There is a new outlook in the Bureau, however, with better communication between FCC Washington Headquarters and the Field Office, together with improved understanding of the obligations both of broadcast licensees and of the Commission's field inspectors, who in many instances are the only FCC representatives the Commission licensee ever sees. Improvement may be slow in coming, but it is on its way and all for the better.

Broadcast Receivers of Increasing Concern to Commission

Until recent years, the Commission had little concern or authority over the performance of broadcast receivers. The Commission's charter, the Communications Act of 1934 as amended, is couched almost solely in terms of control over radiating devices, and in the case of radio and television receivers this could be stretched only to cover local oscillator radiation, and even that was rarely of concern.

the Bauer 707 was 'just right' in its day

THE SPARTA 701B IS 'JUST RIGHT' TODAY!



In the tradition of the most successful broadcast transmitter in history, the Bauer 707, now comes the SPARTA 701B:

THE NEW MODEL 701B SPARTA/1kw AM TRANSMITTER IS THE ONLY ONE MANUFACTURED TODAY WITH EVERY ONE OF THESE 'JUST RIGHT' FEATURES AS STANDARD EQUIPMENT!

- **All solid state, right up to the finals**
- **125% positive modulation**
- **Tally light overload indicators**
- **New long-lived 4-500 tubes**

Plus these and other time-tested SPARTA/Bauer 'just right' quality features; oil filled modulation transformer, built-in dummy load, vacuum capacitor final tank tuning.

Did you know...
Sparta manufactures a full line of AM and FM transmitters, and audio products? Look to Sparta for EVERYTHING in your broadcast equipment needs.

SPARTA
ELECTRONIC CORPORATION
5851 Florin-Perkins Road, Sacramento, Ca. 95828
916 383-5353 TELEX 377-488 CABLE SPARTA
A DIVISION OF COMPUTER EQUIPMENT CORPORATION

For More Details Circle (6) on Reply Card

(Continued from page 4)

This situation began to change even before the advent of the current consumerism crusade with the passage of the law requiring television receivers to be capable of all-channel reception. This act empowered the Commission for the first time to set performance standards for television receivers, which was done initially in terms of such performance aspects as receiver sensitivity and noise figure.

This latter authority was subsequently expanded in the absence of protest from the receiver industry to include requirements for comparable television tuner performance at UHF and VHF. The Commission continues to delay full implementation of the comparable tuning requirements as tuner designers are unable to find economical solutions to the production of compact precisely-tuned detent mechanisms.

The Commission is also in the process of commenting on a bill pending before Congress to require all-channel radio tuning, that is, to include FM as well as AM. The failure of automobile manufacturers to include combination AM and FM radios in new automobiles becomes increasingly difficult to understand as the market is flooded with inexpensive AM-FM portable receivers providing surprisingly good performance at modest prices.

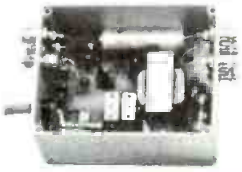
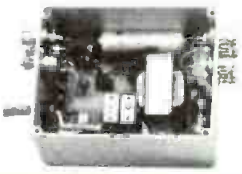
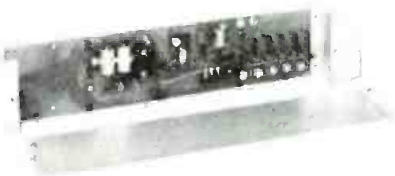
Notes on CCTA and Related Cable Activities

The recent CCTA (California Cable TV Association) convention at Las Vegas has to be characterized as strictly a "downer". At atmosphere of pessimism pervaded the meeting as cable operators and franchise holders began waking up to the fact that cable operators in the large metropolitan areas have got to find something new and different to offer their customers if they are going to make money.

There is a growing feeling that overpromotion of "blue sky" cable services is causing very real problems today. While great claims of potential cable services were made, municipal franchising authorities, taking these promises seriously, have begun to demand that cable operators make good on them by providing free-access channels and a host of municipal public services. All this costs money, and however meritorious, the service isn't the sort of thing the public is going to stand in line to pay for.

At least one major MSO has concluded that his company will stick strictly to the "traditional" role of cable as a master antenna system, a route which will be increasingly followed by many more operators unless some novelty, such as pay cable, turns out to be a source of profit for cable operators in metropolitan areas.

ADC'S ECONOMY LINEUP

MODEL 800 VDA		Looping Input 4 Outputs Self Contained	$125
MODEL 801 VDA		Differential Input 4 Outputs Self Contained Cable Compensation	$165
MODEL 8125 ROUTING SWITCHER		12×5 Audio Follow Video Input & Output Amps Expandable (6×5-$2350)	$2550
MODEL 811 COLOR SYNC GEN		EIA Specifications Totally Digital Proportional Oven	$585
MODEL 701–702 VDA – PDA		4 Modules Per Frame Looping Input Dual Outputs	$455 (Frame + 4 DA's)
MODEL 705 AUDIO DA–PRE AMP		4 Modules Per Frame Balanced or Unbalanced 6 Outputs + 18db Out	$655 (Frame + 4 DA's)

DELIVERY FROM STOCK

AMERICAN DATA CORPORATION

AN AIRPAX COMPANY

315 WYNN DRIVE, N.W. P. O. BOX 5228 HUNTSVILLE, ALABAMA 35805 TEL. 205-837-5180

ADC SOUTHEAST	ADC SOUTHWEST	ADC MID-ATLANTIC	ADC NORTHEAST
DAVE SPINDLE	RUSSELL TREVILLIAN	DWIGHT WILCOX	JOHN SULLIVAN
205–837-5180	713–941-7272	301–460-1454	617–237-2600

For More Details Circle (7) on Reply Card

INDUSTRY NEWS

Daylight Savings Problems

In response to Congressional consideration of legislation to make Daylight Saving Time mandatory during the current energy emergency, Clint Formby, president, KPAN, Hereford, Tex., and chairman of the Radio Board of Directors of the National Association of Broadcasters, issued this statement:

"Broadcasters understand the national need to conserve energy and we will cooperate fully in that effort.

"However, the Congress and the Federal Communications Commission should be aware of the tremendous hardship year-round Daylight Saving Time would impose on many people—particularly those who live in smaller communities and rural areas.

"These people depend on local radio stations as the only source for weather, local news, emergency information, school closings, etc. If Daylight Saving Time is imposed year-round, these people will be deprived of this vital service because many stations will not be able to sign on until 9:00 a.m. DST.

"I urge the FCC to investigate every possibility that might offer relief. I also urge affected broadcasters to make their Congressmen aware of the serious nature of this problem."

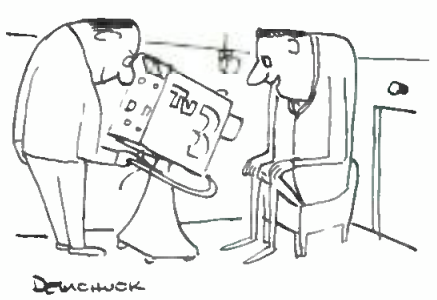
ITVA Schedules Annual Conference For April 21-24

Plans for the annual Conference of the International Industrial Television Association meeting April 21-24 in Chicago have been completed according to Conference Chairman and ITVA vice-president Ronald Butler, AV Specialist, Nissan Motor Corporation in U.S.A., Carson, California.

Each year the ITVA meeting attracts world-wide management and operating specialists concerned with the use of television and related techniques for communication, training, instruction, information and security purposes in business, industry, education, government, health care, public safety and other applications.

Butler said the Conference meeting will be organized to provide maximum opportunities for personal and professional contact for attendees. General sessions will feature widely known experts. Small workshop sessions will deal with specific topics on a problem solving basis.

A special feature of the April 1974 ITVA Conference is an arrangement made with the National Cable Television Association - meeting at the same time in Chicago - to admit ITVA Conference registrants to their very large and diversified Equipment Exhibition. Butler said, "These Exhibits by all the leading television equipment and system manufacturers relate very closely to our communication and training uses of television. I am certain ITVA Conference attendees will find them exceptionally informative." NCTA exhibits will be open to ITVA registrants for the **entire** Conference.



"YOU HAVE A NICE LITTLE STUDIO HERE."

All persons interested in receiving specific Conference information should contact: Chairman, 1974 ITVA Conference, International Industrial Television Association, P.O. Box 297, Summit, N.J. 07901.

The International Industrial Television Association is made up of individual user and supplier members concerned with the effective use of television and related techniques for communication, training and similar purposes.

Education Agencies Join ITV Cooperative

Twelve State education agencies and one Canadian Province have joined the first WETA-TV National ITV (Instructional Television) Cooperative, according to Donald V. Taverner, President of The Greater Washington Educational Telecommunications Association, Inc. The pooling of funds from the Cooperative members will make possible the production of an updated version of the popular in-school series, **COVER TO COVER,** as an educational services activity of WETA-TV, the public television station serving the Nation's Capital.

Several more state educational television agencies are also expected to join the ITV Cooperative in the near future, according to Ray Gladfelter, the newly appointed Director of National ITV Development.

FCC Adopts Plan To Reorganize Field Bureau

A reorganization plan for the Field Engineering Bureau which will structure the Bureau's programs along functional lines, has been adopted by the FCC.

All enforcement functions, including inspections, investigations and monitoring, will be directed by a new Enforcement Division. Public service functions, including radio operator examinations, processing of applications for the marking of antenna towers, and certain equipment certification matters under Part 18, will be conducted by the new Regional Services Division through 10 field offices. The plan also provides for an Engineering Division which will be responsible for standards and facilities, equipment construction and installation, and miscellaneous field support functions.

Compliance Chief Named

Merlin H. Smith, an investigator and compliance specialist in the Complaints and Compliance Division of the Broadcast Bureau, has been appointed Chief of the Compliance Branch. He fills a vacancy created by the retirement of John H. McAllister in June 1973.

Smith has been with the Commission since 1964 when he was appointed a general investigator in the Complaints and Compliance Division. Before coming to the Commission he had been in the broadcast industry for 17 years as a station owner and in various executive capacities.

SOCIETY OF BROADCAST ENGINEERS, INC
P.O. Box 88123 Indianapolis, Indiana 46208

How To Plan A Mini Convention

Editor's Note:

The recently successful Mini-Vention, held at the Owego Treadway Inn, Owego, N.Y., on October 19th, sponsored by three SBE chapters, was largely the work of Larry Taylor, Chief Engineer of WENY-TV, Elmira, N.Y., and previous chairman of Chapter 1. Larry plans to make the Mini-Vention bigger yet next year, perhaps to cover a 2-day span and to include engineering papers. We prevailed upon Larry to write up a report on how he went about planning for this affair, for the benefit of others who might be interested in conducting similar regional affairs in other areas.

It's easy to have a small "NAB" type equipment demonstration! Your chapter should try it...here's how we did it.

Chapter 1, Binghamton, N.Y. is lucky to be situated about one hours driving time south of Chapter 22, Syracuse, N.Y., and about the same distance from Chapter 2, Wilkes-Barre and Scranton, Pa. Each year our three chapters have a very successful joint meeting. It was, in part, this success that prompted one of the members to suggest an equipment demonstration on a much-expanded scale. So for the next few weeks I contacted some of the larger manufacturers, getting a feel of what they thought of the idea. (Use your handy salesman, he will be truthful with you and may have some ideas.) **Everyone** I talked with was for the idea. The word was "go" for Mini-Vention '73.

The motel where we hold our regular meetings had a nice size banquet room. It was decided that this was the place. The room was approximately 40' x 50' and the charge was about $150.

A date was decided upon; October 19, a Friday. The date was chosen because we felt that the summer vacation would be over, the bad weather of winter would not be upon us, and it didn't seem to clash with any other events.

A "booth" size of 7½' x 6½' was allotted for each participant. We had planned to use a 6' banquet table as a display area. The night before the event we substituted 8-foot tables, slight rearranging allowed for the added space. For this space we charged the manufacturer $50. A double space could be purchased. (We sold 5 doubles.)

Once these details were settled, I started making phone calls in earnest. I contacted salesmen who normally called on me. I also contacted the smaller manufacturers and suppliers who were located within a few hundred miles of the Binghamton, N.Y. area. I assumed that a smaller company located, say, in Kansas, or California, would not be likely to send a representative. After word got out, the response snowballed. I had manufacturers calling **me**. It got to the point where I had to turn away business, even after an adjoining banquet room was added to provide more space.

Most of my publicity was word of mouth. Participating salesmen told all of their clients, some printed up their own literature. I also had printed pamphlets made up and gave these to different salesmen to use on their mailing lists. Some were mailed by me.

Besides equipment, we offered free food, (make your own sandwich), free beer, pop and coffee. A couple of "hospitality suites" popped up. The motel had a nice restaurant and bar with live enter-

tainment. What more could an engineer ask for?

We had a total of 20 manufacturers show, with 25 booths sold. Two vans were outside in the parking lot with displays; two operating color cameras appeared; two displays of operating time base correctors, an AM transmitter, cart machines, mikes, test gear, audio consoles, and more audio consoles, demods, frequency and modulation monitors, remote control gear, limiters, translators, and the list goes on. The displays were beyond our wildest imaginations.

The show was to run from 12 noon till 12 midnight. Noon came and the customers poured in. The show was free and open to anyone in an associated media, i.e. broadcasters, cable, colleges, closed circuit, etc. We got them from all forms of the media.

Each manufacturer thought the day was well spent, that the "quality" of the person attending was very high. Some thought this was much better than most of the small shows they attend. With limited "feed-back" from the manufacturers, I have found that one man closed a deal for $68,000, another for $600, two cart machines were sold; a consultant said his business doubled because of the contacts he made just talking to people he knew and the new friends he made.

With our heads still swelled from this success, we are planning a bigger and better "Mini-Vention '74". Next year we will have a larger display floor, maybe run for two days, and we will have technical papers presented.

Here are a few hints if you wish to hold your own "Mini-Vention".

1. Find a large enough room. Think big! You will be able to fill it.
2. A $50 to $100 booth fee is considered negligible by most manufacturers. A salesman may spend this much "wining and dining" a prospective client.
3. The free food idea went over well but it was quite costly. If you offer free food, keep a close running account of the cost as it mounts up fast. I will not have free food again, but do plan to keep the free beer, pop, and coffee.
4. Make sure your room has plenty of outlets. We ran extension cords all over creation and back. The manufacturer should bring his own extension cords.
5. Have a registration booth for all to sign in. Make sure you get a supply of write-on name tags and write each persons name on it and the station to which they belong. This is extremely important to the salesmen.
6. Noon to midnight was too long. The crowd started at noon and kept up till about 5, picked up again about 7 and then died. We finally quit about 9 PM. That still was a long day!

I would be glad to talk to anyone planning a "Mini-Vention" and give more details of ours, and I would like to hear how yours went.

Larry Taylor
Chief Engineer WENY-TV
Past chapter chairman 2 years

SBE Chapter Growth

The number of SBE chapters continues to increase. In the previous issue we mentioned that there was some interest in organizing a chapter in the Las Vegas area. In this issue, the chapter reports section includes a notice that an organizational meeting has already been held under the leadership of Joe De Angelo, chairman pro tem.

Bart Paine and William D. Roh continue to guide the growth of the Tucson, Arizona chapter. John McNally at WCNW and WFDL, Fairfield, Ohio, is working toward forming a Cincinnati-Dayton, chapter.

Word has been received from Paul H. Bock, Jr., completing 14 years of service in the U.S. Navy, has accepted the chief engineer post at WSSV, owned by the Petersburg Broadcasting Co., Inc., in Petersburg, Virginia. Paul hopes to start a Petersburg chapter, and would like to hear from anyone nearby interested in attending meetings.

However, it appears that SBE now needs a new chapter promoter in the Miami, Florida area since John Blattner, who had been working along these lines has accepted a new job with a Wilkes Barre, Pa. station. Charles Morgan, of WARM, Avoca, and Asst. Chief of Susquehanna Broadcasting, Avoca, Pa., feels there is sufficient interest in the vicinity of York-Harrisburg-Lancaster-Reading area to form a chapter. Anyone interested, let him know at (717) 346-4646.

Reports on SBE chapter meetings and on announcements of future events will be published in these pages monthly. It is important that chapters send information on meetings and other news as promptly as possible. Include photographs whenever available; preferred photo size is 8 x 10 but smaller sizes are also usable.

The monthly deadline for submitting copy to the SBE editor is the 25th of the 2nd month preceding the month of publication; for example, the date by which copy must be received by the SBE editor for the March, 1974 issue is January 25th; for the April 1974 issue, the deadline is February 25th, and so on.

Letters to the SBE editor for publication are invited. Send all material for publication to: SBE Editor, Joseph A. Risse, P.O. Box 131, Dunmore, Pa. 18512.

Chapter 1 - Binghamton, N.Y.
Chairman: Douglas S. Colborn
Horseheads, N.Y. 14845

At the November 13th meeting, at the Owego Treadway Inn, Larry Taylor, previous chapter chairman, was congratulated on his work on bringing about the successful regional Miniconvention on October 19th. Guest speaker for this meeting was Tom Siglin, chief technician for Elmira Schools Instructional TV. Tom spoke on The Ground Fault Interrupter and its use which is now mandatory, according to OSHA, as of January 1, 1974.

Chapter 2 - Northeastern Pa.
Chairman: Paul Evanosky,
WVIA-FM-TV
Pittston, Pa. 18640

On November 5th, Art Silver of Gates Radio and Tom Schoonover of Gates Television presented a dual program. Silver covered the Pulse Duration System of obtaining Amplitude Modulation as is used by Gates in high power AM transmitters. Schoonover covered TV transmitter systems, the Gates IF Modulation system in particular. Plans for the December Christmas get-together were discussed.

Chapter 9 - Phoenix, Ariz.
Chairman: Chuck Deen, KOOL-TV
Phoenix, Ariz. 85003

Application of Digital Techniques to Video was the program provided by Tom Meyer of Telemation on September 17th at KTVK-TV. Meyer is a designer of digital equipment marketed by Telemation. On October 29th, Lou Burroughs, vice president, Broadcast Equipment, Electro-Voice, Inc. provided a practical, how-to-do-it discussion and demonstration of microphones and microphone techniques. The meeting was held at KOOL. The November meeting, covering the Ampex Video Cartridge Machine, will be reported in a later issue.

Chapter 11 - Boston, Mass.
Chairman: Ross B. Kauffman,
WCVB TV,
Needham, Mass. 02192

The chapter met recently at WGBH-TV studios, to hear Jerry Sarno, engineer in charge of the FCC Boston office, speak on various topics related to broadcasting including "reregulation" and viewer complaints. Sarno also presented Vincent J. Kajunski FCC field inspector in Boston.

Chapter 15 - New York, N.Y.
Chairman: John M. Lyons,
WWRL-AM
Woodside, N.Y. 11377

Dinner, available to all those attending, in the **New York Times**

(More...)

cafeteria, 11th floor, 229 West 43rd St., was followed by a multi-feature technical session in WQXR Presentation Theater, 9th floor, George Endres, chief engineer of WXLO-FM, RKO General, spoke on Evaluation and Correction of AM Transmitter Difficulties. The second topic centered a short film on the installation of the WSNL-TV antenna. This meeting was held on November 15th. Specifics on the December 20th meeting on Belar Monitoring Equipment, the January 10th meeting on CBS Labs limiting equipment and programming aids, and the February 14th meeting on RCA AM-FM-TV transmitters, arranged by Art Silver, program chairman, will be provided in later issues by Bob Woerner, chapter secretary.

Chapter 16 - Seattle, Wash.
Chairman: John A. Maxson, KETO Seattle, Wash.

On November 14th, noon lunch at the Norselander Restaurant, preceded a technical session "The Computer in Broadcasting - Where is it Taking Us?" Those participating in the program included Chuck Morris, KIRO director of Engineering who uses computers for FM automation, and at the TV transmitter and master control; Danny Coulthurst and Nick Solberg of IGM, suppliers of computerized automation systems; Chester Coleman of Schafer Automation, the pioneer in computerized automation; Bill Wolfenbarger of KOL, where A Schafer 903 using a complex MOSFET memory is employed; and Bob Plummer of KOMO. Nick Foster, Editor of the chapter Newsletter, reported on his efforts to persuade the FCC to provide improved Study Guide Materials, especially for the Third Phone/ Broadcast Endorsement exam.

Chapter 18 - Philadelphia, Pa.
Chairman: Jack Jones, WCAU-TV, Philadelphia, Pa. 19131

On November 26th a steak dinner at the Bell Telephone Company facilities, #1 Parkway, 16th and Arch Sts., was followed by a technical session in the Bell CCTV Studio, where MARCO Electronics demonstrated Anderson Labs Time

Base Corrector. Later, Russ Wedger provided a tour of the Bell CCTV facilities.

Chapter 20 - Pittsburgh, Pa.
Chairman: Henry R. Kaiser, WWSW,
Pittsburgh, Pa. 15212

On November 15th, noon lunch, upstairs in Buddies at 439 Market St., Market Square, preceded a session on "Pet Gripes", as related to the responsibilities of broadcast engineers in their day-to-day activities. Some of the gripes covered poor equipment design, personnel problems, manufacturer service, and problems of cooperation with the program departments. In the recent election, Hank Kaiser was reelected chairman, and Roy Hoover and Tony Viviano were elected vice chairman and secretary-treasurer, respectively.

Chapter 23 - Portland, Me.
Chairman: Roland A. Desjardines
WCBB-TV, Lewiston, Maine 04240

Members and guests met at the COMSAT Andover Earth Station, Andover, Maine, for a 2½ hour tour of the facilities, provided by Dave Durand, chief engineer. Durand covered the Intelsat System completely through the plant and included an elevator trip to the Cyrogenic Amplifier at the focal point of the giant open-face parabola.

Chapter 25 - Indianapolis, Ind.
Chairman: Joe Missick, WISH-TV
Indianapolis, Ind. 46202

On October 9th, the chapter met at the Indianapolis Schools Radio and TV Center, where John Krom, chief engineer, and Art Smith, former Indiana chapter chairman, hosted the meeting. Guest speakers were Ed Andre, audio products engineer, and Ron Bowllman, representative, for Burwen Laboratories, who discussed the Burwen Model 1000 Dynamic Noise Filter as designed for the broadcast and recording industries. At the September 18th meeting, Lenco Electronics representatives Fred Wilkhe and Bruce Blair described the Lenco sync generator, slave units, and distribution amplifiers.

**Moving?
Send Your Change
Of Address To:**

**Broadcast Engineering
1014 Wyandotte
Kansas City, Mo. 64105**

**Chapter 26 - Chicago, Ill.
Chairman: Bradley Anderson,
Univ. of Illinois,
Chicago, Ill. 60680**

On October 16th, members and guests met at the University of Illinois Medical Center TV Studio for a program presented through Swidersky Electronics, who also provided refreshments. Charles Corbett and James Hahn of Consolidated Video Systems demonstrated a digitized time-base corrector for video tape, include a half-inch to quad dub as a sample of what the "corrector" can do. NABET Local 41 is a Sustaining Member of Chapter 26.

**Chapter 28 - Milwaukee, Wisc.
Chairman: Ed Wille, KENCOM,
Milwaukee, Wisc. 53218**

On November 20th, members and guests dined at Eastbrook, Inc., and then proceeded to Radio City Auditorium at WTMJ, Inc. to hear Michael A. Gittinger, sales and engineering representative for Eastman Kodak Co., talk on Television Film. He covered the problems of producing and reproducing local film. "Do's and Don'ts" of shooting film, from the approach of both the engineer and the photographer were covered.

**Chapter 32 - Tucson, Ariz.
Chairman: Hobart J. Paine
4631 E. 8th St.,
Tucson, Ariz. 85711**

Bart Paine has announced that growth of this new chapter continues, with Will D. Roh, membership coordinator, carrying a big part of the load of membership promotion through a mail campaign to more than 100 potential members throughout southern Arizona; Bart also promoted SBE membership while attending the NAEB convention in New Orleans.

**Las Vegas, Nevada
Chairman: Joe De Angelo (pro tem)
1536 Sombrero Drive,
Las Vegas, Nevada**

Organization of this newest chapter of the SBE, spearheaded by chairman pro tem Joe De Angelo, began with its first meeting on October 11th at Capri Mobile Home Park, Las Vegas. Bart

Williams, West Coast Sales Rep for Ampex Corporation Audio Division and Hans Schrouder, Ampex Field Technician, provided a rundown on after the sale service and a demonstration of service techniques on the Ampex AG-440.

KDKA

KGO

KING

KMOX

KOB

WABC

WGN

WINS

Gates' 50,000-watt MW-50 keeps some very fine company

The pace-setting AM stations listed above are now broadcasting, or soon will be, with Gates' MW-50, 50 kilowatt PDM (Pulse Duration Modulator) transmitters. With good reason.

The MW-50 signal is strong and clear—backed by a 125% positive peak modulation capability that allows higher average modulation levels.

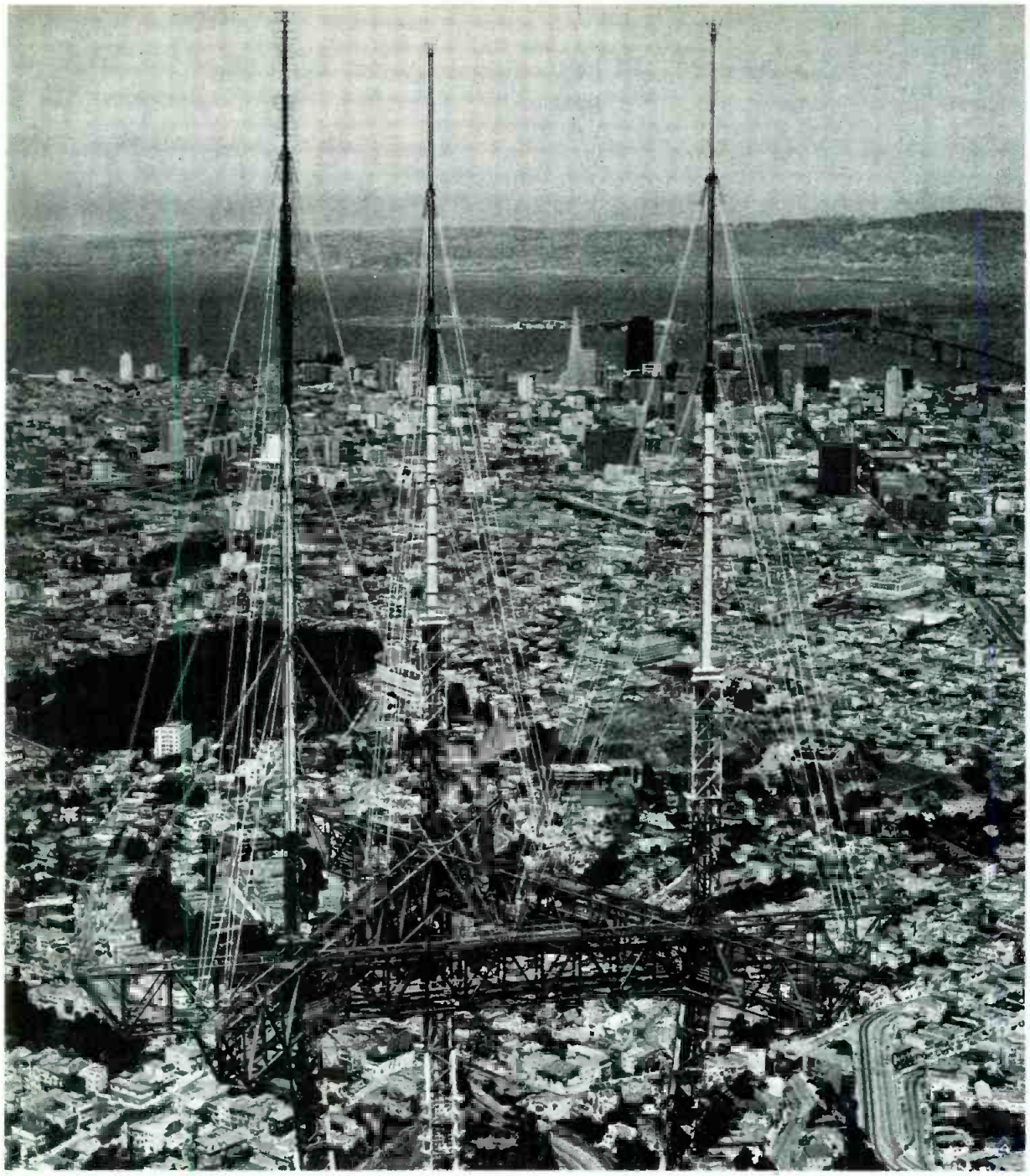
Overall transmitter efficiency is greater than 60%! And the MW-50 employs only five tubes (with just three tube types). Compact design saves space, and simplifies installation.

There's much more. Investigate today, and find out why the MW-50 is at home in so many of the country's top stations. Write or call Gates.

HARRIS

GATES DIVISION

Quincy, Illinois 62301, U.S.A.



Closeup of the antenna farm atop the Mt. Sutro tower.

Mt. Sutro Tower... end of a TV nightmare

By Joe Roizen

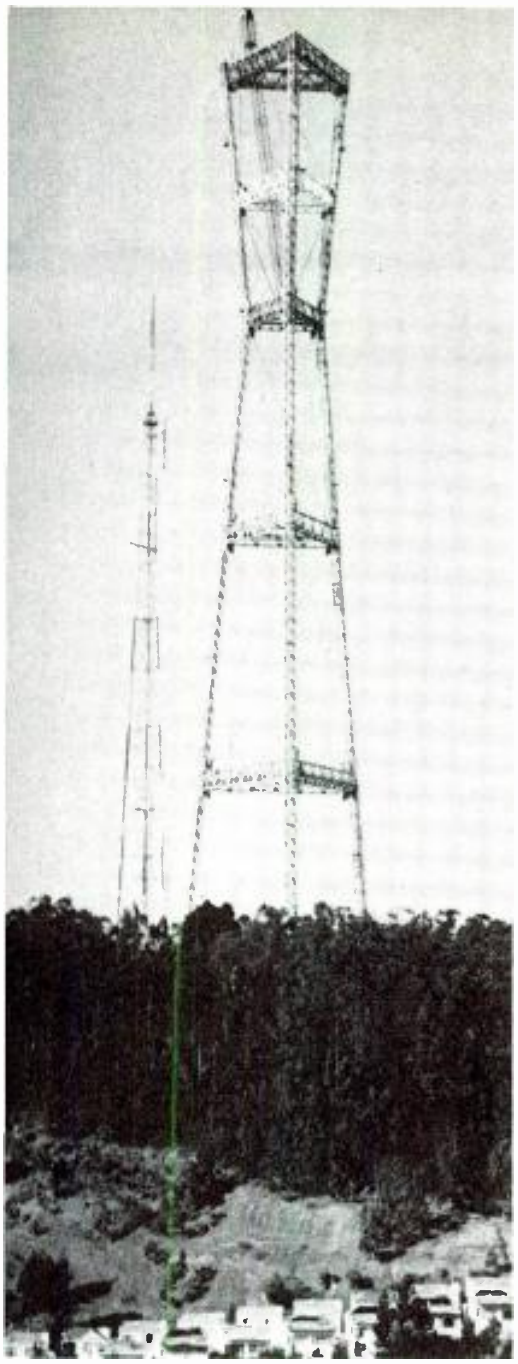
Video Editor for BE and head of Telegen, a consulting company located in Mountain View, Calif.

The topgraphy of San Francisco and the general Bay Area is a television engineering nightmare.

The steep inclines that delight cable car riders and the picturesque hills extending along both sides of the Bay have always been a severe handicap to adequate and uniform TV reception throughout most of this area that is home to more than five million people. Add to this the sequence of independent development of a variety of network and non network television stations using different transmitting sites and you have a situation in which the best solution is a compromise of receiver antenna location and direction. There are a lot of rotors used in this area.

The new Sutro Tower that went into operation on July 4th of this year is a twelve million dollar answer to the propagation problem for seven TV and four FM radio studios in the Bay Area. A project of this magnitude requires not only considerable detailed planning but also approval of various government agencies, cooperation between the tenant stations, acceptance by local government (who control zoning regulations), and the tacit approval of the local population who have become more and more cognizant of esthetic and ecological problems associated with large and very visible structures.

The Sutro Tower, in addition to achieving it's technical goal, has hurdled all of these requirements in



Sutro Tower during construction dwarfs the original ABC tower that was erected during the late 1940's. Proximity of the tower to residential housing is evident from this view. Nearby residents need 20 dB pads on their antennas to attenuate signals to usable levels.

FM Stacking, Too

An illuminating paper, "Multiple Station FM Antennas", authored by Peter K. Onnigian, president, Jampro Antenna Company, Sacramento, was presented by Ross Shelton, Jampro sales manager, when he appeared before the 23rd Broadcast Symposium of the IEEE group in Washington, D.C., late September.

In his opening paragraph, Onnigian stressed that the use of one antenna by two or more FM stations has become increasingly common due to the necessity of obtaining good antenna locations, the requirements for high power operations and basic economic reasons.

The paper went on to say that Jampro has supplied two antennas which are being used in Jacksonville, Florida and Dallas, Texas. The Dallas station is being used by two stations which are 800 kilowatt transmitters. The antenna in Dallas is a 12 bay JSCP-12 which has been frequency VSWR compensated to present VSWR's of under 1.1 to 1 for both frequencies. Being fed in the middle, the beam tilt is approximately the same for both stations.

The Jacksonville, Florida station is similar to that in Dallas. Here one station has an ERP 100 kilowatts while the other station 800 KC removed has an ERP of 50 kilowatts. The Jacksonville operation has been in existence for approximately three years, while the Dallas station has been going now for nearly four years.

Wide Band FM Antennas

WASH, Washington, D.C., has been in operation since March, 1973 and has only one transmitter feeding it at the present time. We understand that a second and third are negotiated to use this facility. The input VSWR has been measured after installation and it follows very closely that measured at the Jampro test range prior to shipment.

Another wide band antenna of the type discussed here is in operation in the San Diego area. While located in Tijuana, Mexico, across the border, it serves San Diego very well from a distance of 18 miles. This antenna system has been in operation approximately four years. It is being fed by a 20 kilowatt station on one frequency and a 10 kilowatt transmitter on another frequency, 7.4 megacycles away.

A third station, with 10 kilowatts of power, has been in operation with this antenna for a long period of time. Due to Mexican allocation problems, the final frequency has not yet been determined. The third station has been using three different frequencies, at one time or another. Now that the Mexican-United States frequency allocation problem involving FM stations has been settled, the third station may find a permanent frequency. It is important to note that this 10 kilowatt transmitter could not be used on various frequencies unless a wide band antenna of this type, capable of a 1.1 to 1 VSWR from 88 to 108 megacycles was available.

order to become an operating reality.

Architecture

The structure differs from most TV towers by using a three-legged triangular configuration with a 150-foot base line between the vertical members. The legs incline inward at 5° (degrees) until the 542-foot level then lean outward at the same angle for another 205 feet. The tower height is 762 feet with the antennas extending 210 feet beyond. Add Mount Sutros altitude of 834 feet and the effective radiation level is 1811 feet above mean sea level.

The self-supporting, flexible steel trussed tower was dictated by the earthquake prone location where top heavy concrete pillars are a definite no-no. In designing to withstand an 8.3 Richter scale tremblor (which is the magnitude of the disastrous 1906 quake), the engineers found they didn't have to worry about wind loading. That automatically came out to be at 250 MPH, a wind velocity not common to the City by the Bay or any other for that matter.

The tower and its antennas weigh 3.6 million pounds, each leg is imbedded in four million pounds of concrete. With that kind of footing the center of gravity of this huge structure is actually below ground. If anything it re-inforces the mountain it is on!

To erect this monster required the construction and use of the worlds longest gin-pole, a device 290 feet long that places consecutive sections of tower in their prop-

er positions for bolting together. Since the trusses on this tower were so far apart, the jumps from truss to truss were up to 180 feet instead of the usual 60. This must be a new high in Erector sets.

Each leg is assigned a specific function, besides holding up the antenna platform. One carries all the TV transmission lines, the second contains the FM and standby lines, while the West leg houses a small (two people) elevator that crawls up at 100 feet per minute. It's an eight minute ride to the top, with a scary 10° (degree) lurch backward where the vertical inclination changes from positive to negative.

Antennas

The antenna structures for Sutro Tower are among the most sophisticated ever designed. Because of the potential problem with radiation interference, it was decided at the early stage of planning to build a precisely scaled operating model of the antenna arrays, and to put them through careful evaluation to determine optimum radiator style and positioning. Computers were used to determine interactive effects of a variety of configurations and the three stack array was chosen as the most acceptable.

The antennas distributed over the three stacks consists of; superturnstile, traveling wave, and polygon structures. The superturnstiles, which have been used for VHF since almost the beginning of broadcast television, have an emergency feature whereby each bay may be divided into separate portions driven by independent transmission lines. Absorption filters provide isolation between stations using the single antenna. The polygon structure is a relatively new UHF design which is especially suited because of its rugged mechanical configuration to permit stacking. In addition, its horizontal directional pattern can be tailored to form a cardioid pattern to minimize wasted signal strength radiated towards the Pacific Ocean three miles westward.

The stacks are divided as follows. Stack A consists of two six section superturnstiles, which serve the three VHF low frequency channels. (Channel 2 KTVU, channel 4 KRON, channel 5 KPIX.) The channel 2 antenna is a very heavy one, because of its low frequency requirements. It is used to support the upper bat winged antenna which is multiplexed to carry channels (4) and (5). Stack B the south leg has a UHF polygon that radiates channel (44) KBHK, and supports a traveling wave antenna that transmits the signals from channel (7) KGO in the VHF spectrum. The north leg, stack C, is similarly structured with channel (32) KQEC polygon antenna supporting the KQED channel (9) traveling wave radiator.

There is room for an additional polygon, should the need arise for another UHF channel. Additional VHF antennas would have to hang below the platform.

Management Highlights

The Mt. Sutro story may seem like a one-time-only operation. That's not really so. There are other such arrangements already in operation, although they are not quite so dramatic.

If the environmentalists continue their influence, this approach to increased signals consistency may become even more important. It can be efficient, cost effective, and it can help local stations improve their community image....both figuratively and literally.

In case of an antenna failure there are standby antennas mounted on the tower at the (170) foot level with emergency transmission lines going back to the transmitter building and switchable at the main facilities.

Besides the TV antennas, there are four FM antennas which are wrapped around the tower legs and provide the radiation elements for KFOG-FM, KRON, KSFX-FM and KCBS-FM. The transmission lines feeding TV antennas range in size from approximately (3) to (8) inches in diameter and make up some of the most sophisticated plumbing ever seen on an antenna installation.

Transmitter Building

The building housing the transmitters and other electronic equipment associated with Sutro Tower is a massive concrete structure encircling the tower leg which carries the main transmission lines. The building has three levels in which the present occupants have individual space for their own control facilities and sufficient additional space is available to accommodate future occupants.

Sutro Tower, Inc. owns the building and the tower; however, the individual stations are the proprietors of the antennas, the transmission lines, transmitters and feeder equipment.

The first floor which is at ground level, contains the FM transmitter facilities which are completely unmanned and remotely operated. The upper two floors house the television transmitter rooms.

Because of restrictions imposed by the land use covenant, a limitation was placed on building population to remain below a maximum of (25) people on the property. The staff at present consists of about two men per transmitter and no origination facilities other than electronic test patterns are available at this site. Back-up micro wave links have made reliability so high that lost air time is virtually unheard of.

While each station has its own facility there are of course certain similarities in the equipment types used. Typical of high powered transmitters are RCA and Gates, Grass Valley switching equipment, Tektronix wave form monitors, Conrac picture monitors, and Belar modulation monitors abound.

The present plan is to dismantle the old mansion and move the engineering office into the new building.

Towers and Tribulations

A structure of this size, complexity and public use could hardly avoid controversial complaints from the general viewing public. To minimize internal interference of the radiated signal with the operation of the electronic equipment in

CHROMATECH(TM)...
Color Keying Never Had It So Good!

Chromakey is good enough for some people. But Technicolor couldn't leave well enough alone.

We felt you would rather broadcast natural instead of artificial looking composite pictures. So we developed Chromatech™, the new special effects system using proportional gating of NTSC foreground and background video.

Chromatech ™ produces composite pictures *without halos and scintillating outlines.* With Chromatech™ you can now key through cigarette smoke, Saran Wrap(R) and other transparent or translucent objects. Foreground subjects can now cast shadows against the background and abrupt transitions between foreground and background objects are eliminated. What's more, Chromatech™ is simple to operate, sets up in minutes, and can be operated alone, *or with any switcher.*

Make us prove it. Ask for a demonstration. Call or Write:

Technicolor®

Astrionics Division

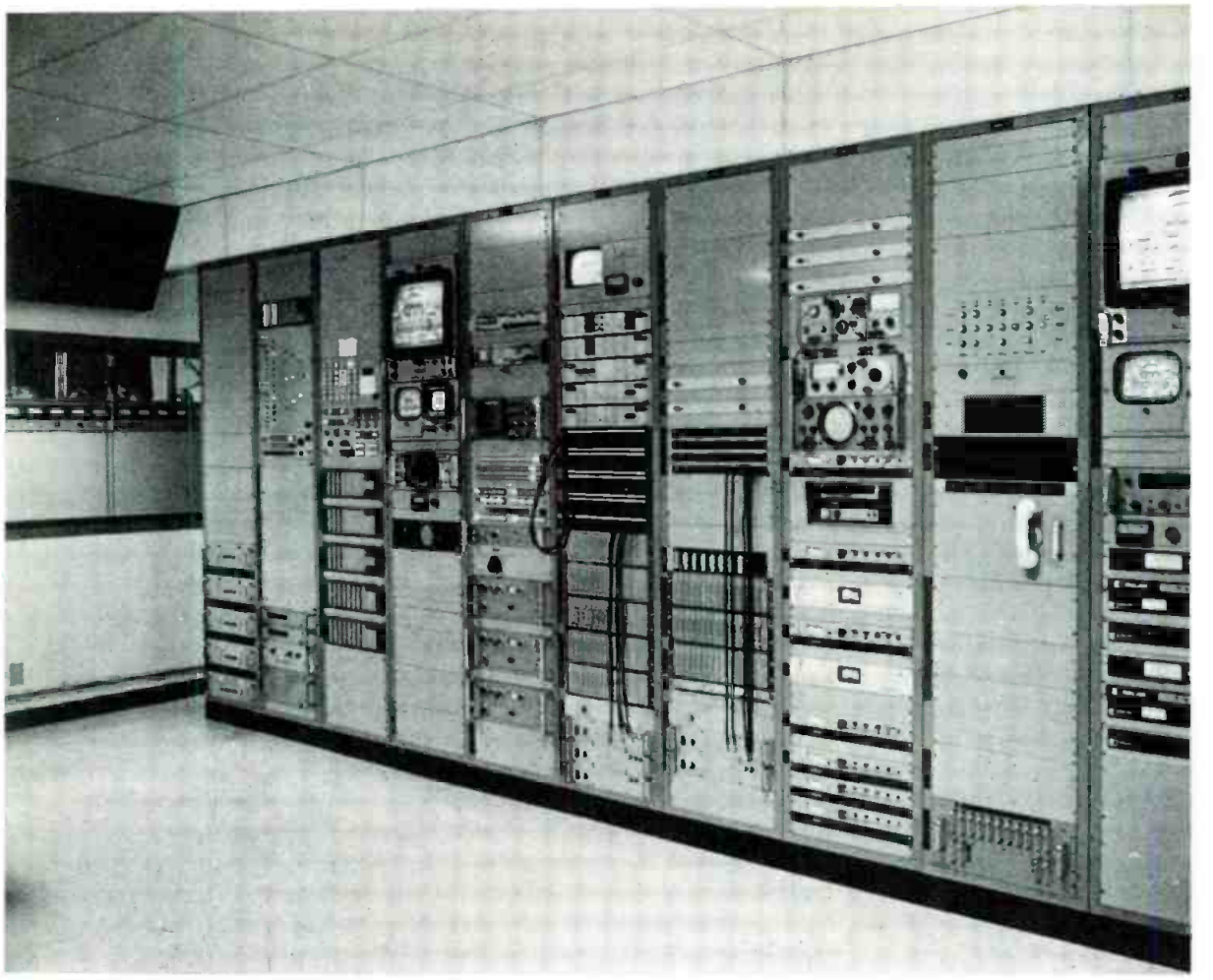
291 KALMUS DRIVE
COSTA MESA, CALIF. 92626

or contact your nearest Chromatech™ representative.

DENVER, COLO.	ANAHEIM, CALIF.	NEW JERSEY
H. Didier/Denver	Broadcast Communications Dev. Inc.	Jim Landy Assoc.
(303) 674-6000	(714) 528-9505	(609) 424-4660

GEORGIA	MILFORD, MICH.	CANADA	N. CAROLINA	TEXAS
Lou Radford Assoc.	H. M. Dyer	Glentronix Ltd.	P. D. Thompson	Gene Sudduth
(404) 237-6097	(313) 685-2560	(416) 444-8497	(919) 765-3157	(214) 242-2690

For More Details Circle (19) on Reply Card



Typical of the TV stations transmitter locations is KGO's control room. The foreground contains a variety of switching and monitoring equipment, including Conrac, Grass Valley, Belar, Tektronix, Rhode and Schwartz, etc. The Gates transmitters are behind glass windows at left.

Harry Jacobs, director of engineering for Sutro Tower, working in the old Sutro mansion which will be demolished. His new office will be in the transmitter building under one of the tower legs.

the transmitter building, a two-inch steel mesh was installed in all the walls throughout the building and properly grounded. Not withstanding considerable trepidation on the part of several consultants who suggested fine wire mesh, screen room conditions for total shielding, it has since been found that the installed shielding was adequate.

There are at present no problems with regard to RF coupling between the antennas and the internal electronic equipment in the building. The same is not quite true about the effects of all this radiated power in the immediate neighborhood.

Tape machines, high-fi units, and other devices close to the transmission site may be affected. Reports from viewers with specific problems are answered by Mr. Jacobs or the chief engineers of the stations involved so as to assist the viewer in overcoming the problem as much as possible.

The largest single deficiency is too much signal, which results in overdriving the AGC on the home receiver. A (20) dB pad in the antenna lead will usually cure this deficiency. Meanwhile, field measurements at the UC Medical Center a few miles away have shown as much as 1.5 Volts per meter, and readings of 0.5 Volts per meter in that area are not unusual. Signals of this amplitude have effects on heart pace makers and other medical equipment, home electronic organs, tape recorders, etc. However, in most cases, corrective

action suggested by Sutro Tower's TV engineers or local servicemen have minimized the problem.

The single largest group of viewers who have been seriously affected by the change from the Mt. Bruno site are those who are in the shadow areas related to Mt. Sutro. Some of these viewers may even be connected to cable systems that do not have adequate head end facilities for the new Sutro Tower site. As a result there has been some publicity regarding the sudden deterioration of signals to these viewers.

Another problem is the inertia of most people with regards to the reorientation of their antennas after the old transmission site was switched. It has required a fair amount of good PR work to convince viewers that checking their antennas or properly readjusting their sets would greatly improve the sudden change in reception characteristics that they were experiencing.

Sutro Tower now serves millions of viewers with improved and more consistent TV signals than they had before. The majority of TV receivers in this area exhibit improved signal to noise ratios, minimal ghosting and better uniformity between VHF and UHF channels. □

Sutro History

Adolph Sutro was one of the many migrants who invaded California during the 1849 Gold Rush days to seek fame and fortune. His unique contribution to the lore of the Virginia City Comstock Lode was to collect a fabulous lease fee for a hole in the side of a mountain that drained water from the mine, making it safer for human habitation. It was such a far out idea that Sutro was forced go go all the way back to his native England to raise the finances for digging the hole. He must have been quite a salesman!

Sutro prospered and eventually was one of San Francisco's early mayors. His property holdings grew and his progeny today are still active on the local social and financial scene.

One of his tracts of land included a hill in the Twin Peaks area which became known as Mount Sutro, a beautiful spot with a commanding view of the whole Bay Area and the Pacific Ocean. In 1930 Adolph Sutro the Third decided to build a Gingerbread mansion with medieval overtones on this property as his permanent home.

Adolph the Third is now an octegenerian and lives on the Costa Brava in Spain, his castle might have faded into oblivion were it not for the need of ABC's San Francisco television station, KGO-TV, for a good antenna site.

In 1947 ABC bought the property and erected a 400 foot tower that carried their own channel 7 and eventually channel 5 (KPIX). As TV and FM services around the bay grew, other antennas sprouted randomly with a cluster for channels 2, 4 and 9 on Mount Bruno.

By the late sixties, the benefit of a single site antenna conglomerate became obvious. The two main contenders, Sutro and Bruno were assessed, debated and fought between the proponents, and before the regulating agencies. Mt. Bruno's proximity to San Francisco International Airport was the FAA's major reason for ruling out that location.

A new company, Sutro Tower Inc., was formed as a consortium of the major potential tenants and a staff was assembled. The prime mover of this group was Harry Jacobs, a broadcasting pioneer and chief engineer of KGO who became STI's director of engineering.

There were a few new hurdles to clear. Local zoning laws, nearby residents, concerned environmentalists, and a few others all contributed actual or potential constraints to the structure and its use. In the end, the obvious utility of this transmission facility won out and the Sutro Tower went into operation on July 4th, 1973. Adolph the First's hole in the ground has been turned inside out.

If you haven't seriously considered the new Setchell Carlson Dual-10 Monitor,

It's time to take a closer look.

At Its Price. At $439* the Dual-10 is certainly worth taking seriously. In fact, the Dual-10 provides 13% more viewing area per monitor than higher priced Dual-9s.

At Its Modular Construction. The Dual-10 features Setchell Carlson's unique Unit-ized Plug-in Circuit Modules for instant on-the-spot servicing and the elimination of downtime. It's the next best thing to serviceless operation.

At Its Performance. Horizontal Resolution, 640 lines. Amplifier Bandwidth, 8MHz. And effective shielding to eliminate crosstalk. It's all in the specs. And it all requires only 8¾-inches of vertical rack space. For complete data and/or product demonstration, write to us today.

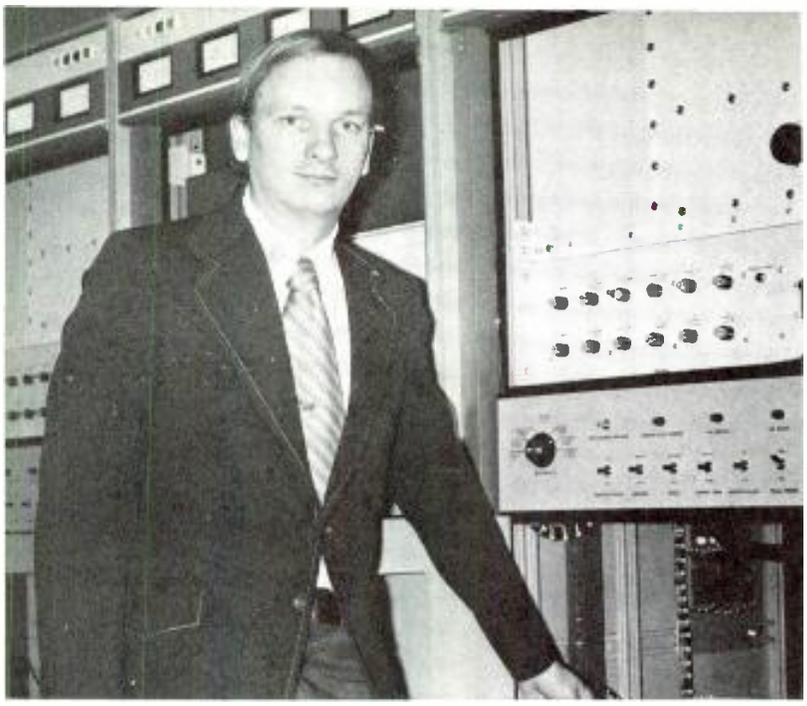
*Suggested User Net

SETCHELL CARLSON
A SUBSIDIARY OF AUDIOTRONICS CORPORATION
530 5th Ave. N.W. St. Paul, Minn. 55112, (612) 633-3131

For More Details Circle (21) on Reply Card

FM stereo... A new guide to an old subject

By Richard Johnson
Design Engineer, Sparta Electronic Corp., Sacramento, Calif.



The author, Richard Johnson, has designed commercially produced FM exciters and stereo generators.

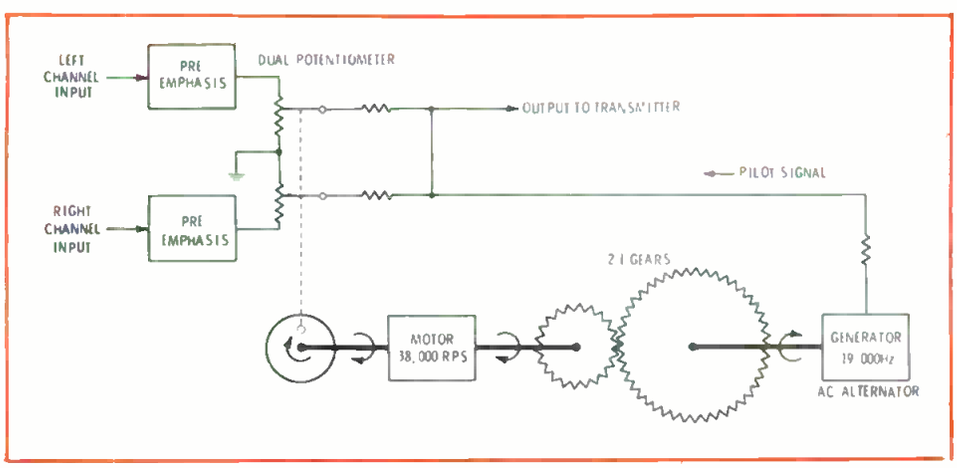


Fig. 1 This is a simplified mechanical analogy of a stereo generator. (See text)

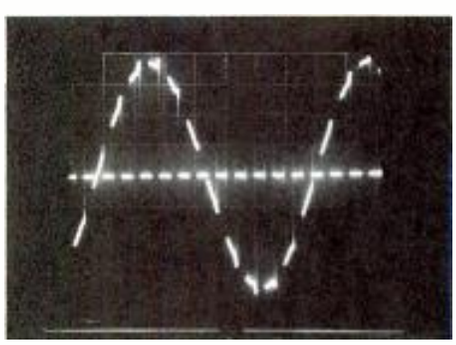


Fig. 2 This is the kind of signal you would expect to get from the "generator" in Figure 1, if you were transmitting only one channel and had disabled the pilot signal.

Some 15 years ago when FM Stereo was getting started there was much talk between broadcast engineers about whether or not the system would really work and if so, just how does it work. Today, with four-channel being considered, two-channel is so "old-hat" that many broadcast engineers don't know how the system works simply because there isn't anything written comprehensively about the subject.

In the various notes and publications all you find today is an assortment of mathematical equations that simply don't mean anything to the average broadcast engineer. This article is my attempt to put stereo transmission in a proper perspective for the broadcaster.

Let's first consider a monophonic FM signal. The audio frequencies that the FM broadcaster is concerned with lie in a range from 50 Hz to 15 kHz. It has been experimentally determined that the average listener cannot hear audio signals above 15 kHz nor below 50 Hz. For this reason, this band of frequencies has been called the **main channel.** The main channel is what you hear.

This band of audio frequencies is FM modulated at the transmitter's carrier frequency and sent up the transmission line to the antenna. The signal radiated by the antenna is "picked up" by the listener's receiver and demodulated. The demodulated signal is fed to loudspeakers or earphones and is called the main channel. This, again, is what you hear.

Even though the frequency response of the listener's ear is limited from about 50 Hz to 15 kHz, the frequency response of the FM transmitter and the receiver's demodulator are not. The practical limit of a typical FM Broadcast Transmitter's high-frequency response is about 250 kHz. A typical FM receiver's frequency response is about 100 kHz.

This supersonic audio spectrum space can be used to transmit hidden programs (SCA), or stereophonic baseband signals (Subchannel). Both of these hidden signals can be transmitted at the same time without interfering with each other.

It is important to remember in our discussion of stereo transmission that we are talking about audio-frequency signals that are

FM modulated on the transmitter's carrier and not some mysterious sideband components that appear for some complicated mathematical reasons. Some of these audio signals are supersonic, so you can't hear them, but they are **audio,** and not radio-frequency components. For the purpose of discussion, the entire audio spectrum from 50 Hz to 53 kHz will be called the **stereo baseband signal.**

Signal Components

Assume we feed an audio signal into the left channel: so that it modulates the transmitter 100 percent. The stereo baseband signal will consist of the following components: forty-five percent of the total modulation will be in the main channel and will correspond exactly in phase, amplitude, frequency to the modulating signal.

Forty-five percent of the total modulation will be in the **sub channel** and will consist of amplitude modulation sidebands displaced equally above and below 38 kHz. The 38 kHz itself is suppressed.

Ten percent of the modulation will be a 19 kHz pilot. Its purpose is to synchronize the stereo demodulator in the receiver. Its frequency is exactly one-half of the 38 kHz used to generate the subchannel sidebands.

Assume that left-channel signal consists of a 500 Hz tone. Its level is adjusted so as to result in a **total modulation** of 100 percent. Our baseband signal would consist of the following frequency components:

.45	500 Hz	(main channel)
.10	19 kHz	(pilot)
.225	37.5 kHz	(38 kHz-500 Hz)
.225	38.5 kHz	(38 kHz+500 Hz)
Total 1.00		(100%)

Certain liberties have been taken in the mathematics to simplify the form $e(t)=A_c g(t) \cos w_c t$. The Fourier transform of the double sideband signals to show how they add up to equal the total modulation. The mathematically-inclined will note that it is not really possible to add peaches and oranges without ending up with fruit-cocktail.

Assume, instead, that we transmit a 500 Hz tone on the right channel. Our baseband signal would still consist of the same components. The **only** difference would be the phase relationships between the pilot and the 37.5 and 38.5 kHz components. In this case the phase would be altered 180 degrees.

Let's transmit identical 500 Hz tones on both the left and the right channels. These tones are transmitted in phase. The baseband components would be as follows:

.90	500 Hz	(main channel)
.10	19 kHz	(pilot)
.00	37.5 kHz	(38 kHz-500 Hz)
.00	38.5 kHz	(38 kHz+500 Hz)
Total 1.00		(100%)

Finally, let's transmit identical 500 Hz tones on both the left and right channels but connect them up so that they are out-of-phase. The baseband components are, in this case, as follows:

,00	500 Hz	(main channel)
.10	19 kHz	(pilot)
.225	37.5 kHz	(38 kHz-500 Hz)
.225	38.5 kHz	(38 kHz+500 Hz)
Total 1.00		(100%)

The Stereo Generator

OK, So what else is new? How does this help me understand how my stereo generator works? Doesn't help at all. To understand that, refer to the block diagram, Figure 1.

This is a simplified mechanical analogy of a stereo generator. This system would actually work, but, because of the "square-wave nature" of the switching between channels there would only be room for one or two FM stereo stations on the dial since the high-frequency components of the switching between channels would cause "splatter" and the stations would interfere with each other.

Figure 2 shows the kind of signal you would expect from this kind of "stereo generator." if you were transmitting only one channel and had disabled the pilot signal. Everytime the signal is chopped to the zero axis, there is room for the other channel to be transmitted in

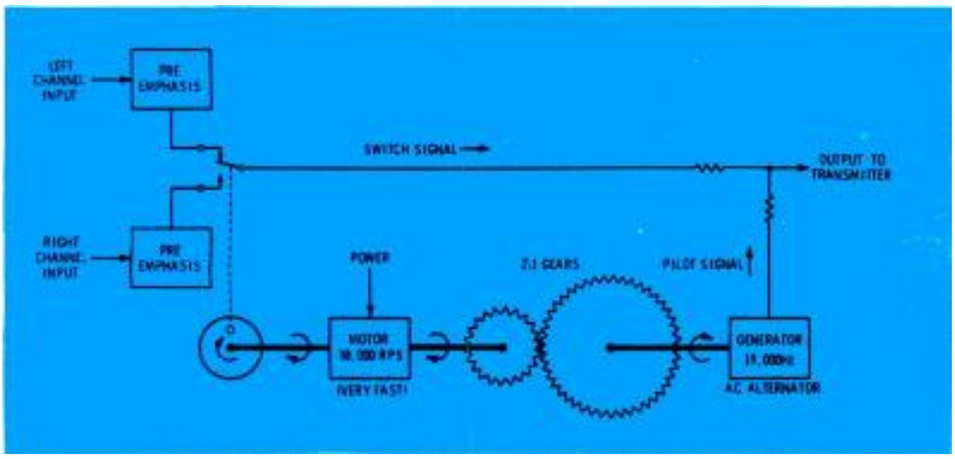


Fig. 3 Same mechanical analogy as previous figures, but with a scheme for changing from square wave switching to a smooth transition.

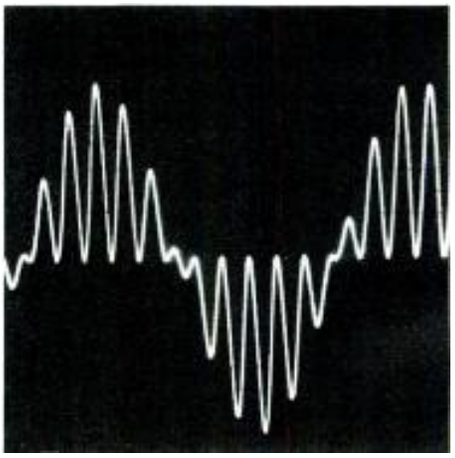
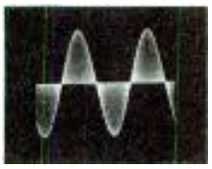


Fig. 4 With higher-order components removed, signal looks like this.

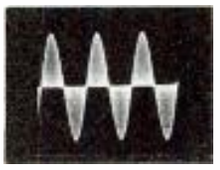
FM Conditions vs. Waveforms

"PERFECT" COMPOSITE WAVEFORM



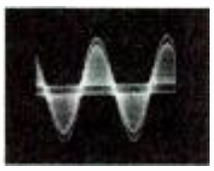
Conditions: left channel only, 1KHz, 100% total modulation, pilot signal included, scope synced to audio oscillator.

"ALMOST PERFECT" COMPOSITE WAVEFORM



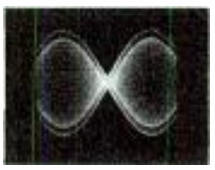
Conditions: left channel only, 15KHz, 100% total modulation, pilot signal removed, scope synced to audio oscillator.

COMPLETE COMPOSITE STEREO WAVEFORM



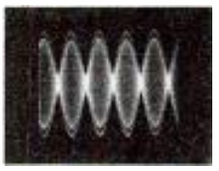
Conditions: left channel only, 1KHz, 100% total modulation, pilot signal removed, scope synced to audio oscillator.

COMPOSITE WAVEFORM SHOWING PILOT ZERO-AXIS CROSSING



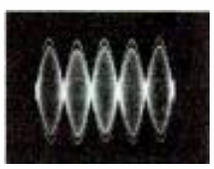
Conditions: left channel and right channel fed out-of-phase at 400Hz, 100% total modulation, scope synced to audio oscillator.

COMPOSITE WAVEFORM SHOWING GOOD SUB-MAIN CROSSTALK



Conditions: left and right channels fed out-of-phase at 1KHz, 100% total modulation, scope synced to audio oscillator. (*Note: alternate peaks of the waveform are the same amplitude.*)

COMPOSITE WAVEFORM SHOWING ACCEPTABLE SUB-MAIN CROSSTALK

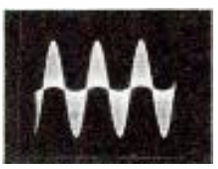


Conditions: left and right channels fed out-of-phase at 15KHz, 100% total modulation, scope synced to audio oscillator. (*Note: There is some variation between the amplitudes of alternate peaks. The cross-talk is still -45dB; which is not too bad.*)

COMPOSITE WAVEFORM SHOWING TOO MUCH SUBCHANNEL SIGNAL

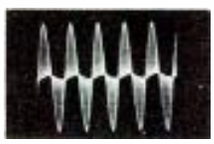
Conditions: left channel modulated 1KHz, 100% total modulation, pilot disabled, scope synced to audio oscillator.

COMPOSITE WAVEFORM SHOWING TOO LITTLE SUBCHANNEL SIGNAL



Conditions: left channel modulated 1KHz, 100% total, pilot disabled, scope synced to audio oscillator.

COMPOSITE WAVEFORM SHOWING ENVELOPE DELAY. THE SUBCHANNEL SIGNAL LAGS THE MAINCHANNEL



Conditions: left channel modulated 1KHz, 100% total, capacitor connected to output of stereo generator to deliberately introduce phase shift, pilot disabled, scope synced to audio oscillator. (*Note: The indicated separation is exactly 30dB—anything better than this passes FCC Specs.*)

CHANNEL IDENTIFICATION:

Conditions: left channel 10% modulation 400Hz, top trace is composite waveform, scope synced to 38KHz "clock" signal, bottom trace is 38KHz "clock" signal.

Conditions: right channel 10% modulation 400Hz, top trace is composite waveform, scope synced to 38KHz "clock" signal, bottom trace is 38KHz "clock" signal.

between.

Figure 3 shows the same mechancial analogy, but with a scheme for changing from the "Squre-wave" switching to a smooth transistion between channels so as to prevent interference. This is the scheme used in most stereo generators today, although a mechanical system is not employed. In Figure 4 you'll see the result of this "sine wave" switching. Very smooth indeed.

Broadcast equipment manufacturers use diodes as voltage-variable resistors or. in the case of Sparta use an appropriate filter to produce this "sine-wave" switching of the stereo channels. In the our equipment, the signal is generated using transistor switches so it looks like Figure 2. It is then passed through a filter to remove the higher-order components and comes out looking like Figure 4. In the process the subchannel component comes out at a higher level than it should so an appropriate amount of main channel is added with "separation" controls to make the ratio of the two signals correct. Regardless of the scheme used, the basic stereophonic system consists of smoothly fading from one channel to another at a supersonic (38 kHz) rate. That is all there is to stereophonic transmission.

A lot of engineers have looked at the baseband signal on an oscilloscope while doing a proof, but didn't have anything to compare their waveforms with to know if they're getting the right thing. The photos in this article are taken from the composite output of a Belar FM Stereo Monitor. Of course you may not be able to get waveforms quite as pretty as these, but they are included as a guide as what to look for.

Good luck on your next proof! □

How to make decisions you can live with

By Pat Finnegan
BE Maintenance Editor

As a necessary part of any ongoing business, a broadcast station will make large equipment purchases from time to time. Equipment will be purchased as replacement units, updating, or for expansion. Whether a relatively small single unit or a complete facilities changeover is involved, all purchases should be made with sound business judgement. Sounds simple. But it's not as easy as all that. In an industry where there are so many competing manufacturers supplying basic and exotic units. If you check the **Broadcast Engineering** Buyer's Guide issue (September), you'll see over 600 manufacturers listed.

How deeply engineering and management become involved in the decision making process depends entirely upon the organizational structure and attitudes prevailing in a particular station. Regardless of the situation in your station, this article hopes to bring out some of the aspects of purchasing that may be helpful when you do become involved in a purchasing decision.

Objectives

The reason for a major purchase is a basic question, but it deserves an honest answer. Desire, prestige, or similar emotional reasons for making large purchases can seldom be justified from a business standpoint. There must be sound engineering and business reasons at the base of the decision.

The end use and maintenance of the equipment should be known from the start, because these factors will dictate involvement in the decision process by those who will be most affected by the change. Replacing a technical test item will require little involvement by station departments other than engineering, but completely rebuilding a recording studio or booth should involve others. By this process, it is possible to develop a clear picture of what the new equipment will be required to do and what equipment is available that is capable of doing it.

False Economy

In the purchasing process, a number of routes may be open, but for a particular application, many of these routes may prove to be an exercise in false economy.

The non-decision route: Procrastination may delay the purchase of a replacement unit far beyond the logical time for replacement—on the assumption that meanwhile this is saving money. On the contrary, the expense curve for that worn out unit may now be prohibitive in time spent on maintenance and for replacement parts. Besides that, the reliability factor may be at a very low point.

The price route: Purchases made with the lowest price as the only criteria can turn out to be a cost nightmare in the months ahead. Price often reflects the quality and utility of a particular model, and there will be price variances among competitive models. With price as the only criteria, however, a light

The team approach to purchasing decisions is becoming more and more important. The technology presses forward, and with it come increasingly difficult decisions. If your station has a good staff, put them to work on the team. Don't wrestle with the problem by yourself. It's not necessary, and it's not always wise.

duty model may be selected and in your heavy duty application, the equipment may soon begin to develop chronic problems.

The "overpowered" route: Needless initial expense can be accomplished by purchasing an item with far more features and capabilities than the immediate or foreseeable application warrants. This is equivalent to using a semi-trailor truck to do the work of a pickup truck. Are those down the road plans really only pipe dreams which seldom materialize and are not justification for an additional expense?

Buy With Knowledge

Any sound decision calls for an objective assessing of facts, so it is necessary to gather information.

When all those at station level have made their contribution, it should not be difficult to outline a relatively clear picture of what the new equipment is supposed to do. These contributions may also be laced with personal desires which can destroy the objectivity of the final decision. Some hard questions should be answered to assure that the additional features required are not simply personal desires which will contribute little or nothing to the efficiency or reliability of your application.

Reduce these facts obtained to specifications required. These may also be translated into terms of reliability, quality and ease of maintenance. But again, try to be objective at all times and take care not to draw up the specifications in such a way that only one model by one manufacturer will meet them. By doing so, a decision has already been made to buy that model which may have been caused by a personal desire on your part. If such is the case, all the activity that follows is mere "window dressing" to give the appearances of an objective decision.

With the specifications determined and a knowledge of what the station budget will allow, a comparison should be made of current spec sheets and price schedules. Cull this information from your catalog files, but make sure everything is up to date. If not, obtain the latest information from the manufacturers.

For the particular equipment needed, there may be several manufacturers represented with their spec sheets. It is necessary to look the specs over carefully so that specs may be compared on an equal basis. It isn't always easy to determine how the individual specs were derived, so it is possible you can be comparing "apples and oranges." These sheets will highlight the features the manufacturer will want to push in his model and other specs may be omitted altogether. It is not safe to assume that the specs must surely be there even though not mentioned. After careful comparisons, you will find several of the models do not have enough specs to meet your requirements so these will be culled out, narrowing down the selections. Here is a clear function of engineering: interpret the specs for management.

The Salesmen

After the list of models has been narrowed to those that appear to meet the requirements, call the different salesmen in and discuss their particular model. Get answers to the questions that have arisen. Many of these men have been broadcast engineers at one time and will have an understanding of the problems of adapting their equipment to meet your require-

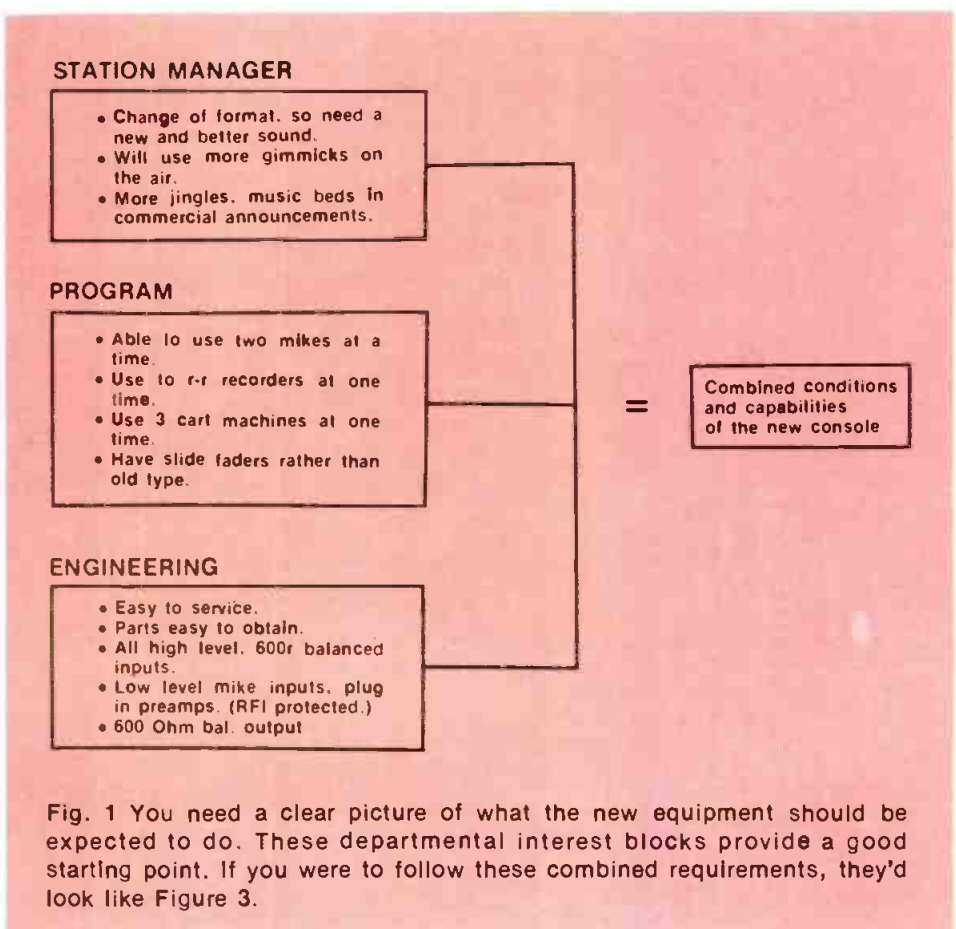


Fig. 1 You need a clear picture of what the new equipment should be expected to do. These departmental interest blocks provide a good starting point. If you were to follow these combined requirements, they'd look like Figure 3.

ments. Most competitive equipments are somewhat standard, while most broadcast applications are somewhat customized. **The important information you need is how effectively a particular model will adapt (without modifications) to your specifications.** In most cases, when a salesman can't answer the questions himself, he will get answers from the plant from someone who does know.

Outside Opinions

Needless to say, equipment salesmen are biased towards the models they are selling. An outside source of information should be pursued. Talk with other stations who use this model in a broadcast situation.

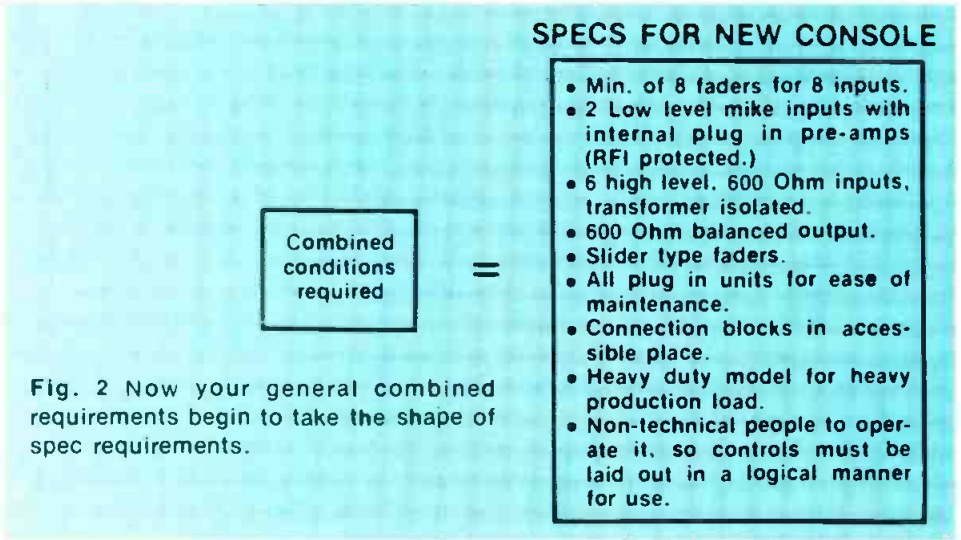


Fig. 2 Now your general combined requirements begin to take the shape of spec requirements.

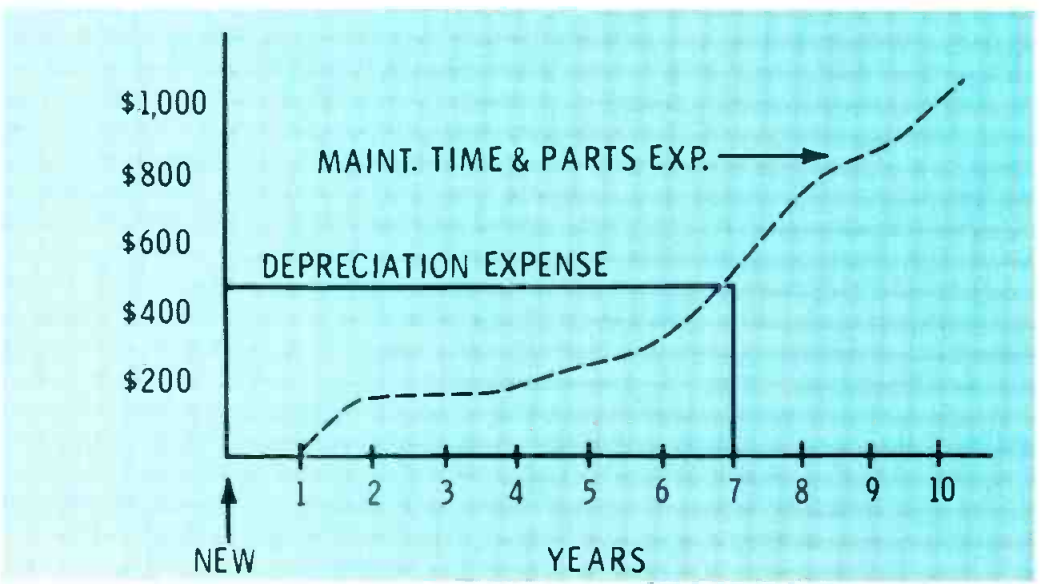


Fig. 3 Well, you can always wait until tomorrow. But delay in replacing worn out equipment can be more costly than purchasing new equipment...especially in view of downtime, make-goods, and rising parts costs (if the parts are available).

Management Highlights

The station equipment is changing today, and that change is making new demands on the staff when new equipment is needed. If your staff is blessed with creative talent, it'll be hard to get the most out of it if one-man decisions are the rule. The team approach to purchases allows involvement in such a way that everyone contributes to making the decision cost effective.

Technological changes require that the engineer become the chief interpreter. Otherwise, the equipment may cause more problems than it solves...from both a production and maintenance point of view.

Here again, be on the lookout for biased opinions. One may be sold on the equipment because of personal feelings and for the same reasons another may be sour. So try to filter this out of the information you gather.

Another important aspect to consider in this area is the application. All stations do not operate alike, so the particular application may not be anything similar to what your application will be. Unless the applications are similar, the information can be very misleading.

When the equipment under consideration represents a large investment, a few field trips are warranted. Try to observe these units in operation at a station under regular broadcast conditions. When equipment is displayed, (even though operating) at a show, such as the NAB, this is better than deciding from spec sheets alone. However, such a unit on display may be a fine tuned unit that is kept that way by a battery of the manufacturer's best engineers. Thus, observation of a unit in a broadcast operation can be more informative.

Criteria

By setting up specifications you desire the equipment to meet in the application you plan, you have developed certain criteria in the final choice of equipment that is selected. But specs cannot tell the whole story and there are other criteria to consider. One bears upon the equipment reliability and the other upon the relationships you will have with the manufacturer after you purchase a particular model.

It is not difficult to develop spec sheets. All it takes is a good writer and a printer. Making equipment that will actually meet those specifications is another story. From other users, try to determine if the equipment meets the published specs easily, or if it is all the equipment can do to just meet them.

Also from other users, learn what technical support the manufacturer provides. Of course, this holds only if you have not had personal experience with that manufacturer before. Technical support will be the manner and speed in which warranty situations are handled, how easy it is to reach someone at the plant who can provide technical answers when you have problems, and the stocking and speed of

when you need parts.

Obtain Bids

Once you have narrowed the field to a few models that you are convinced will meet your application requirements, call for bids. Published prices are not always firm and you are obligated from a business standpoint to obtain the most favorable pricing for the station.

In the area of pricing, particularly when large sums of money are involved, there can be as much dickering and double talk in figures as there is in dealing with a used car salesman. Most manufacturers do not like to appear to discount prices, so they prefer the trade-in route. In this manner, published prices appear to remain firm while the high trade-in figures (no relationship to value of the trade-in equipment) accomplishes the same effect as discounting.

Accepting a Bid

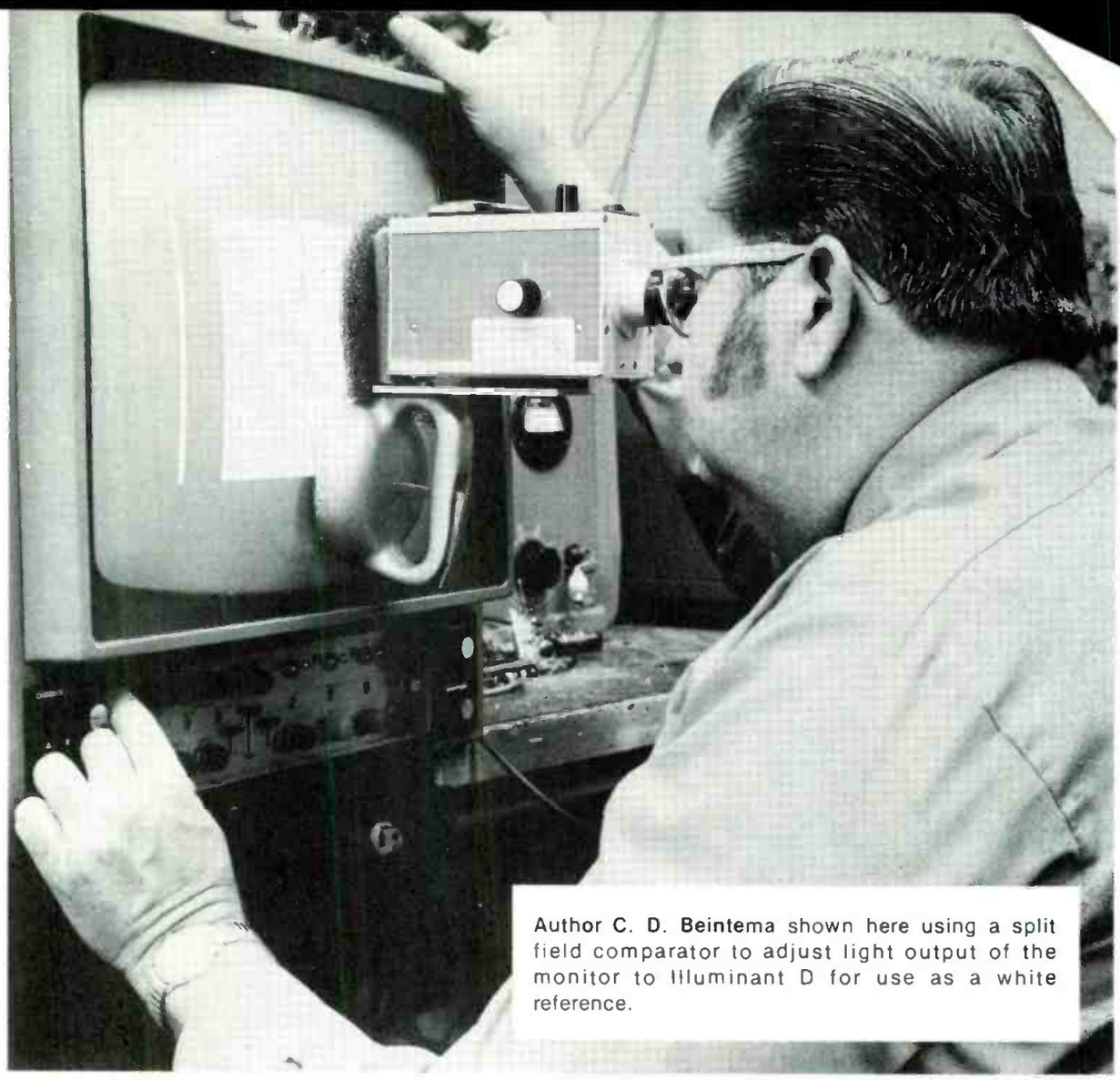
Once you receive the proposals, ordinarily you have 30 days to accept or reject. After that period, the manufacturer is free to refuse to make the deal, if he so chooses. Thus, try to get all the bids in about the same time so you can compare them together. Watch out for bids on models that do not represent and meet the specifications you asked for. The sales rep may have misunderstood and is actually bidding equipment with less specifications than you need, so the price quote may be well under the others.

When all bids are competitive in almost all respects, you have a difficult decision to make. But each manufacturer is different, and if the purchase is a large system or large item, you will be going into a "partnership" with this company for a long time. Once more it is important for engineering to make some final interpretations for management. If your engineering staff is small and not really well trained, it should be important to know how well the manufacturer will back his equipment or supply technical assistance. A given unit may meet all your needs and be offered at the "best" price, but if it is a high ticket item using highly sophisticated circuitry, technical assistance may be a high priority consideration.

On the other hand, if you have a really good engineering staff, they may indicate a manufacturer's backup weakness but dismiss it on the basis of in-plant technical capabilities. And this is precisely why an honest approach must be taken to the decision-making team. It's possible to maintain a mediocre engineering staff and keep it from developing. And in the short run, it may seem economically reasonable. But, as they say, when the chips are down - either in a downtime crisis or when a major purchase decision is pending - then management is at the mercy of the most glib sales rep. Later, that "gut decision" may develop into an ulcer, and what could have been a cost effective decision becomes a cost defective blunder.

Summary

Large equipment purchases should be made only after careful consideration has been given to many facts, and then an objective decision made. Large purchases made in haste and without proper knowledge of the facts, can be a nightmare you will live with for a long, long time. □



Author C. D. Beintema shown here using a split field comparator to adjust light output of the monitor to Illuminant D for use as a white reference.

Whose face is green now?

By C. D. Beintema*

This article gets down to some overlooked basics that affect color quality and fidelity. It's a thrust at the need for a practical method of evaluating a color picture against standards.

"Beauty is in the eye of the beholder."

Does this mean that color television can be only as good as the eye that beholds it? A look at the history of color television, might cause you to conclude just that. The lack of uniform color picture quality, differences between monitors, and differences between home color television receivers, all indicate a need for a practical method for evaluating a color picture to determine whether it approximates some color standard.

*Engineering Manager, TV Products, Conrac Corp.

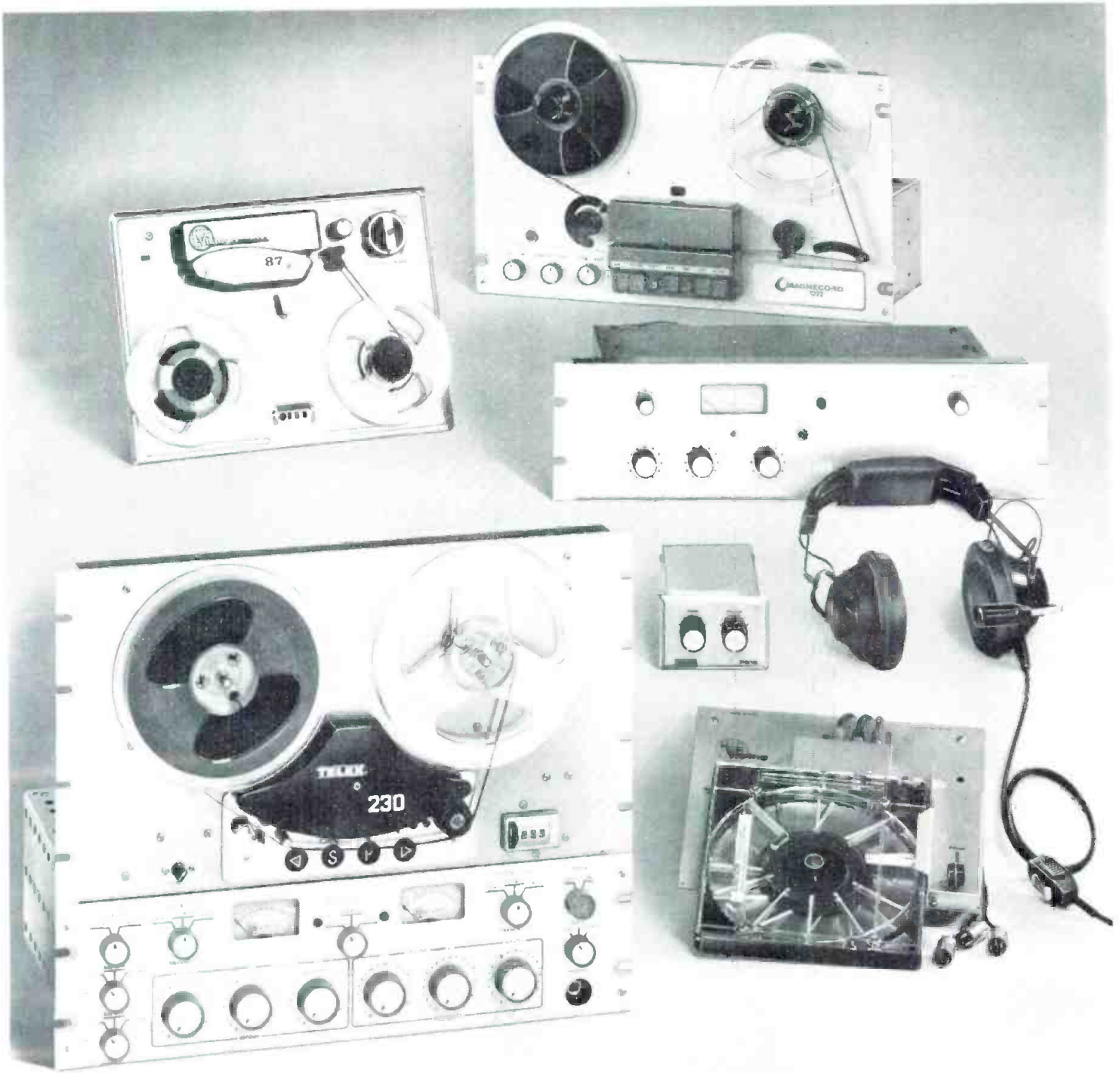
Illuminant D has been selected as the standard daylight white with a color temperature of 6500 degrees K + 7 MPCD. On the CIE coordinates, this amounts to x value 0.313 and y value 0.329.

You could then surmise that all that would be needed would be a source of illumination equivalent to Illuminant D, and all of your troubles would be over. All you would have to do would be to compare the color tube being adjusted to the standard. When a match was achieved, all should be well.

Your Guess Is As Good As Mine

The foregoing is an obvious oversimplification of the problem of setting up a color television set or studio monitor to exacting standards. In practice, very few people concern themselves with exact adjustments. As long as flesh tones appear as the adjuster thinks they should, he is happy and very willing to leave further knob twisting to anyone who comes along. Indeed, television set salesrooms are a prime example of misadjusted sets. Some people will buy a set that is completely misadjusted and would have no other at any price. The serviceman confronts his customers time after time and finds their individual tastes depart considerably from the "standard observer."

There is a segment of the populace who are critical, concerned, and wish to be precise. These people are the professional broadcasters, engineers, and others whose interests are in producing on-the-air color transmissions of true color character and being able to monitor and reproduce that transmission on



For your every broadcast and tape equipment problem or need ...Telex.

You'll find that Telex has both quality and range.

From economical, manually operated tape cartridge transports to heavy duty, commercial/industrial three motor tape transports with hysteresis synchronous capstan drive.

And from compact, monaural tape playback pre-amplifiers to single and dual channel professional magnetic tape record/playback amplifiers.

For recording and reproducing sound of incomparable quality, of course look no further than the standard of the industry Magnecord series.

In fact, look no further than Telex for any and all of your broadcast and tape handling needs, including headphones. For literature, write Telex Communications, Inc., 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420.

PRODUCTS OF SOUND RESEARCH

TELEX®

COMMUNICATIONS INC

CANADA: Double Diamond Electronics Ltd., Scarborough, Ontario

INTERNATIONAL: Telex Export Dept., 9600 Aldrich Ave. S., Minneapolis, Minn. 55420 U.S.A.

7310

For More Details Circle (23) on Reply Card

Management Highlights

You may not understand Illuminant D. Even so, this article will help you understand color deficiencies as you and your viewers see them.

We all have our preferences in color hues. What is green? Green as we see it on the football field (which often looks more blue than green on TV), or green as we see it around the station? Or how about the more obvious problems of orange faces and purple meat?

As you know, the dramatic color problems come when an advertiser complains. Yet how many stations presently use equipment like the split field comparator? Does yours?

a remote device with the same true color character, or those who just enjoy a good television picture in true color.

A few individuals have been apparently endowed with the amazing ability to accurately discriminate color temperatures and are able to accurately adjust equipment day after day to the same values without peripheral standards or instrumentation. These are the "Golden Eyeballs" of the industry. Not many are so endowed. The rest must struggle along and attempt to make use of the available instrumentation and subjective standards with their inconsistencies and frustrations.

The Search For Standards

Conrac Corporation has studied this problem for a long time and still cannot conclusively say that there is an answer. At best, the industry still faces a compromise. Here we will relate some of the tests and instrumentation used and point out the difficulties that were experienced as well as the success achieved.

The project started out in a search for monochramatic cathode ray tubes whose emission was Illuminant D. Several samples were obtained from vendors. These, of course, had to be evaluated to determine if they were indeed Illuminant D. Selected cathode ray tubes were operated in a prescribed manner, and the emission was plotted with a spectroradiometer.

The results were not what was expeeted and so the same tubes were re-run on a second spectroradiometer. These results looked somewhat better and a complete checkout and restandardization of the first instrument was instituted. Errors were discovered and corrections to the equipment were made. Subsequent results are believed to be within the experimental errors and are now traceable to the United States Bureau of Standards.

Both of the spectroradiometers used have graphic outputs, one has also an integration system for accumulating energies at specific wave lengths which, when calculated properly, produce the CIE coordinate values for the sample. (The second unit also has provision for binary coded decimal output but this was not used.)

In order to achieve good correlation with each instrument, the graphic outputs were tabulated for each 5 nanometer point between 400 and 700 nanometers. This tabulation was fed into a Digital PDP-11 computer where the program performed the necessary calculations, and produced the x and y coordinate values.

Calculations are as follows: The spectroradiometers have graphic outputs which indicate the energy output E_e of the sample of each wavelength λ. To calculate the CIE tristimulus coordinates x and y, the curve data $E_e(\lambda)$ for each discrete value of wavelength, must be multiplied by the CIE tristimulus functions of the visual spectrum for the average human eye - $\bar{X}$, $\bar{Y}$, and $\bar{Z}$. These products are then summed to provide the integrations between 400 nanometers and 700 nanometers, which are then X, Y, and Z, the tristimulus values. The tristimulus coordinates x and y can then be derived from:

$$x=\frac{X}{X+Y+Z} \quad \text{and} \quad y=\frac{Y}{X+Y+Z}$$

Having established a secondary color standard in the monochrome cathode ray tube, means of transferring this standard to color tube set up could be investigated.

A Hunter Lab colorimeter capable of readout to three places was used as a transfer instrument. This unit, along with most other colorimeters, has the inherent problem of calibration. Good accuracy can be achieved over only a portion of the CIE diagram for any one standard point of CIE coordinates.

For example, if a standard light source were used for a particular color and the instrument was standardized for that source, only a limited area around that standard point can be relied upon for coordinate accuracy. Standards must be available for other areas of the spectrum if accurate and repeatable measurements are desired and expected from the instrumentations. It was, therefore, necessary to create cathode ray tubes which could be used as a standard to set the instrument to those areas where measurements were desired. These standards were checked and coordinates determined from the spectroradiometer data on each tube.

In checking these standard tubes and monitors, it was found that reliable and consistent results could be obtained by careful reading of the graphs and calculation of this data as previously mentioned. The integrators on the spectroradiometers read only the pre-determined pick-off points. This allowed much information to be lost due to spikes and unusual curves, such as those encountered in the rare earth phosphors as noted on the spectrogram of the red phosphor.

Color tube phosphors presently being used do not conform to the NTSC points set up in the early history of color television. The EBU system is much more practical from the standpoint of existing and presently used phosphors.

Confusion Abounds

With all of the possible combinations of available phosphors that have been built into monitor tubes, it is no wonder the industry is confused as to what is needed to achieve a picture with an Illumi-

nant D white. The human eye evaluating the picture always seems to be the final criterion for quality. No matter what an instrument gives in absolute values or abstract numbers, if it doesn't look right to the eye, the customer isn't happy.

In order to achieve a phosphor emitting in the white region of the CIE chart, common practice has been to use a mixture of two or more phosphors; for example, most P4 phosphors are blends of blue and yellow phosphors. Likewise, a phosphor blend can be made that will emit the region of Illuminant D.

Tubes made from these blends were checked with the speetroradiometer and certain ones seleeted for use as a reference standard.

Now that light sources traceable to the U.S. Bureau of Standards have been achieved, various types of instruments can be checked against the standard and thus against each other for comparison and consistent and stable results.

The instruments investigated fall basically into two categories: (1.) Those that use an internal source of illumination as a standard with which to compare the sample source of illumination commonly known as visual color comparator, and (2.) Those units that make use of various combinations of sensors, filters, etc., to give an electrical readout either as a preset null or some numerical value.

Examples of the visual comparator are the Hellige IRT and MacBeth instruments. Examples of the sensor electrical output types are E. G. & G., Tektronix J.16, and Gardener Colorgard. Several units of each type were investigated.

Questionable Results

In setting up a color picture tube, some standard of reference white is used as a beginning point. The light sensors are of little value unless they have been standardized against a source of illumination that has identical color primaries to that of the color picture tube being set up. This is not true of the visual comparators where the tube is adjusted to the standard and the eye is used to compare the standard with the sample in both luminance and chrominanee. The normal human eye has a high sensitivity for differences in both luminance and chrominance so that the visual comparator, if constructed properly and used carefully, can be an exacting standard. Unfortunately, no two instruments were found to be exactly the same or give the same results. Slight differences in lamps, voltage sources, filters, edge effects and eye response all add up to give questionable results.

Several instruments were dismantled to the point where the standard lamp used could be checked with the speetroradiometer. This point was also as close to the sampling point as possible to eliminate any effects of the optics in the path common to both the standard and the sample beams of light. The results of these tests revealed very significant differences in the lamps, and filters used with coordinate points considerably departed from Illuminant D.

In obtaining consistent results in the use of one instrument, the items most affecting results were: (1.) The line of demareation between the standard and the sample. (2.) Ease of holding the instrument in place while making adjustments to avoid operator stress and fatigue which influence consistency of results.

If even a small discontinuity is seen in the visual field, luminance and chrominanee matching can be seriously influenced. Various means of holding the instruments were devised to decrease operator stress and fatigue, the pneumatic gripper being the most versatile.

To accomplish set up with the light sensor electrical output devices, the devices must be standardized for each set of phosphor coordinates used in the color tubes. Slight variations in the color coordinates of the phosphors used can be sufficient to prevent the accurate set up of the color tubes. Therefore, only tubes manufactured to exacting color coordinate standards, such as the Conrac color matched professional monitor tubes, can be set up consistently with instruments of this type. Even then, the instruments must be of adequate stability, preferably battery operated to avoid AC line changes, and the inconvenience of cords.

Recomendations

Where only a few monitors are used, it is recommended that the user obtain and use a visual color comparator. This enables him to set up any color tube to the light standard within the comparator. This light may not be exactly Illuminant D, but for most purposes, it will be adequate.

Where many monitors are used having known phosphor matched coordinates, much time can be saved by also using a light sensor electrical output device to transfer information with less operator fatigue. A visual comparator is still necessary to arrive at a starting point on monitor.

Desirable features of a visual comparator include: (1.) A stable standard light source equalling Illuminant D or other desired illuminant. (2.) At least two light levels of brightness (3.) A very sharp line of demarcation between sample and standard (4.) Small size (5.) Light weight (6.) Some means of affixing the device to the monitor under test (7.) Battery operated.

Desirable features of a light sensor, electrical readout unit include: (1.) Battery operated, stable power supply (2.) Light weight (3.) Small size (4.) Wide band response (5.) Digital readout (6.) Means for affixing the sensor to the monitors under test.

In summary, the importance of consistent color cannot be minimized. What is seen by the camera must be reproduced by the monitors and transmitted to the consumer for reproduction on the television receiver. Only consistent standards and consistent use of these standards as checks and balances will truly achieve color reproductions from scene to camera to transmitter to the end receiver and viewer. □

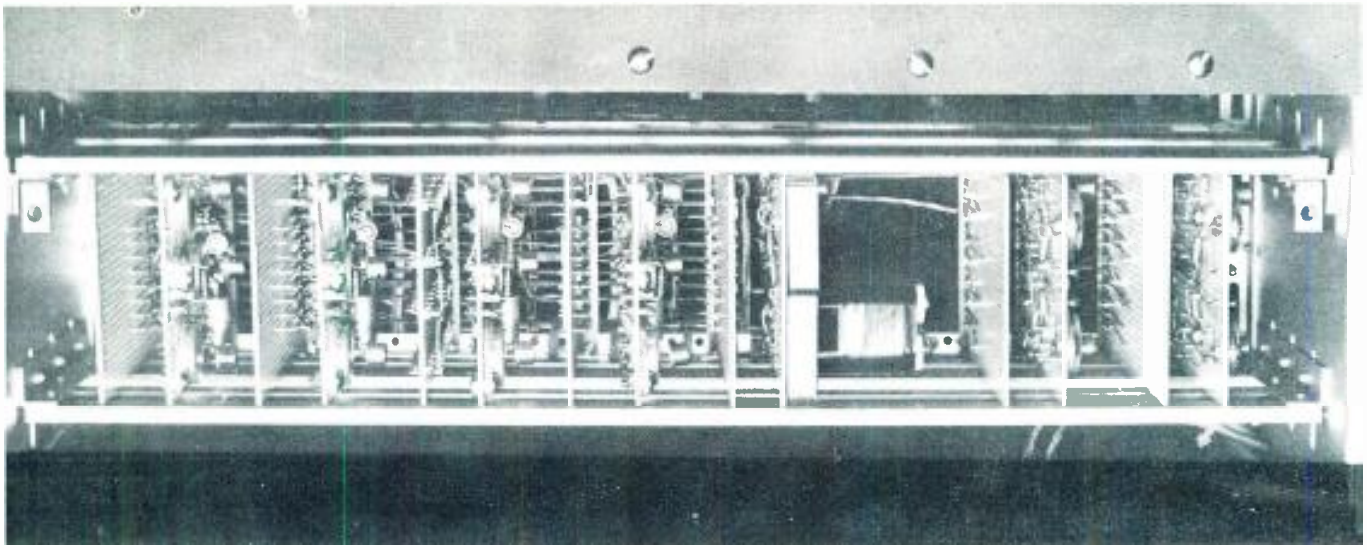


Fig. 1 Plug-in cards contain all control circuitry.

How to build a full-service phone system Part 1

By Mark Durenberger*

Radio stations are converting more and more day and night hours to a talk format...a highly successful idea when properly applied. While much has been written on the format itself and we've seen some attractive installations, little has been said about the mechanics of maintaining a smoothly-flowing talk show.

WLOL is in its sixth year of 24-hour phone-ins. We faced and solved all the usual problems inherent in a continuous-duty on-air telephone system and have gone a bit further in adding refinements not available in any commercial installation.

The unit we built fulfills a great number of requirements:

1. It's completely noiseless in switching, even when taking a line that may be ringing at the time you pick it up.

2. It can be expanded to handle as many lines as you wish to select. Our system has four incoming lines and four outgoing trunks which double as studio business phones. Normally the incoming lines are switched on a mutually-exclusive basis, like the buttons on a desk phone, but any or all of these trunks can be "locked-on" while the others are switched normally.

3. The entire system was to look electrically like two extension desk telephones. All wiring is AT&T standardized, appearing both at a telco connector block and a standard 50-pin Amphenol plug. The plugs make it a simple matter to disconnect the system for telco trouble-shooting.

4. We wanted to be able to conference any trunk with any other without regard to the kind of "office" the line was coming from. Using isolating circuits we bus only the audio together and have thus eliminated the tip/ring polarity problem.

5. Since the system is in use 24-hours a day it had to be highly reliable with easy access for maintenance. Toward this end we have dual power supplies, and we used transistor drivers for all relays to keep switching currents at an absolute minimum. Each line has its switching circuitry on a separate plug-in card (Figure 1) so a line-check or maintenance is as easy as

*Formerly with WLOL. Currently CE at WCCO-FM, Minneapolis.

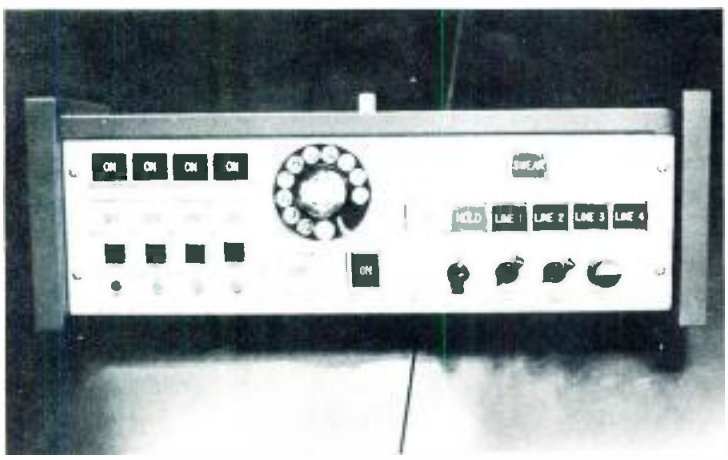


Fig. 2 Main switcher of the full-service system.

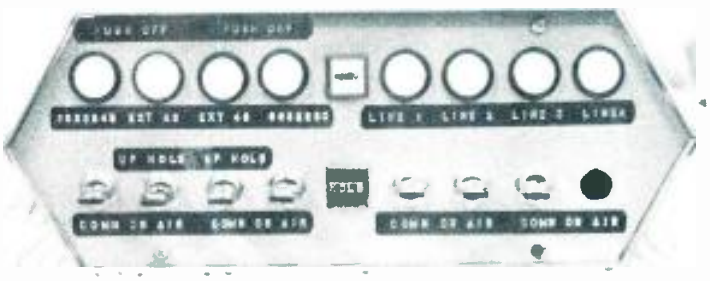


Fig. 3 The secondary switcher. As you'll note, it was not quite finished when this picture was taken.

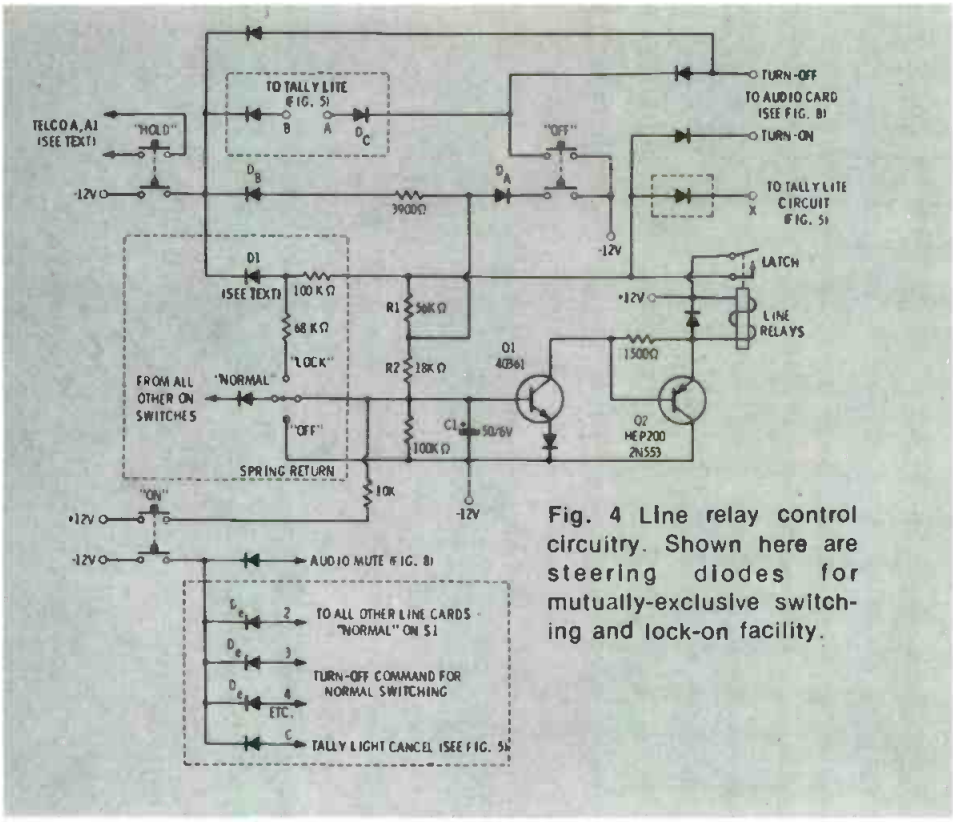


Fig. 4 Line relay control circuitry. Shown here are steering diodes for mutually-exclusive switching and lock-on facility.

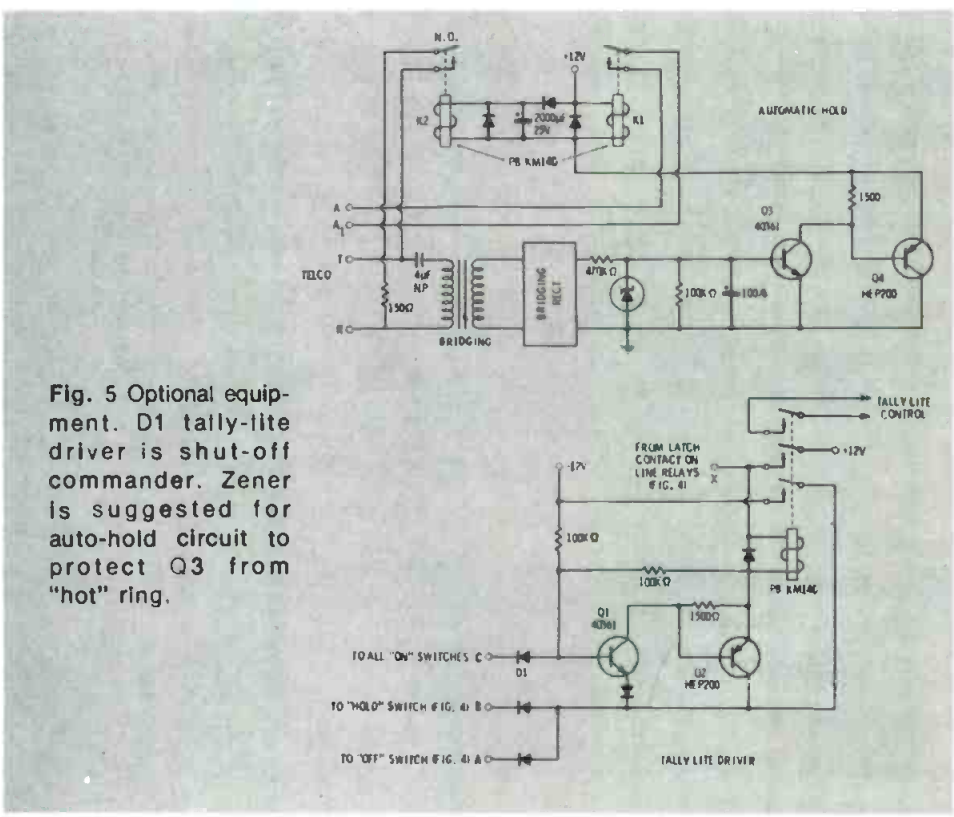


Fig. 5 Optional equipment. D1 tally-lite driver is shut-off commander. Zener is suggested for auto-hold circuit to protect Q3 from "hot" ring.

replacing the card.

6. An "automatic-hold" circuit was incorporated into the incoming lines switching for periods (after Midnight) when no producer is on duty to answer calls. The 20Hz ring voltage fires a circuit which puts the line on "Hold" during the last half of the ring cycle.

7. Pre-delayed program was to be fed to callers waiting in line, at a sufficient level as to cause them to turn the radio down. This feature alone, paying off in program flow, has made the cost of the entire system worthwhile.

8. Because momentary-action silent push-buttons are employed, we wanted some sort of "flagging" device to tell the announcer with which of the four incoming lines he has just finished. Coming back from a break, faced with four "lit" lines, he had to know which call to take next to keep the rotation fair. A memory device lights a tally light above each line when the announcer goes from that line to "Off" or "Hold". That light is lit when he comes back to the lines, and is extinguished when **any** line switch is depressed.

9. As a result of problems with our earlier system, we eliminated all series circuits with the exception of the telco "Hold" circuit. All control functions require a positive make. Not only is this much more reliable, but it allows for easy addition of a satellite control unit such as the one we installed in master control.

10. While we were designing this system we went to the telephone company with another problem. Some kid with a little intelligence and four dimes was able to go to four payphones around town, tie up all four lines, and put us out of business. So we asked for and received a special delayed-release circuit on our exchange so that about thirty seconds after we hang up the phone, the caller is automatically disconnected. We like the delayed-dropout for two reasons... we can recover a caller we may have accidentally switched off, and we can drop a caller from the air and tell him why (he's now getting pre-delay program feed until he's dropped by the telco gear).

The unit to be described fulfills all of these requirements and gives us a bit more.

Construction

Figure 2 shows the original design of the studio switcher. (We've since disconnected the dial.) All switches are silent, momentary contact DPDT, normally open and illuminated, with the exception of the "Hold" switches on the left side. This picture does not show the "tally" lights now mounted directly above each of the incoming lines (right side) nor the "lock-on" keys mounted to either side of the "Swear Switch." You'll note that the right group duplicates a telephone desk-set while the four lines on the left (outgoing) can be controlled individually. The cabinet is a Bud Mark-T series. The front

steel panel is removable, a bit hard to machine, but it makes an extremely strong control surface. The rear of the cabinet opens for access to wiring.

Figure 3 displays the control room switcher which duplicates most control functions but in a high-density application. The lever keys are Switchcraft series 41000. The Dialco push-button/indicators on the left group are used as off switches and status lights. On both switchers the line switches are illuminated by #330 lamps connected directly to the telephone busy lamp circuits.

Line-Switching Controls

First, a discussion of how the line-switching relays are controlled, then we'll see what they switch. Refer to Figure 4, actually one-third of the circuitry on each incoming line card, but it's common to all line relays. (We'll ignore tally light and auto-hold circuits for now.)

The two-stage current amplifier may seem a bit elaborate, but it keeps the switching currents low and allows us a great deal of time-domain flexibility. The relay-driver circuit responds to four different commands. First, the ON switch applies a positive voltage to Q1. A latch contact on the line relay holds the circuit through R1 and R2 and also applies a control voltage to a delayed-make audio switch to be described later.

The OFF and HOLD switches apply a ground to the junction of R1 and R2, releasing the circuit. The HOLD switch sends a slightly delayed command because C1 must also discharge through the added resistance in that circuit. This is necessary for proper operation of the telco "Hold" relay and will be explained further.

Note that there is only one OFF and one HOLD switch for all incoming lines, no matter how many you wish to control. Diode steering is the answer and for a quick refresher I refer to Pat Finnegan's great article, Automatic Assistance Circuits, BE, June, 1971. Through the installed logic, all incoming

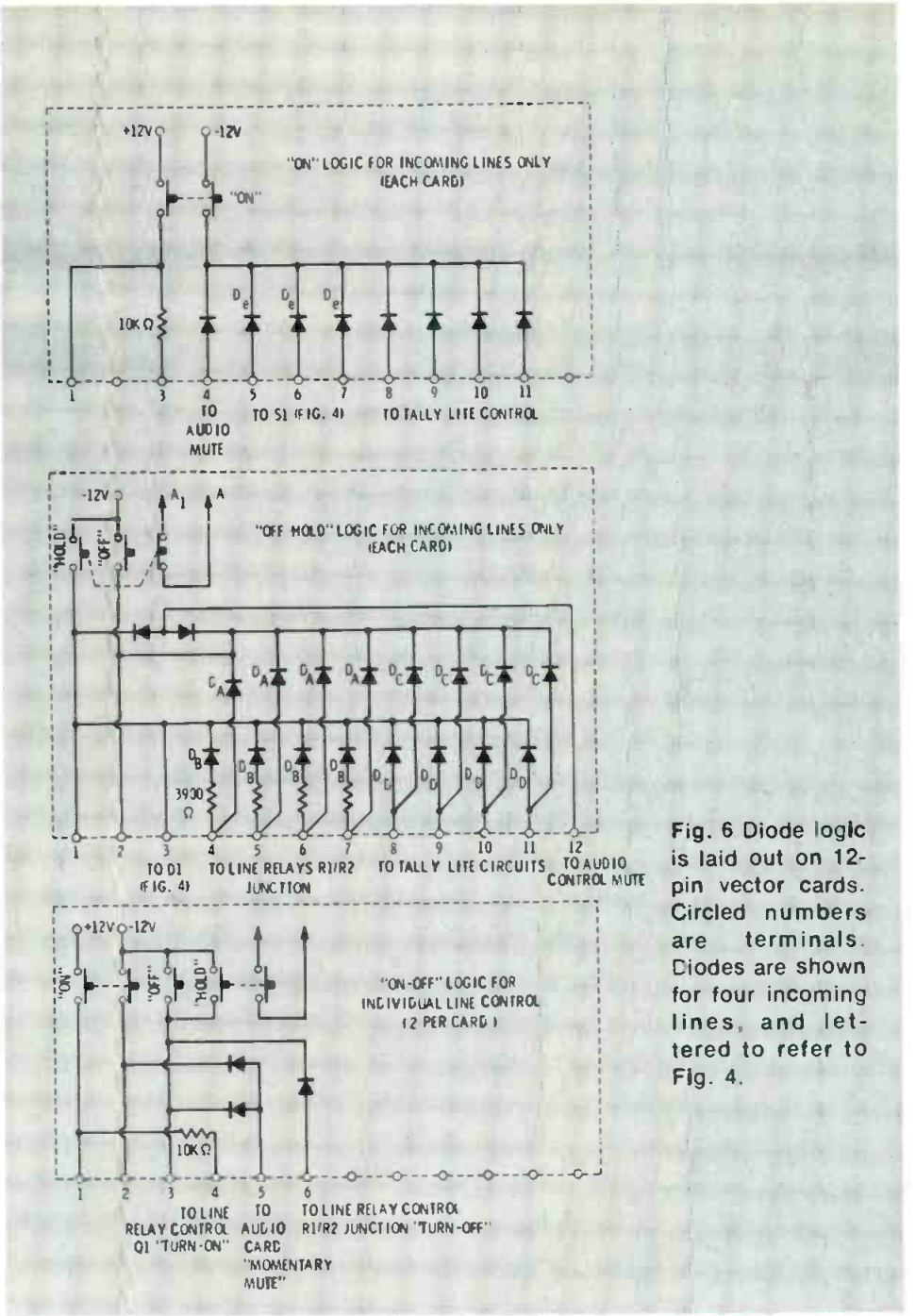


Fig. 6 Diode logic is laid out on 12-pin vector cards. Circled numbers are terminals. Diodes are shown for four incoming lines, and lettered to refer to Fig. 4.

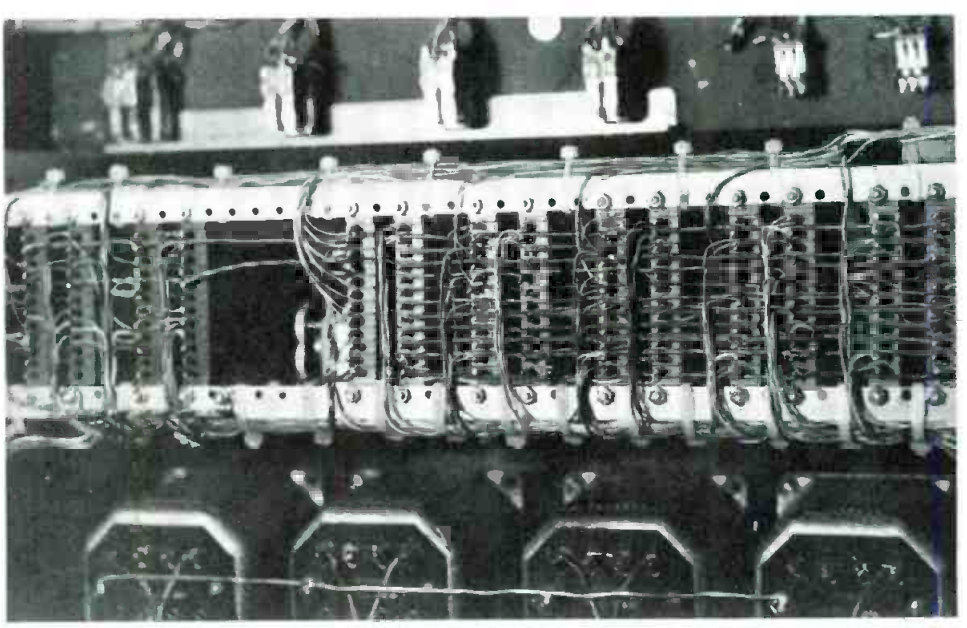


Fig. 7 Rear of card cage shows cross-wiring, line relays at top, isolation transformers at bottom.

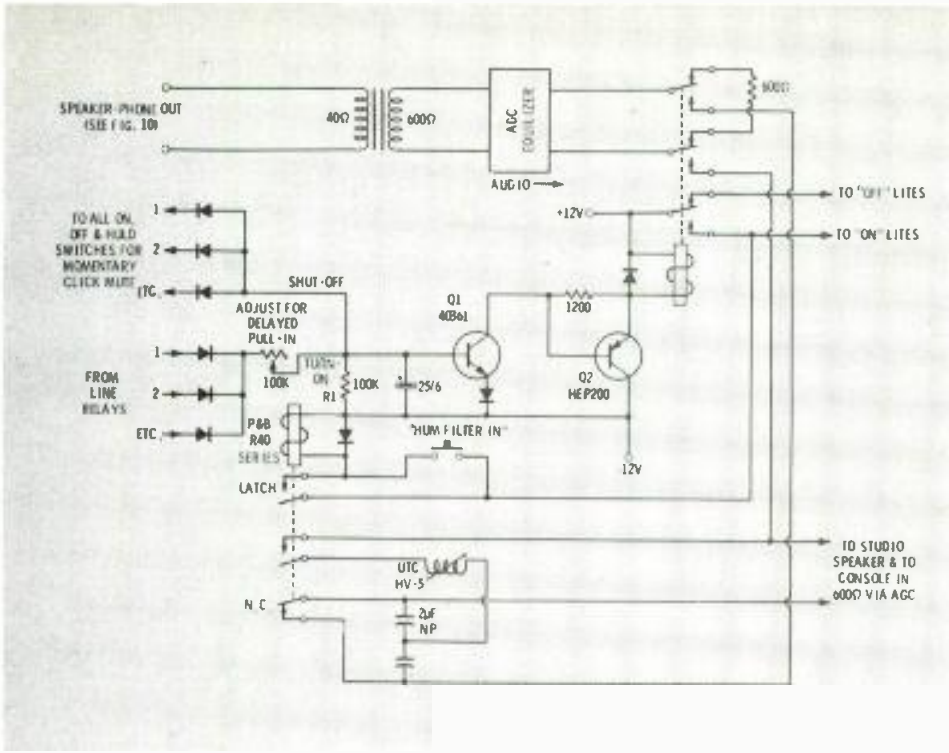


Fig. 8 The delayed-make/fast release audio on/off card with hum filter.

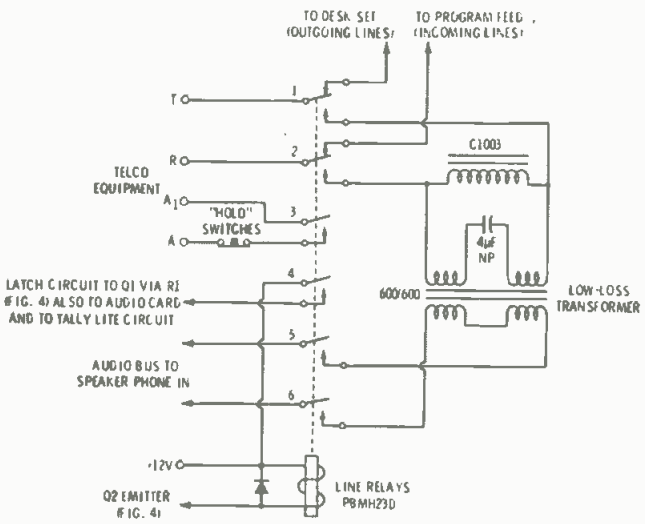


Fig. 9 Line relay, isolation transformer and holding circuit. The holding reactance, Stancor C-1003, is about the most reasonable for this application.

lines are normally switched on a mutually-exclusive basis...i.e., a turn-on command to one card simultaneously turns off all others. The exception to this mode is under the condition that you wish to lock any one (or all) of the lines ON while still switching the others. The action of a mechanically-locked switch (S1 Fig.4) creates a second voltage path at a different potential at Q1. Enough positive voltage remains even when the R1/R2 junction is shorted, to hold up the circuit.

As soon as this switch is returned to normal, the next switch command will shut down that line. Or you can turn it off immediately with the other half of the switch. To further complicate things we wanted to be able to put this "locked-on" line in HOLD along with any other line on the air when taking a break. Thus the addition of diode D1 in Figure 4. From the "Hold" mode you simply go back to that line when you're ready by pushing the ON switch.

Outgoing Lines

The switching for the outgoing lines is basically the same, but here each trunk is individually controlled (Figure 2). The additional components on each incoming line-relay card are shown in Figure 5. Q1 and Q2 comprise a tally-light circuit actuated by the process of switching any incoming line from On Air to Off or Hold. A light comes on above that line which you've just left...it's extinguished as soon as **any** line switch is depressed. Q3 and Q4 amplify the 20Hz ring voltage and operate two relays in a special delay function to put incoming calls automatically in "Hold". Their action will be described later.

In our system of eight lines we used more than 100 diodes, (Mot. Hep-170) and were faced with an installation problem until we found that the plug-in cards were ideal. Figure 6 shows one way of laying out the diode logic. The boards are Vector 837 with 12-pin terminals. The entire system fits nicely into an H. H. Smith enclosure. Judicious placement of the cards will keep cross-wiring to a minimum (Figure 7).

Whenever you switch a DC telephone line you create some pretty nasty transients. Rather than try to eliminate them (I wonder if it can be done?) we simply ignore them by telling our system to: **1.** Wait a fraction of a second after the DC switch is made before closing the audio path to the console. **2.** Open that audio path an instant before the next DC switch is made.

Figure 8 displays the delayed-make/fast-release audio relay circuit and hum filter card. Any line relay in the ON mode sends a control voltage via the 100k (delay adjust) resistor to the base of Q1. The switching transient has decayed before the capacitor can charge enough to cause the relay to operate. Reversing the process is a matter of grounding the base of Q1. This is done every time a button is pushed...ON, OFF, or HOLD, on any line...again via steering diodes.

You'll note from Figure 4 that while the audio relay thus must open immediately, the discharge of the line relay transistor driver capacitor C1 through R2 takes a fraction of a second...and thus our reverse delay! Our original design called for a fast reed relay, but we found we didn't need it and went in favor of a flat-pack P&B R40 series which adapts nicely to a card. We added a switchable high-pass filter to the card which can be turned on only when the audio relay is on.□

PEOPLE IN THE NEWS


Robert Heron


Tom Fuller


Richard Russell

Robert Heron has rejoined the EVR Partnership, London, as marketing....**Albert T. Kieninger** has been named president of Video Products Company, exclusive distributor of Norelco Video Cassette Recording Systems in Northern California....**K. Blair Benson,** director of audio-video engineering, Goldmark Communications Corporation, has been reelected to the board of governors of the Society of Motion Picture and Television Engineers.... **Jerry Chapman** has been appointed Vice President of the McGraw-Hill Broadcasting Co., Inc. Chapman is General Manager of WRTV6, Indianapolis and will continue in that position....Appointment of **W. Wallace Warren** as Marketing Analyst—FM Transmitters, for RCA Broadcast Systems has been announced.

Koss Corporation has named **Tom Fuller** regional sales manager and **Joseph Purtell** house territory manager for stereophones....**Glenn R. Petersen,** General Manager of General Electric's Mobile Radio Department, Lynchburg, Va., has been elected Chairman of the Communications and Industrial Electronics Division of the Electronic Industries Assoc....VIP Agency of Los Angeles, a nationwide executive search firm, is pleased to announce the appointment of **W. C. Wiseman** to head their Broadcast Executive Recruitment Dept....**Richard Russell** has been appointed Sales Manager for Chemtronics Inc....Kalart Victor Corp. announced the promotion of **Robert L. Schwartz** to Regional Sales Manager for the Mid-West Territory....Belden Corp. has appointed **William J. O'Connell** to the newly created position position of manager-legal services and **David G. Billish** as general credit manager.

Appointment of **Ted Larson** as manager of test engineering was announced by Nortronics Company, Inc....**Glenn H. Vought** has recently joined Coastcom, Inc. as Manager of Applications Engineering....**James H. Geers** has been elected vice president of marketing for Scientific Micro Systems, Inc.....**R. Terry Hoffmann** was recently appointed by the Board of Directors of TeleMation, Inc., to the position of Vice President, Administration....**Stanley D. Becker** is appointed director of product development for CMX Systems.....The appointment of **David A. Aptaker** as Regional Manager for Marco Video Systems, Inc. has been announced....**Angelo (Angie) Fraticelli** has been appointed to the newly created post of Manager of Customer Relations for Technology Inc., HF Photo Systems Division.

Dyma Engineering, Inc. announces the appointment of

David Billish

Glen Vought

Terry Hoffmann

Jacob Miller as Sales Engineer....**Philip Garnick** has been elected president of Electro-Voice, Inc., a subsidiary of Gulton Indust., Inc. Garnick also continues his responsibilities as a corporate group vice president....**Richard O. Williams** has been appointed Senior Applications Engineer in Television Microtime's Marketing Department....**Francis**

Angelo Fraticelli

Philip Garnick

Richard Williams

M. Dowd and **Rulon G. Shelley** have been elected vice presidents of Raytheon Company....Raytheon Data Systems has named **Joseph L. Hitt** as vice president-marketing.

bookreview

Acoustic Techniques for Home & Studio, covers a neglected subject—for hi-fi buffs, audio technicians, and professional broadcast and recording studios. After a brief and simplified review of the basics (how sound is produced, how the ear hears, descriptions of dB, phon, sabin, etc.), author F. Alton Everest plunges right into his specialty—the design of speech and music broadcast or recording studios.

Throughout, emphasis is placed on the fidelity of final reproduction and the design of the listener's room. There's nothing mysterious about environmental acoustic design. Those who handle simple algebra and read a graph will be at ease with this book's "design" treatment for assuring maximum intelligibility and faithful reproduction of recorded material.

The text places long-neglected emphasis on the acoustic treatment of listening rooms and studios. Tables are included, along with examples of specific "acoustic" materials (tile, wood, plaster, aluminum, etc.) used in ways and placements to achieve specific room modes, colorations, reverberation, livening brilliance or required deadening.

The author tells what test equipment to use in objectively determining the performance capabilities of audio systems. With proper application of the stated techniques and tests, anyone can determine what his room acoustics are and what they could be with specific modifications—at minimum prices. This easy-to-understand book is truly a "do-it-yourself" acoustic design handbook.

This book is available through Tab Books, Blue Ridge Summit, Pa.

For More Details Circle (55) on Reply Card

Don't Look At The Camera!, by Sam Ewing and R. W. Abolin, will prove invaluable for photographers, producers and directors.

The authors have produced literally thousands of TV commercials, plus numerous documentaries and news photo work. The easy-to-read, fully illustrated text explains the basic techniques of TV photography, including dozens of tried-and-proven shortcuts for getting pictures on the air quickly and economically. Emphasis is placed on low-cost production. Featured throughout are scores of case histories relating the experiences—both good and otherwise—of this two-man production team.

This book is available through Tab Books, Blue Ridge Summit, Pa.

For More Details Circle (56) on Reply Card

Since the first television tape recorder was introduced in 1956, there has been phenomenal growth in the use of video magnetic tape by telecasters and independent production centers. It is difficult for the "old-timer" to realize that many of his fellow workers do not remember the days before tape, when practically two-thirds of the nation watched TV programs at odd hours or from "hot kines" that had little resemblance to modern recordings. Video tape, from the very start, provided superior picture quality, giving a presence that cannot be matched by film. In addition, this medium provided the telecaster, for the first time, with a capability for local spot-commercial and program production well within the means of a modest budget.

In spite of (or because of) the rapid growth, students and practicing engineers have been faced with a scarcity of information relative to basic recording systems. The primary purpose of **Television Broadcasting—Tape and Disc Recording Systems**, by Harold E. Ennes, is to provide fundamental knowledge for the practicing engineer who feels the need for a better understanding of his equipment; this information may also serve as an introduction to the subject for the beginner.

Specific circuitry will undoubtedly change in the future as it has in the past. Therefore, this coverage is general in nature, pointing up the primary functions of video-tape equipment. The scope of coverage is from basic theory to testing and maintenance of complete systems.

This book is available through Howard W. Sams & Co., Indianapolis, Ind.

For More Details Circle (57) on Reply Card

Station to Station

Rapid Cue For Projectors

The addition of "cue" switches to film projectors can facilitate cueing films to the proper pre-roll point. The switch is a momentary contact type controlling only the projector drive motor. This allows the projector to be run forward without taking the control switch out of "remote" or using the two hand start-stop operation. This also effectively eliminates operators forgetting to return the projector to "remote" operation.

The switch is a normally open momentary contact switch wired in parallel with the relay contacts that control the drive motor(s). The switch should be a heavy duty type to withstand the constant use and current of the drive motors.

On the Eastman model 275 projector the switch should be wired between terminals 4 and 9. On the model 285 wire the switch between terminals 8 and 9.

Check your projector wiring diagram for model changes. On other projectors carefully study the schematic for proper location of the cue switch.

Terry Hoff
Assistant Chief Engineer
WPTA-TV
Ft. Wayne, Ind.

Concertone Schematic Needed

We are currently using a Concertone series 90 professional recorder/reproducer, model #91 serial #A901332-D-40 Watts, 60 cycles,

We are planning to rebuild this machine and need a blow-up or schematic of parts, and parts numbers. To date we have been unable to locate a Concertone dealer or to locate parts or information.

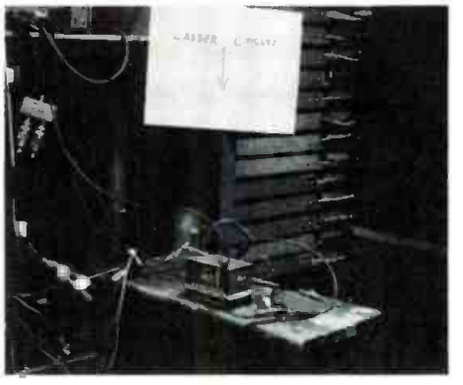
I have checked the 1973 Buyers Guide of BROADCAST ENGINEERING, and did not find any information to locate the company. If you have any knowledge, or information concerning who is now producing this machine, or where parts are now available, I would appreciate your prompt reply. Any assistance you can provide will be greatly appreciated.

Keith Greer, CE
KIHN Radio
Box 430,
Hugo, Okla. 74743

Onward And Upward

The new technology has sprung some new terms and symbols on us. Sometimes it seems almost impossible to keep up with it all. There is no denying that the director of engineering, the CE, and the techs must keep their track shoes on if they're to keep pace with the acceleration of progress.

And just about the time I thought things were levelling off a bit, I heard from E. Dietz in Buffalo, N.Y. Mr. Dietz allowed as how there was an easy way to show the "ladder circuit". And he was kind



enough to supply a shot of same for our enlightenment! (Looks like a delapidator circuit to me.)

Meanwhile, from the manufacturer's side of the news, there is every indication that there will be a host of truly innovative new products on display at the 1974 NAB convention in March.

NEW PRODUCTS

High Speed TV Zoom Lenses

Lenzar Optics Corporation now has available two new CCTV motorized zoom lenses. These are basically lenses designed for use in educational, cable and industrial systems.

The models include their 10 x f1.8 and 6 x 1.8 lenses, and they are available in manual as well as motorized versions (both made in the U.S.)

A full line of accessories, including rod and cable controls also are offered along with attenuation filters and inffrared coating. Lenzar also has a radiation resistant 5 x f2.7 special applications lens.

The company offers wide angle coverage, 1200 TV line resolution, and they guarantee conformance to all applicable ASA standards.

For More Details Circle (60) on Reply Card

Master Control Switcher

American Data Corporation, an Airpax Company, has announced the release of a new Master Control Switcher which is companion to the 556 production system.

The 570.11 is a two bus switcher which features Audio-follow-Video on both busses and four-Auxiliary inputs. The audio mode may be selected between A-F-V, AUX or AUX into AFV mix. Ten Watt monitor amplifiers are utilized to drive 8 Ohm speakers and have remote panel gain controls. The program line amplifier has a maximum output level of +24 dBm into 600 Ohms. Two large VU meters are incorporated into the control panel.

Various methods of machine control may be included as options. A digital "one event" Preset-take/Cutbar-preroll system is one method, another is the use of dedicated start-stop switches for each machine.

For More Details Circle (61) on Reply Card

Color Genlock Sync Generator

Video Aids Corporation of Colorado has introduced their new NTSC color genlock sync generator model 5000 with a deceptively simple front panel and a sophisticated internal approach.

The 5000 offers H, B, V, dual sync burst flag and subcarrier, a phase lock indicator, external sync presence indicator, loop through BNC video input, low cost, and the fact that the unit meets all requirements and specifications NTSC/RS 170.

All output widths are digitally controlled to eliminate drift from temperature and aging. Also there is an economy in parts reduction by using MOS/LSI technology.

The 5000's genlock provision allows synchronization of the entire video system to an external video source. This loop-through video input accepts a composite video signal.

For More Details Circle (62) on Reply Card

Patching System

Cooke Engineering Company has introduced a unique EIA RS-232 interfacing and patching system. Called DYNA-PATCH, this new patching system transfers an entire EIA duplex data circuit (together with clock and control signals) by means of a single patchcord. DYNA-PATCH permits 100% flexibility in rearranging interconnections between modems, multiplexers, terminals, and computers.

DYNA-PATCH jacks provide normal through circuits without the use of any patchcords. Alternate circuit connections are made by inserting a single 12 conductor shielded patchcord. Circuits may be monitored or tested without interruption by patching to a monitor jack where signals appear at individual test points and a standard 25 pin EIA connector. Installation is accomplished by plugging line and equipment cables into EIA connectors on the rear of the chassis.

For More Details Circle (63) on Reply Card

DC Coupled Log Amp

A DC to 5 MHz logarithmic amplifier recently announced by **American Astrionics Division of Technicolor Inc.,** is now available. The amplifier was designed to provide a wide band logging device with a good low frequency response and a capability to process pulsed data at duty factors exceeding 25 percent.

This duty factor performance may be compared to the typical AC coupled log amplifier that requires duty factors around 1.0 percent to

NEW PRODUCTS

maintain specified accuracy. Since the direct coupled LVA has no interstage capacitors, pulse trailing edge fall times are considerably faster than those of AC coupled amplifiers. Each DC amplifier is tested to insure that a small pulse whose leading edge occurs 2 to 3 microseconds after the trailing edge of a large pulse can be accurately detected, and that its amplitude will always be within the specified log linearity of plus or minus 0.75 dB.

The new DC amplifiers can accomodate an input dynamic range as great as 80 dB, with input voltages as low as 70 microvolts, and as high as 2.0 Volts. The output voltage range is 0 to 3.0 or 0 to 4.0 Volts. The direct coupled stages within the amplifier are precisely temperature compensated so that over the specified 0° C to 50° C operating temperature range, the amplifier temperature characteristic will never exceed 0.07 dB/°C.

For More Details Circle (64) on Reply Card

Broadcast And Production Consoles

The **Maze Corporation** has introduced its new "M" line of broadcast and production consoles.

The new line consists of three models that are available in either stereo or mono. They include the mini/4 four channel, Midi/6 six channel, and Maxi/10 ten channel models.

All models use state-of-the-art solid state circuitry and use dual VU meters. Prices begin under $800.

For More Details Circle (65) on Reply Card

Sound Level Meter

A rugged new, hand-size, easy-to-read-and-operate Sound Level Meter (SLM), designed to economically determine sound pressure levels and to help pinpoint "noise pollution" sources in industrial and other environments, has been introduced by the **Triplett Corporation**, Bluffton, Ohio.

The low-cost, portable, Type 3 SLM, designated Triplett Model 370, is a true general purpose survey sound pressure level meter that meets or exceeds ANSI specifications S1.4-1971 for Type 3 sound level meters. It will satisfy all the requirements of the Walsh-Healey Public Contracts Act, and the Occupational Safety and Health Act of 1970 (OSHA). The Model 370 is a completely self-contained sound level meter that is ideal for rapid surveys and checks on noisy environments in all industrial, commercial and manufacturing processes and facilities.

For More Details Circle (66) on Reply Card

Broadcast Monitors

Belar Electronics Laboratory, Inc. is making available new information on it's prime line of broadcast monitors.

Featured are the TVM-1 Television Aural Modulation Monitor which provides modulation monitoring for UHF or VHF television broadcasting; the Belar Frequency Monitors designed expressly for measuring TV visual and aural carrier, or aural intercarrier deviations; and the RFA-3 TV RF Amplifier for off-air monitoring of both aural and visual TV transmitter in the VHF and UHF band.

For More Details Circle (67) on Reply Card

Modular TV Titling System

Video Data Systems, Inc., manufacturers of Data Display Systems has announced the development and availability of a low cost modularized color character generating system for broadcast and CCTV studio titling applications.

The VDS T1000 TV Studio Titling System provides two channel outputs (program and preview) and two character sizes which are switch selectable for 18 or 36 scan lines.

The VDS system also eliminates obsolescence by providing optional plug-in modules to add future capability to the titling system. These include provisions for RS170 sync generation, two-speed vertical roll, audio tape storage, color background and characters and up to 10 pages of memory.

The standard Model T1000 Studio Titling System features a standard electric typewriter keyboard, full editing capability, two-page memory, high resolution 7x9 element character matrix with a 10x14 element matrix optionally available. Other features include one or two line selectable title window, character blink and two-speed horizontal crawl.

For More Details Circle (68) on Reply Card

Multimeter

A new 3-1/2 digit, 2000 count bench multimeter that measures AC and DC Volts, Ohms **and capacitance** has been introduced by **Data Technology Corporation.**

Called the Model 20, this new precision capacitance meter has a resolution of 1pf and an accuracy of 0.2

NEW PRODUCTS

percent of reading.

In addition to capacitance, the Model 20 has four DC voltage ranges with 1mV resolution and 0.1 percent accuracy; four AC voltage ranges with 1mV resolution and 0.5 percent and four resistance ranges with 1 Ohm resolution and 0.2 percent accuracy. Other specifications include power consumption: 3.5 Watts; display:1/3" Sperry's; size:2.5" x 6.25" x 9"; weight: 2.5 pounds.

The Model 20 is housed in high impact resistant polycarbonate plastic with aluminum top and bottom covers. It uses a single PC board with all components laid down. No flying components dangle by their leads and there are no stand-up resistors or large capacitors.

The panel opens easily with a pop-release button; a spare fuse and circuit card connector for testing are housed behind a rear entry panel.

For More Details Circle (69) on Reply Card

Rebuilt Quad Video Heads

An unprecedented 500-hour warranty on rebuilt quad video heads is now being offered by **Videomax Corporation.** Until this time all industry warranties have been in the 125 to 200 hour range. The new "L" series, for "long life", quad heads are priced at $950.00 for all Mark III and Mark X configurations.

Videomax, the only company specializing in refurbishing VTR quad heads, has also announced an extended warranty on its current product, now designated as the "M" series, for "mastering", from 150 to 200 hours at $800.00. This series is engineered for the most demanding, highly critical applications.

According to Allan J. Behr, Videomax President, "This is the first time end users have had an opportunity to choose a quad head to match their specific requirements."

Quad video heads are completely rebuilt by Videomax and are certified to meet or exceed the industry's highest standards, insuring total compatability. Delivery is quoted at ten working days or less.

For More Details Circle (70) on Reply Card

Broadcast Color TV Camera

Commercial Electronics Incorpo-

rated came on strong at the NAEB with live demonstrations of their CEI-280 color camera. The CEI camera is an NTSC broadcast color camera designed for demanding productions.

While its moderate cost is a definite feature, the 280 is not a compromise. It's a three Plumbicon™ and dichroic optical beam splitting system provides high sensitivity and color rendition.

Another main feature of the 280 is remote control. Set-up and operating ajustments are simplified and completely remote controlled. All operating engineering controls are located at the remote set-up panel. CEI claims 50 dB signal-to-noise ratio FET preamps that should give quiet pictures at any lighting level.

A peak video level indicator on the picture monitor is provided to permit the operator to control iris without a waveform monitor. System includes provision to monitor external video with the camera viewfinder, a plus in special effects production.

For More Details Circle (71) on Reply Card

Broadcast Consoles

No doubt about it, the hottest item going these days is the audio console. The reasons are many, but probably the most obvious is the upgrading of the state-of-the-art in control technology.

At the NAEB convention in New Orleans, **Fairchild/Robins** unveiled a new F30000 series of broadcast consoles. Available off-the-shelf, these consoles offer custom features along with the traditional requirements for AM, FM, and TV.

IC op-amp circuitry on plug-in modular PC boards makes it easy to interchange modules, simplifying maintenance. All input channels are identically wired and will accept any one of the input modules available.

Main features include: stepless linear motion faders with cue switches; multiple input preselection; two-way remote line channels; dual independent outputs; and a broad selection of optional plug-in modules.

Specs include: S/N 65 dB or better, below 0 dBm output (with -60 dBm input); THD .5 percent at +18 dBm output; equivalent input noise -125 dB or better; and gain at 90 dB (100 dB available).

For More Details Circle (72) on Reply Card

Custom Recording Consoles

Cetec, Inc., has announced the introduction of the Electrodyne Series 2000 custom recording console, the

NEW PRODUCTS

first of a new line of audio control consoles.

Features of the Series 2000 include Electrodyne's exclusive 712L 9-frequency graphic equalizer input module and the compact SML-20 channel assign switch module which incorporates up to 24 assignment positions, 4 echo send selections, program and echo quadraphonic pan pots and solo selector.

This board is equipped with 8, 16 and 24 output buses, separate quad bus and 3 mono buses for headphone distribution. The completely independent quad monitor mixdown has the quad encode/decode and mono/stereo compatability test functions required by the modern day studio.

Other standard features are a patchbay wing, 5 frequency test oscillator, talkback and slate controls, tape recorder remote controls and many others.

For More Details Circle (73) on Reply Card

Frequency Counter

A new 512 MHz Frequency Counter, Model 6252, designed for monitoring and measuring frequency carriers in the mobile communications bands, has been introduced by **Systron-Donner.**

This field portable counter, designed to FCC requirements, offers the following features: 1) a level meter coupled to the input for indication of signal level, 2) an overload relay circuit to prevent damage to the input when overloads occur, 3) a frequency multiplier with a phase-locked local oscillator for making highly accurate direct reading measurements of tone and LF inputs, and 4) a choice of 5 optional oscillators offering stability from ± 3 parts in 10^7/month to ±5 parts in 10^{10}/day.

For More Details Circle (74) on Reply Card

advertisers' index

For Latest News See Direct Current page 4

PROFESSIONAL SERVICES

VIR JAMES
CONSULTING RADIO ENGINEERS
Applications and Field Engineering
345 Colorado Blvd.
Phone: (Area Code 303) 333-5562
DENVER, COLORADO 80206
Member AFCCE

CAMBRIDGE CRYSTALS
PRECISION FREQUENCY
MEASURING SERVICE
SPECIALISTS FOR AM-FM-TV
445 Concord Ave. Phone 876-2810
Cambridge, Mass. 02138

RALPH E. EVANS ASSOCIATES
Consulting Radio Engineers
AM - FM - TV - CATV - ITFS
3500 North Sherman Blvd.
MILWAUKEE, WISCONSIN 53216
Phone: 414-442-4210

SESCO, Inc.

47 NICHOLS AVENUE
P. O. BOX 518

(206) 378-2137

FRIDAY HARBOR,
WASHINGTON, 98250

CLASSIFIED

Advertising rates in Classified Section are 15¢ per word, each insertion, and must be accompanied by cash to insure publication.

Each initial or abbreviation counts a full word. Upper case words, 30¢ each.

Minimum classified charge, $2.00.

For ads on which replies are sent to us for forwarding, there is an additional charge of $2.00 to cover department number, etc., which is printed in advertising copy, and processing of replies.

Classified columns are not open to advertising of any products regularly produced by manufacturers unless used and no longer owned by the manufacturer or a distributor.

WANTED

WANTED: All surplus broadcast equipment especially clean A.M. & F.M. transmitters, contractors, capacitors. Surpluss Equipment Sales, 2 Thorncliffe Pk. Dr. Unit 28 Toronto 17, Ont; Canada. 1-73-tf

TUBES WANTED—All types-CeCo 2115 Avenue X, Brooklyn, N.Y. 11235, 212-646-6300-Anytime. 7-73-12X

"**WANTED** type approved microwave system to pass color. Respond to Box 4371, Inglewood, Cal. 90309. 12-73-2t

WANTED (Cont.)

WANT A TAX DEDUCTION? College TV needs color electronics for Ampex VR1000C. Write Ken Kendall, KTSC/Channel 8, Pueblo, Colorado 81001. 1-74-1t

WANTED TO BUY: USED COLOR QUAD HI BAND VTR AND NORELCO 70 CAMERA. Call collect (212) 586-3693, or write Mr. A. Neil, 424 West 49th St., NYC 10019. 1-74-3t

WE NEED YOUR HELP! Pepperdine University students are building an F.M. station from scratch. Financial help and studio equipment needed. Any aid appreciated. Box 697, 24255 Pacific Coast Highway, Malibu, Calif., 90265. 1-74-2t

EQUIPMENT FOR SALE

MOTORS FOR SPOTMASTERS
NEW Paps hysteresis synchronous motor HSZ 20,50-4-4701) as used in series 400 and 500 machines. Price $39.00 each prepaid, while they last. 90 day warranty. Terms check with order only, no COD's. Not recommended for Tapecaster series 600 or 700.
TAPECASTER TCM, INC., Box 662,
Rockville, Maryland 20851
1-72-TF

ONE STOP for all your professional audio requirements. Bottom line oriented. F. T. C. Brewer Company, P.O. Box 8057, Pensacola, Florida 32505. 7-71-tf

QUALITY AUDIO CONSOLES are our specialty. Modern styling with slide potentiometers and "soft" audio switching. We manufacture 8 standard consoles at very competitive prices. However, we'll manufacture a custom system to your specifications if you prefer. Also plug-in audio modules including distribution amplifiers, preamplifiers, monitor amplifiers, etc. Write or phone for pricing and specifications. **SYSTEMS ENGINEERING COMPANY**, P.O. Box 49224, Atlanta, Ga. 30329. 404-482-2446. 2-73-12t

HELIAX-STYROFLEX. Large stock—bargain prices—tested and certified. Write for price and stock lists. Sierra Western Electric, Box 23872, Oakland, Calif. 94623. Telephone (415) 832-3527. 1-73-tf

SURPLUS MICA AND VACUUM TRANSMITTING CAPACITORS. Large stock; immediate delivery. Price lists on request. SURCOM ASSOCIATES, 1147 Venice Blvd., Los Angeles, Ca. 90015 (213) 382-6985. 5-73-12t

NATIONAL TAPE CARTRIDGE SERVICE SPECIAL Pressure Sensitive Labels. Fits All Cartridges. Comes in 5 Colors. Write for FREE Sample. MASTERTONE COMPANY, 1105 Maple West Des Moines, Iowa 50265 515-274-2551 8-73-tf

NATIONAL TAPE CARTRIDGE SERVICE CARTRIDGES RECONDITIONED - NEW TAPE 12 Years Experienced Personnel. Write for new and reconditioned price sheet. Mastertone Co., 1105 Maple, Dept. B-E 1, West Des Moines, Iowa 515-274-2551 8-73-tf

"**PARTS** — for SPOTMASTER cartridge units. IN STOCK — IMMEDIATE DELIVERY, overnight to PA, NY, & NJ. COMMUNICATION MEDIAS, Box 54, Allentown, PA 18105 (215)-437-0607 or 437-9447. 10-73-12t

CARTRIDGE TAPE EQUIPMENT—Rebuilt. New paint, heads, flywheel, pressure roller, belts, etc. Spotlessly clean and thoroughly tested, 30 day money-back guarantee, 90 day warranty. Also contact us for discounts on new equipment and accessories. AUTODYNE, Box 1004, Rockville, Maryland 20850. (301/762-7626). 7-72-tf

EQUIPMENT FOR SALE CONT

BUILD YOUR OWN TV AND RADIO PRODUCTION EQUIPMENT. Easy, inexpensive, (mostly IC). Plans or kits: Special Effects Generator, Automatic Logger, Vertical Interval Video Switcher, Solid State Lighting Board, Preset Audio-Video Board, Preset Lighting Board, Crystal Controlled Wireless Mikes with matching receivers, Subsonic Tone Control for audio tapes, 8MM SOF Cameras and Projectors, Distribution Amplifiers (Sync, Video, Audio), Audio Control Boards (Studio & Remote) Proc-Amp with compensation and regeneration for adapting Helical Scan VTR's to broadcast standards, PLUS specialized correspondence courses in Telephone Engineering ($39.50), and Integrated Circuit Engineering ($49.50). Plans from $5.95 to $15. SUPER CATALOG plus years updateing of new devices Air Mailed $1.00. Don Britton Enterprises, PO Drawer G, Waikiki, Ha. 96815. 4-73-12t

"**TWO RCA TK-42** color camera chains complete with auxiliary electronics and controls. $10,000.00 each. E. Newton Wray, General Manager, KTBS-TV, Shreveport, La. 71104. Telephone 318-868-3644." 11-73-3t

FOR SALE: 1. GE 4TT24A1-3 UHF DRIVER at Ch 22 removed from service 10/14/73. 2. 3-COHU 3200 cameras with 10 x 1 lense and remote CCU. 3. 2-SONY 5000 color camera chains with 6 x 1 lense and sync. gen. 4. 1 RCA TK 21C film camera. Reply to D. Zulli, KWHY-TV, 213-466-5441, Los Angeles, 90028. 12-73-2t

COLLINS 212F console in perfect cond. viewfinder cameras, tripods & Dollies, switcher, 9 in. twin monitores, lenses, R.F. Generator, mikes, booms, Etc., Write Box 294, Broadcast Engineering, 1014 Wyandotte St., Kansas City, Mo. 64105. 12-73-2t

EQUIPMENT FOR SALE, TWO AMPEX AUDIO MIXERS, AM-10 6 input 2 Ch. output audio mixers, with, 2 Ch., v.u. meter panels. Less than one year old. Used 5 times (one day each). Current net mixer/v.u. panel $666.00, slightly used $400.00. Write to Life Style Productions, Inc., P.O. Box 1377, Lansing, Michigan 48904 or call 517-482-1152. 1-74-1t

TELEMATION WEATHERSCAN Model TMW-97, fully equipped, less than 2 years old, extra camera. Contact John Dennis, General Manager Sunflower Cablevision, 7th & New Hampshire, Lawrence, Kansas 66044, (913) 841-2100. 1-74-2t

IMMEDIATE DELIVERY Revox 1302, Scully 270-2, Sennheiser HD414, Carousel 250-Rs, Carousel Selector, VIF International, Box 1555, Mtn. View, Ca. 94040. (408) 739-9740. 1-74-1t

VIDEO TAPE SCOTCH 379 & 400. Some new. Four hours with shipping cases. $200.00 takes all. Kenneth Whitman, 8346 Brimfield Ave., Van Nuys, Ca. (213) 780-1624. 1-74-1t

3-KW FM STATION in southeast Nebraska. New C.P. owner will build and lease with option to buy. Qualified management/owner required. Write 1711 So. 22nd St., Lincoln, NE 68502. 1-74-1t

MOTOROLA MICROWAVE Freq. 7.1-8.4 GHz. Broadband for color TV Xmission. Xmitter freq. deviation ±3 MHz at 60 Hz-5 MHz. Rcvr video response ±0.5db from 50 Hz to 5 MHz. Xmtr Bay $750 ea., Rcvr Bay $750 ea. Radio Research Instrument Co., Inc. 3 Quincy St., Norwalk, Conn. 06850. Tel. 203-853-2600. 1-74-tf

TEKTRONIX 543/A MODS, with Type H plug-in $400; Tek type N plug-in $50; Gertsch FM-3 freq. meter $225; HP-400DR $65; HP-540B $100; HP-560A $150. All equipment in very good condition; F.O.B., S. Mieth, P.O. Box 14508, UCSB, Santa Barbara, California 93107. 1-74-1t

EQUIPMENT FOR SALE CONT.

ANTENNA, used GE BY1C two section hoops. Gain 1.9, tuned 91.1 MHz. Good condition, best offer. WTSC FM, Potsdam, N.Y. 13676. 1-74-1t

RCA M1-40790-AZ AIRBEARING HEADWHEEL assembly $600. **IVC VIDEO HEADS** for 800, 900 machines $75.00. RCA style **VIDEO JACKS** new $2.50 each. You supply panels & save. Send that P.O. today. Norman Gillaspie, Box 2124, Monterey, Calif. 93940. 1-408-375-7424. 1-74-3t

SERVICES

BROADCAST CRYSTALS: Frequency change, repair or replacement of oven types; also new vacuum types. A wise engineer keeps a dependable spare crystal handy; if you don't have one contact us. Repair and recalibration service for AM and FM frequency monitors. 30 years in business! Eidson Electronic Co., Box 96, Temple, Texas 76501. Pho. 817-773-3901. 1-74-tf

HELP WANTED

TEACHING-BROADCAST ELECTRONICS TECHNOLOGY We need a technically strong person to teach and develop a new program leading to the Bachelor of Science Degree in broadcast Electronics Technology. The person we are looking for will have experience as a Chief Engineer and possibly additional experience in CCTV, CATV, or microwave communications. His academic credentials will include preferably an M.S. degree in Electronics Technology. Qualified applicants should contact M. R. Halsey, Head, Electrical and Electronics Department, Ferris State College, Big Rapids, Michigan, 49207. Phone (616) 796-9971, Ext. 208. An Equal Opportunity Employer. 12-73-2t

MOVE UP from your present job in broadcast engineering. We handle all engineering jobs and openings coast to coast. Send full resume confidentially now. The AMPS Agency, 11661 San Vicente Blvd., Los Angeles, Calif. 90049 8-73-tf

CHIEF ENGINEER WANTED: Superb opportunity for chief engineer in midwest and midsouth. Two-station chain needs first capable of handling directional AM, maintenance, repairs, and annual proofs. Good fringe benefits. Salary open. Write: Box 295, Broadcast Engineering, 1014 Wyandotte St., Kansas City, Mo. 64105. 12-73-2t

CHIEF ENGINEER for 5kw-D, Da. WGSM - automated 3kw WCTO Stereo. Long Island, New York. Experienced, hard working, deeply committed technical and administrative pro needed. Chiefs at smaller operation ready to move up or Number Two person at large stations ideal. All details, resume, salary requirements - first letter. Contact Richard J. Scholem, General Manager, Box 740, Long Island, New York 11746. 1-74-1t

HELP WANTED (CONT.)

TV ENGINEER (2 positions) immediately available at upper midwest University. Install, maintain and operate broadcast and closed-circuit equipment. Award winning, full-color operation. FCC 1st class license or E.E. degree. Salary dependent on qualifications and experience. Equal Opportunity Employer. Write to: Broadcast Engineering, Box 296, Kansas City, Mo. 64105. 1-74-1t

DYNAMIC EDUCATIONAL communications center of constituent college of State University of New York seeks television technician to operate and maintain production and distribution equipment including: quadruplex and helical recorders, 10 studio cameras, 24-channel campus CATV, and several TV sub-systems; and to provide technical support of other media when necessary. Position requires FCC First Phone or equivalent in formal training, strong background in quality/broadcast video, some CATV, digital logic experience helpful. Three years operational experience or equivalent is expected. Moderate salary; excellent benefits; recreational opportunities in growing residential community. Contact Director of Educational Communications, State University College, New Paltz, N.Y. 12561. EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. 1-74-1t

CHIEF ENGINEER, FM stereo station; news, telephone talk, music, sideband. Resumes only to General Manager, WRVR, 85 Claremont Avenue, New York, N.Y. 10027. 1-74-1t

FRUSTRATED TEACHER? Manufacturer of SPOTMASTER® needs broadcaster to write maintenance manuals for tape cartridge machines and other audio equipment. Desire candidate with radio or television operation and maintenance experience, first ticket, some news or writing. Will work with design team to prepare customer and plant documentation. MUST have desire to explain the HOW TO. Permanent position, good salary, benefits. Send explanation of background and goals with resume to Bob Sweeny, BROADCAST ELECTRONICS, 8810 Brookville Rd., Silver Spring, Md. 20910. 1-74-1t

TRAINING

PASS FCC EXAMS with Arneco books. Each book contains FCC questions plus simplified answers plus FCC-type exams and answers. 3rd class 75c, 2nd class $2.25, 1st class $1.50. Free catalog. Arneco Publishing, 314G Hillside Ave., Williston Park, N.Y. 11596. 8-72-tf

FIRST PHONE through tape recorded lessons at home plus one week personal instruction in Washington, DC, Atlanta, Boston, Detroit, New Orleans, Minneapolis, Seattle, Denver, Portland, Los Angeles. Proven results. Our 17th year teaching FCC license courses. Bob Johnson Radio License Preparation, 1060D Duncan, Manhattan Beach, Calif. 80266. Phone 213-379-4461. 1-69-tf

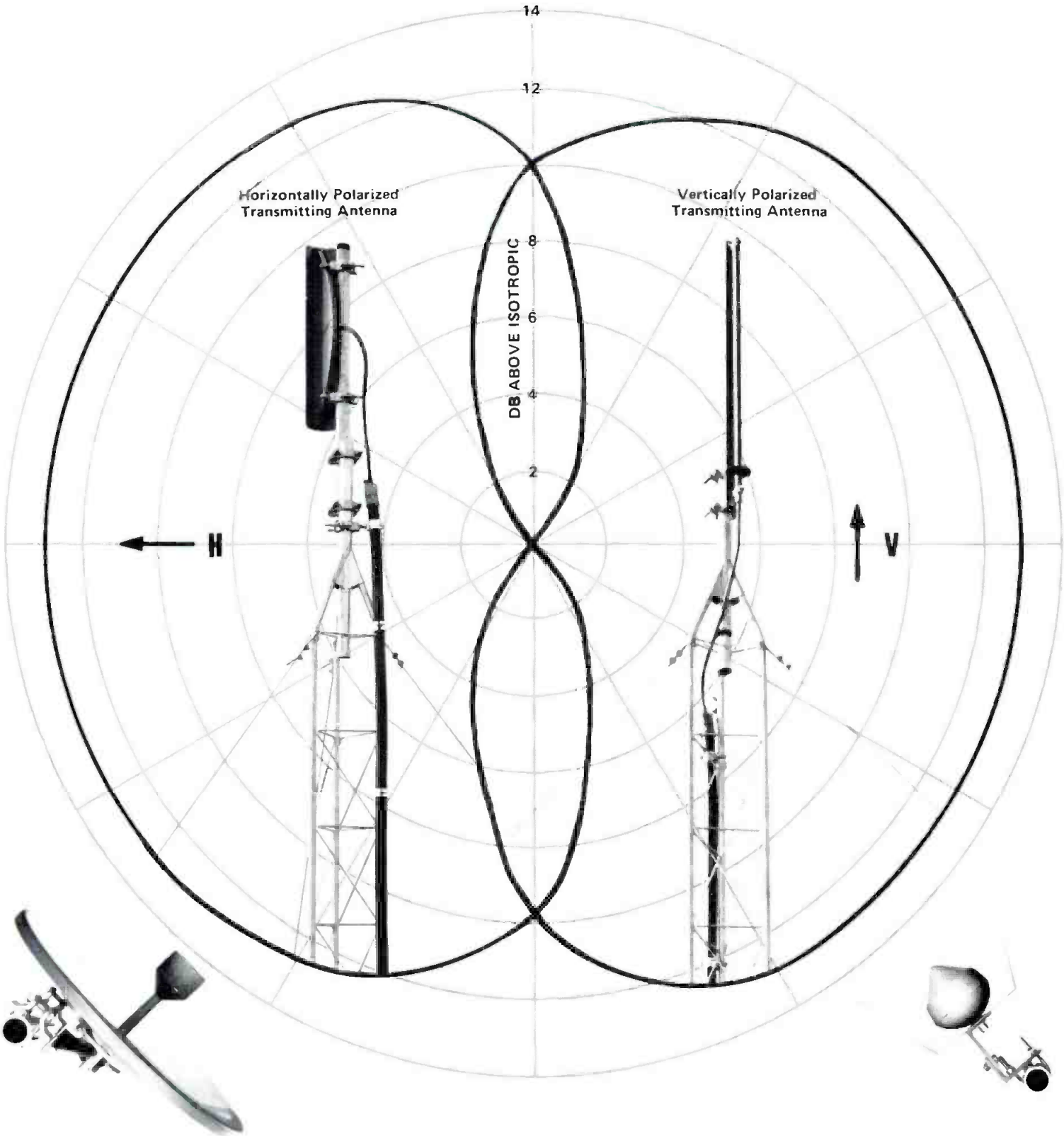
FCC RADIO TELEPHONE OPERATORS LICENSE in six weeks. Classes (day & evening) in Atlanta, Dallas, Denver, Ft. Worth, Hartford, Houston, Memphis, Nashville, New Orleans, Oklahoma City, and San Antonio. For information contact Elkins Institute, 2727 Inwood Road, Dallas, Texas 75235. 214-357-4001. 5-73-tf

PASS FCC first and second class exams with new 21 lesson, 450-page course. Starts with basic electricity. Over 600 FCC-type, multiple-choice questions and sample exams included. No previous technical knowledge required. Commercial Radio Operator Theory Course, #15-01. Only $5.95. Arneco Publishing, 314G Hillside Ave., Williston Park, N.Y. 11596. 8-72-tf

TRAINING CONT.

EARN YOUR ELECTRONICS DEGREE by correspondence. G. I. Bill approved. For free brochure, write Grantham School of Engineering Information Desk, 2000 Stoner Avenue, Los Angeles, Calif. 90025. 8-72-tf

CHIEF ENGINEER—Experienced Chief needed for AM 5Kw eight tower DA-111 and Class A automated FM. Located in midwest town of 15,000. Very good salary with excellent equipment and working conditions. Send resume, references, and salary requirements. Write to: Broadcast Engineering, Box 297, 1014 Wyandotte St., Kansas City, Mo. 64105. 1-74-2t



FIRST IN MDS ANTENNA SYSTEMS

Andrew is first to offer a complete and proven line of antenna system equipment for the new Multipoint Distribution Service (MDS). We introduced our line of MDS antennas at the first Common Carrier Association for Telecommunications Convention in July, 1972, and are now first to have equipment in service in an actual operating system.

First "on-the-air" MDS station, WOI93 in Washington, D.C., uses two orthogonally polarized Andrew antennas with cardioid patterns, as illustrated. This arrangement provides omni-directional coverage and eliminates blockage of a nearby building.

We are now in a position to ship complete MDS transmitting and receiving antenna systems from stock. For further information, ask your Andrew sales engineer or write for Bulletin 1052B.

ANDREW

ANDREW CORPORATION
10500 W. 153rd Street
Orland Park, Ill., U.S.A. 60462

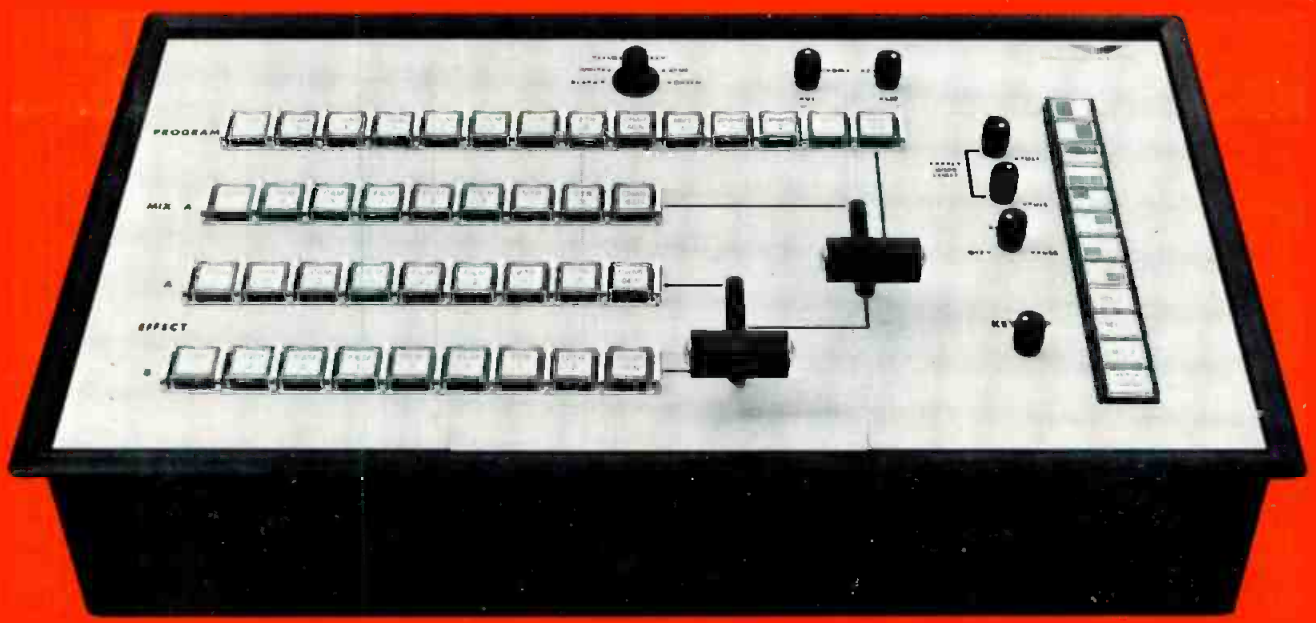
ANDREW ANTENNA COMPANY LTD.
606 Beech Street
Whitby, Ontario, Canada L1N 5S2

ANDREW ANTENNA SYSTEMS
Lochgelly, Fife
Great Britain KY5 9HG

ANDREW ANTENNAS
171 Henty Street
Reservoir, Victoria, Australia 3073

For More Details Circle (2) on Reply Card

VIX-1 The Professional One



VIX-1

New performance standards in video switching. The VIX-1 is designed to fulfill the need for high quality production switchers where a medium number of source inputs are required while providing versatile production capability.

SALIENT FEATURES:

- ☐ No adjustments required
- ☐ Independent 13-input program bus
- ☐ 9 sources on mix-effects buses with tally functions
- ☐ 8 effects patterns with variable border
- ☐ 4 independent key sources
- ☐ Preset effects pattern limits
- ☐ Effects entry into mix
- ☐ Built-in black burst and color background generator with no adjustments
- ☐ Less than 10-inch rack mount electronics
- ☐ D.C. control cables to panel available in 25-foot increments

Price $7,900.00

Options:

Chroma key VCK-1	$980.00
Audio-follow on program bus	$800.00
Video processor	$2,400.00

GOOD ENGINEERING IS VITAL

11 years of specialization. Designed, manufactured and delivered some of the world's largest and most complex integrated telecommunication systems.

VITAL INDUSTRIES, INC.

MAIN OFFICE: 3700 N.E. 53rd Ave., Gainesville, Fla. 32601 — Phone 904/378-1581

Fox Hill Rd., Lynchburg, Va. 24503 — Phone 804/384-7001 3620 Ridgewood Rd., N.W., Atlanta, Ga. 30327 — Phone 404/233-9459
7960 W. Beverly Blvd., Los Angeles, Calif. 90048 — Phone 213/653-9438 2644 N. Seventh St., Terre Haute, Ind. 47804 — Phone 812/466-3212

For More Details Circle (3) on Reply Card