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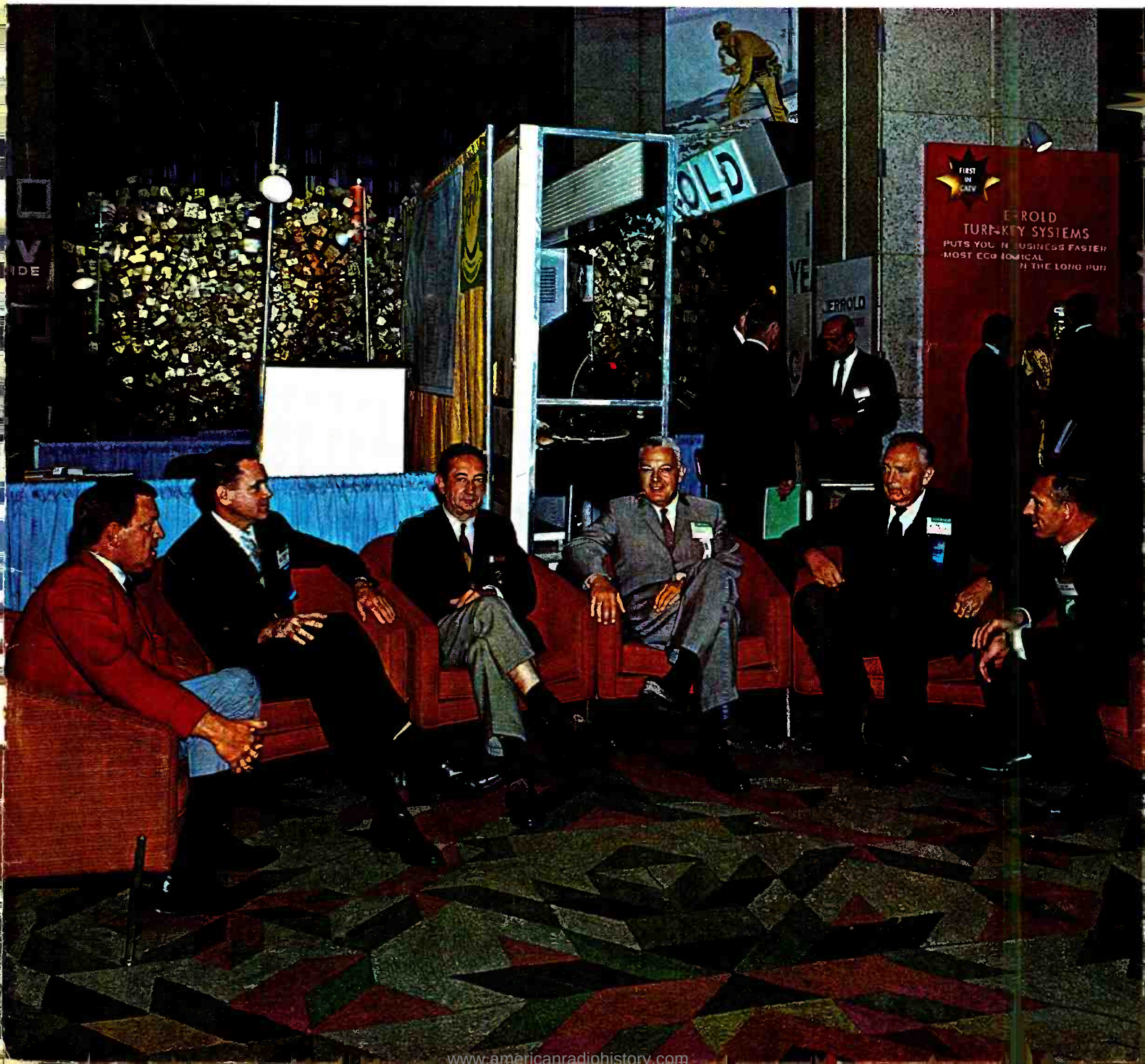
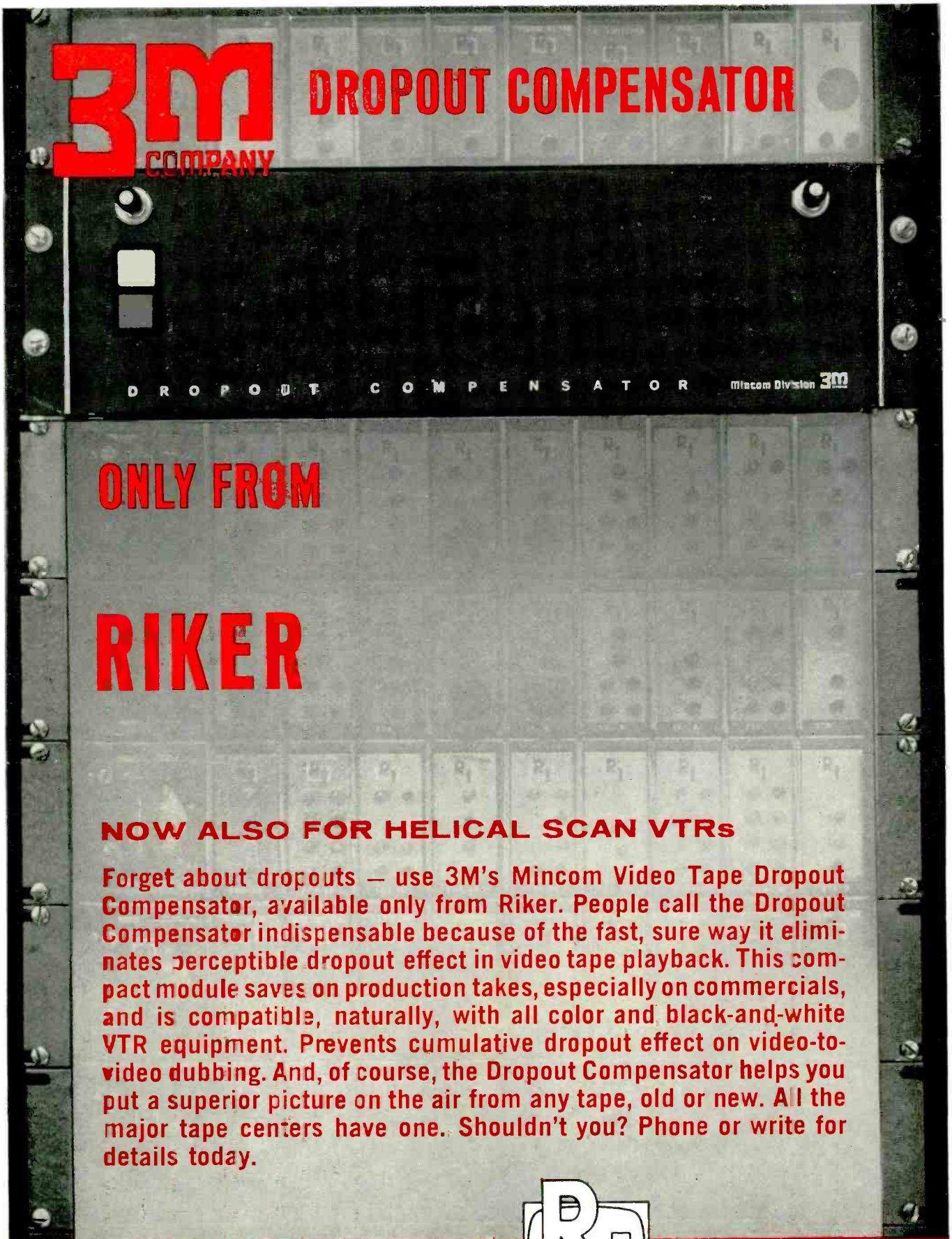
SEPTEMBER 1965/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry





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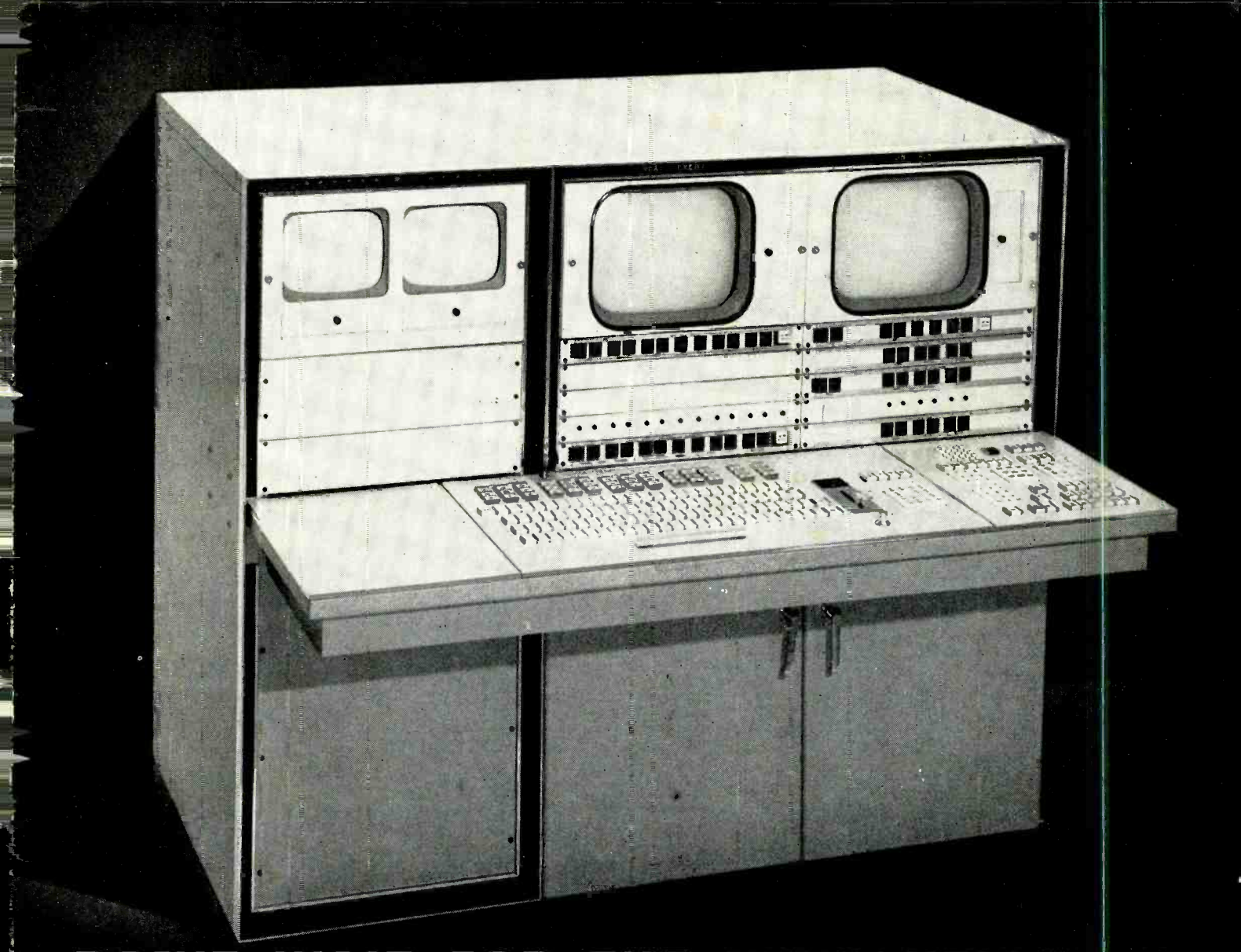

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BROADCAST ENGINEERING is published monthly by Technical Publications, Inc., an affiliate of Howard W. Sams & Co., Inc. Editorial, Circulation, and Advertising headquarters: 4300 West 62nd Street, Indianapolis 6, Indiana. SUBSCRIPTION PRICES: U.S.A. $6.00, one year; $10.00, two years; $13.00, three years. Outside the U.S.A., add $1.00 per year for postage. Single copies are 75 cents, back issues are $1.00.

the technical journal of the broadcast-communications industry

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Volume 7, No. 9 **September, 1965**

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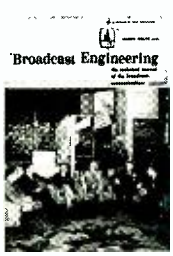

Shown discussing the 1965 NCTA convention at the Denver Hilton are (l. to r.) Bill Daniels, of Daniels & Associates; NCTA Chairman Ben Conroy; FCC Commissioner Robert E. Lee; NCTA President Frederick W. Ford; NCTA Past Chairman Bruce Merrill; and BE Editor Forest Belt.

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Telemike Exclusive: Built-in Monitor Facility*

Now, with *three* readily interchangeable sound tele-probes, similar in principle to changeable telephoto lenses, you can 'zoom' in from varying distances for the precise sound you're after. The 18-inch probe may be used for 'close-ups,' as far back as 75 feet from the sound source; the 34-inch probe from 150 feet. A 7-foot probe is optional for distances beyond 150 feet.

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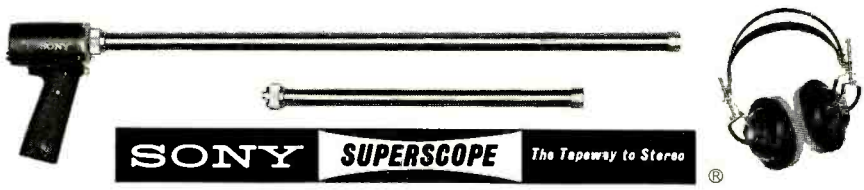

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LETTERS to the editor

DEAR EDITOR:

There is a typographical error in my article "What to Do in Tower Emergencies" in the April 1965 issue of BROADCAST ENGINEERING. In the expression for X_1 in Fig. 4 on page 80, the last term should be Zs^2 instead of Zs. The correct expression should read:

$$X_1 = +\sqrt{\frac{Z_S}{R_A}(R_A^2+X_A^2)-Z_S^2}$$

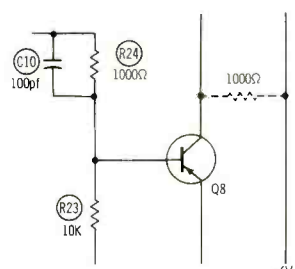
GEORGE M. SKLOM
Associate, Walter F. Kean
Consulting Radio Engineers
Riverside, Illinois

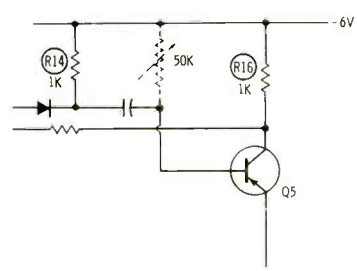
DEAR EDITOR:

In June 1964 you published an article describing a solid-state chopper for monitoring video modulation ("Solid-State Chopper for Modulation Checks," June 1964 BE, page 26). With the addition of a 1000-ohm, ½w carbon resistor connected between the collector of Q8 and —6 volts as a load, this unit becomes an excellent VIT keyer for a video-test signal generator requiring 4 to 5 volts to key. The generator output is bridged across the program line or used to source terminate, depending on the system in use at your station. R-15 in the chopper unit is made variable (a 50,000-ohm pot is suitable) to facilitate proper timing of the VIT signal.

ROBERT E. L'ROY
Transmitter Supervisor, KLRN-TV
New Braunfels, Texas

We've been gratified by the reader acceptance of the solid-state chopper. Our thanks to Bob for suggesting this additional use for the unit. The partial schematics below show where the modifications are made.—Ed.





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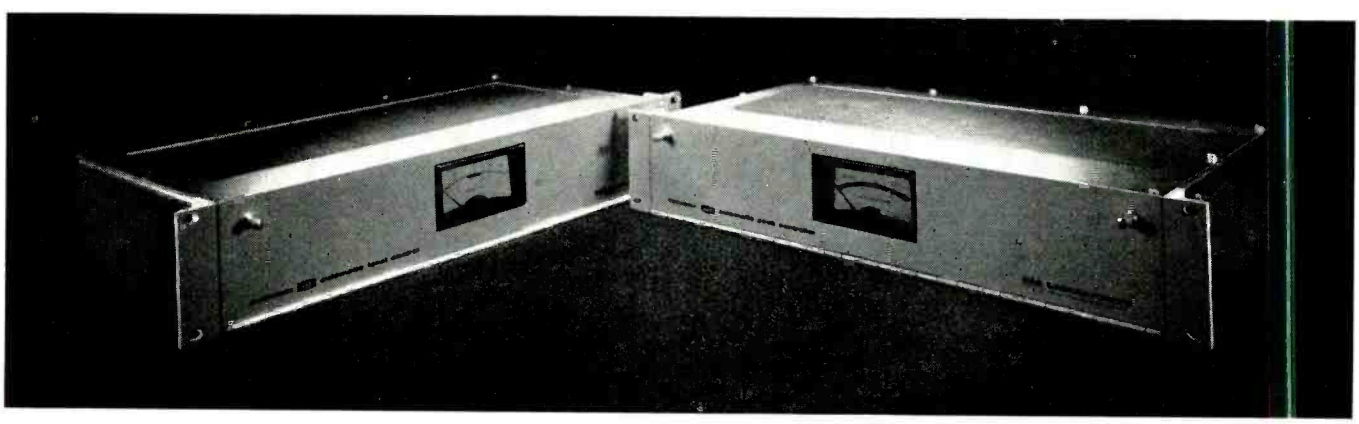

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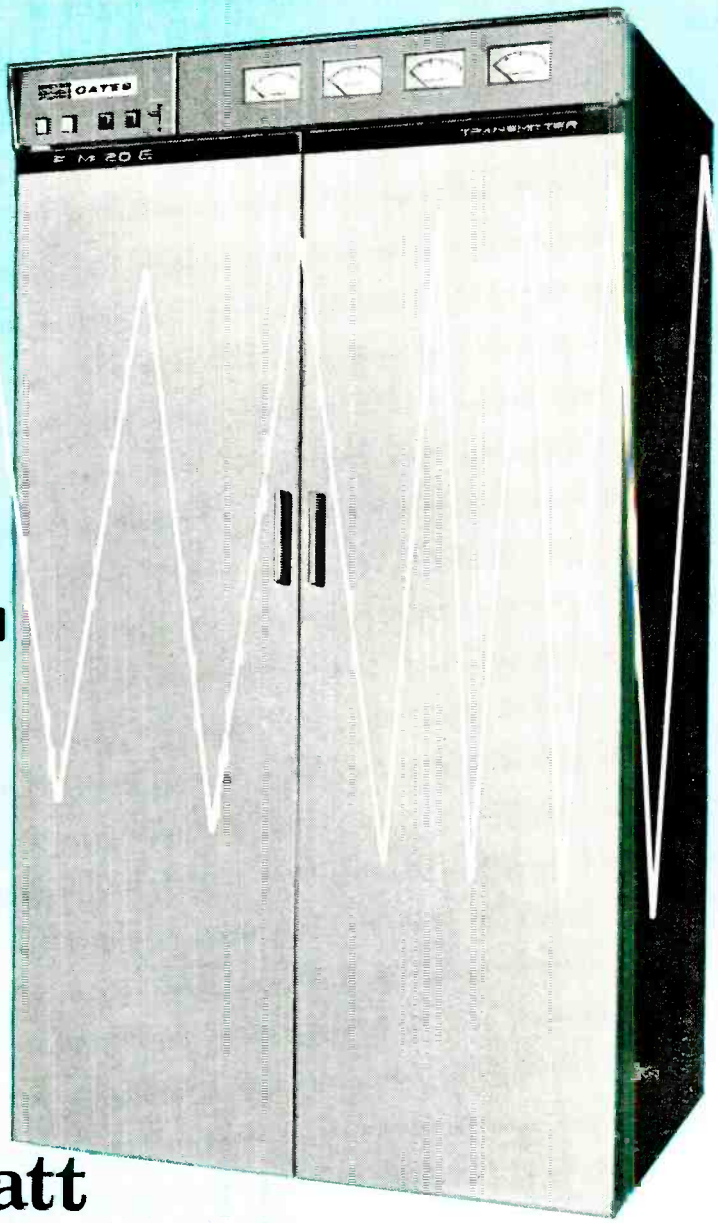

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Cooperation—Latent theme of CATV Convention

by Forest H. Belt

Denver, Colorado, July 18-23, 1965—On the wide plateau along the upper reaches of the South Platte River, a long stone's throw from the Front Range of the Rocky Mountains and not many miles from the Continental Divide, this mile-high city witnessed this week a gathering of nearly 2000 under the banner "14th Annual Convention of Community Public Servants"—the 14th Annual National Community Television Association (NCTA) Convention took over the Denver Hilton Hotel.

If any one factor stood out, it was that this was a working convention. Systems owners, several broadcasters, equipment manufacturers, and representatives of FCC and certain telephone companies—all gathered and conferred to formulate exactly the problems facing the wildly growing CATV industry and to devise solutions.

Days of strenuous meeting, planning, and learning were followed, however, by nights of well planned entertainment—a welcoming cocktail party Sunday night by TV Digest publisher Al Warren; a Western ranch party by Jerrold, with entertainment by Rocky Starr's Western Band, girl fast-draw artist Willie Sessums, the Koshare Indian Dancers, psychologist and mind-reader Chan Canasta, and the Parrish Square Dancers; a Hawaiian luau by Ameco, with Hawaiian band, Tahitian dancer, plus food and drink from the Islands; a Discotheque au Go Go every night by Entron; several cocktail parties sponsored by various manufacturers; professional entertainment, such as Paul Ford and Mimi Hines sponsored by Entron, The King Family by Viking, Ray Bloch Orchestra and The Taylors by Aberdeen Co. and Tape-Athon Corp.; plus various outings and tours sponsored by companies and local or state associations.

Hats are off to the committee who planned this affair. Organized—in cooperation with the NCTA Washington staff—by Bill Daniels (cover photo, in red coat), of Daniels & Associates, well known CATV broker, the planning combined convention seriousness with vacation liveliness for the families of attendees. Daily programs for the ladies and special arrangements for the children contributed the ingredients for a successful family outing.

Work for the NCTA executives began on Friday, July 16, with three days of meetings—Pole Line Committee, Budget & Audit Committee, ETV Committee, Membership Committee, Associate-Member Committee, Ladies' Convention Committee—plus Executive Committee meetings and two days of meetings by the NCTA Board of Directors.

By 3:00 PM Sunday afternoon, July 18, most of the ninety exhibitors had their booths ready for the official opening of the Convention. In the exhibit area just off the hotel lobby, registrants jostled each other for a look at the latest equipment and services offered by manufacturers. The photo groups show activity at several of the booths.

Monday, July 19

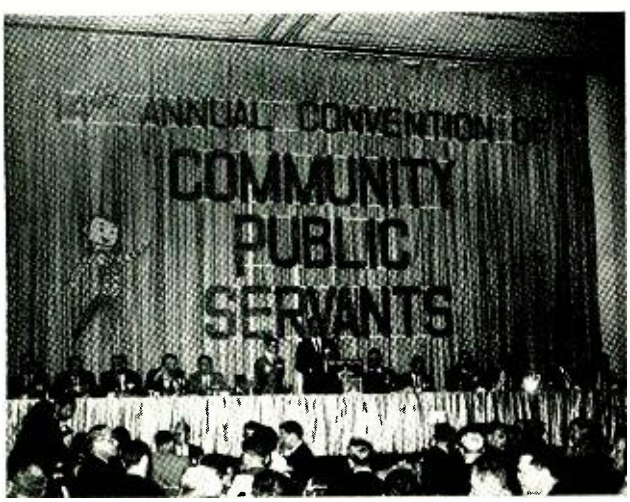
Work began after a breakfast hosted by Wyoming CATV operators, when system operators heard the Annual Report of the Chairman of NCTA, Bruce Merrill.

Chairman's Report

Mr. Merrill recapped the hiring of former FCC Commissioner Frederick W. Ford as NCTA President effective January 1, 1965. He further analyzed the posture of CATV today: There are presently 1600 systems operating in 48 states, representing an increase in the past year of 200 or more systems. Applications are pending in at least 800 more communities. The gates are down and the flood is ready to start. In the way of this flood, however, stand certain major adversaries—the FCC, the NAB, copyright syndicates, and on the sidelines the telephone companies.

Reviewing the year, Mr. Merrill mentioned six states in which Public Utility Commissions considered taking over CATV regulation—Nebraska, Nevada, North Dakota, Ohio, Oklahoma, and Pennsylvania; of these, Ohio decided, "no," while decisions in the others are still pending. State legislatures in 13 states also considered making public utilities of CATV systems: Connecticut, Idaho, Maine, Minnesota, Missouri, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Vermont, West Virginia, and Arizona. Only in Connecticut did the law pass; in that law it was further stipulated that Connecticut CATV systems must pay 6% of their gross profits to the state. Legal attacks will be instituted on both phases of the law. In New Jersey and Vermont, legislation is still waiting to be acted upon, so the result cannot be predicted accurately.

Next, Mr. Merrill discussed extensive and, to NCTA, futile negotiations with NAB, but iterated willingness to talk further at any time. He insisted "only that public interest be the criterion for



any restrictions, and that damage to the public interest be proved in evidentiary procedures."

The FCC's First Report and Order in the microwave dockets was described as "arbitrary, cumbersome, inequitable, unjustified, and ill-advised." The NCTA Chairman feels "as if (CATV operators) are being offered up as a peace offering by the FCC to the broadcasters."

The new copyright-law revision—which has drawn attention from all facets of publishing, writing, and broadcasting—came in for a share of attention in Chairman Merrill's address. Briefly, the right of CATV systems to rebroadcast programs without royalty payments is at stake. NCTA is actively presenting their case before Congress.

On telephone companies: "This was the year when the nation's giant telephone systems awoke, like one of the three bears, and said, 'Somebody's been building CATV systems on my poles.' We're here to tell them that somebody's going to go right on building CATV systems. We started this industry. We proved the need for our service and we have shown the public what we can do. We're not going to allow any ten-billion-dollar-a-year giant to stop us or slow us down."

On Ratings

In a workshop meeting well attended by system operators, discussions of rating services for CATV seemed to hover closely around the idea that broadcasters and CATV operators should work more closely together for their mutual benefit instead of fighting each other. George Blechta of A. C. Nielsen Company and George W. Dick of American Research Bureau indicated the kind of information their companies need if their audience research activities are to be dependable in the field of CATV.

Mr. Blechta pointed out the importance of program analysis and viewing-habit analysis among the 1,700,000 homes served by cable systems, and explained the problems Nielsen encounters in counting noses in these markets. Besides the difficulties inherent in developing accurate viewer statistics among CATV subscribers, the importance of ratings to both CATV operators and the stations their systems carry was made clear. The Nielsen executive enumerated the following facts the rating company needs from CATV operators if it is to evaluate accurately tabulations among CATV viewers: (1) What communities, large or small, are served by your system? (2) What stations, by call letter, does your system receive, and on what system channel does your subscriber view each? (3) If any one system channel is used to carry more than one station, exactly what days of the week and what hours is each station carried? (4) What type of protection, if any, do you provide any station against network duplication? Nielsen needs this information about every CATV system in operation.

George W. Dick, president of American Research Bureau, expressed the viewpoint that "public interest," on which CATV operators and broadcasters base their arguments, is best uncovered by audience research that estimates not only which stations can be received but which are regularly watched. He described the method used by ARB for measuring TV audiences, which is similar to the Nielsen method—both companies use viewer diaries. Since CATV subscribers are considered somewhat heavier viewers than ordinary, special methods must be used to analyze their viewing habits.

ARB has been working with broadcasters for several years developing sampling-control techniques adequate for projecting CATV viewer statistics; special analysts at ARB handle the problems created by altered channel numbers and nonduplication agreements. **Mr. Dick urges CATV operators to join this cooperative effort by supplying the stations they carry (and ARB, too, of course) with adequate information on the extent of their operations.**

Particularly pertinent to CATV operators (and broadcasters) are these comments by Mr. Dick: "Some of you . . . don't see yourselves as part of the broadcasting industry. On the other hand, I am sure the great majority of you recognize that you are part of the vital and dynamic broadcasting industry, an industry that couldn't have grown to such great proportions if it did not have one whale of a lot of cooperation from everyone concerned with it."

Some ways audience rating can help CATV operators: (1) It would help to know which stations and programs your subscribers value as reasons to remain subscribers. (2) If FCC does control CATV, expanding your services may depend on justifying the need of viewers for additional television in your area. (3) If copyright laws eventually include CATV payments, you should pay on the basis of what you actually do deliver, not merely what you could deliver. (4) The same holds true if Section 325 of the Communications Act is amended so you have to pay stations instead of copyright owners. (5) If you win your argument that you are contributing to a station's circulation, which is already included in determining copyright fees for the station, you'll need to know how much additional circulation you are contributing. (6) Suppose your services eventually include program origination, and you become sellers of broadcast time; you'll need audience research the same as present broadcasters do.

Mr. Dick summed up by enjoining CATV operators and broadcasters, "I know some of you may not be palsy-walsy but, for auld lang syne, please cooperate. You CATV pioneers are meeting here in the West where the word 'pioneer' still is meaningful . . . those pioneers found that survival depended in large measure on cooperating with each other . . ."

Congressman Oren Harris

At lunchtime, well over 1,000 NCTA'ers were found listening to a speech by the Honorable Oren Harris, Arkansas member of the U. S. House of Representatives. Representative Harris reiterated his feeling of the justice of his controversial bill, H.R. 7715, particularly of the part which states: ". . . it shall be the purpose of this part (of the Communications Act) to give the people of the United States access to the greatest particable diversity of local, network, educational, and other television programs."

The Arkansas Congressman called to mind Dr. Martin H. Seiden's report (the controversial Seiden Report) which estimated that 16 million homes—about 28% of the population—do not have a viewing choice from among the three national networks, and then opined that much of the objection among broadcasters is motivated by fear of changing the status quo, of encroachment on what they consider their exclusive markets. Congressman Harris feels that Congress should determine the degree and extent of regulation to be exercised over CATV by the federal government, while the FCC should limit its activities in CATV to recommending to Congress specific legislation which would then become an integral part of the national communications policy.

On duplication: "I can see some reason for prohibiting the carrying by CATV of programs prior to the time when such programs are carried by local stations; I can see little, if any, reason at all in imposing on CATV limitations with regard to duplication **following** broadcasts by local stations."

On cooperation: "I challenge all segments of the industry to work together toward this important objective (a national television policy) and to do their utmost to bring to an end the bickering and dissension which now prevail. One or the other segment may feel that their separate interests may be best served by holding on to the status quo. . . . Such attitude in my opinion is contrary to the best interests of the American people, and it is also contrary to the enlightened self-interest of the individual segments of the communications industry."

Sales, Sales, Sales

After lunch, systems managers attended a forum on SALES. J Fred Weber, vice-president for sales at American Cablevision Corp., delivered a paper on the use of direct (face-to-face) sales for selling CATV connections to prospective subscribers; he included figures and examples to drive home the profit point of this type of selling.

John F. Gault, vice-president of Television Communications Corp., to the theme of "You've Got to Believe It Yourself," expostulated two basic commandments of cable-TV success: (1) Get them on the cable, and (2) Keep them on the cable. To accomplish both, the system operator must provide for the CATV viewer (a) good pictures, (b) good service, and (c) variety of service. Furnishing these, the operator-owner and his salesmen must "believe it themselves" if they are to sell effectively.

Robert H. Berger, sales VP for National Trans-Video, told seminar attendees they had "Better Sell It Today." In a most informative address, Mr. Berger passed along idea after idea for promoting, advertising, and selling CATV connections. He divided systems into three categories for purposes of selling: mature systems, those which have reached the saturation point where the cost of further sales is high; middle-ground systems, where direct selling and promotion are necessary and profitable; and new systems, where with advance publicity many sales are to be had merely for the asking, and selling costs are at a minimum. Mature systems can't be abandoned, however, for selling is necessary to maintain the saturation level in the face of a normal attrition and turnover of subscribers.

Tuesday, July 20

Following an "Arizona" breakfast, a brace of speakers taught system owners about the financial aspects of CATV business, particularly in the area of financing. Ralph Fratkin, CPA from Philadelphia, started the morning's bill by speaking on taxes and how to look for tax advantages when buying or selling CATV systems.

Financing Systems

James F. Ackerman, finance-company executive from Indianapolis, dwelt on certain advantages of obtaining system-expansion and development dollars from a commercial finance company. One significant reason cited was that a finance company looks at the future cash flow of a system when gauging loan-worthiness, while other lending institutions are more inclined to consider the initial capital investment. Thus, Mr. Ackerman pointed out, the system owner can borrow needed funds without necessarily signing away his equity in system assets, nor restricting the management of his company unnecessarily.

Alvin H. Hartman, vice-president of a small-business investment company, explained details of financing through his type of firm. SBIC's, of which there are more than 700, will provide capital for system development quite liberally, but they usually want part ownership in the system—they are interested primarily in loaning equity or "risk" funds. Mr. Hartman assured system owners, however, that an SBIC seldom is interested in controlling their companies, merely in protecting its usually sizeable investment.

Bank financing received attention in the address of William R. Putnam, banking executive from New York. Mr. Putnam enumerated reasons for the careful and cautious policies of banks when making loans to industries such as CATV. Because the money involved belongs to depositors, operations are closely regulated. As a result, bank lending has historically been limited to short-term notes against collateral such as inventory, crops, and so forth. Recently, however, some banks, especially smaller ones, are participating more aggressively in term loans. Bankers are also inclined to judge business health by the balance sheet, Mr. Putnam commented; with a business whose cash-flow turnover is as rapid as that of CATV operations, the balance sheet may mean little unless special bookkeeping procedures are followed. His banking firm, when analyzing a CATV loan application, considers: (1) How much have the owners already invested? (2) What potential does the bank's CATV consultant see for the service area? (3) What management ability and character does the applicant offer? (4) Can the loan be retired in six years or fewer?

President Ford's Address

At luncheon, following a half-hour of jollity led by FCC Commissioner (and able comedian) Robert E. Lee, members of the press were introduced briefly. Frederick W. Ford, president of NCTA since January 1965, then addressed the membership. Mr. Ford posed some interesting statistics: As of July 1, membership in NCTA comprised 565 operating CATV systems, serving 962,862 subscribers. With 77 systems under construction, members will soon operate 642 systems.

He then outlined three major policy problems facing CATV, as he views them: (1) federal jurisdiction, both legislative and administrative; (2) pole-attachment contracts and CATV activities of telephone companies; and (3) copyright legislation. He went on to describe steps NCTA has taken in each area to protect the interests of NCTA and the viewing public. Mr. Ford mentioned the nearness of agreement with NAB on the matters of regulation, and expressed regret at the failure of negotiations to date.

Particularly significant are these remarks by Mr. Ford: "We welcome the participation of our natural allies—the broadcasters—in the CATV industry and in NCTA. We hope that neither the FCC nor the broadcast industry will oppose the entry of CATV operators into the broadcast field. . . . I truly believe that both industries can and will grow and expand together, if the proper cooperative attitudes are adopted, and that out of the conflict that exists today and the fair competition which CATV fosters between stations will emerge a stronger nationwide television system, with better programs and clearer pictures and the increased confidence of the American people."

CATV Viewpoints

The afternoon panel session had as its topic, inevitably—"CATV, Its Problems and Solutions." The three most recognized problems—telephone companies, FCC, and copyrights—were brought up and discussed at length, with some added attention given to the public image of CATV. In fact, E. Stratford Smith, of the law firm of Smith & Pepper in Washington, D. C., ventured that "if we could solve (the need for im-

proved public relations) adequately, the other (problems) would be relatively easy."

Marcus Bartlett, vice-president of Cox Broadcasting Co. which has interests in both broadcasting and CATV, digressed from the usual angle to point the finger at some of CATV's "self-made problems": (1) Failure to insist on standardization of cable equipment; (2) failure to establish good relations with broadcasters from the beginning; (3) failure to establish good public and political relations during CATV's growth; (4) mistakenly allowing the "Pay-TV" tag to be hung on CATV; (5) failure to quench the myth that CATV is a gold mine; and (6) failure to recognize the need for federal regulation before it was forced on the industry. He further insisted that another key problem is the lack of facts about the many questions raised in FCC's Notice of Inquiry. **Mr. Bartlett noted that the true answers to this latter problem can best be derived by CATV and broadcasting interests working together.**

Climaxing the panel session was a statesmanlike address by Max D. Paglin, of the law firm of Grove, Paglin, Jaskiewicz, Gilliam, and Putbrese of Washington, D. C. Mr. Paglin suggested a course of action for both the CATV operator and the broadcaster, which should help resolve some of their differences. The CATV industry will be helping its subscribers, the broadcaster will be helping himself and his public, and both will be helping the government, said Mr. Paglin, if they make every effort to cooperate in gathering all available information and data.

Some of Mr. Paglin's key remarks: ". . . the CATV industry must convince itself and then convince the broadcasters and the FCC that it truly believes the only valid national policy is one which envisages an integrated system of wire and radio to serve the nation's needs for television programming efficiently and adequately. Secondly, it must persuade itself that the broadcast industry is not an enemy, but a natural ally. Only by (CATV and broadcasters) joining forces and crossing over into each other's camps—where appropriate—will the people of this country be assured of the multiple-choice television they are demanding and to which they are entitled."

Mr. Paglin's theme was one of "Dual Development." The television broadcaster, by entering CATV, can add to his coverage area. . . ." "The CATV operator . . . already has the nucleus of local support for a broadcast operation. . . ." "The broadcaster and the CATV operator . . . have a particularly sobering responsibility because of the unique potentialities and powerful impact of the medium (television) in which they work. For the same reason, they have also a rare opportunity for contribution to the overall advancement of our democratic way of life. It is up to (both) to go out and grasp this opportunity."

Wednesday, July 21

This day opened with a series of addresses which undoubtedly made ears burn at the Federal Communications Commission. John P. Cole, Jr., in a peppery and documented commentary on the FCC's attitude toward CATV, charged that the FCC hasn't taken the trouble to obtain sufficient facts to justify the conclusions in their First Report and Order 38 FCC 683 (1965). Other speakers included W. H. Borghesani, Jr., who analyzed the multiple considerations facing FCC, CATV, and the microwave industry in the matter of frequency allocations in the microwave-relay spectrum; and Morton L. Berfield, who suggested that the Fairness Doctrine of the Commission gives CATV owners a right and a means to defend on the air any accusations brought justly or unjustly by television broadcasting stations.

Luncheon was topped by an address by David M. Snow, president of National Education Sciences Corp. He spoke on ETV as an affiliated service of CATV, and intimated how extensive and vast are the possibilities for the imaginative CATV entrepreneur who includes educational and instructional television facilities in his system to serve schools as well as commercial and entertainment needs. Mr. Snow's talk was the subject of much conversation after the luncheon meeting was adjourned

On Thursday, technical sessions covered topics such as: Measurement of Noise and Cross-Modulation, Amplifier Specifications and System Performance, Envelope Delay, AGC, and System Reliability. The afternoon sessions were divided into two sections—Transmission Lines, and Systems and Antennas. The former covered Sweep Testing of Coaxial Cable, Coaxial Cable Performance for CATV, Microwave by Wire (G-Line), Pressurized Cables, and Underground Cable Installation Techniques. The latter section included Color TV, Problems in Line-Powered CATV Systems, Coaxial Jumpers, and A Parabolic VHF Antenna for CATV.

Recap

Just as CATV owners and operators were noticeably present at the National Association of Broadcasters Convention in late March, broadcasters were conspicuously represented in this National Community Television Association gathering. More of this intermingling—to see and understand problems that very often are mutual—is destined as time passes and members of both groups cease regarding one another as "the enemy." Many enlightened companies are now engaged in both methods of providing entertainment services to the viewing public. Why not? There is apparently money to be made either way, providing the public is willing to watch and support the media. The time shouldn't be far off when both factions will devote themselves to providing—together, by air and by wire—a nationwide system of high-quality television entertainment for every U. S. citizen. Progress in that direction was made in Denver this week. ▲

INTRODUCTION TO STUDIO ACOUSTICS

by J. Gordon Elder, Consulting Engineer, King City, Ontario, Canada, and BE Consulting Author — Some of the important principles of acoustics as applied to studio design.

Perhaps your programs are accompanied occasionally by extraneous, interfering sounds — from trucks, typewriters, or talkers, for example. Or possibly you are planning new studios. In either case, it will help you to consider various design methods and criteria for ensuring adequate noise control and for optimizing the acoustical properties of the studios.

A well designed broadcast studio should be "sound proofed" so that the background noise level is very low. Quietness is especially important in an announcer's booth or in a small studio used for intimate talk or music productions. The control of reverberation time is equally important, to avoid programing that sounds either too lively or too dead. High-fidelity "live" programing — particularly for FM stereo—obviously requires an excellent design in which the acoustics are controlled from at least 50 to 15,000 cps.

Acoustical engineering has developed rapidly in recent years. Architectural building specifications and acoustical properties can now be planned together and the latter predicted with reasonable accuracy. Equipment is readily available for making detailed and accurate measurements. The final design is frequently compromised from the acoustical standpoint, however, by economic, architectural, and aesthetic considerations.

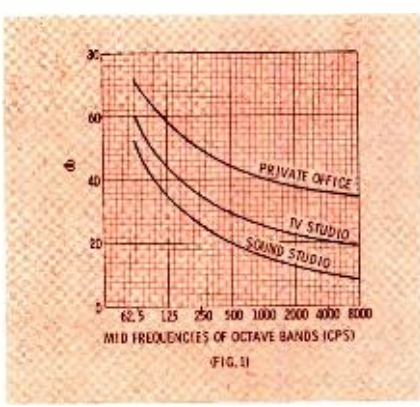


Fig. 1. Noise-rating curves (Kosten and Van Os) for three different environments.

A number of terms occur in acoustics that are unfamiliar and confusing to the newcomer. Some of these will be introduced as required, but the discussion that follows will be kept as uncomplicated and practical as possible. Though sound waves bend more readily due to wind, temperature, or obstructions, in many respects their propagation characteristics are similar to those of electromagnetic waves at radio frequencies.

Acceptable Noise Levels

Reliable data have been obtained concerning the desirable maximum noise levels in different environments. Fig. 1 shows three conservative noise-rating curves recommended by Kosten and Van Os for broadcasting studios and for a private office. Other published families of noise curves have been constructed in various ways, but all of them generally agree with only a few decibels of difference, notably at the higher frequencies.

In Fig. 1, the sound-pressure level in decibels is plotted against the mid-frequencies of the recommended standard octave bands for convenience in comparing the curves with measurements made using an octave analyzer. (Measurement techniques will be discussed later.) The curves are identified and the noise rating designated as the corresponding pressure level in decibels at 1000 cps, a convenient reference frequency. Any sound levels that are quoted later relate to this frequency unless otherwise stated.

The simple equation shown in the box relates the acceptable noise level and the other two basic design factors. Levels typical of broadcast station studios in quiet and noisy environments are shown under the equation. They are expressed in decibels referred to a zero level of .0002 dyne/cm^2.

The required noise reduction governs the combined transmission loss and absorption of the walls and ceiling — and hence the selection of building materials, the location of the studio, and the architectural specifications. These will be considered later.

The actual noise level may be assessed from measurements made in an existing studio. Similarly, the background noise level may be measured in the vicinity of the studio. It may also be predicted based upon the levels expected from street or corridor traffic, typewriters, and other noise sources.

In most communities, noise levels vary cyclically and peak regularly at certain times. Protection should be provided against a noise level that is exceeded very rarely, if ever. If two equal noise levels are added, the increase is 3 db. If one is 6 db greater than the other, the combination is only 1 db more than the larger. Therefore, only the main sources of noise contribute significantly. Assume that the studios are or will be in a noisy location — near heavy traffic, factories, or low-flying aircraft, for example. In such a case the maximum background noise level should be verified by measurement if possible, because predictions are imprecise.

Studio Location

Most of the noise discussed so

Required Noise Reduction	=	Existing or Predicted Maximum Background Noise Level in the Vicinity	−	Acceptable Noise Level in the Studio
40		55		15
60		75		15

far has been transmitted through the air. If new studios are involved, an obvious remedy would be to locate them as far as possible from the noise source. The peak sound level at the side of a busy highway or city street is about 75-80 db. One hundred feet away it has decreased by 20 db. If a noisy location is unavoidable, the studios themselves should be shielded from the source of noise as much as possible — by private offices or other similar areas.

The same reasoning applies to the studio location relative to sources of noise within the building. Preferably it should be some distance from: offices equipped with typewriters or calculating machines; washrooms; cafeteria; elevator; workshop and furnace room. The noise may be airborne from these places along air-conditioning ducts. It may also be structure-borne — caused by impact or vibration and transmitted through the walls, floors, and ceilings.

Expense and effort can often be saved by reducing the offending noise at its source rather than at the studios. For example, a typewriter may be set on a sponge-rubber mat. For larger or heavier machines, compression-spring mountings may be used provided the system does not resonate at audio frequencies. Severe cases may require a special box or enclosure. Worn bearings or imbalance can cause excessive noise in rotating machines. Impact noise from stiletto heels may be reduced by lining corridors with rubber or other resilient tiling.

Soundproofing

The sound insulation of solid materials is approximately proportional to their density and thickness. However, many modern building materials are porous and must be plastered on both sides to obtain results comparable with predictions based upon this "mass law." Nine-inch brickwork so treated provides a loss of 50 db. A loss of 60 db may be obtained by using double-wall construction with an air gap. Gaining the maximum possible loss requires that the floor and inner wall be mounted floating on resilient material such as cork, rubber, or glass wool. Though expensive, this procedure is very effective in attenuating both airborne and impact noise.

Doors and windows are much more difficult to insulate than walls. Double doors and windows are normally essential. Two panes of glass ¼" thick and spaced 6" apart can provide about 40 db of transmission loss. A narrower air gap reduces this loss (by up to 10 db for zero gap), due to excessive coupling and insufficient damping action.

It is of paramount importance that all doors, windows, pipes, and conduit be installed carefully to avoid any looseness, cracks, or holes around them. Otherwise noise inevitably will leak into the studio.

To illustrate this point, assume that there is a heavy 7' x 3' x 2" door which by itself would provide a sound loss of 35 db. A crack 1/10" wide along its base would reduce the loss to 32 db.

For simplicity, the transmission loss specifications for building materials often include an average of the values measured at several frequencies throughout the band. These average values are used for the preliminary design. Later on, the composite loss at specific frequencies is calculated to ensure that the design satisfies the curve of Fig. 1.

In order to calculate the composite loss of the walls, doors, windows, etc., their surface areas and transmission coefficients must be known. The latter are obtained directly from the material's transmission loss by solving the formula:

$$\text{loss} = 10 \log_{10} \frac{1}{\text{coefficient}}$$

Thus:

$$\text{coefficient} = 10 \log_{10} \frac{1}{\text{loss}}$$

The transmission coefficient would be zero for a perfect insulator, or unity for a perfect conductor. Air approximates a perfect conductor of sound. (In it the sound pressure falls 6 db as the distance from the source is doubled—inverse-distance law.)

Each surface area is multiplied by its corresponding transmission coefficient. These products are then added and divided by the total surface area to obtain the composite coefficient and hence the composite transmission loss for the room.

The studio sound insulation may be improved further by lining walls and other surfaces with absorbent material, such as carpeting, drapes, and acoustic tiling. A maximum improvement of 5 db is possible by this means. However, the principal effect is to alter the reverberation time and other sound characteristics of the studio, so these materials must be applied carefully. Their use and misuse will be discussed later.

Two important sources of studio noise are fans and air-conditioning systems. The air velocity should be lower than 20 ft/sec. Suitable fans have well designed blades operating at a low tip speed. Air ducts should be large in cross section. Covers and grilles should not obstruct the flow of air appreciably. The ducts should be lined with rock wool to muffle the sound waves by absorption. Sheet-metal separators may be installed in the duct, either laterally or lengthwise, and lined to provide additional high-frequency absorption and some reflection. For lining which occupies half the cross-sectional area of the duct and has a density of about 6 lb/ft^3, the attenuation will be 5 to 10 db/ft. If necessary, a filter can be incorporated to attenuate noise in specific frequency bands to a greater degree.

Studio Design

The design should not only adequately exclude undesired sounds, but should preserve the acoustic quality of the desired sounds that constitute the station's live or locally recorded programing. For many small radio stations this is limited almost entirely to the spoken word. However, even an announcer's booth must be acoustically designed if it is to produce pleasing results. The size of a studio is naturally dependent upon programing policies and market economics. Many studios and most booths are quite small. The discussion that follows will concern primarily these small rooms, though much of it also would apply to larger studios.

The reverberation time of a room is the transient time in seconds re-

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NAB REEL-TO-REEL TAPE STANDARD

by James M. Moore —A report on the contents of the technical standard for reel-type systems.

The use of recorded program material is universal throughout the broadcast industry. This very fact makes almost mandatory the adoption of some kind of industry-wide standard for each recording method if the advantages of system compatability are to be realized. Through the years, the NAB Recording and Reproducing Standards Committee has issued such standards. The most recent are the standards for tape-cartridge systems (see "Progress in Recording Standards," January 1965 BE) and the NAB Standard for Magnetic Tape Recording and Reproducing (Reel-to-Reel).

The reel-to-reel standard was adopted by the NAB Board of Directors January 29, 1965. It is the result of the cooperative efforts of broadcasters, manufacturers, recording companies, and other interested parties. The full cooperation of the NAB in supplying the information for the following summary is gratefully acknowledged.

General Scope

Although a tape speed of 7½ ips is preferred for program-exchange purposes, standards are also given for 15 and 3¾ ips tape speeds. Full-track, two-track, and four-track systems, both mono and stereo (for multitrack systems) are covered.

Two classes of systems are recognized: high-performance equipment and "Special-Purpose Limited-Performance Systems." The latter are systems in which "portability and weight are the primary considerations and technical perfection is made secondary to accomplish this greater portability." Naturally, this distinction must be kept in mind when applying the Standard.

The Standard specifies physical properties and mechanical requirements for the tape and performance requirements for systems. Compliance with the Standard is determined in terms of standard tapes; annexes to the standard explain how these tapes are made and calibrated. Mechanical drawings of the standard reels, response curves, and a glossary of terms complete the Standard.

Tape and Reel Requirements

Logically enough, the Standard begins by stating specifications for the tape

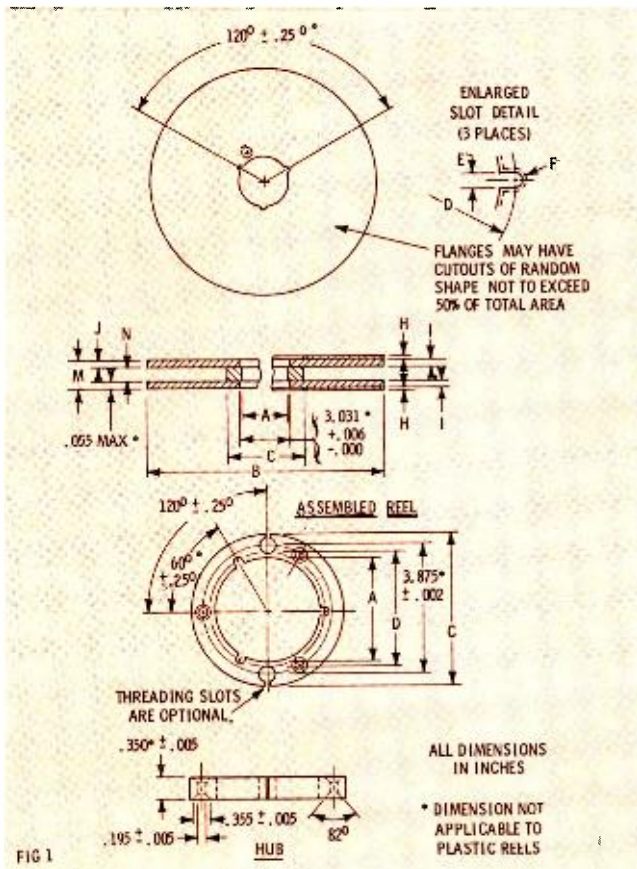

Fig. 1. Dimensions specified in Standard for NAB Type A reels.

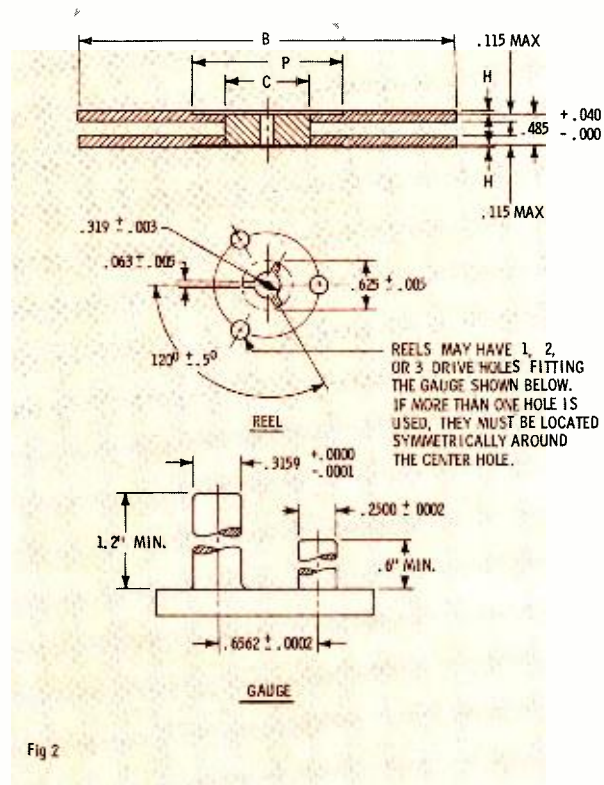

Fig. 2. Dimensions specified in Standard for NAB Type B reels.

Table 1. Tape Length vs Reel Size

Nominal (Reel)	Dia (Hub)	1.5 mil base	1 mil base	.5 mil base
3″	1.75″	125′	200′	300′
5″	1.75″	600′	900′	not
7″	2.25″	1200′	1800′	rec-
10.5″	NAB 4.5″	2500′	3600′	om-
14″	NAB 4.5″	5000′	7200′	mended

itself. Nominal ¼″ sound-recording tape shall measure .246″ ± .002″ in width and not more than .0022″ in thickness. Standard minimum lengths for various reel sizes are listed in Table 1.

Standard dimensions are prescribed for the reels as well as for the tape. Two types of reel are recognized: NAB Type A reels are metal or filled plastic reels 10½ or 14″ in diameter and having a 3″ center hole (Fig. 1). NAB Type B reels are filled or unfilled plastic reels having a 5/16″ center hole (Fig. 2). Dimensions are listed in Tables 2 and 3, respectively.

Certain other specifications relate to the tape as used in record-reproduce systems. The tape shall be wound with the oxide coating facing the reel hub. Normally the start of the program should be at the outside of the reel, but if the tape is to be stored for an extended period of time it should be wound with the start of the program at the inside of the reel.

Full-track recordings are to be .238″ + .010″ — .004″ in width. When more than one track is recorded on the same tape, the tracks are designated by number as shown in Fig. 3. The illustration also shows the important track dimensions.

For two-track stereophonic recordings, track 1 is to carry the left-channel signal, and track 2 is to carry the right-channel signal. The tracks are to be recorded "with the head gaps in line and phased for reproduction on equipment so connected that when a full-track tape is reproduced, it produces in-phase signals in the two channel outputs."

For four-track monophonic recordings, the standard sequence for recording the tracks is to be 1-4-3-2. Tracks 1 and 3 are to be used for recording in one direction as the tape is unwound from the supply reel. Tracks 4 and 2 are to be used for recording when the tape moves in the opposite direction. The Standard specifies that left-channel information shall be recorded on tracks 1 and 4 and right-channel information shall be recorded on tracks 2 and 3. A further specification is that "tracks 1 and 3 and tracks 2 and 4 shall be recorded with the head gaps in line and shall be phased for reproduction on equipment so connected that when a full-track tape is reproduced it produces in-phase signals at the two channel outputs."

Requirements for uniformity of tape output are as follows: The average output level at 400 cps and a tape speed of 7½ ips must not vary more than ±.5 db throughout the reel; the output of any given type of magnetic tape must not vary more than ±1 db from reel to reel. The level measurement ". . . is to be made at the NAB Standard Reference Level[1] and read on a Standard Volume Indicator (ASA Standard C16.5-1961) with bias adjusted for maximum output for the tape under test."

NAB Standard Recorders

The requirements for recording and reproducing systems are divided broadly into two classes, those for high-performance systems (designated "NAB Standard Recorders") and those for "Special Purpose Limited Performance Systems" (designated "NAB Special Purpose Recorders"). The first class will be discussed now; the second class will be covered later.

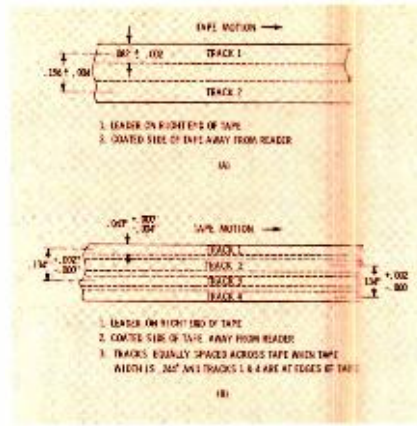

Fig. 3. Standard tape-track designations.

Speed

The preferred tape speed is 7½ ips ± .2%, but supplementary tape speeds of 15 and 3¾ ips ± .2% are also recognized. Annex A of the standard describes in some detail a method for measuring tape speed. It consists of placing a pulley of precisely known diameter against the tape between the capstan and the head. The speed of rotation of the pulley is then measured using an AC-generator tachometer or a stroboscope disc illuminated by a neon lamp excited from the 60-cps motor supply. The measurement must be made using tape having a thickness of .0019″ ± .0002″.

The annex suggests a pulley (having precision low-friction bearings) with a diameter of 1.4305″ + .0002″ — .0000″. To this is attached a stroboscope disc having rows of 36 and 72 dots under 60-cps illumination (120 flashes per second) the dot rows indicate, when stationary, 15 and 7½ ips, respectively. (To measure the 3¾-ips speed, a diode in series with the neon lamp causes it to flash at 60 pulses per second.) The tolerance limit of ±.2% corresponds to a

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Table 2. Dimensions for Type A Reels

Dim	Metal Reels	Plastic Reels
A	3.002 + .006 −.000	3.010 + .015 −.000
B	10.500 or 14.000 + .020 −.010	10.500 ± .020
C	4.500 ± .010	4.500 ± .015
D	3.250 + .008 −.002	3.250 ± .020 −.000
E	.219 + .010 −.000	.219 + .013 −.000
F	.109 + .005 −.000	.109 + .007 −.000
H	.025 max	.060 max
I	.080 max	.115 max
M	.462 ± .020	.485 + .040 −.000
N	.350 ± .005*	.285 ± .015

*". . . the distance between the flanges at the hub shall not vary more than ± .050″ when measured from the hub to the periphery of the flanges. Flange wobble shall not extend beyond the hatched areas . . ."

"Reels shall be symmetrical in that they shall mount and be functional when mounted on either lateral mounting surface."

Table 3. Dimensions for Type B Reels

	NOMINAL REEL SIZE							
DIMENSION	3″	5″	5″	7″	7″	(Tolerance)	10½″	(Tolerance)
B	2.938	5.000	5.000	7.000	7.000	± .031 −.000	10.500	± .020
C	1.750	1.750	3.000	2.250	4.000	± .010	4.500	± .015
H	.050	.050	.050	.050	.050	max	.060	max
P	1.750	1.750	2.250	2.250	2.250	min	4.500	min

[1]The NAB Standard Reference Level is defined as follows: ". . . that 400-cps level which is equal to the recorded level on the NAB Primary Reference Tape."

"The NAB Primary Reference Tape is a tape of the normal general-purpose type which has been selected for average characteristics of output, sensitivity, and distortion. The 400-cps recording on it was made at 7½ ips with bias adjusted for maximum output, at an output level 8 db below that which produced 3% third harmonic distortion . . . Since neither the tape nor the measurement conditions can be duplicated exactly in the field, all NAB Standard Test Tapes contain a 400-cps recording at the NAB Standard Reference Level within ±.25 db as a means for making this level available."

LINE SERVICES FOR BROADCASTERS

by Allen B. Smith — Every broadcaster should be familiar with available common-carrier services.

A well-established truism says we often fail to get a good look at things with which we are very familiar; we seem to suffer from severe nearsightedness that prevents us from seeing the whole picture. This is certainly true among many staff engineers—and not a few chiefs—when it comes to the broad range of services offered by the extensive communication system of the common-carrier telephone companies of the United States and Canada. Broadcasting as we know it today certainly could not exist without these services, yet we seem to take the entire range of facilities for granted most of the time. Only when something fails do we become aware—in this context, certainly, not in a complimentary sense.

By far the greatest network of communication paths is provided by two major corporations, but there are also many independently operated telephone companies serving relatively limited local areas. These smaller companies, of course, utilize the lines and other facilities of the major systems, and their capabilities generally follow those of the wider-based system. This standardization of equipment and operational procedures simplifies the task of securing a wide variety of line services from practically any point within the continental limits of the U. S. and Canada. Indeed, the advent of the Early Bird communication satellite and other synchronous relay stations promises to extend the ready availability of international circuits to broadcasting groups or individual stations, in addition to the major networks, for programs originating overseas.

While the expense of using the new generation of relay satellites is prohibitive for most purposes, charges made for more familiar services enable broadcasters to employ remote-line links for sports, news, and public-service programs even in small communities where station revenues are limited. While the cost for these services will vary somewhat within the boundaries of individual states, interstate line charges are set by Federal regulation and are common to all areas within the United States. State Public Utilities Commissions or Departments of Commerce establish rates for paths wholly within each state. Despite the possibility for a confused pricing structure, however, there actually are only relatively small differences in line charges among the states.

Services Available

To accommodate the demands of broadcasters for lines of varied quality, the telephone companies provide a selection of circuits which range from 10-mc video paths to some, normally used for two-way telephone conversations, that have very narrow frequency-response characteristics and little or no equalization. Tables 1 and 2 list the audio and video services available and show the approximate bandwidth tolerances held in general practice, though for some independent companies these figures may vary. As in other kinds of service businesses, rates vary with the complexity of the specific service provided. Higher-grade scheduled lines require more expensive wideband amplifiers, and levels must be equalized and monitored more frequently along extended paths. Video lines must be maintained by technicians familiar with the techniques involved in coaxial-cable and microwave-signal transmission, which contributes to increased costs to broadcasters.

Audio Services

Over the years, broadcasters have more or less dictated the bandwidth requirements for the various schedules. The advent of FM broadcasting, for example, spurred the development of the AAA lines having nominally flat response to 15 kc for use in FM studio-to-transmitter loops. Schedule AA lines (8 kc), primarily used for AM studio-to-transmitter loops, and schedule A lines (5 kc) provide the majority of program needs for AM stations.

Table 1. Scheduled Audio Services Available

Designation		Useable Bandwidth
Schedule AAA	(Permanent)	50 cps — 15 kc
Schedule AA	(Permanent)	100 cps — 8000 cps
Schedule A	(Permanent)	100 cps — 5000 cps
Schedule B	(Temporary)	100 cps — 5000 cps
Schedule C	(Permanent)	150 cps — 3500 cps
Schedule D	(Temporary)	150 cps — 3500 cps
Schedule F	Local channel (voice) equalized or unequalized (nondedicated)	

Table 2. Scheduled Video Services Available

Designation	Description
A2A	Local channel video pairs or cable (4.5-mc bandwidth)
TD-2	Intercity 3700 mc to 4200 mc SHF microwave (45 cps to 4.5 mc bandwidth)
L-1	Intercity coaxial cable (2.7-mc maximum useable bandwidth)
L-3	Intercity coaxial cable (4.2-mc maximum video-channel bandwidth)

Table 3. Unloaded Losses

Schedule	AAA ±	1 db 50 cps to 1000 cps and 1000 cps to 15 kc
Schedule	AA ±	1 db 100 cps to 1000 cps and 1000 cps to 8 kc
Schedule	A ±	1 db 200 cps to 1000 cps and 1000 cps to 5 kc

Transmission-path losses are held to no more than 10 db for 15-kc lines and 12 db for 5-kc lines.

For short-term remote-broadcast locations, the temporary schedule B (5 kc) or, sometimes when quality is less important than immediacy, schedule C or D lines fulfill the rest of the requirements of AM broadcasters. For remote work, FM outlets often use the AA or even A lines when expediency requires rapid setup.

Responsibility for providing program services is divided among two separate operations: the Long Lines Department of American Telephone and Telegraph and the local operating company—in most cases one of the subsidiary Bell Telephone Systems. In cases where independent telephone companies are involved in program-contract services, the local company employs its facilities to whatever extent it can and then calls upon AT&T and/or the nearest Bell System company to complete the connection.

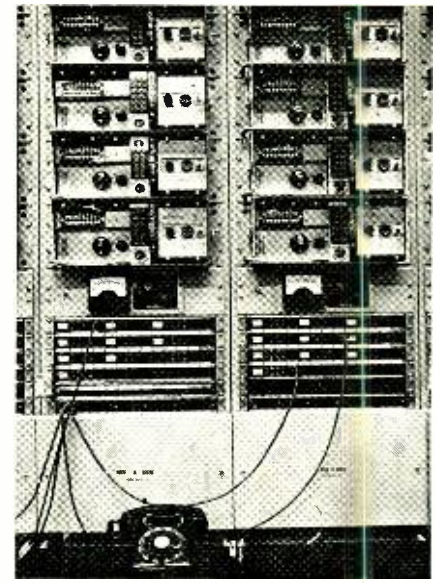
Equalization of the audio-network program lines is accomplished by using a series of line amplifiers and compensating networks spaced at frequent intervals. Table 3 lists the nonloaded losses for the three schedules in most frequent use. Using 22-gauge pairs, the 10-db and 12-db loss figures are reached within 6 miles and 7 miles, respectively; for 19-gauge pairs, the allowable losses occur at 8 and 10 miles. Line amplifiers incorporating compensating networks must therefore be used at no greater distances than these specified intervals.

Video Services

The video-service lines shown in Table 2 are part of the extensive network of lines available to the three major television networks and to local stations equally. Generally speaking, there are two grades of video lines available, one capable of transmitting the maximum frequencies encountered in black-and-white television signals, and one capable of handling those required for color signals.

It is general practice in this country for the video and audio portions of the composite signal to be transmitted separately, with the video being carried over microwave paths and the audio being fed over wire lines. These separate modes of transmission focus attention on the effects of differential time delays which for a microwave path may be on the order of 25 msec and for a cable path more nearly 150 msec. The discrepancy in transit time is sufficient to be objectionable unless specific steps are taken to compensate for the effect. In general practice, the differential delay is minimized by using as few tandem-carrier terminals as possible and by careful layout engineering to provide very direct paths for the television audio. Delays within a maximum of 60 msec are attained over transcontinental paths, and extensive listening tests have demonstrated that most listeners are unaware of delays of as much as 100 msec.

Whatever method of transmission is used for television signals, and both cables and microwave would be used by most stations—cables for short intercity connections and microwave for longer hops—in normal operation, the heart of the signal-transmission operation is the Television Operating Center which is a part of the local Bell System installation. The TOC is the control point for all TV signals passing into, out of, or through a major population center. In the TOC are racks of test equipment, video and audio jack panels, video and audio monitors, and communication facilities which are used to correlate the entire operation. In most centers, there are two or more men on continuous duty to make whatever level adjustments or other changes must be made to assure uninterrupted service.



Line amplifiers located in modern POC.

Securing Services

When one applies for line services for typical remote broadcasts, initial contact is made with the supervisor of the Program Operating Center (POC) for radio links or with the TOC supervisor for television links. The station's requirements are entered as an order on a

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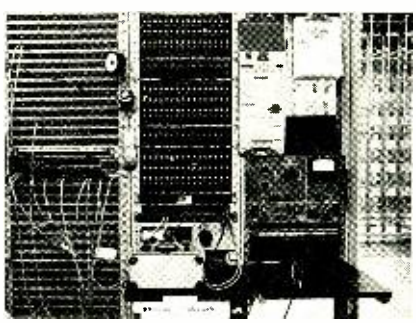

Audio jack-panel and switching board.

Two men watch monitors, A-scope at TOC.

Video, other microwave transmitters.

A PORTABLE STEREO CONSOLETTE

by Lt. George M. Durenberger, Jr.

— This inexpensive little unit fills the need for a remote or auxiliary console.

In production work and remote broadcasts, the need often arises for a compact and inexpensive control console as an auxiliary unit. Unfortunately it is often difficult to equate low cost with high quality. The stereo unit (Fig. 1) to be described meets FM specifications, is "packaged," and was constructed mostly from the spare-parts bin. It is hoped that this account will prove helpful to those interested in the construction of such a piece of equipment.

Description

The consolette will accept a monophonic microphone, two magnetic stereo turntable heads, one high-level monophonic turntable output, the stereo outputs of two tape recorders, and the signal from an FM tuner. Inputs to all channels are switched through lever keys. There are two dual-channel outputs, one 600-ohm balanced and the other of the cathode-follower variety. The utility monitoring amplifiers deliver about ten watts of music power to 8-ohm speakers or to stereo headphones (which can be switched from monitor to audition/cue circuits or to an external source). Included is a 5-watt cue amplifier. The unit measures 12″ x 17″ x 14″. All inputs and outputs appear on the rear panel at jacks or barrier strips (Fig. 2), so the unit can be set up at a remote location with a minimum of effort.

Design

The original planning envisioned an integrated stereo preamp/amplifier with the mixing system located in a high-level stage. Cost estimates ruled out the use of low-impedance faders and attendant transformers, so it was decided to go high-impedance throughout. To do this and still meet the hum and noise requirements of a high-quality unit, we designed an outboard power supply and used low-noise tubes. Leads from the turntables were kept to less than 3′ in length, and shielded plugs were employed to reduce further possible hum pickup.

Since the microphone input was to be used for announce purposes only, it was designed to accept a monophonic signal, and a single microphone was used. The turntable preamplifiers follow a standard design and are RIAA equalized. They will accept any magnetic phono head having an output of 5 millivolts or more. All other inputs with the exception of channel 6 are connected through their respective keys to faders. The input to this channel is designed to accommodate a monophonic high-level output from an FM tuner or from the outboard preamplifier associated with an automatic turntable. This input is parallel-fed to both sides of fader 6 through resistors. This design was established simply because FM stereo is not available at our location. It is, of course, a simple matter to convert the channel to accept stereo.

Input Stages

The schematic diagrams referred to in the text that follows show the circuits for one stereo channel only unless otherwise specified. In Fig. 3A, V1 is the low-distortion microphone preamplifier. Its output is fed to two halves of a 12AX7 (only one of which is shown in Fig. 3). The twin triode's outputs appear at key S1 of each channel to feed the No. 1 faders of the mixing system. Should the reader wish to design this stage to accept stereo microphones, it is an easy matter to replace the 12AX7 with another pentode as the second preamplifier. Fig. 3B shows the circuit of a standard phonograph preamplifier with RIAA equalization. Twin triodes were used here primarly because of the low distortion factor and also because of the simplicity of applying the required equalization.

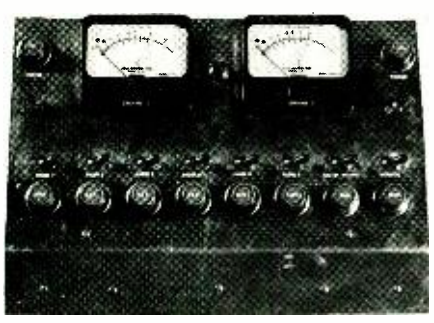

Fig. 1. Front view of the consolette.

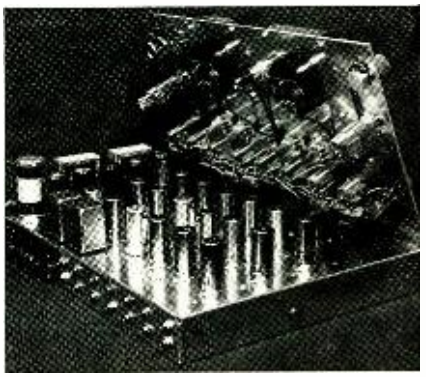

Fig. 2. Rear view shows parts locations.

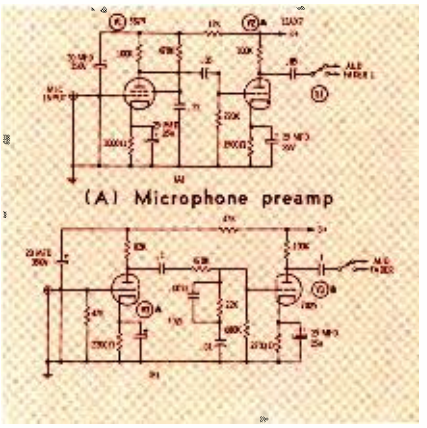

Fig. 3. Preamplifier schematic diagrams.

The Switching/Mixing System

Note from Fig. 4 that all key switches are 4PDT. Two contacts (one is shown for each key) switch the stereo channels. Keys S1 through S6 also have the function of energizing relays for speaker muting and for remote starting of tape recorders and turntables; two contacts on each key are used in parallel for this purpose. All key wiring appears on terminal strips beneath the chassis, so it is a simple matter to alter the switching sequence. In order to keep the cost in line, we employed lever switches with only two positions; consequently the "off" and "audition/cue" positions were combined. When the switches are in this position, the audio is fed to monitor-input key S8 through the audition buses and is also fed to the cue amplifier. (Note that the input to the single cue amplifier is through two 180K resistors. This enables cuing of both stereo channels without loss of separation to the audition buses.)

The mixers are dual 50,000-ohm carbon controls connected in a voltage-divider arrangement. All six faders for each channel are connected in parallel through six 220K resistors to the grid of a section

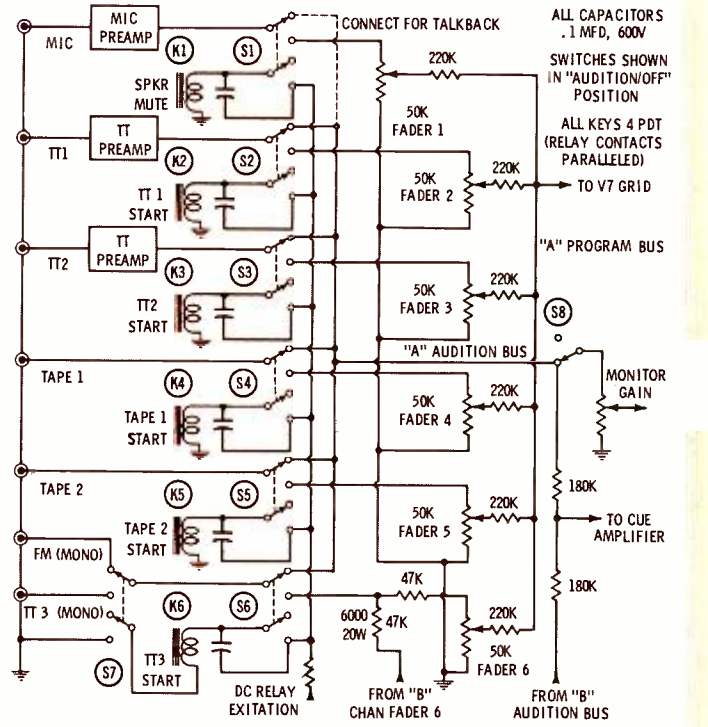

Fig. 4. Switching section controls both audio, stop-start relays (one channel shown).

of V7, a high-gain preamplifier, which sees an equivalent resistance of from 220K/6 (with all faders closed) to 270K/6 (with all faders open). The small change in overall resistance as an individual control is rotated through its range results in a fairly linear frequency response and keeps the faders independent of each other.

Amplifier Circuits

The output of V7 is fed through fader 7, the master gain control,

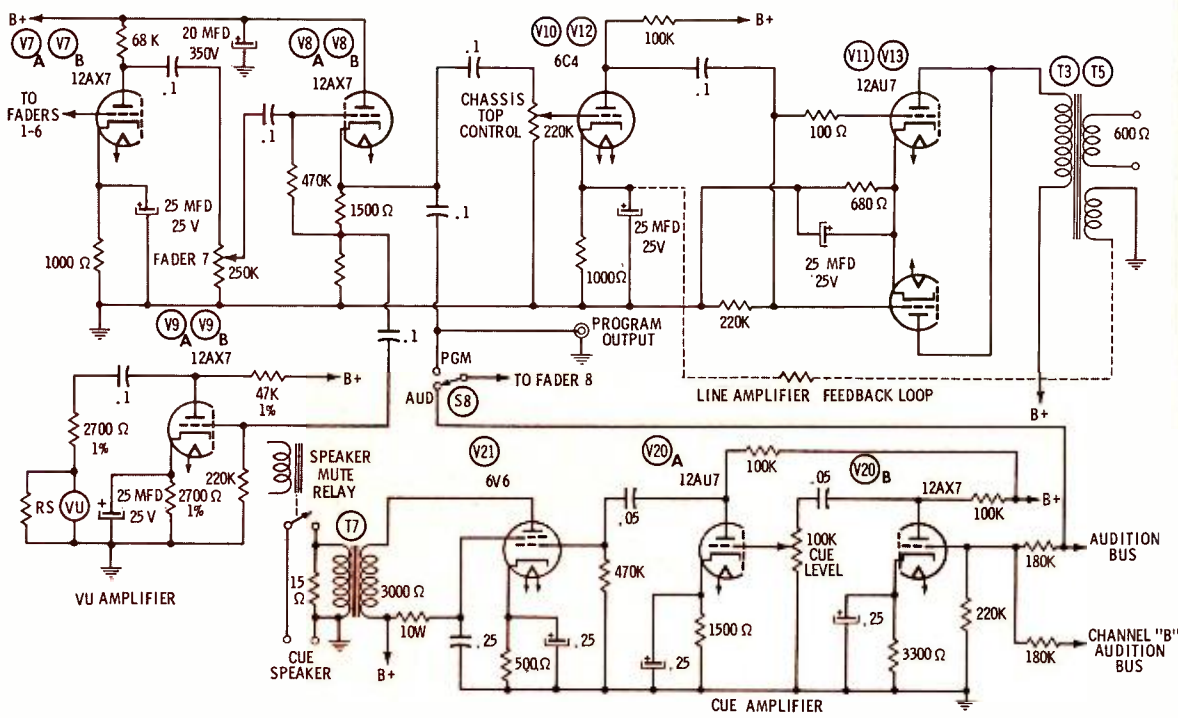

Fig. 5. Schematic diagram shows circuit arrangement and parts values of cue amplifier and one of the two-main channel amplifiers.

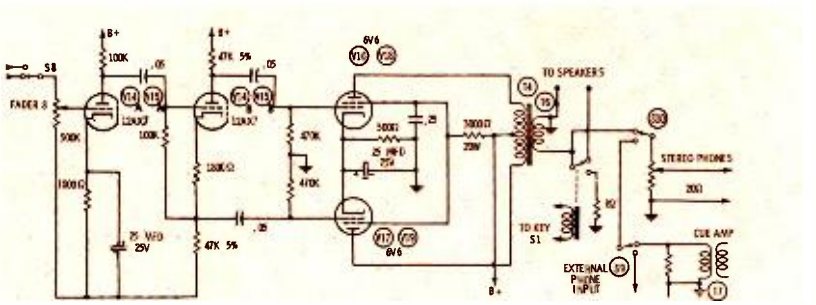

Fig. 6. One of the two identical monitor amplifiers for use in the stereo consolette.

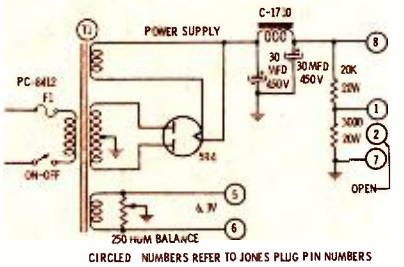

Fig. 7. Circuit of outboard power supply.

to V8, a cathode-follower stage used as a distributing amplifier (See Fig. 5). V8 feeds the line, VU, and monitor amplifiers and is also tied to the output jacks to provide a cathode-follower output. This connection was deliberately designed so as not to isolate the output jacks from the monitor-amplifier input. Thus, by using the same jacks, a program can be fed **into** the monitor and line amplifiers without tying up the mixing system. This application is quite useful in our installation.

V9 is employed as a VU-meter amplifier. Precision resistors were used since they happened to be readily available. The reader can change the 220K grid-bias resistor to a variable control if variable meter multiplication and balancing are desired.

Output Circuitry

Notice from Fig. 5 that the line amplifiers are fed through chassis-top controls. In use, the 600-ohm balanced outputs can be varied through a range from —20db to +10db with respect to the reference output level. Once a suitable output level has been established, there is no need for further adjustment of these controls. While transformer T3 (and T5 for the "B" channel) is shown as series-connected to the output tubes, the author's original installation used UTC O-1 "Ouncers" and .5-mfd blocking capacitors in a shunt-fed arrangement. Response was equally as good, but usable line level suffered. T3 and T5 can be obtained with dual output windings, and one winding might then be employed as a feedback loop to improve response (as shown in dash lines in Fig. 5).

Monitor amplifiers are fed through S8, the monitor input key, and fader 8, monitor gain control (See Fig. 6). V14 (and V15 for the "B" channel) is a voltage-amplifier/phase-splitter driving twin 6V6's in push-pull. The outputs are fed through speaker-muting relay contacts to enclosed 12" utility speakers, and the sound is quite clean. The output is also connected to key S10 for feed to the stereo headphones. Fader 12, "earphone volume," is connected as a voltage divider, and its output will match almost any type of headphone. Notice from Fig. 6 that key S10 can be engaged to provide cuing by earphones. A further connection is made through key S9 to enable monitoring of an outside source such as a tape-recorder output.

Power Supply

The power supply (Fig. 7) employs the standard full-wave rectifier. The voltage-divider output serves the dual function of acting as a bleeder while providing the operating voltage for all relays in the system. (The only relays the parts bin provided were the high-resistance, low-current type.) Arcing is suppressed by .1-mfd capacitors across the relay-control contacts of all switches. Power to the consolette is furnished from the power supply by a twelve-conductor cable through Jones plugs.

Construction

The front panel is constructed from a 12¼" x 17" sheet of ⅛" aluminum shaped as shown in Fig. 8. No detailed panel layout is given, because hole sizes and locations will depend on the specific components used. Care must be taken to provide enough clearance for the rear of the switches where they approach the first row of tubes (Fig. 2). We used the tube layout in Fig. 9. Of course, the builder may

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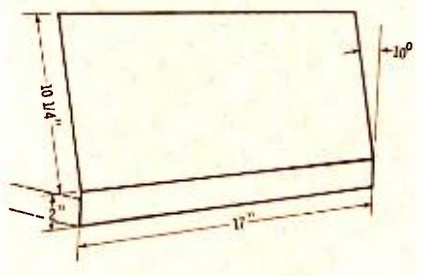

Fig. 8. Dimensions for bending the panel.

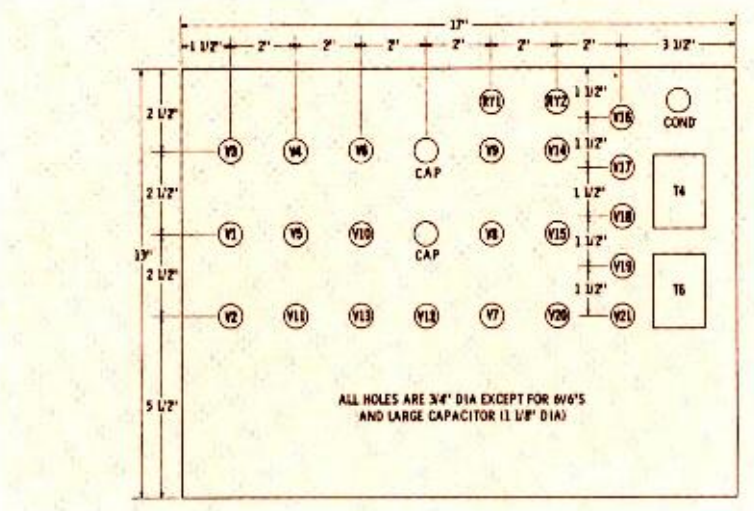

Fig. 9. Typical tube and transformer layout for the portable stereo consolette.

THE MONTREUX TELEVISION SYMPOSIUM

by Elliott P. Fagerberg, BE Consulting Author, Geneva, Switzerland — A complete report on an international gathering of television experts.

Montreux, Switzerland, May 24-28—Space satellites for telecasting and color TV in Europe were highlighted at the Fourth International Television Symposium and Equipment Exhibition here this week. Considerable attention was also given to "Television in Emerging Countries" and to "Industrial, Biological, and Medical Applications of Television." Climaxing the biennial meeting was the presentation (Fig. 1) of Symposium Citations for outstanding contributions to TV.

In a survey of the most promising technical developments of the next decade, Dr. George H. Brown of RCA stressed the value of space satellites for relaying color TV programs.

Dr. Walter E. Gerber, discussing world standards, pointed out that nearly all of mankind could watch TV programs relayed by a single medium-level satellite, since 90% of the world's population inhabited a relatively compact contiguous area (Fig. 2). He also emphasized the increasing number of satellite TV transmissions (Fig. 3).

Speculating on the future of TV, Prof. Werner Nestel, Telefunken (Ulm, Germany), declared that "satellite use would sharply increase when an electronic standards converter becomes operational." According to Prof. Nestel, such a converter has been developed in Great Britain. This equipment, which converts the 625-line standard to the 405-line standard, embodies a frame-storage converter that can also convert 525 lines, 60 frames per second into 625 lines, 50 frames per second, and vice versa.

Maurice Oudin, of the French radio and television organization, discussed the problems and advantages of using satellites for telecasting. Mr. Oudin explained that TV transmissions by satellite, although more rapid, were also more expensive than those by purely terrestrial techniques. He also pointed out that a time lag of several seconds, especially if the satellite was on an east-west orbit, might offset advantages such as (1) the facility of simultaneous worldwide transmissions, (2) possibilities for both indirect and direct spot news broadcasts, and (3) exchanges of national news programs on a daily basis. The French engineer called attention to the 45% increase in noise which results from slight atmospheric disturbances, as well as the high noise-to-signal ratio inherent in satellite telecasting.

From an economic viewpoint, Mr. Oudin added, the wide band required for telecasting is disadvantageous since it reduces the profitability of satellites for two-way telephone circuits. The economic disadvantage may be reduced, however, by using navigational satellites for both monochrome and color TV programs.

Underscored by several as the basic requirements for satellite TV systems were (1) flexibility and (2) adaptability for liaison with earth stations and with other space stations.

Kevin Corrigan, manager of ABC's Worldvision Network, presented a film report of the launching of Comsat's Early Bird, plus highlights of the Worldvision symposium held during the NAB Convention at Washington, D. C., in March 1965.

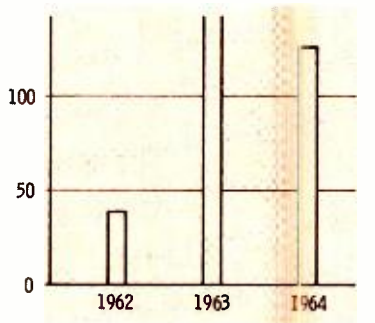

Fig. 2. Distribution of population as it might be viewed from the satellite.

Color TV for Europe

Not surprisingly, the "hottest" subject of discussion at the symposium was the problem of a color TV system for Europe.

Prof. Dr. Richard Theile, Direc-

Fig. 1. Honored were (l to r): Dr. Richard Theile (Germany), Dr. Vladimir Svoboda (Czechoslovakia), Dr. Johan Haantjes (Holland), and Dr. George H. Brown (United States).

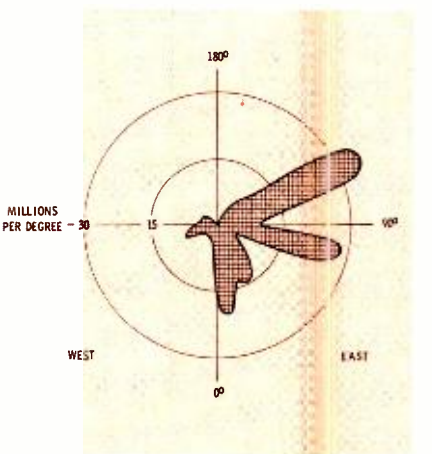

Fig. 3. Satellite transmissions on rise.

tor of the Institut Für Rundfunktechnik (Munich, Germany), in his lecture on "Compatible Color Systems, with Special Reference to Different Subcarrier Modulation Methods," compared the PAL (Phase-Alternation-Line) system with other techniques.

M. Chauvierre, Videon Laboratories (Paris, France), aroused considerable debate when he asserted that mask tubes for color TV should be replaced by a more efficient system. In his exposition of an experimental method of eliminating line lag in color TV using the SECAM process, the French engineer explained that, in tests with a four-tube decoder, trinescope receivers had proved more reliable than cathode tubes.

Dr. W. Bruch, Telefunken (Hanover, Germany), in his lecture on the PAL system, declared that the German technique was "doubly compatible." Telefunken's scientist explained that the PAL system, which uses a monochrome camera with a special tube, is only 35% more expensive for color than for black-and-white transmissions.

Responding to a question from a symposium participant, Dr. George H. Brown (RCA) said that, although the PAL system has many advantages, it unfortunately necessitates receivers that are expensive. Dr. Brown stated that his personal preference was for a system which embodied a subcarrier with FM phase modulation. He recommended that European equipment manufacturers undertake cooperative research which should enable them to agree on a common system possessing the virtues of all competing techniques and none of the flaws.

Pointing out that standards conversion is "undesirable from the producer's point of view," Dr. Walter E. Gerber, Swiss television expert, expressed the opinion that a uniform world-wide standard—of approximately 600 lines, 30 frames per second and 55 fields per second —could be achieved. Referring to the problem of "flicker," Dr. Gerber insisted it should not be solved by using unusually wide bands for TV transmissions.

The Future of Color

There was general consensus among symposium attendees that the economic factor is the crucial element in the future development of color television.

In the USA, where consumer purchasing power is high, color TV is expanding rapidly. It was envisaged that 2,000,000 new color receivers would be installed in American homes during 1965. Dr. Brown underscored that ". . . in the United States . . . , at present, nearly four million homes have color receivers, all major networks are broadcasting in color, and receiver production can scarcely meet demand. With increased production and growing industrial competition, set prices have decreased sharply." Dr. Brown also called attention to the fact that ". . . Japan and Canada are already evolving color-TV industries, and Europe and Russia have both determined to establish color service. Commercial transistorized small-screen color-television receivers are being introduced in Japan and the United States this year." Prof. Werner Nestel insisted, however, that in Japan, as in most other countries of the world, consumer buying power was not high enough to assure greatly expanded use of color-TV receivers. He said: "In my opinion, four conditions must be fulfilled before . . . color television has reached the breakthrough mark: (a) Transmitter and receiver design must mature, (b) there must exist a certain saturation of monochrome sets, (c) the income of the population must be in reasonable relation to the price of color TV sets, and (d) the entertainment value and length of color programs must provide an incentive.

Henry Benaroya, managing director of Telicolour Ltd., told the symposium that his firm, in collaboration with the Rank Electronic Tube Division, was developing a technique which will make possible the conversion of monochrome equipment at about 20% of the cost of other systems. He added that ". . . in broadcast studios, the existing black-and-white equipment can be converted rapidly . . . to the Telicolour system at an additional expense of about one-third the cost of existing equipment."

Genevan expert Georges Valensi, a TV pioneer who offered the principle of "double compatibility" in 1933, announced his current research on economical land-line transmission in cables carrying hundreds of coaxial circuits. He said his system includes a chrominance-encoding technique he first demonstrated in 1956.

Dr. Brown declared: "One of the most significant recent advances in color broadcasting equipment is the four-tube camera which has a luminance channel on a par with the best black-and-white cameras. Work on camera tubes with electrostatic instead of magnetic focusing and deflection may lead to lighter-weight, more easily handled, and simpler color and black-and-white cameras." The RCA expert emphasized that more versatile magnetic tapes are being developed, with higher resolution and greater wear resistance. He likewise foresaw integrated circuitry for color TV receivers and broadcasting equipment, conversion of color television from analog to digital transmission, and flat-screen TV displays.

Exhibits and Papers

Jean L. Delvaux, French Thomson-Houston (Paris), explained the operation of his firm's flying-spot scanning system. This scanning equipment, exhibited at Montreux, is used for both films and transparencies. Fully transistorized, the apparatus comprises a remotely controllable device for moving transparencies and slides.

Prof. Miroslaw Bano, Czechoslovakian Radio and Television Research Institute (Prague), reported on the "Optical System of an Experimental Color TV Camera." Jean Cayzac, Electronics and Applied Physics Laboratories (Paris), explained the "Operation of 4-Micrometer Infrared Television."

Walter E. Turk, English Electric Valve (London), surveying the range of existing image orthicons, traced their evolution from the 5820 through the 3" field-mesh types to the 4½" tube, with special reference to color adaptability. Mr. Turk indicated new techniques may replace camera tubes. His firm exhibited its new line of image orthicons and other tubes.

Prof. Werner Nestel, in predicting that "about 90% of TV programs will soon be transmitted from magnetic tape," underscored the high quality of taped color broadcasts. Similarly, Dr. Brown

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EIMAC

four-cavity amplifier klystrons pass the 33,000 hour mark at WWLP-TV Springfield, Mass.

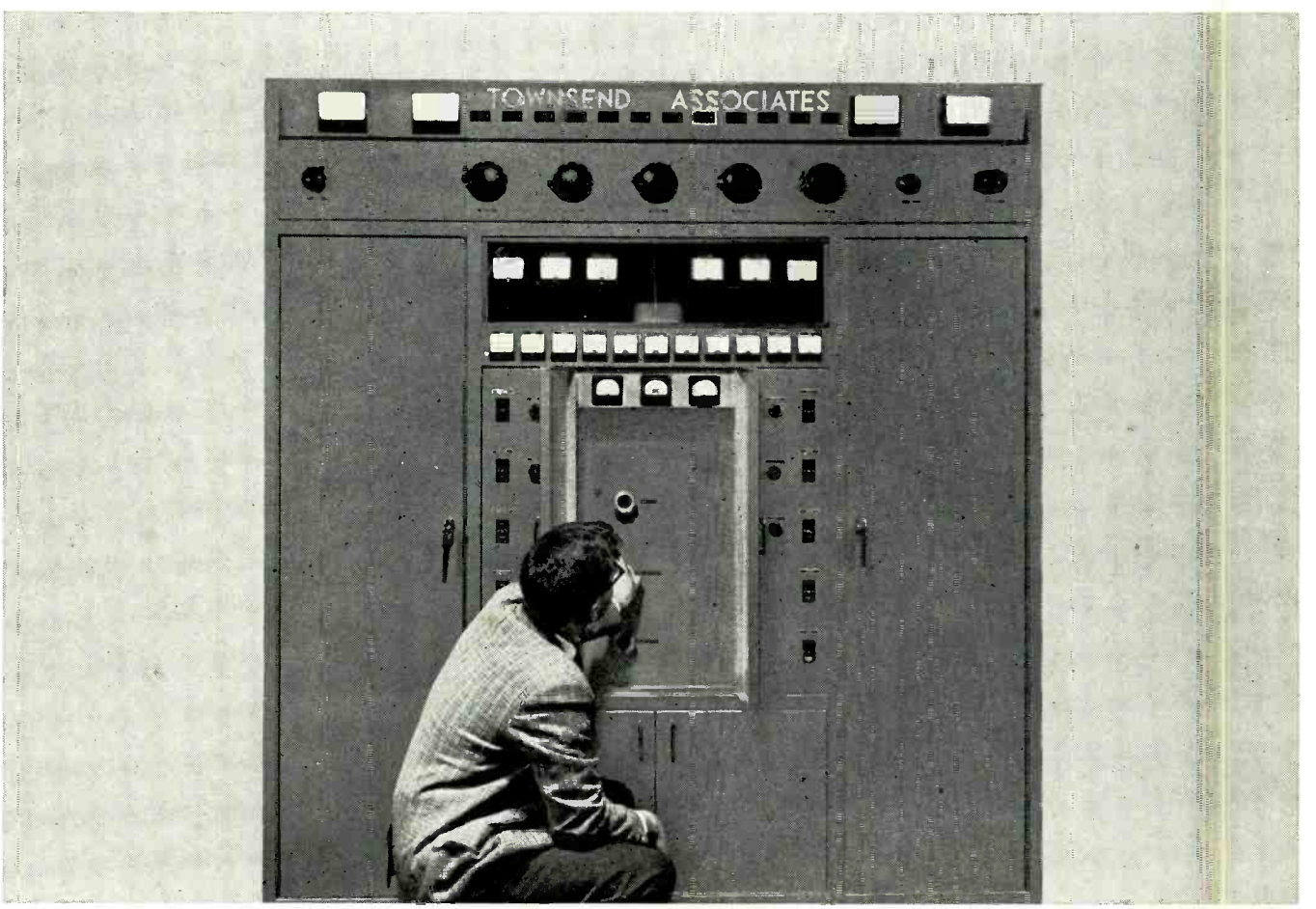
The new generation of UHF klystrons is now time tested with two Eimac type 4KM100LA power klystrons. These two tubes have been in use for the past 2½ years at Station WWLP-TV in Springfield, Mass., with a total hours of operation now exceeding 33,000 hours! The two Eimac tubes installed in a 25 kilowatt TOWNSEND ASSOCIATES transmitter are operating without change in their original characteristics. Five other TOWNSEND ASSOCIATES transmitters are now in service using the same series of Eimac klystrons — with a history of no failures. Reliability, economy of operation, and ease of maintenance is now a reality. Experience tells the story. If you're in need of really dependable tubes for broadcast transmitters, contact Eimac's Microwave Division. We'll send you more data immediately.

4KM100 SERIES TYPICAL CHARACTERISTICS

4KM100LA (470-610 Mc)
4KM100LF (590-720 Mc)
4KM100LH (720-890 Mc)

Output power	25	kW
Drive Power	20	W
Beam Voltage	16	kVdc
Beam Current	3.82	Adc
1 db Bandwidth	8	Mc
Heater Voltage	26	Vdc
Heater Current	11.5	Adc

EIMAC — a division of Varian Associates
San Carlos, California



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Studio Acoustics

(Continued from page 15)

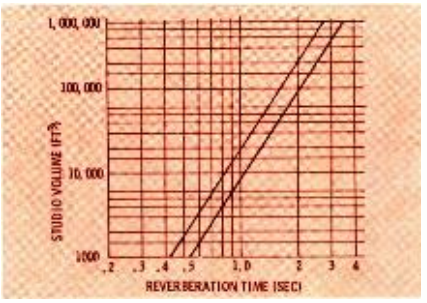


Fig. 2. Graph relating studio volume and recommended reverberation-time range.

quired for a sound to decay 60 db to threshold level. If it is much too long, a discernible echo will result. If it is much too short, one feels depressed by the resulting deadness of sound. Since Sabine's initial experiments 70 years ago, numerous investigators have carried out subjective tests and objective measurements to determine optimum values of reverberation time. The accepted range of values for use in broadcasting is shown plotted against studio volume in Fig. 2. These are intended for monaural systems; the optimum values for stereo may be somewhat longer. Reverberation time varies with frequency and with room occupancy. The quality of studio acoustics is closely dependent on the frequency variation. Typical curves for good sound quality are shown in Fig. 3.

The approximate reverberation time can be calculated. The simplest formula to use is Sabine's:

$$R.T. = \frac{V}{20\ KA}$$

Where,

R.T. is the reverberation time in seconds,
V is the room volume in cubic feet,
K is the average absorption coefficient, and
A is the surface area in square feet.

The initial step in the design is to establish the size and shape of the studio. In a small room it is very difficult to avoid objectionable reflections, which cause resonant modes or standing-wave patterns, dead spots, and poor sound diffusion. The effect is aggravated by incorrect room dimensions, the poorest being a cube shape. In such a case bass voices boom, and distortion occurs at higher frequencies also. In order to space the low-frequency modes as evenly as possible throughout the band, the optimum room proportions are usually near 1.6:1.25:1. At least one dimension should be 16′ or more, and the volume should be at least 1500 ft³.

Reverberation time can be controlled most effectively by the correct choice and placement of sound-absorbing materials. A completely uncarpeted floor and a ceiling covered with acoustical tile produce

Fig. 4. Treatment of surfaces in small studio gives desired sound properties.

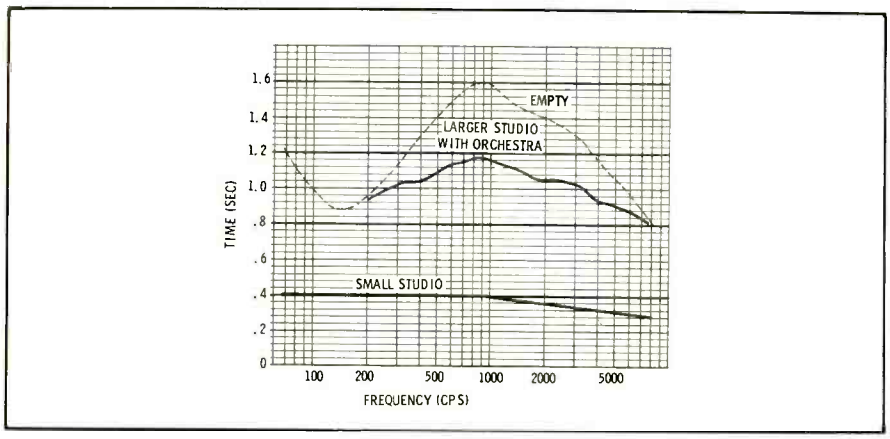


Fig. 3. Reverberation time depends on size and occupancy as well as frequency.

poor results. Instead, the materials should be broken up and applied to smaller areas. It is often necessary to change the locations, quantity, or types of materials used in order to optimize the acoustic performance.

A typical small studio is shown in Fig. 4. It is 13′ x 19′ x 9′ 6″ and is suitable for talks or a very small orchestra. One 19′ wall has panels of ½″ plywood projecting 2″ and interspaced with two types of perforated panels. These have an asbestos-cement facing and glass-wool backing. The end walls employ a staggered arrangement of perforated and unperforated panels.

Irregular boundary walls may help a little in breaking up troublesome reflections. Concave surfaces cause focusing and therefore must be avoided. Considerable improvement is possible if the microphone is directional and is positioned so that its response to reflections is minimized. A very small studio or booth presents severe acoustic problems if it is to be used for stereophonic discussions or interviews. Some FM stations conduct these in two separate rooms to achieve optimum microphone placement and to avoid echoes.

Fig. 5. Automatic frequency-response recorder can measure reverberation time.

Measurements

The severity of a noise problem can be assessed quickly using a palm-sized sound meter. The "A" weighting curve of the filter should be selected so that the meter's response approximates that of the human ear, especially when low sound levels are being measured. Readings of 15-20 db, 25-30 db, and 40-45 db would correspond with the curves of Fig. 1. For a more detailed study, a precision sound-

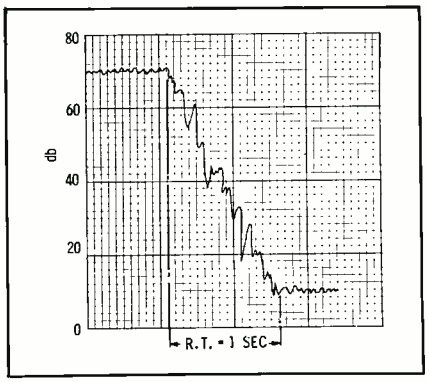


Fig. 6. Typical decay curve for a pure tone source shows reverberation time.

level meter and octave analyzer should be used.

Reverberation time may be measured using an automatic frequency-response recorder similar to the one shown in Fig. 5. The oscillator output is pulsed and fed to an external power amplifier and speaker system of high quality. The oscillator frequency may be varied or warbled at a low audio rate to smooth out the decay curve. A typical recording of a single pure tone is shown in Fig. 6.

Many other types of measurements are possible, but their cost usually is not justifiable in a commerical operation. The techniques menioned above are normally adequate and eliminate much guesswork. Moreover, acoustics is not an exact science, and theoretical predictions do not always agree with measured results.

Conclusion

The basic principles of studio sound conditioning have been outlined. The inclusion of complete design information was obviously not possible in this introductory article. On most projects it is advisable to obtain the advice of an acoustics consultant. ▲

Further practical information may be obtained from various textbooks and publications including:

Handbook of Noise Control—C. M. Harris (McGraw-Hill)

Acoustics—L. L. Beranek (Wiley)

Journal of the Audio Engineering Society

Some plain talk from Kodak about tape:

Noisemanship...modulation noise... and how to get extra dbs. of silence

Noisemanship is a very hip subject. The more noise your sound system has, the muddier your reproduced signal. Which brings up the subject of defining tape noises, how they occur, how they are measured, and what can be done to reduce them. Like at the start of Salome's dance, there's a lot to uncover.

Starting at the beginning

Kodak tape is mighty quiet when it leaves the factory. Because of special milling techniques and our now-famous "R-type" binder, the gamma ferric oxide particles are more uniform in size and shape and more uniformly dispersed than was ever before possible. Result: a superior degree of magnetic randomness, and thus, built-in quietness. To make sure that the roll of Kodak tape you purchase is as "quiet" as possible, we also bulk erase each roll. By "randomizing" the particles' polarity in *all* dimensions, foreign signals picked up during manufacture are eliminated.

This fairly pristine state doesn't last long. Once the tape has been subjected to the erase field and record bias from your recorder, a certain degree of randomness is lost. So-called zero-signal noise results because a recorder's erase system is not as efficient as a bulk eraser. Whereas bulk erasers cause 3-dimensional decay of the remnant signal, an erase head causes decay in one dimension only—along the length of the tape. This explains why zero-signal noise is always higher than bulk-erase noise.

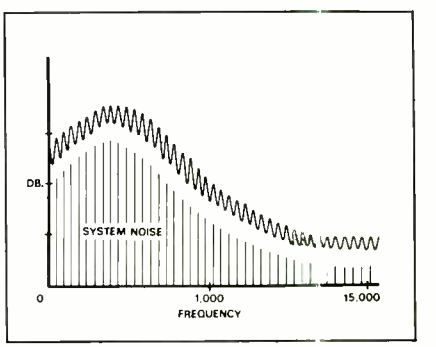
Blue plate special—noisewise

Noise in the presence of a recorded signal—modulation noise—is the real meat and potatoes of tape performance. Testing for modulation noise is a bit tricky, however, because both ac program and noise get mixed up in the amplifier. And if we are to determine the amount of noise in a system, it's imperative that we distinguish between one and the other. One way to do this is to use what our scientists refer to as a dc equivalent in r.m.s. milliamps of an ac signal.

Simply explained, we select the ac signal level that represents the practical limit for linear recording—2% third harmonic distortion. Then we apply a dc signal to the record head and increase the record current until it reaches the same level as that of the above ac signal. On the tape we have recorded a "zero frequency" program plus the modulation noise contributed by both equipment and tape. Since the reproduce amplifier filters out dc signals, only the modulation noise comes through, and this can be measured by an output meter.

Strike up the band pass

Final proof-of-the-pudding is to examine the total noise spectrum through band pass filters. Fun! One could, for example, measure the noise that comes through a 1-cycle band pass filter—even get a signal-to-noise ratio of about 115 db. But this really tells nothing about the tape's practical performance. For as the graph shows, there is much more noise in the lower frequencies than in the higher. For more meaningful evaluation, we specify two signal-to-noise ratios . . . one for the average low frequencies (20-1000 cycles at 15 ips) and one for the high frequencies (1000-15,000 cycles at 15 ips) . We are happy to report that Type 31A (Kodak's general-purpose/low-print tape) rates as much as 6.5 dbs better in the low frequencies and 1.5 dbs better in the high frequencies. At Kodak, "shhh" is the word.



TOTAL NOISE SPECTRUM

KODAK Sound Recording Tapes are available at most electronic, camera, and department stores.

FREE. New, 24-page, comprehensive "Plain Talk" booklet covers all the important aspects of tape performance, and is free on request. Write: Department 8, Eastman Kodak Company, Rochester, N. Y. 14650.

EASTMAN KODAK COMPANY, Rochester, N.Y.

Circle Item 14 on Tech Data Card

Magnetic Tape

(Continued from page 17)

Table 4. Minimum Signal-to-Noise

Tape Speed	Full Track	Two Track	Four Track
	Unweighted		
15 ips	50 db	45 db	not used
7½ ips	50 db	45 db	45 db
3¾ ips	46 db	46 db	45 db
	Weighted		
15 ips	58 db	53 db	not used
7½ ips	60 db	55 db	52 db
3¾ ips	57 db	54 db	52 db

drift in either direction of 14 dots per minute past a reference point for 7½ or 15 ips or 7 dots per minute on the 36-dot row for 3¾ ips.

Level

The standard recorded program level is such ". . . that recorded program material shall produce the same reference deflection on a Standard Volume Indicator (ASA Standard C16.5-1961) as that produced by a 400-cps sine-wave signal recorded at the NAB Standard Reference Level."

Frequency Response

Frequency-response limits for reproducing are shown in Fig. 4. The recorded-response limits are shown in Fig. 5. "The recorded response is defined as the difference between the overall record-reproduce response and the reproduce response from an NAB Standard Test Tape of the same speed." "The measurement of recorded response shall be made at the same level as that on the NAB Standard Test Tape. Normal operating bias shall be used."

Signal-to-Noise Ratio

Minimum weighted and unweighted signal-to-noise ratios are given in Table 4. Unweighted noise is measured over the frequency range of 20 to 20,000 cps with a measuring system having response uniform within ±.3 db from 30 to 15,000 cps. Response shall be 3 db below the 400-cps level at 20,000 cps and shall fall 12 db or more per octave above 20,000 cps. The measurement is made using a tape recorded with bias

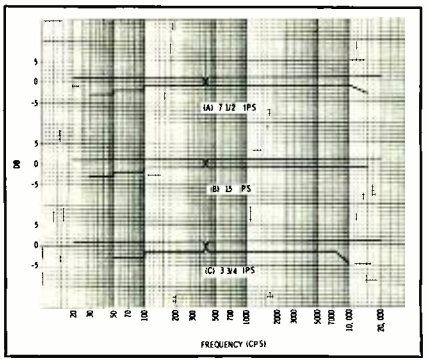


Fig. 4. Reproducing frequency response.

but without signal. The reference level at 400 cps is the NAB Standard Reference Level, the meter conforms to ASA Standard C16.5-1961, and the measuring system has a full-wave rectified average measurement law.

The weighted noise measurement is designed to give an indication of the "subjective signal-to-noise ratio." It makes use of a frequency response similar to that of the ear at low volume levels. It is measured using the weighting curve in Fig. 6. The measurement technique is similar to the one just described. "Calibration is made (with the weighting network inserted) at 1000 cps using the 1000-cps Standard Level which is included . . . on the NAB Standard Test Tape."

Distortion

Total harmonic distortion for the record-reproduce system must be less than 3% rms when a 400-cps sine wave is recorded so that a reproduce level 6 db above the NAB Standard Reference Level is obtained.

Flutter

Flutter, like noise, has limits specified on both a weighted and unweighted basis. The measurements are made while playing back a 3-kc recording that is essentially flutter free. The measurement is prescribed as follows:

"Unweighted flutter content shall be measured over the frequency range of .5 cps to 200 cps. The response of the measuring system shall be 3 db down at .5 cps and 200 cps, and falling at a rate of at least 6 db per octave below and above these frequencies, respectively. At low frequencies where the meter pointer follows the waveform, the maximum de-

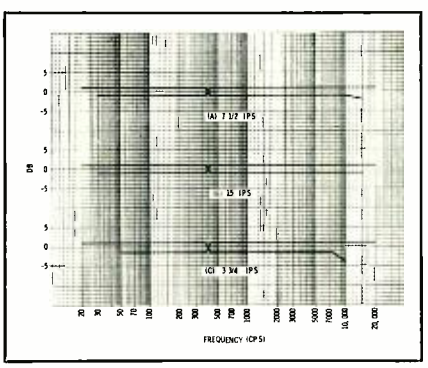


Fig. 5. Recording frequency response.

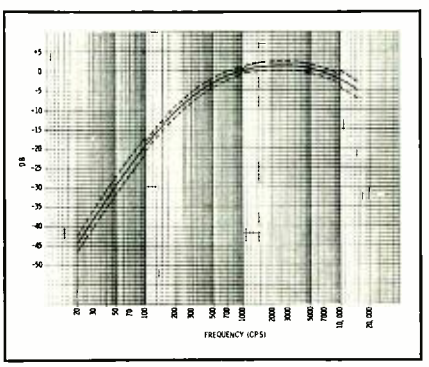


Fig. 6. Weighted noise measurement curve.

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3. Solid state rectifiers.
4. Extended operating console for metering and control.
5. Unequaled compactness — only 69″ high, 67-7/16″ wide, 32″ deep.
6. No external power components.
7. Remote control circuits incorporated.
8. Designed for automatic operation.
9. Loading control of power output.
10. Automatic tuning of PA.
11. Variable vacuum capacitors in tuning and loading.
12. All components accessible; easy maintenance.

It's Collins' new 820 E/F-1 5/10kw AM transmitter. Contact your Collins Sales Engineer or write Broadcast Communication Division, Collins Radio Company, Dallas, Texas for descriptive brochure.

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Circle Item 16 on Tech Data Card

Table 5. Maximum Flutter

	rms Flutter (Unweighted)	(Weighted)
15 ips	.15%	.05%
7½ ips	.20%	.07%
3¾ ips	.25%	.10%

flection shall indicate the rms value. The indicating meter shall have the dynamics of the Standard Volume Indicator (ASA C16.5-1961), a full-wave rectified average measurement law, and shall be calibrated to read the rms value of a sinusoidal frequency variation."

Readings are to be made at random intervals throughout the reel of tape. The average of the peak readings is observed, and peaks occurring less frequently than 3 times in a 10-second period are disregarded. Weighted flutter is measured with a measuring system having the response shown in Fig. 7. The maximum permissible values of flutter are given in Table 5.

Table 6. Frequency Response Test Tones

15 ips 0 db	7½ ips −10 db	3¾ ips −15 db	1⅞ ips −15 db
15 kc	15 kc		
12 kc	12 kc		
10 kc	10 kc	10 kc	
7.5 kc	7.5 kc	7.5 kc	
5 kc	5 kc	5 kc	5 kc
2.5 kc	2.5 kc	2.5 kc	2.5 kc
1 kc	1 kc	1 kc	1 kc
750 cps	750 cps	750 cps	750 cps
500 cps	500 cps	500 cps	500 cps
250 cps	250 cps	250 cps	250 cps
100 cps	100 cps	100 cps	100 cps
75 cps	75 cps	75 cps	75 cps
50 cps	50 cps	50 cps	50 cps
30 cps	30 cps	30 cps	30 cps

Crosstalk and Separation

For two- and four-track monophonic systems and four-track stereophonic systems, the minimum adjacent-track signal-to-crosstalk ratio between 200 and 10,000 cps is 60 db, measured without bias applied to the unrecorded tracks.

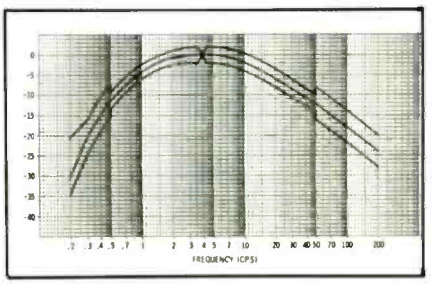

Fig. 7. Flutter measurement weighting.

A minimum channel separation of 40 db in the range 100 to 10,000 cps is specified for stereo systems; this measurement is made with bias applied to both tracks.

Limited-Performance Systems

A special section of the Standard recognizes the use of lightweight, portable recorders and sets minimum performance requirements for them. Standard tape speeds are 7½, 3¾, and 1⅞ ips, measured by the method previously described. Unweighted flutter must not exceed .5% rms, measured by the same method as for high-performance systems. The Standard Recorded Program Level for these systems is the same as previously stated.

The reproduce-system response when

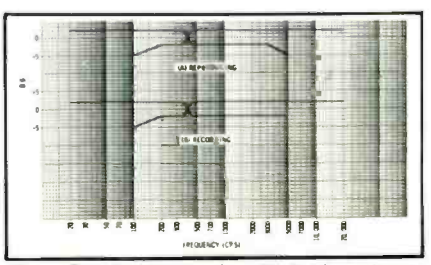

Fig. 8. Response for limited systems.

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playing "an appropriate NAB Test Tape" must fall within the limits shown in Fig. 8. The recorded response (defined previously) must also fall within these limits. This response is measured under the same conditions as for high-performance systems. The standard recommends that the response be attenuated 6 db per octave below 100 cps to improve speech intelligibility and above 5 kc to reduce the possibility of tape overload at high frequencies at lower tape speed.

The unweighted signal-to-noise ratio is measured by the method already described. Minimum ratios are 46 db for full-track recordings, 43 db for two-track recordings, and 40 db for four-track recordings.

Standard Test Tapes

There are four NAB Standard Test Tapes, designated 15 NAB 65, 7½ NAB 65, 3¾ NAB 65, and 1⅞ NAB 65. The initial number of each tape designates its speed in ips. All of them are recorded across the full tape width, and each contains five parts, as follows:

(1) A 60-sec azimuth-adjustment tone of 15 kc for 15 and 7½ ips, 10 kc for 3¾ ips, and 5 kc for 1⅞ ips, recorded at the same level as the corresponding frequency in the frequency-response recording. The recorded azimuth is at 90° ±1′ to the tape edge,

(2) A 20-sec, 400-cps sine-wave tone recorded at the NAB Reference Level for 15 ips, 10 db below that level for 7½ ips, and 15 db below the reference level for 3¾ and 1⅞ ips,

(3) 12-sec frequency-response test tones as listed in Table 6. Each signal is preceded by a voice announcement. Tone levels would produce constant output when played on an Ideal Reproducing System; levels on the tape are measured during manufacture on a system of known response characteristics.

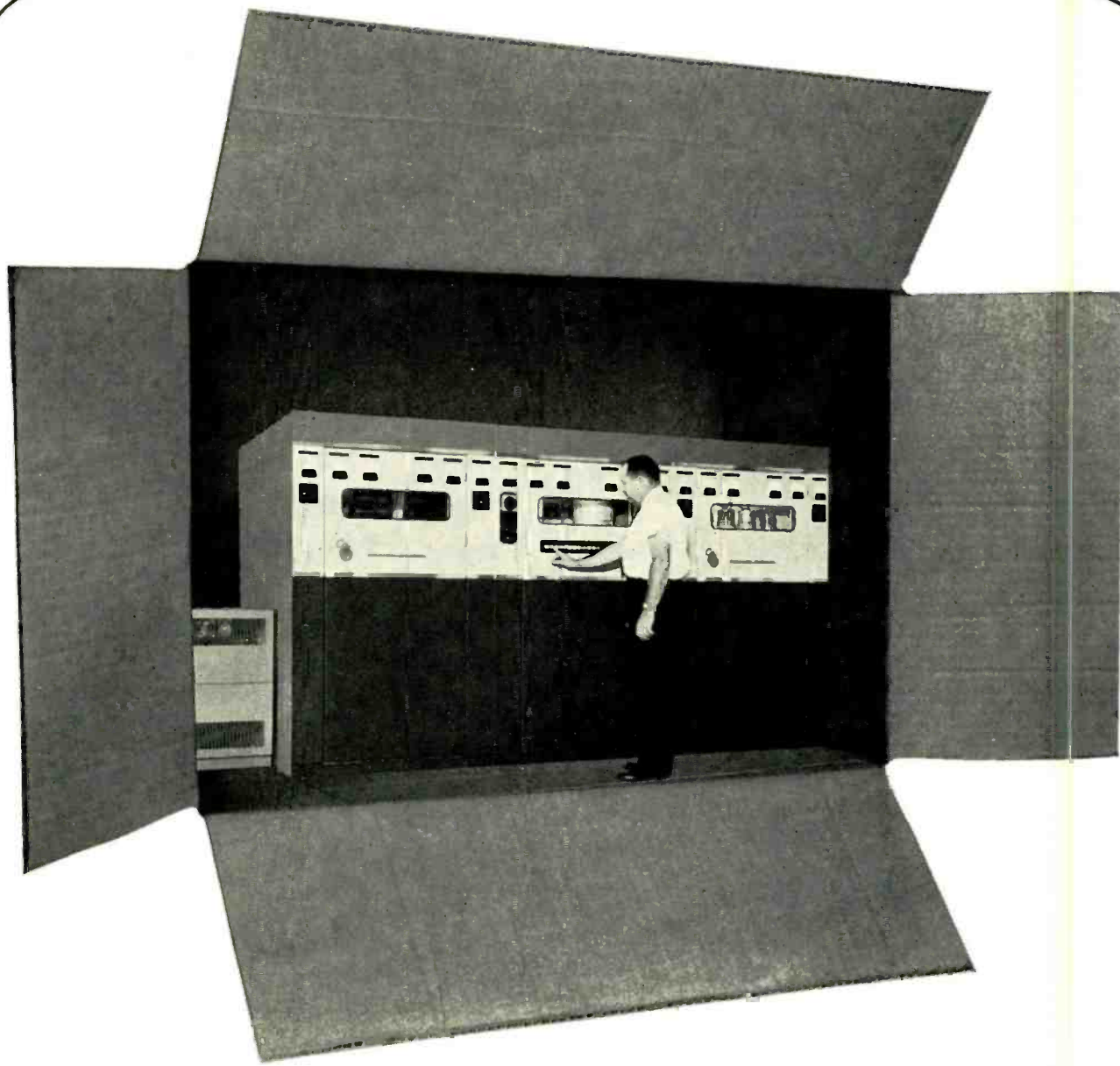
(4) A 20-sec 400-cps sine-wave tone recorded at NAB Standard Reference Level,

(5) A 1000-cps sine-wave tone recorded at NAB Standard Recorded Program Level.

Conclusion

An attempt has been made to present the significant points of the NAB reel-to-reel tape recording and reproducing standard. Other portions of the standard further amplify or qualify the information given here. Annexes define an "Ideal Reproducing System" and a "Primary Calibrated Reproducing System."

Copies of the complete standard may be obtained by writing to the Engineering Department of the National Association of Broadcasters, 1771 N Street, N.W., Washington, D. C. ▲



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☐ overall efficiency: 62% or better ☐ plate efficiency: 80% or better ☐ power consumption: 120 kw @ 100% modulation, 92 kw @ 30% modulation, 82 kw @ 0 modulation ☐ completely self-contained, including blower: compact design assures minimum installation cost and uses only 62 sq. ft. of total floor space.

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Circle Item 20 on Tech Data Card

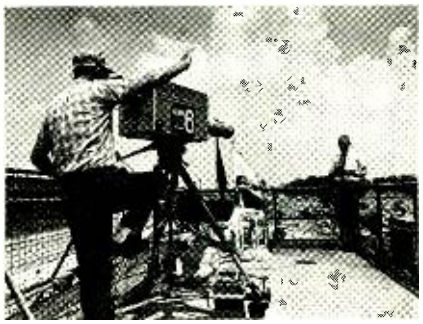
Line Services

(Continued from page 19)

form similar to that shown in Fig. 1. The entire path of the signal within the POC is shown directly on the order card, and the input and output jacks are identified by numbers corresponding to the loops from the program source and to the transmitter, respectively. In the event of failure of any circuit component within the POC, the path diagram provides a simple means of locating the offending part, which may then be bypassed by means of patch cords or by changing a few simple connections. For the higher-service lines, another form is used which also includes a chart on which the actual measured frequency response of the circuit is recorded for reference.

When planning for the line services required for a new radio or television station, contact is usually made through the sales and engineering departments, and, through a series of conferences, agreement is reached on solving the specific demands of the new broadcaster.

As an example of how the line-service companies will work to accommodate the demands of special events, Indiana Bell installed approximately 16,500 feet of cable to provide the basis for the closed-circuit telecast of the Indianapolis 500-Mile Race originated by a local television station. Each cable contains from 4 to 24 video pairs; the largest cable has 24 video pairs and 300 regular telephone wires. The installation provides the equivalent of 870 miles of new circuits, making possible the use of 12 separate camera locations around the track. Both picture and sound are fed from each of these camera positions to either the main remote TV studio



One camera position at 500-mile race.

located on top of grandstand B or to the control room in the paddock. Two portable microwave systems provide the link from the Speedway, located west of Indianapolis, to the TOC downtown. The extent to which Indiana Bell accommodated the principals involved in telecasting the event is not entirely divorced from the sizeable revenues which will be received over the ensuing years, but common-carrier people are almost universally concerned about doing a good job for any customer.

Summary

In day-to-day operation, the station engineer often falls into a rather complacent attitude regarding the services that may help improve the sound or the versatility of his station. By examining the many services available, he can better utilize them in planning new installations and in updating old ones. Until he cares enough to examine fully how he may benefit from a common-carrier system, the chief of a local 250-watt AM or the technical director of a multi-station combined radio and TV operation may be depriving himself of many direct and indirect services utilizing a vast and versatile communication system. ▲

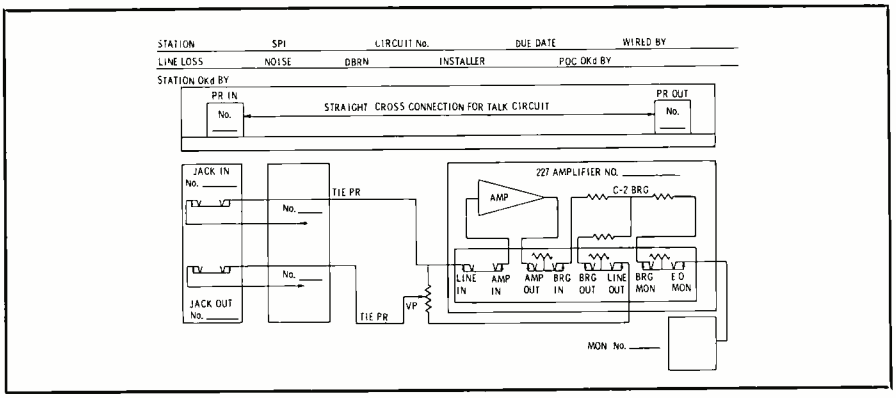


Fig. 1. Order card similar to this contains all essential circuit-routing information.

Left, W. Hansher; right, R. E. Christie, Manager G-E Visual Communications Products.

G-E UHF Klystron Transmitters Win—Again.

The event pictured above is noteworthy.

William S. Hansher (left) Vice President in Charge of Engineering, Taft Broadcasting Company, is signing a contract with the General Electric Company for a new 50 KW second-generation UHF Klystron Transmitter.

The transmitter will provide WNEP-TV, Scranton-Wilkes Barre, Pa., with an effective radiated power in excess of one megawatt.

Almost a decade ago, WNEP-TV went on the air with a first-generation G-E UHF Klystron Transmitter whose 45 KW output provided the country's first ERP of over one megawatt.

The noteworthy point in this contract signing is that WNEP-TV's success with the first-generation transmitter, and the advanced design of the new unit, won the Taft order for General Electric.

This is the kind of customer acceptance which also won both first and second-generation G-E UHF Klystron Transmitter orders from WEEK-TV, Peoria, Ill., and WETA-TV, Washington, D.C. No other manufacturer can claim such a record of customer acceptance for high-power UHF klystron transmitters. For details on television's most-accepted UHF klystron transmitters, contact your G-E Broadcast Equipment Representative, or: General Electric Company, Visual Communications Products, #7-315 Electronics Park, Syracuse, N.Y., 13201. GE-19

Visual Communications Products

GENERAL ELECTRIC

Electronics Park, Syracuse, New York

Circle Item 22 on Tech Data Card

Portable Stereo

(Continued from page 22)

have to modify this slightly to fit the components at hand.

Construction was aided by the use of turret sockets where possible and by the installation of numerous tie strips under the chassis. Shields are used on all miniature tubes. Belden 8450 cabling was employed because of its small outside diameter and its rigidity. Where possible in the under-chassis wiring, DC and filament-supply wiring were harnessed together away from all other components. Holes were drilled and grommets inserted beneath the faders to facilitate dressing of leads to keys and mixers.

Transformers T3, T5, and T7 are mounted beneath the chassis near their respective circuitry, as are several large decoupling capacitors. The plug-in speaker-muting relays are on the top of the chassis; space is left near them for the installation of small transformers to accommodate low-impedance microphones.

As mentioned earlier, all inputs and outputs appear on the rear apron. Microphone, turntable, FM, and tape inputs and the cathode-follower and headphone outputs appear at phone jacks; the dual-channel monitor outputs, the output of the cue amplifier, the excitation for all relays, and the 600-ohm balanced outputs all appear on barrier strips.

Operation

The first step after construction was completed was to age all tubes for several days and then begin to balance the unit for stereo. We were ready to insert a balancing control in the program preamplifier but found instead that switching tubes around did the trick. The sequence followed in balancing was as follows: First the VU stages were balanced, using a monophonic tone fed to the grids of both VU amplifiers. Once this stage was set, we worked back through the cathode-follower, the program preamplifier, and the turntable and microphone preamps, always tying the feed to both grids of the stage being balanced. This procedure seemed to work well, and, although the unit has been in operation for several months, it has needed no further adjustment.

The next step was to determine the desired output level. After arriving at an arbitrary figure of one volt for zero VU, we connected an audio VTVM at the cathode-follower jacks, and the VU meters were adjusted to read a corresponding zero VU. This was done by varying resistance RS (See Fig. 5). The line amplifier, as mentioned previously, is independent, needs no balancing, and can be varied from —20db to +10db with the chassis-top level controls.

The system of which this unit is the heart consists of three automatic turntables, three stereo tape recorders, an FM tuner, and one microphone. Turntables and tape decks have switches installed in parallel with the remote relays for local control and audition purposes. The equipment is capable of fast starts, and production capability compares favorably with more elaborate professional gear. The system is being used with excellent results in the production of recorded programs for playback on two Midwestern radio stations. ▲

September 1965

We interrupt this magazine to bring you...

Late Bulletin from Washington

by Howard T. Head

NAB Seeks Relaxation of DA-Remote Requirements

The National Association of Broadcasters (NAB) is preparing a petition requesting that the Commission relax the present directional-antenna remote-control Rules, which require complete meter readings at the transmitter each day within two hours after switching to directional operation. This requirement has proved a burden, particularly for a station whose night pattern differs from its day pattern. The changing sunrise and sunset times throughout the year further complicate matters.

The request for relaxation will be based on successful experience at KQV, Pittsburgh, Pa., employing a new type of commercially available phase monitor which can be read by remote control; until the development of the new monitor, the only practical way of taking phase readings was to send a man to the transmitter. Since this instrument is now available, NAB will point out the technical feasibility of relaxing the requirement for daily visits to the transmitter.

AM-FM Nonduplication Deadline Postponed for Some

The Commission has postponed the effective date of new Rules requiring FM stations in cities having population greater than 100,000 to program separately from their AM affiliates at least 50% of the time (May 1965 Bulletin). The October 15 deadline has been changed to December 31, 1965. The extension of this deadline, however, applies only to slightly more than 100 FM stations which have asked for permanent exemption from the proposed new Rule; stations which did not request an exemption will be expected to comply with the October 15 deadline.

The Commission has announced that it expects to reach a decision on the outstanding exemption requests during September, to afford sufficient time to comply with the new December 31 deadline.

TV Receiving Antenna Improvement Program

Following recent studies by KIRO-TV, Seattle, and KSL-TV, Salt Lake City, which disclosed large numbers of television receiving installations not equipped with proper antennas, a campaign has been launched by the Association of Maximum Service Telecasters, Inc., (MST) and the American Institute for Better Television Reception, to acquaint both television dealers and the public with the need for adequate television receiving

antenna installations. The necessity for maintaining receiving antennas in proper condition is also stressed.

The studies at KIRO-TV and KSL-TV showed that an unexpectedly high percentage of television viewers did not realize the importance of installing and maintaining adequate receiving antennas, needed particularly for color reception. Perhaps even more serious, large numbers of television dealers were either likewise unaware of the problem or had not had the need made sufficiently clear to them. The present campaign is aimed at educating both the viewer and the dealer, and at encouraging development of receiving antennas that meet the requirements of individual installations.

FCC May Waive Filing Fees on Certain Applications

In recent instances involving floods and other natural disasters, the Commission has noted that reconstruction of broadcast facilities has required filing of formal applications normally subject to regular filing fees. In these instances, the Commission has announced favorable consideration to requests for waiver of filing fees. Applicants requesting a waiver must submit a statement to the Commission describing the circumstances and the damage which required the application to be filed.

Commission Concerned over CATV "Leapfrogging"

In a recent case in northern Alabama, the Commission has designated for hearing an application by a CATV operator for microwave facilities that would permit "leapfrogging" -- the bringing in of distant stations in preference to stations nearby (June 1965 Bulletin). In addition to the "leapfrogging" issue, the Commission also announced its intention to inquire into charges of economic injury to a local TV broadcast station, as well as conspiracy between the CATV operator and a broadcast competitor.

In a related action, the Commission has issued a policy statement which sanctions the acquisition of CATV systems by television broadcast licensees. The Commission stated that its inquiry had "not disclosed any substantial evidence of widespread abuses," but the right was reserved to take action in any specific case of abuse.

This latter policy action stemmed from an inquiry dealing with CATV system ownership only by television broadcast licensees; no such inquiries have been announced with respect to CATV ownership by AM or FM station licensees.

Howard T. Head...in Washington

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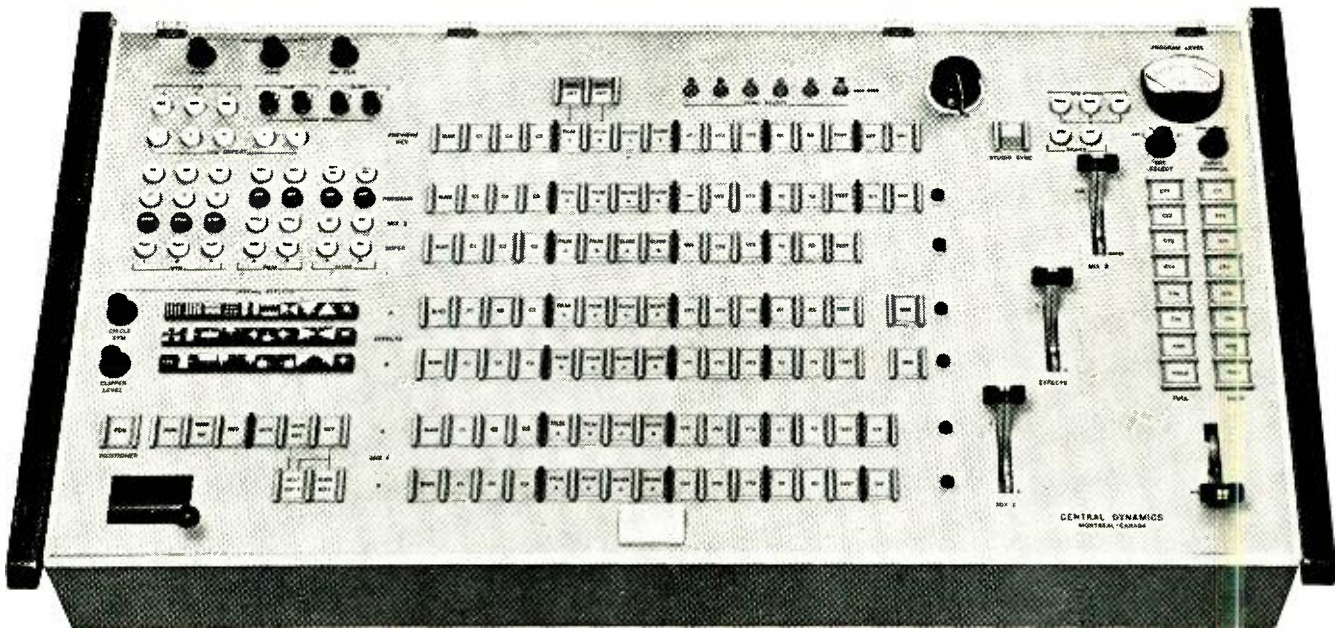

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Circle Item 25 on Tech Data Card

Television Symposium

(Continued from page 24)

Fig. 4. Among exhibitors from the USA.

stressed the trend toward solid-state recording equipment.

Visual Electronics' new solid-state equipment (Fig. 4) for recording color television on tape attracted interest, as did C. R. Webster's reading of the paper "A Simple Trouble-Free Quadruplex VTR System," which Steve Allen had presented at the NAB Convention.

Likewise of interest at the exhibition was the new Ampex color-TV tape recorder which had been unveiled at the NAB Show. Grant M. Smith discussed the equipment in a paper entitled "Design of an Optimized 625-line Color Television Tape Recorder."

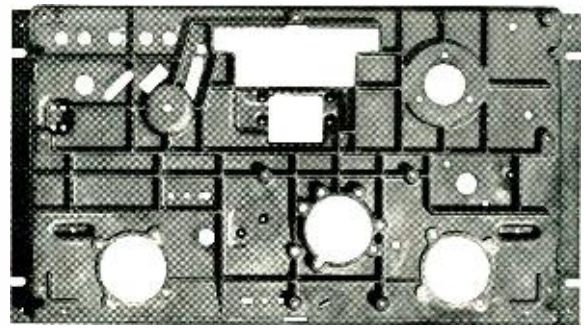
Transistorized Gear

New solid-state equipment was featured by many exhibitors and speakers at Montreux.

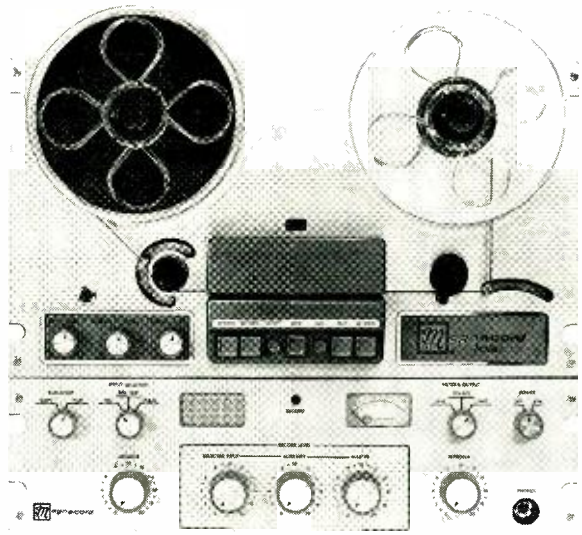
Much interest was aroused by a paper on Microwave Associates' solid-state 7000-mc equipment for remote broadcasts; C. R. Russel, G. A. P. Teasdale, and J. J. Tither presented the paper. One feature of this non-demodulation-equipped transmitter — employing kystrons, silicon transistors, and varactor diodes — is that it can be attached directly behind the antenna dish (Fig. 5).

At the exhibition's largest booth, Marconi Company, Limited

Fig. 5. Remote-program microwave unit.



DIE-CASTING

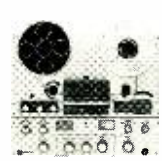


[RHYMES WITH LASTING]

■ Quality in a professional tape recorder has got to last. That's why a sturdy, solid die-cast main plate backs up famous Magnecord durability.

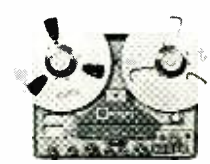
Only a solid die-casting can provide rigid support and stable alignment of assembled parts. Mounting holes and bases are molded in for perfect uniformity between each instrument, insuring precise location and smooth operation. This extra strength in a Magnecord reduces wear to a minimum, cuts down-time and lowers maintenance cost.

Casting about for a professional tape instrument that is broadcast-ready and stays that way? Write for our new brochure featuring the complete line of Magnecord recorder/reproducers.



Model 1021 $708

Model 1022 $788



Model 1028 $995

Model 1048 $995

Magnecord SALES DEPARTMENT
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Circle Item 26 on Tech Data Card

(Chelmsford, England) introduced its fully transistorized Mark V 4½" lightweight image-orthicon zoom camera. Marconi's engineer, Hendryk Mirzwinski, discussing "Automation of Master-Switching Systems," told the symposium that selection of a particular type of memory for such equipment depends upon the number of operations to be controlled. He explained that automated control may be introduced gradually; hence its installation is not necessarily expensive. Marconi exhibited their transistorized Type B-3720 semiautomatic master switching system, which affords video and audio shifts for up to twelve inputs, and switching—in sequence—of up to eight separate units from a memory device. It is suitable for either monochrome or color.

Other Products

The main exhibit of Thomson-Houston was the French firm's new TH T605 twin-use cine-television camera which allows shows to be filmed at the same time they are transmitted.

Another French manufacturer, Compagnie Generale de Telegraphie Sans Fil (CSF), showed a new 4-watt 800-mc portable UHF transmitter.

Sony displayed its PVC-101 CE-1A portable vidicon camera and its 120E VTR.

RCA, in a spacious booth, demonstrated its TR-4 and TR-5 tape recorders, as well as the latest cameras.

Videon, S. A. (Paris) had a full line of new transistorized components.

Tektronix International exhibited oscilloscopes, video monitors, and its new TV vector-scope.

Other products displayed include Erni Schwach Stromtechnik's new TV monitor receiver Mr 11-40, Weinch Engineering Company's precision coaxial devices, Boonton Electronics Corporation's Model 95A sensitive DC meter and 91D sensitive RF voltmeters, Sperry Electronics Company's microwave test instruments, Hoffman Semiconductor Company's 1-watt solar energy converter, W. Vinter, Limited's pan-and-tilt head Type 111, Wilcox Electric's completely compatible DME equipment, and Alto Scientific Company's 10-watt Altovue Pak transmitters.

J. C. Moll, Ediphor A. G. (Glarus, Switzerland) delivered a lecture on "Large Screen Projection and its Applications" in which he pointed out uses for background projection in TV studios. Mr. Moll discussed the comparative merits of projectors working with TV projection tubes mounted in an optical system (the Schmidt technique) and the Ediphor system which employs the dark-field control-layer principle.

A. Rother, Diemens and Halske (Munich, Germany), discussed his firm's experience with the YH 1020 traveling-wave tube in UHF TV translator service.

Roher Hibbard described Ampex's "new low-cost television system and recorder for CCTV applications."

Special Interest

Of particular interest to the numerous Asian, African, and Latin-American engineers attending the symposium was the paper of Saburo Oyama, Nippon Electric Co. (Tokyo), on "Receivers and Transmitters for Developing Areas."

Haruo Kondo, IAMCR (Tokyo), discussed "Television in Japan" after Prof. August Karolus presented "The History of Television."

Considerable discussion was provoked by Dr. George H. Brown's survey of "New Opportunities in biotechnology" as well as by Joseph Roizen's exposition of "Magnetic Video Recording in Radiology."

To round out the program, W. S. Sharps (London) and R. Pontillon of Thomson-Houston (Paris) presented papers on educational uses of television.

Ian S. Douglas (Melbourne, Australia) received the grand prize for the best paper offered at the Third Symposium in 1963.

End for This Year

This Fourth International Television Symposium, in which about 400 specialists participated, was concluded with awards for meritorious service. The Fifth International TV Symposium and Exposition is scheduled for May 1967 at Montreux. ▲

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Federal Electronics, Inc. (Subsidiary) / Vestal Parkway, Vestal, N.Y. / (607) Pioneer 8-8211

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NEWS OF THE INDUSTRY

INTERNATIONAL

TV for India

Consulting author P. U. Sukhadia reports from Bombay that plans are under way for the expansion of TV service in India. Present operations are limited to programing during the evening from stations in Delhi and New Delhi. Extended hours of service are to be inaugurated next year.

Planning is also in progress to establish new stations in such cities as Bombay, Calcutta, Madras, and Bangalore. These stations are envisioned for the 1966-67 period. Broadcasting in India is solely in the hands of the government, and negotiations are in progress between the government and some foreign firms concerning the procurement of equipment for the new stations.

Another problem is the manufacture of TV receivers. However, the Central Electronic Research Institute at Pilani (Rajasthan) has developed a low-cost receiver using Indian parts.

Montreal SMPTE Conference

New concepts in television engineering techniques and a display of new TV equipment will bring TV engineers from all parts of the world to the 98th SMPTE Technical Conference and Equipment Exhibit at the Queen Elizabeth Hotel, Montreal, October 31 to November 5. International discussion of some of the critical problems confronting the TV industry will be a major feature.

In the transmission field, reports will be presented on color TV in Europe before and since the recent CCIR Conference in Vienna, new UHF-transmitter design, and cable distribution of UHF signals. A description of recent research work by the Institut fur Rundfunktechnik, Munich, on quadrature distortion correction will show how NTSC color transmission can be improved. A panel discussion on network problems is also planned.

A special session on the relatively new art of vertical-interval testing and monitoring will bring together contributors from Canada, Australia, and Germany. Engineers from the Canadian Broadcasting Corp. will discuss automatic video switching and some of CBC's quality-control procedures. Equipment papers from several countries will discuss new cameras, electron-beam recorders, monitors, color-slide scanners, complete mobile units, and new studio designs. Much of the new equipment described in the technical program will be included in the equipment exhibit.

NATIONAL

NCTA Opposes CATV for Telephone Companies

The Board of Directors of the **National Community Television Association** (NCTA), in a statement issued at the national convention, expressed deep concern with regard to the activity of telephone utilities in the field of community antenna television (CATV). The statement said:

"Many community antenna operators have expressed concern that the practices and policies of telephone companies may seriously impair, if not destroy, the future development of CATV as an independently owned industry.

"Special concern has been expressed over the offering by Bell and other telephone companies in tariffs filed in more than 20 states to provide virtually the entire physical plant for CATV systems at public utility charges.

"Many system owners and prospective system owners view this development as an outright entry into the CATV busi-

ness by the telephone industry and assert that this, together with the telephone companies' ability to restrict or prohibit use of utility poles for privately owned community antennas, could sound the death knell to future CATV development outside the control of the telephone companies.

"The NCTA Board of Directors has directed the Association's staff to develop immediately all available facts regarding the plans, policies and practices of the various segments of the telephone industry regarding the tariff offerings, the availability to independent companies of pole line attachment space contracts, the rate for such contracts when available, restrictive provisions therein impairing the opportunity of privately owned systems to compete, and all other matters pertinent to the problem including plans for direct entry into CATV.

"All appropriate measures will be taken to prevent the development of a telephone monopoly in the manufacture, installation and operation of new CATV systems and to protect the integrity of existing CATV systems as independent businesses.

"It is the intention of this Association to maintain close liaison with Bell System and other telephone companies in the interest of working out arrangements which will accommodate the legitimate interests of both groups and result in the best and most economical service to the public."

Expands Color TV Production

Expansion of its Camden, N. J., production facilities to meet the anticipated demand for new color television cameras is planned by the **RCA** Broadcast and Communications Products Division. The new facilities include "clean rooms," where camera modules are assembled under dust-free conditions, and additional camera test positions.

PROPERTY TRANSACTIONS

Radio station **KOPY,** 1 kw full time on 1070 kc., Alice, Texas, has been sold by **Robert N. Aylin,** principal owner. **Tom E. Foster,** his son, **Tolbert Foster,** and others comprise the buying group. The Fosters, owners and operators of KDET, Center, Texas, and other properties, are veteran Southwestern broadcasters. The consideration was $200,000.

Subject to the approval of the FCC, the administrators of the estate of the late Dr. Roscoe R. Miller have sold Radio Station **WDBF** in Delray Beach, Florida to the **Quality Broadcasting Corporation.** Officers of the purchasing group are Frederick M. Ayres, president, John C. Appel, secretary-treasurer, and Victor M. Knight, executive vice-president. Consideration is in excess of $250,000. ▲

BOOK REVIEW

Collected Papers on Acoustics; Wallace C. Sabine; Dover Publications, Inc., New York, N. Y., 1964; 279 pages, 5⅜" x 8½", paperback; $2.00.

This book is a collection of the writings of the late Professor Sabine. The paperback edition is a republication, without change, of the original edition published in 1922 by the Harvard University Press. In the introduction to the 1964 edition, Professor Frederick V. Hunt refers to Professor Sabine as the founder of the science of architectural acoustics, for during a period of 20 years beginning in 1895, Professor Sabine's original research exposed the fundamental concepts on which the science is based.

This collection of papers, which originally appeared in a number of scientific and industry journals, chronicles, in his own words, Sabine's experiments and the conclusions he drew from them. Although the basic conclusions were derived for the most part from experimental results, a number of cross checks were used to establish the validity of the results.

The first section of the book consists of a series of papers on reverberation. Later papers are "The Accuracy of Musical Taste in Regard to Architectural Acoustics," "The Variation in Reverberation with Variation in Pitching," "Melody and the Origin of the Musical Scale" (in which Sabine takes exception to some earlier statements by Helmholtz), "Effects of Air Currents and of Temperature," "Sense of Loudness," "The Correction of Acoustical Difficulties," "Theatre Acoustics," "Building Material and Musical Pitch," "Architectural Acoustics" (a summary and review of previous material), "The Insulation of Sound," and "Whispering Galleries" (explanations of the characteristics of some well-known whispering galleries and how they work). An appendix contains notes on a lecture on sound-intensity measurement.

The book is written in the style of the late 1800's and early 1900's, and some of the concepts involved are not obviously apparent. Even so, the author presents them in a manner that is rather easily understood. A number of line drawings and photographs illustrate points made in the text. In the section on "Theatre Acoustics" are a number of interesting photographs showing the movement and reflection of wavefronts in models of theaters.

This volume is interesting in that it relates some of the early history of the development of the science of architectural acoustics. At the same time, it serves the reader as an introduction to acoustical principles. ▲

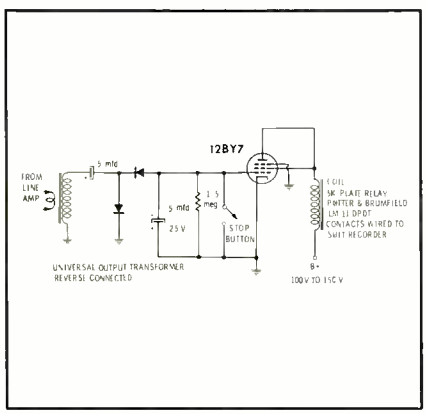
ENGINEERS' EXCHANGE

Automatic Recorder Control

by Frederick N. Davis, Chief Engineer, WELW, Willoughby, Ohio

At WELW, we record a number of remote broadcasts that occur at unscheduled times. Frequently, one of these broadcasts would be missed, and a repeat was required. The circuit shown solved this problem.

A 12BY7 is used in conjunction with a 5000-ohm plate-circuit relay. The 12BY7, which is normally conducting, keeps the relay energized and the tape deck off. When the cue is sent, about 30 seconds before the



broadcast begins, a sample of the audio from the output of the line monitor amplifier is stepped up by the input transformer and rectified by a half-wave doubler, charging the 5-mfd filter capacitor and cutting off the 12BY7. This allows the relay to drop out and starts the tape deck.

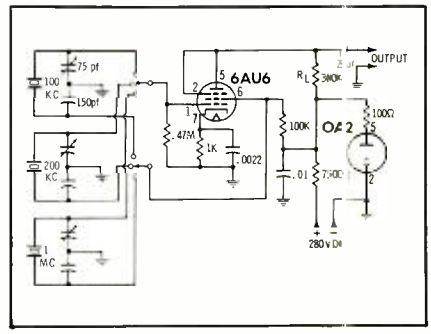
With the grid resistor shown, it will take from 30 to 45 seconds for the capacitor to discharge sufficiently to allow the tube to conduct and turn the recorder off.

Crystal Reference Oscillator

by James W. Thweatt, Staff Transmitter Technician, WPSD-TV, Paducah, Ky.

A 100-kc crystal-controlled frequency standard can be quite useful at the TV station. The circuit shown is of an oscillator that we constructed. The 200-kc and 1-mc tuned circuits were added simply because we had the crystals, but they give added utility to the unit. Each of the crystal circuits is calibrated by zero-beating a harmonic with WWV.

A 100-kc signal is required as part of the complete alignment procedure of the AFC unit in our microwave receiver. The value of R1, for this reason, was chosen so as to obtain a sinusoidal 100-kc output. The 1-mc output was used to check each frequency of the time-mark generator in our scope. Of course either the 100-kc or 200-kc output could be used if no 1-mc crystal is available. ▲



Audio Engineering Society Convention

The Audio Engineering Society will hold its annual Fall Convention and Exhibit of Professional Equipment October 11-15 at the Barbizon Plaza Hotel, 106 Central Park South, New York City. Registration will be from 9 AM to 8 PM Monday, October 11, through Friday, October 15, on the hotel mezzanine. Professional exhibits will be open from Monday noon through Thursday. An awards banquet will be held Thursday evening.

More than 100 papers on all aspects of audio engineering will be read during the five-day technical sessions. Following is a partial program for the technical sessions, with emphasis on those papers of interest to broadcast engineers.

MONDAY

9:00 AM **Annual Business Meeting**

9:30 AM **Microphones and Earphones**
Two-Way Dynamic Cardioid Microphones

1:30 PM **Audio Amplification**
Recent Trends in Audio Amplifiers
Design Considerations of A Solid State Amplifier for Use in High-Quality Professional Studio Recording and Broadcast Consoles

7:30 PM **Music and Electronics**
Report on A Seminar in Electronic Music Composition
Duration and/or Frequency Alteration

TUESDAY

9:30 AM **Miniaturized Audio Applications**
Integrated Audio Voltage and Power Amplification—Problems and Solutions

1:30 PM **Loudspeakers I**
An Ultra-Compact Lightweight Speaker System

7:30 PM **Loudspeakers II**
The Effect of Commonly Used Baffles on the Sound Dispersion of Typical Direct Radiator Loudspeakers
A Repeatable Technique for Listening Tests

WEDNESDAY

9:30 AM **Audio Instruments and Instrumentation**
A Program Distortion Monitor

1:30 PM **Electronic Control of Auditorium Acoustics**
Demonstration of Electronic Room-Acoustic Concepts
Passive and Active Acoustics in Architectural Enclosures
Natural and Artificial Reverberation

7:30 PM **Sound Reinforcement**
Acousti-Architectural Considerations in the Harris County Domed Stadium
Theoretical and Practical Considerations in the Equalization of Sound Systems
"Behind the Actor's Back"

THURSDAY

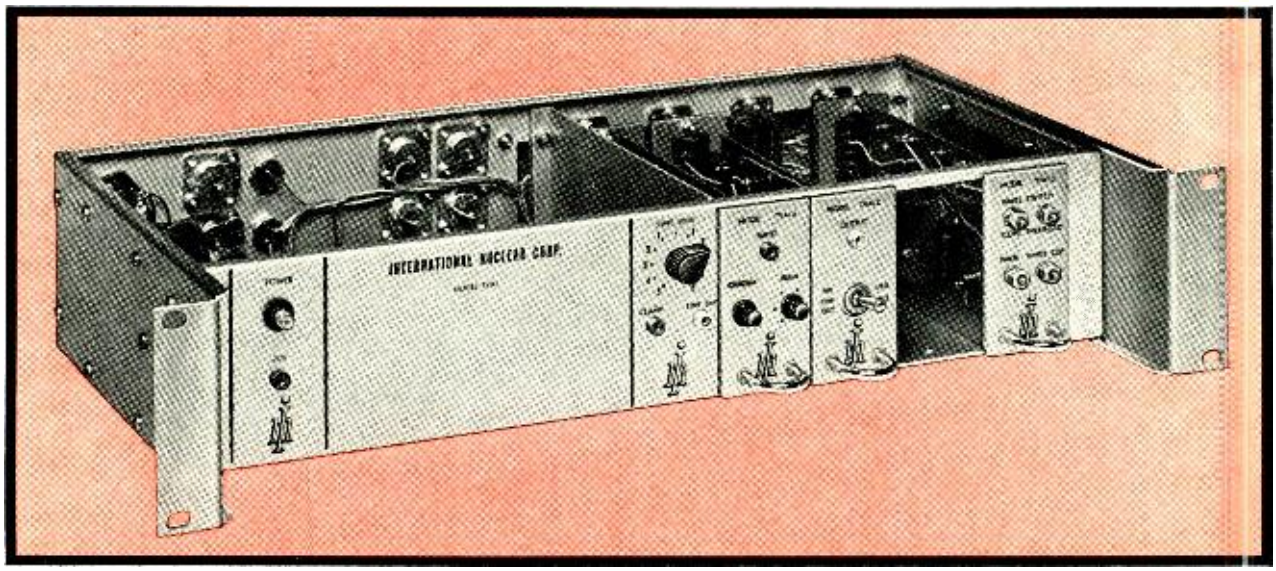
9:30 AM **Studio and Control Systems**
Audio Control Equipment for Use in Studio Sound Recording
Design of Control Consoles with Theater Reinforcement Systems
New Trends for Studio Console Design
Balance Requirements of Equipment Connected to Telephone Lines

1:30 PM **Disc Recording and Reproduction**
Absolute Calibration of Pickups and Records
Optimizing the Dynamic Characteristics of A Phonograph Cartridge
Application of the Silicon Semiconductor Phonograph Cartridge
Stylus Mass and Elliptical Points
Instruments for Record Cleaning
Performance Evaluation of Pickups With Elliptical Styli

FRIDAY

9:30 AM **Magnetic Recording and Reproduction**
Modulation Noise in Tape Recording
Flutter Perceptibility and A New Flutter Analyzer
A Flexible-Sheet Magnetic Recorder
Dropouts at Low Tape Speeds
Transient Response and Cross Modulation Distortion in Magnetic Recorders

1:30 PM **Speech Analytics**
Approaches to the Synthesis of Speech



TVA1 TRANSISTORIZED VIDEO STABILIZING AMPLIFIER
AND ASSOCIATED PLUG-IN UNITS

International Nuclear's Model TVA1 Video Stabilizing Amplifier, with its associated series of plug-in units offers high level performance and versatility for studio or transmitter use. It removes all low frequency disturbances such as hum, bounce and tilt by sync-tip clamping. The back porch level is precisely stabilized without affecting color signals in any way. Sync is stretched after back porch stabilization and then clipped accurately to desired level. This level may be set by means of a front panel control which can be extended to a remote location. Stripped sync is provided at one 75 ohm internally terminated output connector, at a 4 volt level. The TVA1 chassis contains a plug-in compartment which accepts up to 4 plug-in units. Among these plug-in units is the TVA1-E, providing a stripped color video channel, and the TVA1-D which provides the means of adjusting peak-white clipping, white stretch and differential phase. Other plug-in units are listed below.

PRICES F.O.B. NASHVILLE, TENNESSEE

Model TVA1 Stabilizing Amplifier (less plug-ins)	$1,380.00
Model TVA1-A, Manually operated input amplifier unit	$ 310.00
Model TVA1-B, input amplifier unit, with provision for remote master gain and chroma	$ 425.00
Model TVA1-C Monitor Amplifier unit	$ 265.00
Model TVA1-D White stretch and clip unit	$ 240.00
Model TVA1-E Stripped Video unit	$ 450.00

for more complete information write Department VA

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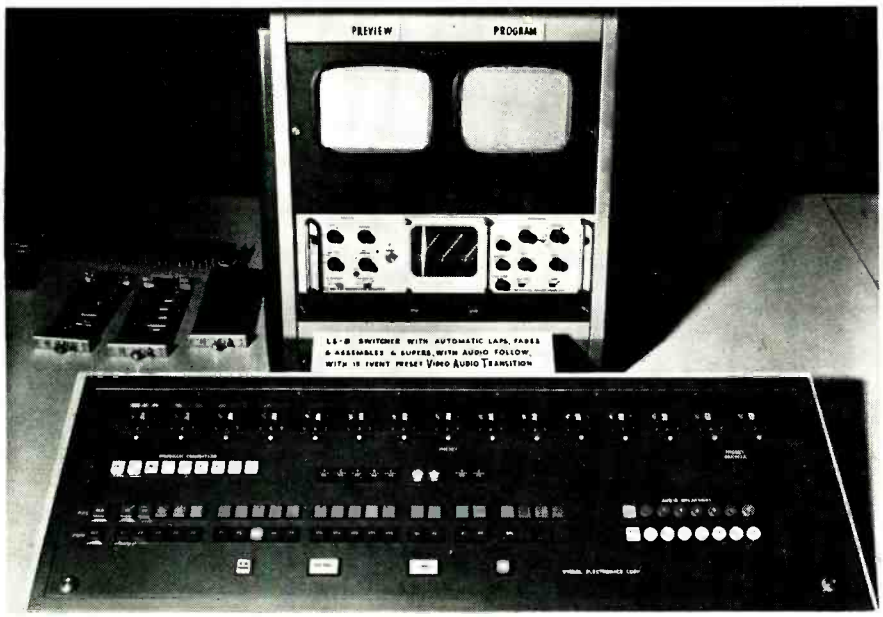
Circle Item 40 on Tech Data Card

NEW PRODUCTS



Preselect Switcher

The preselect switcher for video, audio, and transistions (VAT) shown here provides for a "take" bar to run off a series of preset events with the inclusion of cuts, automatic laps, fades, or supers. The **Visual Electronics** VAT systems utilize thumbwheels for control, storage, and readout of preselect information. Audio may be preselected to follow video or may be from a separate source. Presetting of the video and audio switching transition (cut, lap, fade, or super) and speed is provided. The system permits previewing the signal immediately prior to airing, and last-minute push-button changes of all preset information can be made. A "Take" or "Preroll" button activates each succeeding event.

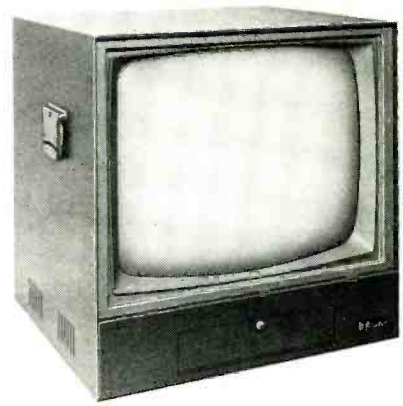
Circle Item 88 on Tech Data Card

Image-Pickup Tube

The WL-23111 is a 3" image dissector tube having a resolution of 3000 television lines per inch and short rise and decay time. This **Westinghouse** tube is designed for microfilm readout, television film scanning, and high-speed flying-spot scanning. The tube has no target, hot cathode, or beam-forming gun. Standard image orthicon components can be used when scan rates permit.

A zoom effect can be attained electronically by magnification through scan reduction. By decreasing the deflection amplitude and underscanning the image, a magnification of several hundred times is possible. In the operation of this image dissector, an electronic picture corresponding to the optical image focused on the face-plate is emitted from the photocathode. The electronic picture is then scanned across an aperture, and at any instant in time only the electrons passing through the aperture enter the electron multiplier. The quantity varies with the light intensity on the portion of the image being scanned. Further amplification is accomplished by secondary emission in the 12-stage multiplier section.

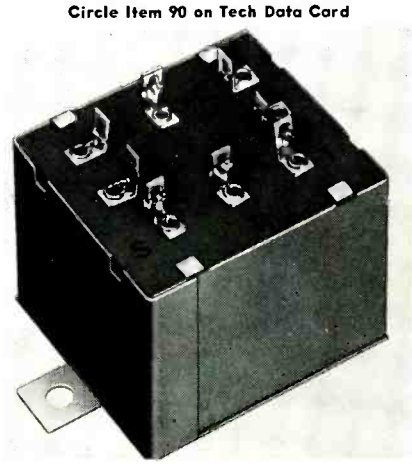
Circle Item 89 on Tech Data Card



Solid-State TV Monitors

A series of television monitors featuring transistorized circuitry and printed-circuit construction is being manufactured by **Miratel Electronics.** This equipment is designed to meet general-purpose TV viewing requirements and provide the advantages of solid-state design. All standard mounting configurations are available.

Circle Item 90 on Tech Data Card

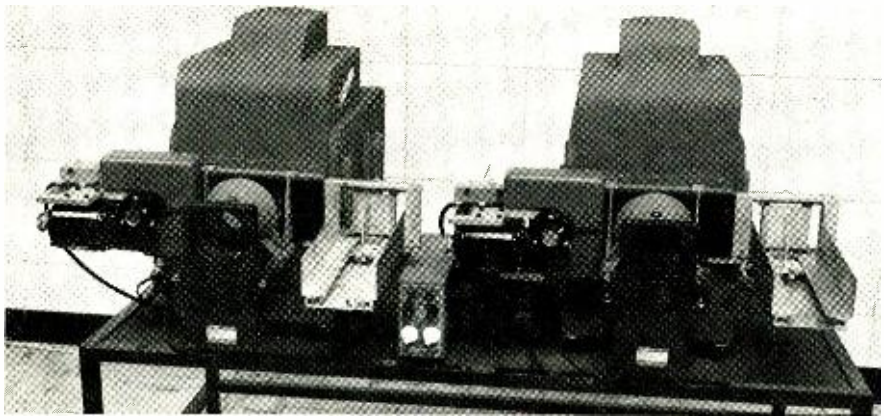


Interphone Amplifier

The Model 90C solid-state interphone amplifier has been designed to meet the requirements of television-studio communication systems. This **Daven** amplifier, which eliminates the need for an induction coil, offers a gain of up to 25 db in received sound level. Up to 32 stations may be used on the same bus, compared to the usual number of 6 possible with an induction coil.

Received signal level can be independently fixed to any desired setting at each station in a system, and sidetone balance can be obtained with a fixed number of stations on the line. Where the number of stations is variable, a compromise setting is used.

Circle Item 91 on Tech Data Card



Horizontal Wipe for Large-Screen Projectors

Designed to fit the "Mod 300" slide changer without shop work, this **TelePro** device consists of a joy-stick type of manual control arranged to operate two projectors for alternate projection of slide sequences. Each projector is fitted with a wipe shutter. When the control stick is operated in one direction, projector A port is opened smoothly by uncovering its slide aperture with a horizontal movement of its shutter. The shutter in projector B is locked to projector A through the control stick so that projector B's port is closed at a rate exactly synchronized to the opening of projector A.

On the screen, the picture from Projector A wipes onto the screen as the picture from Projector B wipes off. The Type 3000 wipe uses complementary shutters operating in the image planes. The gate temperature of the blanked projector is lowered, reducing bleaching effects and prolonging transparency life.

Circle Item 92 on Tech Data Card

Transistorized 4½" IO Camera

A compact, fully transistorized 4½" image-orthicon studio camera is available from **Ampex Corp.** The Mark V camera, which is manufactured by **Marconi Co., Ltd.,** of England, and marketed in the United States by Ampex, weighs 98 lbs. Controls on the camera include only basic "on-off" and lighting adjustments, with all other camera electronics on separate equipment racks, leaving the operator free to concentrate on controlling the position and field of view of the camera. A tilting viewfinder permits the cameraman to obtain the most comfortable viewing position at any camera angle. The viewfinder is four times brighter than previous viewfinders and can display the picture from the camera, a picture from an outside source, or a mixture of the two. Other major features of the camera include a single integrated zoom lens.

Circle Item 93 on Tech Data Card

Solid-State TV Relay

An all-solid-state relay for STL, intercity, multihop or portable pick-up, the **Microwave Associates** MA-7 operates in the 6875 to 7125-mc TV relay auxiliary broadcast band. It is designed to meet or exceed FCC and CCIR standards for color and black-and-white visual and audio subcarrier. The equipment requires no warm-up and features low power consumption and reduced size and weight. The transmitter and receiver are housed in separate cases which include interchangeable power packs for 12 VDC, 24 VDC, 110 VAC, or 220 VAC sources. Transmitter RF power output is ¾ watt with 35 watts input. The receiver is crystal controlled and has 25 watts continuous-duty power consumption. Noise figure is 12 db nominal and 7 db with RF preamplifier (optional). Rack-mount size is 19" x 8½" for both units.

Circle Item 94 on Tech Data Card

Solid-State Stereo Console

Selection and mixing of FM stereo program sources and complementary mono program sources are the functions of the **Melcor** Model AF-37A solid-state console. It features seven mixing inputs normalled through push-button selectors to seventeen program sources, six of which are dual stereo sources. The mixing inputs are push-button selectable to either of two programming channels, or to a third output channel which can be used for cue or echo send. The cabinet design provides forearm support at working height, with knee space below and space for script. A complete jackfield is exposed when the arm support is pivoted downward. The mixing console can be used for simultaneous SCA operation from a separate program source by assigning the third output channel for this purpose. ▲

Circle Item 95 onTech Data Card

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

47. AMPEX—Bulletin 2273 and price sheet 2274 list data for AG-100 magnetic mat recorder/reproducer.
48. ATLAS SOUND—Illustrated catalog supplies specifications for new Series AP-30 public-address loudspeakers for indoor and outdoor systems.
49. BRITISH INDUSTRIES — Catalogs describing full line of Garrard turntables and Wharfedale speaker systems.
50. BROADCAST ELECTRONICS—Packet contains specifications and prices on Spotmaster tape-cartridge equipment including: Portapak I, 400A Series, Ten Spot, and Super "B" Series.
51. CBS LABS—Literature on the "Volumax" automatic peak controller and the "Audiomax III" solid-state automatic level control.
52. CINE SONIC—Data sheet describes rental service which supplies background music prerecorded on 7", 10½", and 14" reels of tape, or in cartridges.
53. CONCORD—Specification sheet describes Series "R" automatic stereo tape recorders.
54. CROWN—Six-page data sheet for new solid-state power amplifier.
55. QUAM—New general catalog No. 65 lists speakers for color-TV replacement, PA systems, high-fidelity, and general replacement.
56. SPARTA—Flyer and price sheet gives specifications for studio turntables, tape cartridge systems, audio consoles, and accessories.

CATV EQUIPMENT

57. ENTRON—Facility brochure describes product line and manufacturing procedures as well as general history of company's participation in CATV.

COMPONENTS & MATERIALS

58. CORNELL DUBILIER—Guide lists cross-reference data for vibrators.
59. MERIT—Form 850, 1965-66 general catalog, provides replacement guide for coils and transformers.
60. MICON—Catalog 103 supplies information on company line of coaxial connectors and devices.
61. SOLITRON—Short form catalog for germanium and silicon power transistors.
62. SWITCHCRAFT—New product bulletin No. 152 describes series H-100, H-200 "HI-D" and series DA "DATA-SWITCH" momentary-contact switches.
63. TENSOLITE—Bulletin 103 shows design and specifications for high-voltage wire and cable.

MICROWAVE DEVICES

64. MICRO-LINK—Planning guide for 2500-mc ITV systems, data on model 420A portable link and Model 600 fixed link.

MOBILE RADIO & COMMUNCIATIONS

65. MILES—Descriptive literature is available for subminiature FM transmitter and matching receiver.
66. MOSELEY ASSOCIATES—Four-page folder gives details and specifications for new Type II and Type III STL radio remote-control systems.
67. MOSLEY—Literature describes Citizens band antennas.
68. SPRAGUE—Circular M-853 describes SK1-, SK-10, SK-20, and SK-30 "Suppressikits" for vehicles with alternators or DC generators.

POWER DEVICES

69. HEVI-DUTY—Bulletin 7-22 supplies data on line-voltage regulator using saturable-core reactor.

RADIO & CONTROL ROOM EQUIPMENT

70. BAUER—Illustrated specification sheet gives information on Model 910 solid-state, eight-channel audio console which is available in factory-assembled or kit form.

REFERENCE MATERIAL & SCHOOLS

71. CLEVELAND INSTITUTE—Booklet outlines courses in electronics, including those for broadcast engineering and FCC-license preparation.
72. HOWARD W. SAMS—Literature describing popular and informative technical publications; includes latest catalog of technical books.

STUDIO & CAMERA EQUIPMENT

73. BENDIX—Specification sheet gives information on BX-8A broadcast-type image-orthicon camera.
74. TV ZOOMAR—Data on Angenieux-Zoomar Model 10-2-1B, and AUTOCAM servo control.
75. VISUAL ELECTRONICS—Technical information covers new accessories for Mark 10 camera line and VAT preselect switcher.

TELEVISION EQUIPMENT

76. COLORADO VIDEO—Eight-channel solid-state "Bar/Graph" generator is described in illustrated specification sheet.
77. DAGE-BELL—Specification sheets on portable video tape recorder, 520 Broadcast Camera, and FC-11 film chain.
78. DYNAIR—Flyers give particulars on RX-4A solid-state professional TV tuner.
79. TELEMET—Sheet supplies description for Model 315-A1 color monitor.
80. VITAL—Data sheets give specifications of Model VI-500 stabilizing amplifier, Model VI-10A video distribution amplifier, and Model VI-20 pulse distribution amplifier.

TEST EQUIPMENT & INSTRUMENTS

81. BLONDER-TONGUE—"Standards for Industry" folder features Model FSM-2 UHF/VHF field strength meter, Model 4122 solid-state UHF/VHF sweep generator, and 75-ohm accessories.
82. LECTROTECH—Data sheets provide technical information on Model V-6 color bar generator, Model V-7 color-bar generator and vectorscope, Metergard meter protection device, and Lectrocell battery replacement for VTVM.
83. MARCONI—Data on Model 1099 video-sweep generator for color video-tape testing and head alignment.
84. SENNHEISER—Literature lists uses and specifications for Model ZP-2 transistorized impedance tester.

TRANSMITTER & ANTENNA DEVICES

85. CCA—Catalog sheets describe type SC-1D FM transmitter subsidiary generator.
86. COLLINS—Two four-page brochures describe Model 212S-1 speech-input console and Model 820E/F-1 5- and 10-kw AM transmitters. "Microwave — Applied to CATV/CCTV/ETV Operations" booklet supplies basic information on economics and advantages of microwave use.
87. GATES—Specifications available for new FM-3G, 3-kw FM transmitter.

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Pioneer Remote-Controlled UHF Helical Antennas for Television Maintenance of Film Chains

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Advertising rates in the Classified Section are ten cents per word. Minimum charge is $2.00. Blind box number is 50 cents extra. Check or money order must be enclosed with ad.

The classified columns are not open to the advertising of any broadcast equipment or supplies regularly produced by manufacturers unless the equipment is used and no longer owned by the manufacturer. Display advertising must be purchased in such cases.

EQUIPMENT FOR SALE

Will buy or trade used tape and disc recording equipment—Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 295 Main St., Tuckahoe, N. Y. 1-64 tf

Ampex Head Assemblies for 300 and 400 series recorders reconditioned. Service includes lapping and polishing all three head stacks, cleaning entire assembly, readjusting and replacement of guides, and realignment of stacks as to azimuth and zenith. Full track assemblies—$60.00. Taber Manufacturing & Engineering Co., 2619 Lincoln Ave., Alameda, California. 5-64 tf

Audio Equipment bought, sold, traded. Ampex, Fairchild, Crown, McIntosh, Viking. F. T. C. Brewer Company, 2400 West Hayes Street, Pensacola, Florida. 3-64 tf

Television/Radio/communications gear of any type available. From a tower to a tube. Microwave, transmitters, cameras, studio equipment, mikes, etc. Advise your needs—offers. Electrofind Co., 440 Columbus Ave., NYC. 212-EN-25680. 8-64 tf

COMMERCIAL CRYSTALS and new or replacement crystals for RCA, Gates, W. E., Bliley, and J-K holders; regrinding, repair, etc. BC-604 crystals; also service on AM monitors and H-P 335B FM monitors. Nationwide unsolicited testimonials praise our products and fast service. Eidson Electronic Company, Box 96, Temple, Texas. 5-64 tf

AMPEX 350 SERIES reconditioned capstan idlers for $7.50 exchange. Send us your old ones, or order them for $10.00 and get $2.50 back after sending the old ones in. Ours have new bearings, the rubber softened and surface precision ground. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California. 1-65 12t

AMPEX 350 SERIES reconditioned capstan drive motors (BODINE NCH-33 only) $85.00 exchange. Send us your old one, or order for $100.00 and get $15.00 back after sending old one in. Ours have new bearings and rewound stator. Package motor well. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda California. 1-65 12t

CO-AXIAL CABLE Heliax, Styroflex, Spiroline, etc. Also rigid and RG types in stock. New material at surplus prices. Write for list. Sierra-Western Electric Co., Willow and 24th St., Oakland, Calif. Phone 415 832-3527. 5-65 tf

Conrac TV Monitors for sale. 3—27", 2—21", 1—17", 3—8". All encased and in good condition. GPL PD-150 camera and control unit. Best offer on any or all. F & B/CECO, Inc., 315 West 43rd Street, New York City, Mr. Zuch. Phone: JU 6-1420. 8-65 tf

Hobart gasoline generator 35 KVA, 230 Volts, 3 phase—$1,000. Federal 101-C field intensity meter—$275. Johnson RF contactor 25 Amps, SPDT—$75. KSJB, Jamestown, N. D. 9-65 1t

Three complete Speedy-Q Sound Effects Libraries, mostly new, worth $384.00 now $175.00 FOB, Hollywood. Write Gold Star, 6252 Santa Monica Blvd., Hollywood, California. 9-65 3t

REK-O-KUT Imperial 11 disc recorder, M12 lathe. TR12H turntable. S120 12" playback arm. R8B transistorized amplifier. Very slightly used. Excellent condition. Bargain at $350. Sales Development Institute, 3338 Chippendale Ave., Philadelphia, Pa. 9-65 1t

Everything in used broadcast equipment. Write for complete listings. Broadcast Equipment and Supply Co., Box 3141, Bristol, Tennessee. 11-64 tf

New and Recondtioned Remote Pickup and 2-way radio equip., Fire and Police Receivers. All brands and models. Sales Manager, Box 238, Phone 817-594-5171, Weatherford, Texas. 5-65 12t

Audio Equipment — Ampex, Altec, Fairchild, Langevin, Neumann, etc. Trades. New and used. Get our list. Audio Distributors, Inc., 2342 S. Division, Grand Rapids, Michigan. 7-65 6t

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ENGINEERING SALES OPENING? Sales background plus nine years in broadcasting, from engineer to management level, adds up to good representative for manufacturer dealing with broadcasting field. Box 133, Broadcast Engineering. 8-65 2t

Announcer with 2½ years experience in general station operation, seeks position in small AM variety format operation on east coast. Age 28, single. Box 137, Broadcast Engineering. 9-65 1t

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Employment

Leading business publication has immediate opening for technical writer/editor. Background in electronics, good knowledge of grammar, experience in broadcasting are essential. Send resume to Box 138, BROADCAST ENGINEERING. tf

TV Broadcast Technicians Wanted—Major Network-owned Television Station in Midwest needs several Technicians. Must be young, energetic, well educated and technically oriented. Experience welcome but not ssential. These are top quality jobs for superior Technicians only. Submit complete resume to Box 135. 9-65 1t

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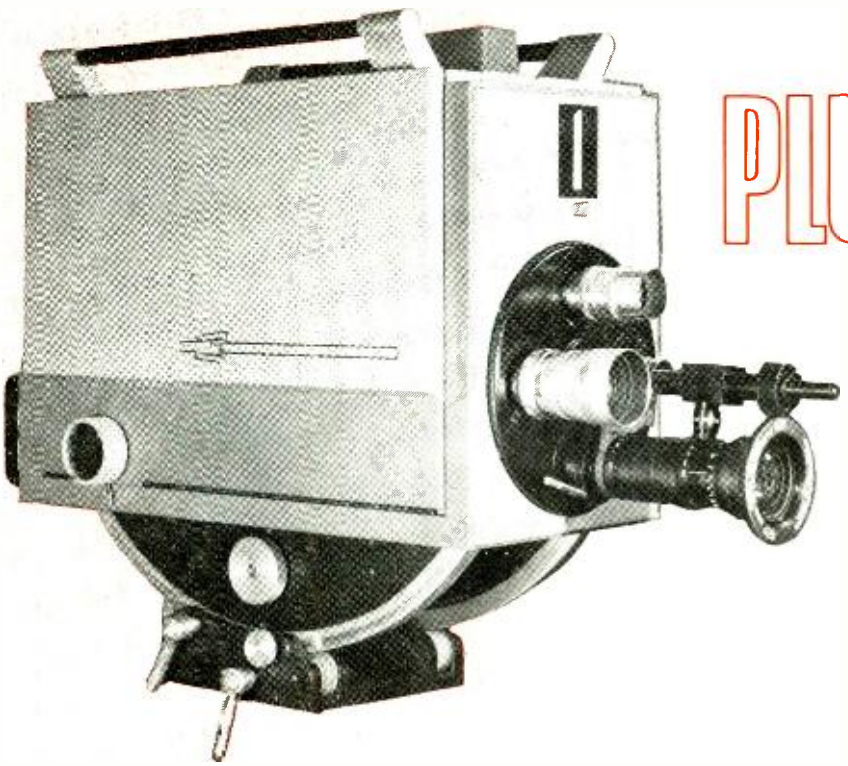

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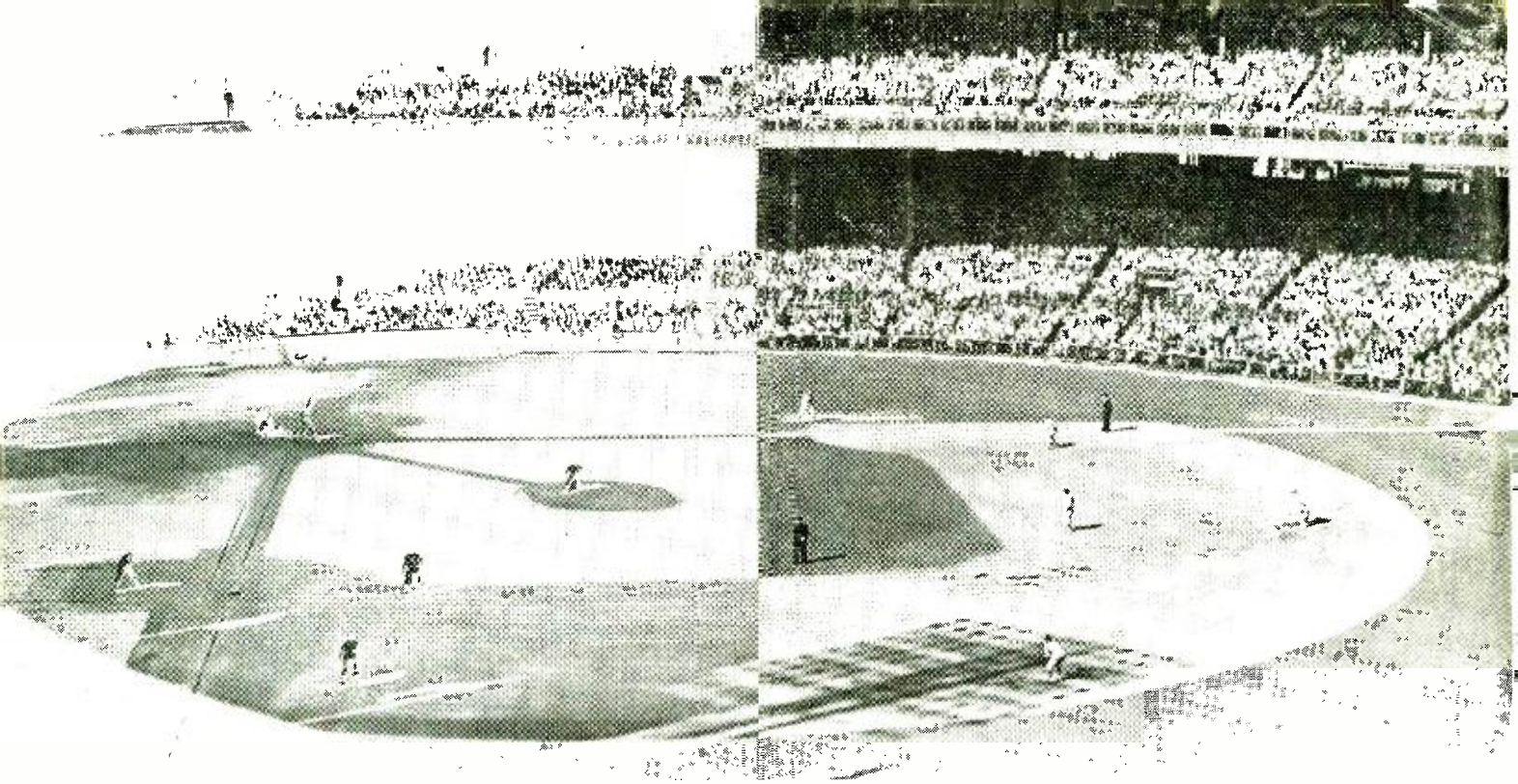


NIGHT... DAY...

A BROADCASTER'S DILEMMA... SOLVED BY RCA 8092A IMAGE ORTHICONS

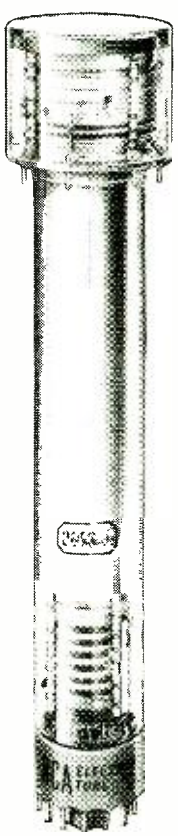
One of our broadcast customers got a hooker thrown at him when he found he had to do a daytime ballgame after a long night stand at a ball park. He did not have time to change his Image Orthicons to tubes that would produce the best picture under bright daylight conditions.

He had been using our RCA-8092A Image Orthicons in his color camera for nighttime baseball pickup since they produced the best possible sensitivity. We introduced the 8092A several years ago after we were able to provide the increased sensitivity, improved signal-to-noise, and eliminated some of the graininess in the picture...problems which had plagued some of the earlier attempts to use these Image Orthicons in quality television pickup.

This broadcaster was very happy with the nighttime operation because he could put a zoom lens on the camera and still obtain good picture quality with infield illumination from about 150 foot candles. When he had to run the outdoor game the next day in broad daylight he certainly didn't need the high sensitivity.

We told him to go ahead and try them out in daylight, feeling that the tube should produce a good picture if he could "stop" the camera lens down far enough to keep from overloading the tubes. We felt that the contrast should be pretty well handled by these RCA 8092A's.

Well, he tried it, and, surprisingly without stopping the lens down all the way, he found that the 8092A's were



able to pull a lot of the low-light signal out of the mud and beat down the highlight signal without washing out the highlights.

He could pan the camera from the brightly-lighted infield to the shadows of the stadium and look into the dugout without seriously upsetting the color balance, or he could watch the runner on first base without having the brightly-lighted outfield overload the picture.

He has been using his 8092A's for both outdoor daylight and nighttime broadcasts ever since.

Of course, he can not get the color fidelity and the signal-to-noise ratio that might be expected from some of our studio tubes. But the operational flexibility and the fact he has all the sensitivity he needs for nighttime pickup are the things that put him into business day after day with no changes of tubes between games.

These tubes do require a little consideration in handling since they have a gossamer thin target which can be damaged by the wrong kind of jolts or camera handling but if you treat them right, they will give you good service and a wide range of operation.

For further information on the RCA-8092A, ask your RCA Broadcast Tube Distributor for a copy of the RCA-8092A bulletin.

This is one of a series of interesting field situations faced and solved by broadcasters through the coordination of RCA Broadcast Tube Distributors and RCA sales and factory engineers.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J

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