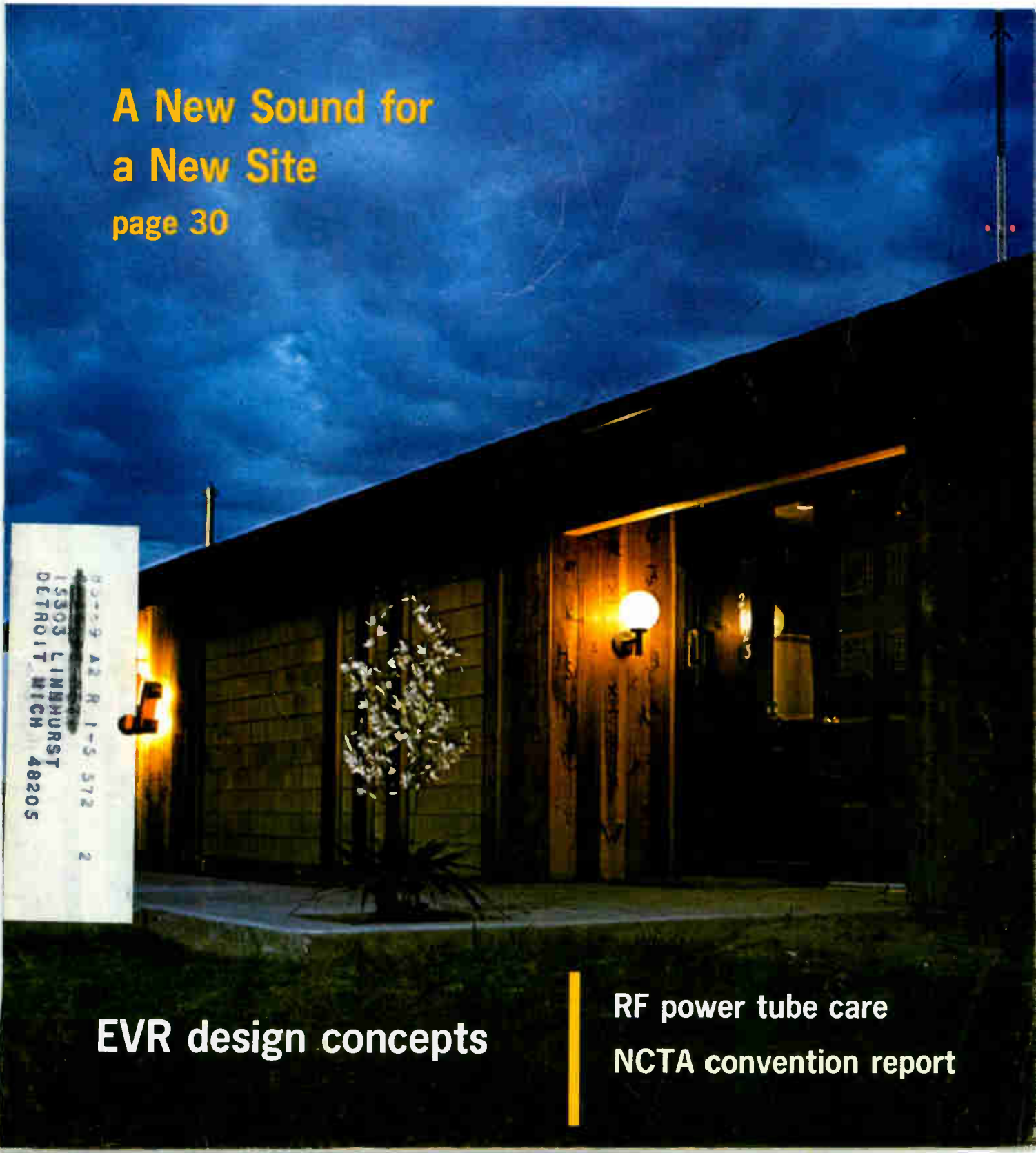
August, 1970/75 cents

Broadcast Engineering

the technical journal of the broadcast-communication's industry

A HOWARD W. SAMS PUBLICATION



A New Sound for a New Site

page 30

EVR design concepts

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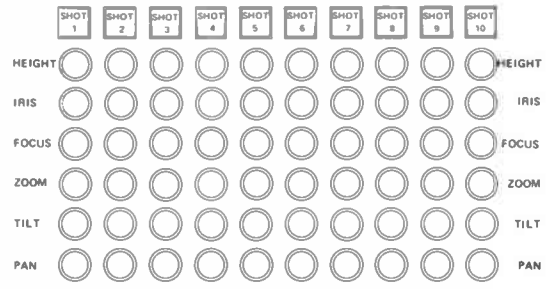
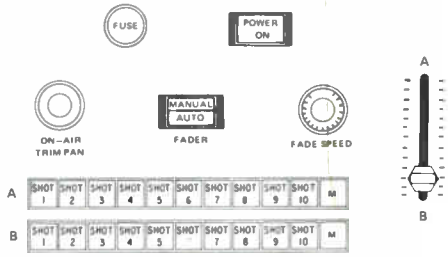


CONTROL PANEL



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August, 1970 • Volume 12, No. 8

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

This month's cover shows the front side of KVOC's all new station after their move to a new site. Claiming site, sound and operational improvement, the station has been branded a success. See page 30. (Photo by Merrill Moore Photography)

DEPARTMENTS

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Robert E. Hertel, Publisher

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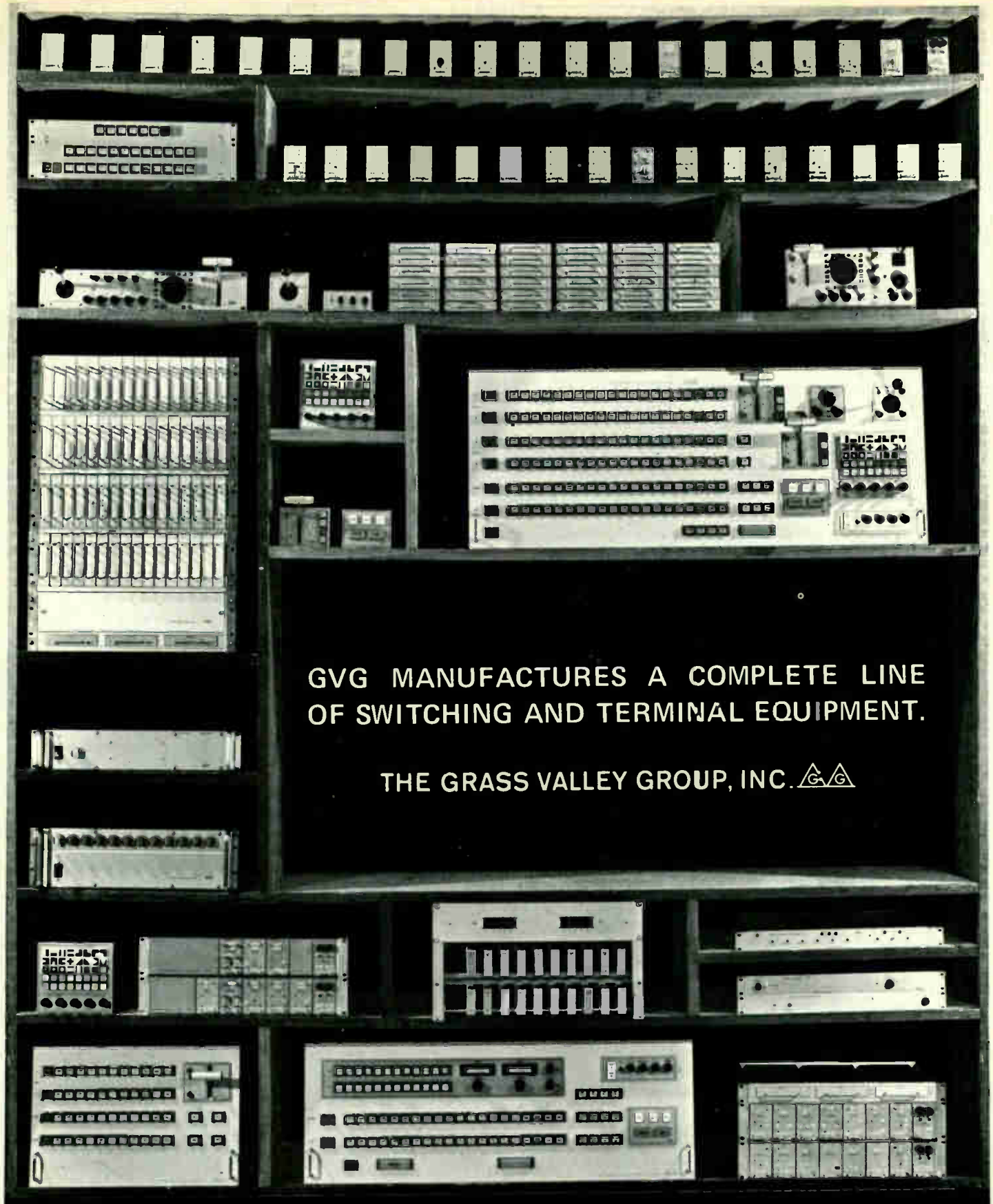

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DIRECT CURRENT FROM D. C.

August, 1970

By Howard T. Head

Commission Proposes CATV Technical Standards

The Commission has proposed the adoption of Technical Standards which would govern the performance of cable television systems. At the same time, the Commission also invited comments on a proposal that the Commission require a minimum of 20 to 40 channels of service, two-way transmission, and the provision of individual community channels.

The Technical Standards were first proposed to the Commission by a firm of consulting engineers. Minimum requirements would be established for such matters as subscriber signal level, return loss, linearity, and uniformity of response. Conspicuously missing, however, are requirements relating to "ghosting", or maintenance of phase relationships.

A similar proposal is also under study by Canada's Department of Communications (DOC) which, under Canadian law, has the authority to prescribe technical regulations not only for CATV systems but for all commercial receiving stations. Although the Canadian proposal is similar to that of the FCC, the DOC Standards generally represent tighter technical controls than those proposed for the U.S.

AM Stereo Being Demonstrated in Mexico

An AM station in Tiajuana is broadcasting in stereo. Although proposals for tests of AM stereo have been made in the U.S., the Commission has not acted and consequently the present tests are being conducted "south of the border".

The stereo separation is accomplished by presenting only the left channel modulation on the lower sideband, and the right channel modulation on the upper sideband. When an ordinary receiver is tuned directly to the carrier, normal monaural reception is achieved. To obtain the stereo effect, two unmodified receivers are employed, each tuned sufficiently away from the carrier to emphasize the appropriate sideband.

Requirements for New AM Application Relaxed

In a recent case involving an AM station in a Cleveland, Ohio suburb, the Commission has accepted for filing an application which ordinarily would have been rejected under the "freeze" rules. In this application, a daytime-only AM station proposes nighttime operation on the same channel.

(Continued on page 6)

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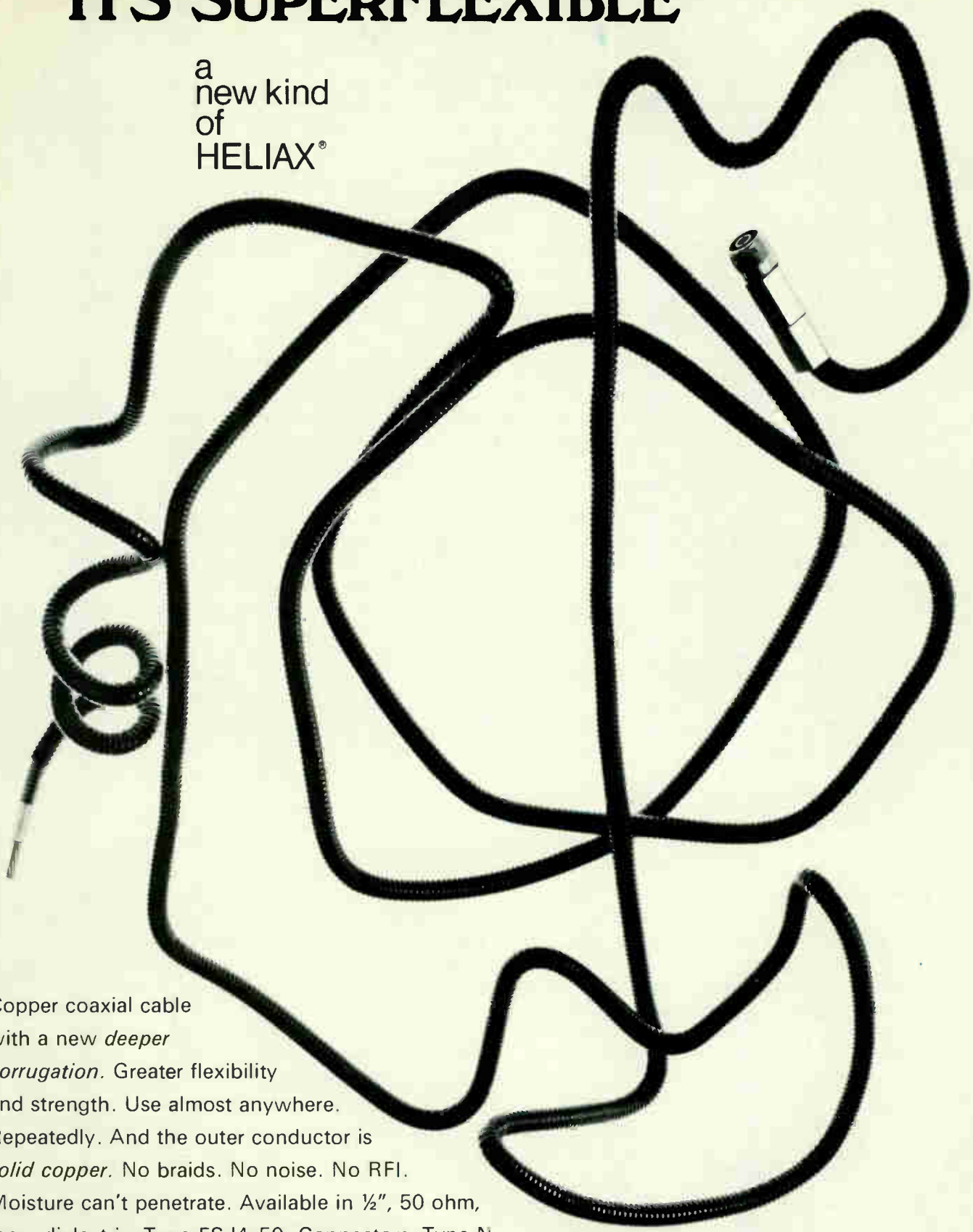

Copper coaxial cable with a new *deeper corrugation.* Greater flexibility and strength. Use almost anywhere. Repeatedly. And the outer conductor is *solid copper.* No braids. No noise. No RFI. Moisture can't penetrate. Available in ½", 50 ohm, foam dielectric, Type FSJ4-50. Connectors, Type N or GR-874. Like a sample? Communicate with Andrew.

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Circle Number 6 on Reader Reply Card

(Continued from page 4)

Under the ordinary application of the "freeze" rules, such applications are acceptable only when primary service would be provided to "unserved" areas (formerly called "white areas"). Although no service would be provided by any of the Cleveland AM stations at night, a clear channel station in Detroit 100 miles away would provide primary service.

In accepting the application, the Commission ruled that the unique situation presented, which included the unavailability of any FM channels, made the ordinary application of the "freeze" rules inapplicable. This ruling apparently represents a softening of the Commission's part, since in past cases similar applications have been returned as unacceptable.

"Invisible" Car Radio Antennas Cause Trouble

The National Association of Broadcasters (NAB) is becoming increasingly concerned over the performance of "invisible" car receiving antennas which are being supplied as standard equipment by one of the leading automobile manufacturers. Although these antennas, which are imbedded in the windshield, are intended to have been designed for satisfactory reception of both AM and FM, actual tests conducted for NAB in the Boston areas indicated performance far inferior to that of the convention external whip antenna. Receiver terminal voltages were low at FM, the loop configuration was highly directional at AM, and the operation of the windshield wipers influenced the antenna response to produce an audible effect.

Although NAB is making every effort to bring about a return to more suitable antennas, it is getting little cooperation. The Department of Transport (DOT) prefers the elimination of the external antenna for safety reasons, and no other federal agency appears to have authority to require adequate antenna performance.

Short Circuits

The Commission and broadcast associations are studying a proposal for reading home utility meters from a high-flying jet aircraft; operation would be in the 216-220 MHz band and might cause interference to television Channel 13 . . . A Philadelphia television station is experimenting with a three-part picture presenting a combination of news, time, and weather information with live programming . . . The Commission has reversed itself on AM remote control renewal applications (See June, 1970 D.C.) and no longer requires non-directional field strength measurements . . . A CATV system in West Virginia has been ordered to carry a TV broadcast station on one channel exclusively; the CATV operator was permitted his choice of channel . . . The three Group H frequencies in the 2500-2690 MHz band have been set aside for non-directional use. . . The 20th Annual IEEE Broadcasting Group Symposium will be held in Washington, D.C. on September 24-25; the program features sessions on cable television, broadcast color television reception, and AM and FM radio including a demonstration of AM stereo (See above).

THE CARTRIDGE KILLER.

Scott Muni
WNEW-FM, New York

This man doesn't have time to baby the tools of his trade. Not with a commercial, a traffic report and time check breathing down his neck. He's got to keep those records spinning fast and furious. And, if he kills a cartridge or two along the way, well—that's how it goes.

Until now.

Meet the Stanton 500AL—the cartridge that's tougher than disc jockeys. Here is the workhorse of the broadcast industry. We designed the entire stylus assembly to withstand the rugged demands of back cueing and the kind of handling that would quickly ruin ordinary pick-ups. Yet its high restoring force and tracking reliability is accomplished without sacrifice of professional standards for frequency response, output, channel separation, etc.

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SPECIFICATIONS	500AL
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Stylus Tip	0.7 mil Spherical
Tracking Force	3-7 grams
Cartridge Weight	5 grams
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STANTON

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LETTERS TO THE EDITOR

On Facing The Issues

Dear Editor:

In your May issue, you published several letters in which several station engineers blamed their troubles on everything from equipment instruction manuals to the managers. These engineers believe they are only noticed and needed when the transmitter is off the air.

If a person is employed by a broadcaster that is concerned and responsible, these problems whether personal or professional, would not arise. If an engineer was not needed or wanted, a manager certainly would not have us around on a full-time basis, no matter how large the market or the size of the paycheck. Therefore, a manager would hire under contract basis if he were only concerned when the station was off the air or being inspected.

An engineer that is worthy of his title does not merely use his talents when the transmitter drops off the air, rather he prevents it from going off. Many articles have been written about proof of performance, but still the majority of the station engineers do the measurements annually, and then only to satisfy the FCC. Engineers must face the fact that this is a true indication of overall performance. By making these measurements monthly rather than once a year, he does not only insure proper operation, but maintains a good signal. This, as several articles have pointed out, does not stop at the main microphone input, but does in fact include other studio devices that are used many more hours than the studio microphone.

The engineers job is also communications and cooperation. Keep management informed. If you have a slight problem with your signal, let him know. Too many managers learn of troubles through the local bank president or the discount store manager.

By cooperation, the manager can plan for large expenditures. Items such as tower painting or repairing during the summer months, replacement of equipment etc., can be planned for several months in advance. By doing this, management can concern himself with the problems of sales and programming.

Some engineers are troubled with the rule making talks of the FCC about fining the engineer for direct technical violations. They say they would leave the job if this goes through. I say leave now! I wouldn't want to work with anyone who refuses to be held responsible for his workmanship. I am sure this type of person would not want to fly with an airline pilot that is in the habit of making human errors through neglect or not understanding certain regulations, then nothing more being done other than a reprimand or fired and he goes on to another airline.

Dennis J. Snyder
Chief Engineer
WJOY
South Burlington, Vt.

More On The Recent NAB Proposal

Dear Editor:

The majority of small sized broadcasters have finally stated openly, through the voice of the NAB, what broadcasting engineers have known for many years—that radio station management would be perfectly happy to proceed as far as possible toward the total elimination of the engineer from commercial broadcasting. I refer, of course, to the latest NAB proposals pertaining to the relaxation of engineering requirements.

To be fair in the matter, radio management indeed has certain justification for their policy of regarding their engineering staff as little more than a nuisance. Working for the small broadcaster has

(Continued on page 10)

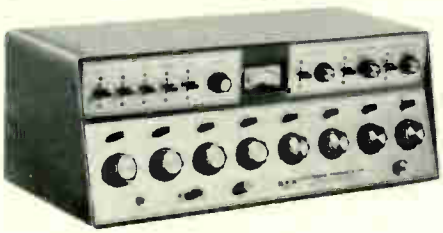
QRK *Announces a Breakthrough*

QUALITY CONSOLES AT REALISTIC PRICES!

QRK-5 MONO PRE-WIRED SYSTEM $1995

QRK-5/5S Prewired Systems — Reflects the epitome of quality to produce either a mono or stereo system capable of serving as either a local or remote studio or production facility. Incorporates the QRK-5 (Mono) or QRK-5S (Stereo) console; (2) QRK-12C Turntables with synchronous motors; (2) Rek-O-Kut S-320 Stereo Tone Arms; (2) QRK F3 stereo cartridges; QRK Ultimate Preamplifiers; and substantial, prewired transportable furniture.

QRK-5S STEREO PRE-WIRED SYSTEM $2995



QRK-8 — 8 CHANNEL MONO $1695
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QRK-8/8S — 8 Channel Console — QRK offers a professional console with Altec faders; plug-in modules (3) pre-amplifiers; built-in power supply; 10 watt monitor amplifiers; independent audition and program channels; muting relays; cue amplifiers; built-in speaker; substantial capacity and ultimate access.

QRK-5 — 5 CHANNEL MONO $995
QRK-5S — 5 CHANNEL STEREO . . $1595

QRK-5/5S — 5 Channel Console — Both mono and stereo units incorporate Altec attenuators with cue switches in every fader, 10 watt monitoring amplifiers, plug-in modules, muting relays, and self-contained power supply. The stereo unit, QRK-5S contains independent audition and program channels as well as a cue amplifier. Both consoles have substantial capacity and total access.

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(Continued from page 8)

traditionally included a total lack of status or authority in the station echelon, extremely odd hours, perpetual shortage of funds delegated to equipment replacement and repair, and in general a wage that necessitates the engineer to perform his engineering duties on more or less a "second job" type basis. It is little wonder that stations find it difficult to attract competent personnel to fill their engineering vacancies.

The most desirable solution to this dilemma would be effected upon the management's realization that the broadcasting art does not end at the microphone. An equitable budget allowance should be made for a qualified engineering staff as a matter of sound business practice, not reluctantly out of necessity or FCC requirement only. This type of outlook, combined with an attractive wage and appropriate personnel screening and selection, would result in an engineering staff that is an asset to the station in a technological sense as well as in public relations and overall station efficiency.

It would appear that the currently sensitive banner of "minority groups" is being employed as a justification for a further relaxation of engineering personnel requirements. It certainly isn't very obvious how this relaxation, with its invariable trend toward further contractualization of engineering services, will produce either more jobs or better engineering practices.

Paul P. Austgen
Faculty, College of Engineering
University of Colorado
Denver, Colorado

Station Needs Help With Tape Deck Info

Dear Editor:

Recently I acquired one of the older PRESTO tape decks and have been trying to track down a problem in the record system.

I have checked back issues of **Broadcast Engineering** to try and find an address for the Presto Company; this has proved futile.

Has this company ceased to exist? If so, where can I find circuit information? I bought the deck second-hand, so you can see how much trouble it is to track down a shortage or other trouble.

Thank you so much for your cooperation. Your magazine is a great asset to the engineering field; keep up the good work.

Bob Ayers
Radio Station WCMA
Cornith, Miss. 38834

Ed. Note: At press time we were not able to locate either the schematic Bob needs or the company address. If you have any information that may be of help, drop Bob a line or send us the information and we'll pass it along.

BE Buyer's Guide Overlooks Schafer

Dear Editor:

We noted the unfortunate omission of SCHAFER ELECTRONICS from the Broadcast Product Directory published in your June, 1970, issue.

For the record—SCHAFER ELECTRONICS pioneered Radio Broadcast Automation fifteen years ago at KGEE, Bakersfield, California, with delivery of the first automation system ever built.

In February, 1970, SCHAFER

Look what our customers say about easy-to-operate Gates automation systems...

"Any of our employees can operate our Gates automation equipment. It's easy to understand and changes in programming are made quickly and without confusion."
Dige Bishop, WCTA, Andalusia, Alabama

"Our equipment might look complicated at first glance, but even new employees learn how to operate it in no time at all."
Art Kinsey, WOAP, Owosso, Michigan

"We have periodic changes in program format that require changes in the automation programmer. These are handled routinely with ease by any of the staff."
Bill Hansen, WJOL, Joliet, Illinois

"All we do is decide what we want to do, then we tell the automation equipment to do it! No fuss and no complications."
Don McDougald, WMCD, Statesboro, Georgia

If you think automation systems are complicated, hard to operate, don't. Gates makes it easy. And we have the customers to prove it!
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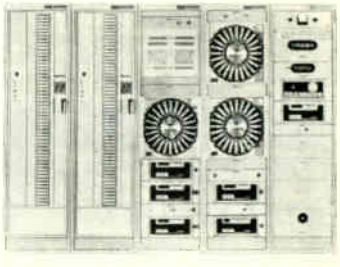

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inaugurated a new era in Broadcast Automation when the world's first computer-controlled automation system went on the air at WKZN, Kenosha, Wisconsin.

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Charles A. Hill
President

Ed. Note: When you compile a list of over 300 products manufactured by 500 manufacturers, such an unfortunate ommission can happen. In order to keep our industry files up to date, we would appreciate it if all manufacturers would send pertinent catalogs and new product information to: The Editor, Broadcast Engineering magazine, 1014 Wyandotte, Kansas City, Mo. 64105.

A Call to Reason

Dear Editor:

When the NAB petitioned the FCC to relax the first class operator requirements for AM directional, non-directional, and FM broadcast stations (BE, May 1970) they (NAB) perpetrated one of the most ridiculous propositions ever to be placed before the Commission. The relaxation of licensing requirements is a farce and, hopefully, the Commission will see it as such.

While it is quite clear that the NAB proposal favors executive management that is not the crux of the matter. The outcome has deeper significance—to the Commission, and to the broadcast engineer.

Quote: "NAB said that relaxation of existing operator requirements would remove a major obstacle to greater minority employment opportunities and permit a greater number of minority applicants to qualify for jobs in broadcasting (BE, May 1970, page 10, column 2, paragraph 2).

Shall we draw two implications from the afforementioned. One, if we must lower the first class operator requirements to provide "equal" opportunity to minority groups, then we imply that they are intellectually incompetent. Stated another way: "We understand your situation (mentally incompetent). We'll make it easy for you by petitioning the FCC to lower the requirements."

Now we draw the second implication: That the FCC is both racially and ethnically discriminating in their establishment of the present licensing procedures. Here is the implication: That the original members of the Commission who drafted the present first class licensing requirements (God bless their souls) were racially and ethnically prejudiced in so doing. If not, then why should the requirements (as suggested by NAB) be altered?

By utilizing a bit of analytical logic we see the fallacy of the NAB petition before the Commission. It's about time that we—broadcast engineers et. al.—understand that just because the word "broadcaster" is included in the title National Association of Broadcasters, that does not mean the association has the interests of "all" engineering personnel in mind. Indeed, the NAB basis for relaxation is absurd in that the implication is one of "superiority" (Come on fella's—let's condescend and help the minority groups by petitioning the FCC to relax their licensing requirements) instead of "equality". Under the diaphanous circumstances surrounding the NAB petition one begins to wonder if, under the guise of pseudo-equality, the NAB isn't surreptitiously plotting a course which would benefit management by providing lesser trained (note that I didn't say incompetent, please) employee's for, supposedly, less remuneration (highly speculative).

True equality is not accomplished by alternation of existing requirements or rules; rather, it is a state manifested in the heart of each individual. Superiority is an alien of "true equality". Since "superiority" overtones pervade the NAB petition, and since superiority has nothing to do with "true equality" then I must abstain from casting my support to the NAB petition. Personally, I view the petition to the FCC as the epitomization of discrimination, both racial and ethnic in origin. Retaliation, from those who share this view concerning the

NAB proposition, should individually voice their unequivocal disapproval directly to the FCC.

Don Hiles
Staff, WCKY
Cincinnati, Ohio

On The Lighter Side

Dear Editor:

With all the serious problems I find discussed in your editor's box, I thought you could use a little light humor. I'll drop a more serious line in the future.

Take it to the chief! The only drawback is, I'm the chief and I thought it would enlighten a few others who may, or may not, have received those little repair notes stuck in their box and really want to do something about them. Here are a few suggestions I have used in relation, or retalliation, to the ones I received recently.

Compaint: Station clocks are constantly out of sync with ABC's.
Answer: Look at it this way—ABC is out of sync with us.
Complaint: Cartridge machines have annoying "clunk" when they stop.
Answer: Do like the P.M. man does —hit it.
Complaint: Refrigerator seems to lack the essentials of life.
Answer: Man shall not live by bread alone—nor by booze either.
Complaint: Turntable #1 has tick in it when running.
Answer: I'll spray it with an insecticide in the morning.
Complaint: We need some more bulbs.
Answer: I'll order a gross each of tulip and lilly of the valley.
Complaint: Entire station in need of rebuilding.
Answer: Open house was cancelled this year—maybe next time.
Complaint: We need at least two more phone lines in here.
Answer: Sorry, we're all out of string and tin cans.

Anyhow, that's how it goes some days and if anyone else can add to the list, fine. Just remember, you have to live with the guys who turn in the little notes. Keep them happy and who knows, maybe they'll send you a get well card after they push you into the high voltage cage.

David W. Huva C.E.
WCER AM-FM
Charlotte, Mich.

Now Philips Broadcast re-invents the PC-70 color camera to set a new broadcast standard for color control and color fidelity

Over 1,000 3-Plumbicon* cameras have been delivered throughout the world, with more than 600 serving broadcasters and production companies in the United States. It is the standard other cameras try to match.

That was tough before. Now it's tougher. Because today the Innovators are introducing the PC-70S-2, with an important list of new features. (And to prove you are always state-of-the-art with Norelco, they're available as field update kits for older PC-70 models.)

Sharpest picture yet. Our key innovation is the sharpest picture detail you have seen from a broadcast camera. A new technique introduces the most basic attack yet on picture-degrading "noise" . . . level-dependent comb-filtered contour enhancement.

Sharp in wider light range. In low-light situations, too, the PC-70S-2 gives you a quieter picture. We've added 48-db signal-to-noise FET preamps. And at all light levels, separate-mesh Plumbicon* tubes increase picture resolution and dynamic range. It all adds up to a snappier picture in every area from light to dark.

More color control, convenience. Now the PC-70S-2 is also available with non-linear matrixing to achieve an infinite range of tints and hues. You can color-match to any camera you own. Even those problem colors in packages and costumes snap into true-to-life color.

But superb picture quality isn't the whole story. There are many convenience features to make your cameraman more expert, more productive. For instance, a built-in test signal generator that takes the guesswork out of set-up. An external filter wheel control at the cameraman's fingertips. The PC-70S-2 ranges far and free from the camera control unit . . . up to 3,000 feet with standard cable, or 1,000 feet with mini-cable.

And with over 1,000 cameras delivered, you are assured of broadcaster-proved dependability. You know a Norelco camera will deliver performance, not headaches. You know Norelco delivers service . . . and updates to keep you abreast of innovations. Ask us about details and prices now.

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INDUSTRY NEWS

FCC Gives Green Light To CATV

For the immediate future, the CATV industry is getting the green light from the FCC. In a series of proposals aimed at shaping the content and direction of CATV, the Commission has proposed rules that will greatly affect the entire communications industry. Not even translators will escape their bite.

Technical Standards

Comments on 20 and 40 channel CATV systems, two-way communications and individual community channels were solicited by the FCC in a rulemaking notice on CATV technical standards. Issued in response to a petition by the engineering firm of Hammett and Edison, the Commission's notice proposed amendments to Subpart K of Part 74 of the rules and ordered that those aspects of Docket 18397 dealing specifically with CATV technical standards be transferred to the new proceeding (RM-1530).

The Commission said, when it issued its Notice of Proposed Rule Making and Notice of Inquiry in Docket 18397 (15 FCC 2d 417, December 13, 1968), the inquiry was intended to present in one proceeding the major CATV policy issues confronting the Commission, and interested parties were advised that the docket would be managed flexibly so that "further notices expanding or altering the scope of this Rule Making and Inquiry may subsequently be issued as necessary or appropriate." Pointing out that recent developments suggest that it is now time to utilize "this retained flexibility," the Commission said it was separating the technical standards material from Docket 18397 in order to be able to give it early consideration.

Stating that the full development of cable television will greatly ease the problem of the scarcity of available air time on standard television stations, and that the economic and technical potential of cable television is so great that the public interest requires it to encourage the growth of CATV, the Commission declared it was putting cable television operators on notice that it intends to continue to require minimum system capacities adequate to serve foreseeable demand and cautioned operators to avoid the economic burden of installing inadequate systems that would soon need to be expanded at extra cost.

Stressing that in developing the proposed new rules it had chosen to write the technical standards in terms of system performance as measured at subscriber terminals rather than placing performance requirements on individual units in the system, and that it is concerned that each subscriber get signals of at least a certain standard without trying to prescribe the methods or the equipment the cable system must use, the Commission said it intended to adopt technical standards which may require of most existing CATV systems "a renewed attention to quality" and that it would revise the standards or add new requirements as the state of technology and regulatory experience may indicate.

Signal Importation

A proposal to permit CATV systems to import distant signals, subject to a specified payment for public broadcasting, deletion of commercials and substitution of commercials of local UHF stations has been put forward by the FCC in a Second Further Notice of Proposed Rule Making (Docket 18397).

The proposed system would benefit the public at large, the Commission said, by making cable more readily available without jeopardizing existing broadcast service.

The Commission action is another step in the CATV rule making proceeding first initiated on December 13, 1968. In previous actions, rules have been adopted providing for program origination and advertising by CATV systems. In the initial rule making notice, the Commission proposed a method under which systems wishing to carry distant signals would apply for "retransmission consent." The retransmission proposal still remains open, the Commission noted. It added, however, that it wanted at this time to explore an alternative proposal.

Under the proposed rules, CATV systems in the top 100 markets would be permitted to carry four distant independent signals in addition to local signals but would be required to delete the commercials from the distant signals and replace them with commercials provided by local stations. Independent UHF station commercials will receive first priority in commercial substitution, followed next by UHF network affiliates. Commercial substitution would also be afforded to any local station able to demonstrate that its ability to serve the public has been threatened.

As a condition to importing distant signals, systems in these markets would be required to pay five percent of their subscription revenues quarterly to public broadcasting. This would come to about $3 per year for each subscriber and would raise about $30 million for each ten million subscribers, the Commission estimated. The CATV system would be permitted to carry any number of distant non-commercial or educational signals if there were no objection by the local educational licensee or permittee. Upon request, the system would be required to delete appeals for funds from such signals and insert similar material to delete appeals for funds from such signals and insert similar material provided by the local educational station.

(Continued on page 18)

The first, and probably the last, Broadcast Automation Sale in Schafer's history. At 40% off even he could clean-up.

Joe the Janitor is the only one around at night in scores of radio stations all over the country as Schafer Automation Systems flawlessly operate — completely unattended. No wonder he's delighted that Schafer is having its first sale ever.

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While they last (which won't be long) we are offering this fine Schafer equipment at up to 40% off — with factory warranty, 5-year financing and free system installation.

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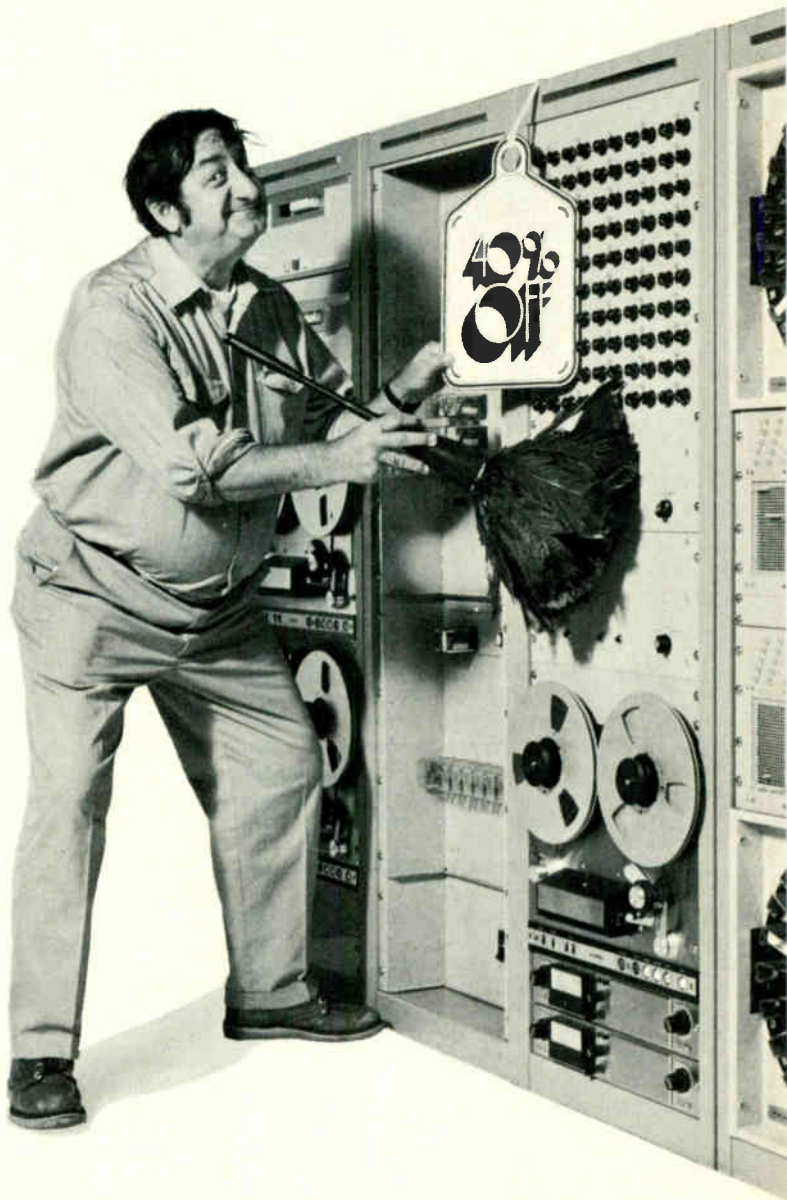

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Circle Number 12 on Reader Reply Card

(Continued from page 16)

Industry News

Cross-Ownership

Local cross-ownership of CATV systems by television broadcasters has been prohibited by the FCC in a Second Report and Order in CATV rulemaking proceeding (Docket 18397).

The new rules apply to all new CATV acquisitions by television interests. A three-year period has been set for compliance in cases where there is existing cross-ownership.

In a Notice of Proposed Rule Making the Commission asked for comments on limitation of multiple ownership of CATV systems on a nationwide and regional basis.

The Commission's order is one of a number of related actions adopted in the CATV rulemaking which was initiated on December 13, 1968. In a First Report and Order released on October 27, 1969, the Commission adopted rules requiring CATV systems with 3,500 or more subscribers to originate programing after January 1, 1971.

The Grade B contour of a television station was set as the "controlling standard" for ownership by the Commission. It said "if the CATV system is wholly or partially within the Grade B contour, cross-ownership should be barred."

CATV Regulation

Comments on the extent of local and state regulation of cable television and their relationship to federal regulation, and on limitation of franchise fees, have been requested by the FCC.

The Commission noted that there are a number of approaches to this question, including federal licensing of all CATV systems and federal regulations. Citing a third approach to a federal-local relationship that combined federal regulation together with establishment of federal standards for local regulators, the Commission asked for comments on the nature of the standards to be adopted for local regulation.

The Commission said that this approach recognized that while CATV is an integral part of interstate electronic communications, "practical considerations argue in favor of leaving important aspects

of cable regulation to state and local governments . . ."

Outlining the scope of this relationship, the Commission specified that the local entity would handle such legal, technical and financial matters. It would investigate the character qualification of the franchise applicant, check on areas to be served, pole line attachments, rates, quality of service and repairs. This information would be certified to the Commission by the local government organization before the Commission authorized the CATV system to use broadcast signals. The Commission would also specify for the local government unit a continuing regulatory program for such matters as rates, repair services and expansion timetables.

The Commission also proposed that franchise fees be limited to no more than two percent of a CATV system's gross revenues. It noted that it has put forward, in a separate rule making, a five percent fee to be paid by CATV systems for use in promoting educational television. This proposal is part of an overall program to expand CATV "to obtain marked benefits to the public interest," the Commission said, warning that this could be "frustrated" by local franchise fees. Pointing out that expansion of CATV service, as a result of the new proposals, could result in greater revenues at two percent than are now being achieved at higher levels with reduced systems, the Commission emphasized that its aim was not to "withdraw revenues from franchising authorities but rather to strike a balance which permits the achievement of the federal goals and at the same time substantial revenues to the local entities."

FCC On Land Mobile – UHF TV Service Will Not be Impaired

In a rule making notice issued July 26, 1968, the Commission originally proposed geographic sharing of channels 14 through 20 in 25 of the largest urbanized areas. It said, however, that modifications of this proposal were necessary to "balance the needs" of the land mobile services for more spectrum space "with a need to assure that the development of the UHF television service will not be impaired. . . ."

The Commission said that the sharing would be confined to one or two UHF TV channels which can be utilized "with maximum protection to UHF television while allowing land mobile facilities to operate with powers and antenna heights suitable for their purposes."

Interference protection standards were set at a level to protect UHF television reception while permitting "significant" land mobile relief. They said these standards would provide an opportunity to check the sharing procedure in actual practice. It said it would evaluate sharing at the end of a five-year period and make further judgments at that time.

Under the new rules, land mobile assignments will be permitted within 50 miles of the center of each of the specified urban centers. Mobile unit use will be permitted anywhere within a 30-mile radius of their base station transmitter sites.

They also said the channels selected for shared use were those where operation with maximum facilities (1 kw power and 500-foot antenna height) would be possible in much of the 50-mile area from the center of a specific city. It pointed out that this standard "severely" limited sharing possibilities. Permitting sharing of more than two channels in these circumstances, the Commission said, would result in "marginal value" to land mobile users "while increasing considerably the risks of interference to UHF TV stations." It stressed, however, that the rules are intended to provide greater protection for UHF TV stations from land mobile interference than they receive from other UHF television stations.

As an additional safeguard, the rules require a minimum separation of one mile between land mobile base stations and UHF television transmitters in areas where, because of strong land mobile and television signals, certain technical problems (intermodulation) could develop.

FCC Proposes Signal Idents

Rules permitting broadcast stations to identify programs by transmitting a coded signal included in aural program material have been proposed by the Commission in a Notice of Proposed Rule Making.

The rule making proposal is in response to a petition filed by Audicom Corporation, and would amend Part 73 of the rules for standard broadcast stations, FM and noncommercial FM stations and television stations to permit the transmission, simultaneously with aural program material, of brief, inaudible signals carrying program identification information in coded form, intended for interception and use at monitoring stations as part of an independent, largely automatic electronic program and commercial identification service.

In its Notice, the Commission specified that the aural carrier should be frequency modulated by a signal with an occupied bandwidth no greater than 60 c/s, a center frequency of 3000 c/s, and a level not exceeding minus 50 decibels with respect to the level for 100 percent modulation; that no signal transmission should exceed 2 seconds duration; and that the transmission should not cause "significant" degradation of broadcast transmission.

Audicom stated that the coded signals would be imposed on a tape or tape cartridge of a commercial or program distributed for broadcast, in the aural channel of a video tape, or the sound track of motion picture film used by TV stations. The system could also be applied to the coding of phonograph records, the applicant said, and, if necessary, recorded or live program material could be coded at the time of the broadcast by an announcer using a manual coding mechanism.

The transmitted coded identification information would be intercepted by monitors strategically located to pick up signals of stations in each area, it was explained. The information received by each monitor would be stored and periodically transmitted by telephone lines to a central location, where information would be assembled and analyzed by computer.

Commision Clamps New Standards On Interference

Manufacturers, vendors and shippers of radio frequency devices that emit electromagnetic energy capable of causing harmful interference to radio communications must meet the technical standards of FCC rules after October 1, 1970, the Commission has ordered (Docket 18426).

The new rules implement a 1968 law empowering the Commission to make reasonable regulations governing the interference potential of certain devices. (Section 302, "Devices Which Interfere with Radio Reception," was added to the Communications Act on July 5, 1968, by Public Law 90-379, 82 Stat. 290).

SCANNING THE CATV SCOPE

NCTA Technial Review

Due to the proliferation of technical papers presented during the recent NCTA national convention, the Scope this month will be devoted to covering two papers whose subjects should be of immediate interest.

"Trade-offs In Cablecasting", by Telemation's Kenneth Lawson, took a long, hard look at color vs. monochrome and permanent vs. mobile cablecasting equipment.

One might expect to get only the color pitch, but, as Lawson put it, low cost vidicon color cameras reproduce color accurately only under controlled lighting of relatively high intensity. Color pictures are more interesting and stimulating, but programming may be limited because of the lighting requirements. For example, the city council may not allow the lighting required for color coverage of one of their important meetings. Then, too, outdoor sports coverage and certain social events may be nearly impossible to accomplish.

Of course, low light level cameras are beginning to show up on the market, but for the moment, most operators are looking at the less expensive cameras.

However, Lawson warned that good black and white cameras—the kind capable of operating in marginal lighting situations — must be used.

Some operators are willing to concede certain programming difficulties and go full color. The decision may be based on the operator's understanding of what his subscribers want and what they expect. In some markets, color is a must.

Assuming that the FCC expects local origination programming to be more than local live talent in front of a camera in the studio, mobile equipment cannot be overlooked.

A simplified definition of a permanent studio facility is one in which the control room facilities for camera and audio switching are not movable for producing programs outside the studio. Mobile, then, is quite the opposite.

To solve the equipment problems associated with programming outside the studio, Lawson offered the following alternatives:

- Rely on single camera productions, bypassing the need for switching.
- Place all equipment in a van which becomes the control room. Connect it to the studio by video, audio, film and VTR remote control.
- Reduce video and audio control equipment to one or two portable cases. Supplement this with a "bare bones" standby switching and monitoring system to be used when the portable console is in the field.
- Develop a dual control facility. Take a modest mobile control unit to the field and leave the the more sophisticated and complete system intact at home base.

He added that if you want to maintain a multi-camera "broadcast" operating format in the field, a mobile van is the most effective equipment mode. As a continuous program protection policy, the film chain and at least one videotape recorder should be left in the studio.

Color Remote Unit For CATV

Agreeing with what so many others have said about the cable operator's need for truly interesting "local" originations, Kenneth Kaylor of Philips Broadcast Equipment Corporation insisted that the mobile unit must be used.

"He (the cablecaster) has to generate almost any type of programming from almost any type of location in relatively little time and at a very low cost," Kaylor said. "One of the most appropriate ways to accommodate these goals is through the use of a self-powered remote unit."

According to Kaylor, a good "rule of thumb" to use when selecting the chassis van or body is that the vehicle should cost about 10 percent of the total cost of the finished unit, which includes all equipment and labor for installation.

After suggesting that, in the long run, the custom designed body is the best buy, he cited several design considerations that should also apply to standard vans. They included: sub-floor space for routing cables; overhead space for lighting, air conditioning and insulation, cable storage capacity, adequate camera storage, as well as room for dollys, tripods and pan heads; lighting storage; exit ports for audio, cue, video and intercom; heat load; power input and stability; legal restraints; and load factors.

Understandably, each address designed for convention delivery hovers hear and there over specific manufacturer design concepts. This is not an unfair approach to convention papers, because it is through just such deliveries that the convention gathers in its most powerful meaning: a review of the state of the art. In fact, this is why those directly involved in modern day communications must attend at least the major conventions.

Without such attendance, how else can you get first hand information on laser links and remotes via microwave. While it is all too easy these days to get lost in the politics and planning that grab the spotlight of convention activities, the exhibits and technical papers placed before this convention clearly revealed the present and the future. And while it may be difficult today for cable operators to find a singleness of purpose and the guidelines of their ultimate future, they certainly do not lack in incentive or imagination.

They might even believe the day of the mobile van loaded with digitally controlled equipment automated for remotes to the studio by microwave.

Taverner Challenges The CATV Industry As Fourth Dimension

NCTA President Donald V. Taverner challenged members of the cable television industry to make CATV the fourth dimension in communications.

Speaking before some 4,000 industry representatives gathered at NCTA's 19th annual convention in Chicago, Taverner declared that "CATV will not only be far more important in the future of communications—but the future of communications will be far more important because of CATV."

Taverner challenged cablemen to put aside parochial concerns, and work together for the common good of the industry.

"Will you allow CATV to become the fourth dimension in communications? Can we take our rightful place alongside the printed word, radio, and over-the-air television?"

Commenting on the FCC's Public Dividend Proposal, Taverner said the plan "represents a truly favorable turn on the part of the commission in finally recognizing that the potential of cable television must be allowed to develop."

However, he emphasized the plan was only a proposal and far from being reality. The NCTA president expressed confidence, though, that the major thrust of the proposal was designed to "free-up" the CATV industry.

Taverner cited four resources that the industry has depended on in the past and would have to rely on in the future.

"Our first and greatest resource is the quality and quantity of leadership to be found in the industry," he stated. "But," continued Taverner, "too many outstanding leaders have not made themselves visible as yet."

"I urge you to get into the NCTA act—personally and constructively," he said.

Another resource he cited was CATV's role as the underdog in the communications world.

Taverner said the public need was a third major industry resource. He flatly opposed the notion that the American public is only getting what it wants in terms of programming. "As a television broadcaster for eight years, I don't believe that. The choice you never get is a choice you cannot make," he declared.

The fourth resource Taverner referred to was the national association. "NCTA," he said, "has been tried and tested in the judicial, legislative and regulatory areas." The association president chided "the fellow who drops out or refuses to join NCTA because he disagrees with some decision.

Taverner expressed confidence that the industry was capable of assuming a new and major role in the telecommunications structure of the country. But, he added, this would only be possible if the industry had the will and desire to do so.

See Page 44 for NCTA Convention Coverage

EDUCATIONAL BROADCASTING

Looking Inside Non-Commercial Broadcasting

By Walter Jung

Checking For Quality

The Public TV broadcaster is beset with some unique circumstances when it comes to reception and transmission of network programming. The audio and video circuits are provided by means of a special tariff arrangement and utilize, for the most part, unmonitored signals via secondary routes. This line agreement provides continuous 24 hour signal paths at lower rates than those paid by the commercial networks. However, this action is not without compromise: The higher rate should and does command better service.

By sacrificing this service, the Public TV broadcaster has, in effect, chosen to do his own line checks and verify signal quality. If the line is in need of service, the burden is then on him to determine the nature of the difficulty and report it to the Telco people with sufficient advance notice to provide time to locate the trouble and correct it before the line is needed for program use. Since the Telco transmission and reception sites are often unmanned, this means service personnel must be dispatched before they can begin troubleshooting.

With these ground rules, it becomes obvious that a rigorous check and a continuing monitoring procedure between the network interconnected stations is imperative. To illustrate just what is involved in this routine we'll discuss the testing techniques used on the Eastern Educational Network, which comprises the backbone of east coast Public TV broadcasting.

For the purposes of test signal routes, the network is split into two sections, the northern leg and the southern leg with the line of demarcation being WHYY in Philadelphia, where the tests are originated. The testing procedure on both legs is similar, so a description of the format on the south leg will give idea of the approach.

WMPB in Baltimore is the last station on the network and can only receive or send signals through WETA in Washington. WETA can send or receive signals either way, to and/or from WHYY or WMPB. So in a daily operational check between these stations the paths to be checked are thus: WHYY to WETA, WETA to WMPB, WMPB to WETA and WETA to WHYY. A round robin signal from Philadelphia and back again then will go through four links in completing this circuit. By making measurements of a common test signal at various points along these paths, problems in various sections can be quickly isolated. Even though a hookup of this nature would not be representative of a normal transmission, day to day observation and logs give a history of test results allowing deterioration of any portion to show up quickly.

The mechanics of the daily tests conducted by EEN start by the EEN test engineer at WHYY placing calls to the Washington and Baltimore stations. An engineer at these stations has previously arranged to "normal-thru" the net signal to the succeeding station so it will arrive truly representative of any distortion suffered along the route. At the same time he has appropriate monitoring equipment to bridge this incoming and outgoing line and give an accurate interpretation of the test results.

Video Level Check

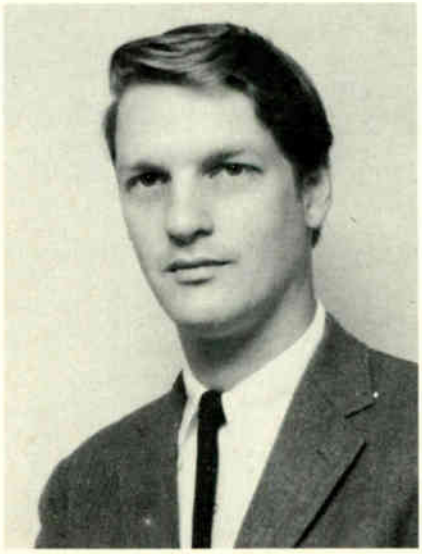
The first test conducted is a video level check on an EIA RS-189 split-field color bar pattern. The peak white, sync and burst ratios are recorded at each monitor point and relayed in turn to the test director. In addition, the vector display is observed on a vector scope for proper phase angles and color saturation. This gives a general picture of the line condition as far as levels and chroma relationships at each point. Deviations from the standard "100 over 40" IEEE units or correct encoded display will generally be a clue to troubles in other areas: an excessively high level quite often mean-

Walt Jung Joins Editorial Staff

With this issue of BE, Walt Jung joins the editorial staff as editor of this column.

An accomplished design engineer, Jung is on the engineering staff of the Eastern Educational Network (EEN). In previous positions, he has worked with military communications, home entertainment equipment, and commercial equipment design. Now firmly planted in educational television, he has passed his First Class exam (see letter to the editor by Jung, June issue).

If you read the industry journals, the name should be familiar. Walt Jung has made some significant contributions to the communications industry through his many articles. We hope you will join us in welcoming him, and we hope you will drop him a line when you have questions in this field.



Walter Jung

ing non-linearity in the white levels or sync region. An abnormally low level might be accompanied by excessive noise components. Abnormal phase shift on either yellow or blue vectors can be a clue to differential phase. Although the levels are recorded as a minimum, it is also common practice to note any other abnormalities about the signals' appearance in the "comments" column (See Figure 1).

The next test is with a 2T $\sin^2$ pulse and window signal. Random noise is measured by observing the "grass" on the baseline of the window signal, using maximum vertical sensitivity on the waveform monitor. And, of course, the K factor of the 2T pulse is measured. These two parameters are recorded as a minimum, but any other defect is also noted. Noteably, those easily detected by this test include: tilt, smearing, streaking, ringing, overshoots, and other discrepancies. All of these observations are important in making a good assessment of performance, both initially and as a day to day status check.

Differential Gain And Phase Measurement

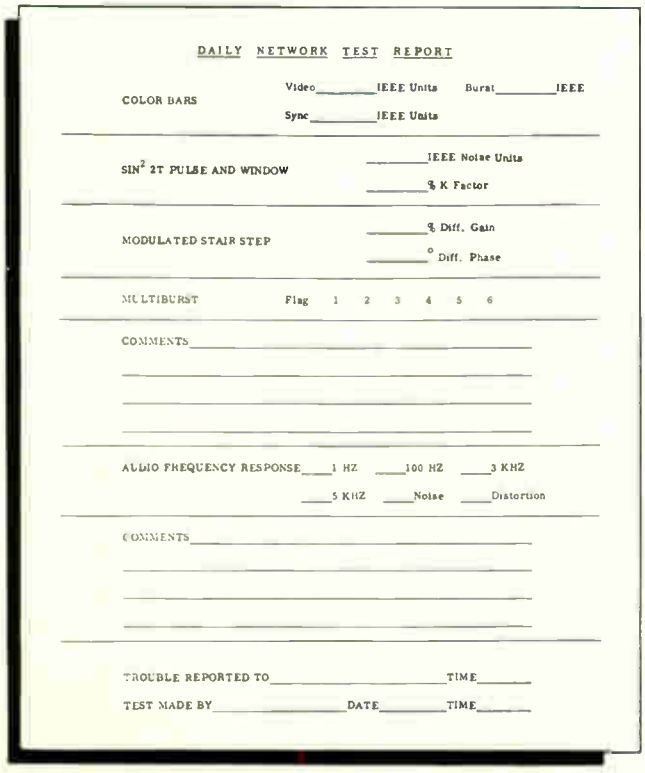
The third video test is a differential gain and phase measurement at 50% APL using a 10 step waveform. This reveals distortion in the color subcarrier portion of the video spectrum, but can also show up other discrepancies. The differential phase and gain readings are read and logged at each point, and any general observations, such as noise, non-linear gray scale, phase jitter, amplitude bounce, are noted. Since differential phase and gain are so important to proper transmission of a color signal, these measurements are made as carefully as possible. For instance, differential gain is read on the vectorscope for greater accuracy, rather than using the waveform monitor. The waveform monitor will provide the reading, but not at the resolution available on the vectorscope.

The final video test is made using a white flag and 6 frequency multiburst signal, 0.5 to 4.2 MHz. These readings are made with the white flag as a 100% reference and measure the peak-to-peak sine wave envelope of each burst. This waveform serves to reveal frequency response uniformity through the upper video spectrum. The levels of each burst frequency, with respect to the flag amplitude, are recorded and reported to the test engineer at the origination point.

An audio check is also made, but is much less involved than the video check. After a reference level of +8dBM at 1KHz is marked at each station, spot frequency checks are made at 100Hz, 3KHz and 5KHz and are recorded and reported to the test engineer. Signal to noise ratios and THD measurements are also made and recorded.

At the conclusion of the tests the data is summarized by the test engineer, and conclusions drawn upon the status of each link. Since he has in front of him the test measurements of each leg, he can readily see where trouble lies by comparing the relative quality of the interconnecting links. If he considers a leg to be in trouble, he will advise the engineer at the receiving end of that leg to turn the line in for service. This concludes the "party line" portion of the daily checks. The EEN engineer now has a report on the line status and it is filed with EEN headquarters in Boston. But the station engineers may have some work to do.

If a trouble is found during tests, the line must be taken out of program service to allow the Telco engineers access to the equipment for servicing. At this point the station engineer has some very definite responsibilities to carry out. To release the line for servicing by Telco, he must clear the removal from service with local traffic and EEN headquarters. When he has gained this authority, he can notify the local Telco office of the discrepancies and advise them of the time period of the release and the time at which restoration is nec-



DAILY NETWORK TEST REPORT

COLOR BARS — Video _____ IEEE Units Burst _____ IEEE; Sync _____ IEEE Units

SIN^2 2T PULSE AND WINDOW — _____ IEEE Noise Units; _____ % K Factor

MODULATED STAIR STEP — _____ % Diff. Gain; _____ ° Diff. Phase

MULTIBURST — Flag 1 2 3 4 5 6

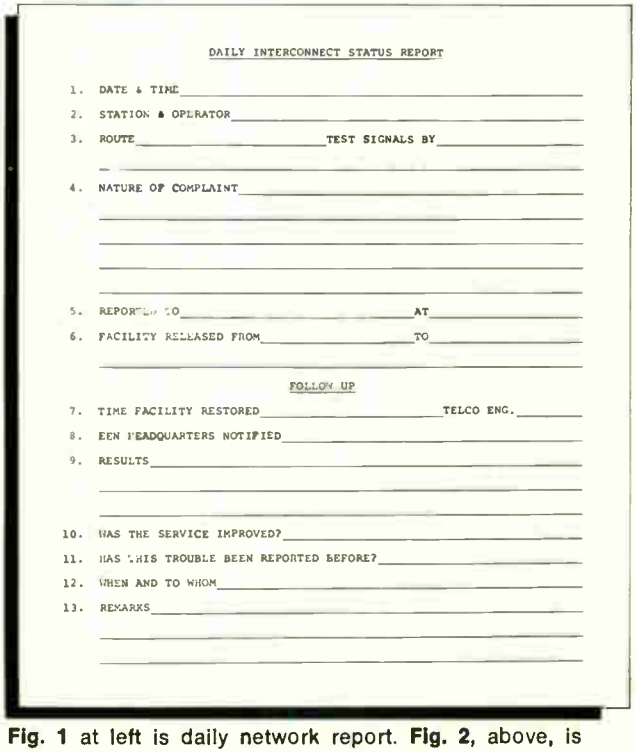
COMMENTS _____

AUDIO FREQUENCY RESPONSE ___ 1 HZ ___ 100 HZ ___ 3 KHZ ___ 5 KHZ ___ Noise ___ Distortion

COMMENTS _____

TROUBLE REPORTED TO _____ TIME _____

TEST MADE BY _____ DATE _____ TIME _____



DAILY INTERCONNECT STATUS REPORT

1. DATE & TIME _____
2. STATION & OPERATOR _____
3. ROUTE _____ TEST SIGNALS BY _____
4. NATURE OF COMPLAINT _____
5. REPORTED TO _____ AT _____
6. FACILITY RELEASED FROM _____ TO _____

FOLLOW UP

7. TIME FACILITY RESTORED _____ TELCO ENG. _____
8. EEN HEADQUARTERS NOTIFIED _____
9. RESULTS _____
10. HAS THE SERVICE IMPROVED? _____
11. HAS THIS TROUBLE BEEN REPORTED BEFORE? _____
12. WHEN AND TO WHOM _____
13. REMARKS _____

Fig. 1 at left is daily network report. **Fig. 2**, above, is example status report.

essary. While the line is being serviced he may be called on to originate a test signal, check levels or monitor adjustments and their effects. Obviously, close communications and cooperation are essential ingredients to making a success of this procedure.

Upon completion of the service interval by Telco, the engineer will receive a "follow up" call from the Telco engineer which is his official notice of service restoration. Now he must notify EEN headquarters and local traffic to this effect. His job is not yet finished, however, as he must file a report of the entire procedure with EEN (See Figure 2).

This report is a summation of the entire activity and denotes the discrepancy causing the report, all parties involved, all pertinent times and, most important, the improvement noted after adjustment or service. A continuing file of these reports serves as documentation of service history. Frequently waveform photographs accompany these reports which allow detailed study of line conditions.

Due to the nature of the transmission services used in Public TV broadcasting a regular testing procedure of this nature is an absolute necessity. All parties involved in the system must carry a high degree of responsibility and work closely together to achieve success. But although the tests being made are quite extensive and thorough, experienced personnel can run through all of the above mentioned checks in 10 to 15 minutes if equipment is made available beforehand.

Admittedly, the system has a built-in time lag and does not provide service checks during actual programming hours. But at this point it does provide day to day information on line quality. Work currently in progress is aimed at establishing a continuous Vertical Interval testing system which will allow monitoring of program lines during peak programming hours. As work in this area progresses, we hope to be able to report on it in this column.

Start Planning Now For The November Convention

2500 MHz Band

Exclusive Access Coming

A plan to afford educators exclusive access to 28 of the 31 television channels available in the 2500-2690 MHz band (Groups A through G in Section 74.902 of the Rules) with corresponding response frequencies has been proposed by the FCC in a Further Notice of Proposed Rule Making (Docket 14744).

The entire band 2500-2690 MHz is presently available on a shared basis with video systems in the operational fixed service (private microwave point-to-point stations for transmission of voice, telemetering, etc.) and the international control service, used for control of remote radio stations engaged in international communications.

Under the proposed rules, the operational fixed service will be accommodated on an exclusive basis on three channels (with band limits 2650-2656, 2662-2668, and 2674-2680 MHz) which comprise Group H in Section 74.902 of the rules. The Commission noted that use of television transmission is not an appropriate function of international control stations and that the stations are provided for adequately in other bands. Under proposed Footnote NG47 to Section 2.106, stations now authorized in the band that do not comply with the new provisions may continue to operate on their presently assigned frequencies and their licenses may be renewed or modified without change in frequency, unless the change complies with the proposed provisions.

The Commission pointed out that in the seven years since the present allocation was established, Instructional Television Fixed Service (ITFS) has grown until, as of April 30, 1970, there were 159 stations authorized. During the same period, eighteen stations were authorized in the operational fixed service for video transmission.

Sponsorship Idents Begin This Month

In response to a Petition for Declaratory Ruling and/or Modification of Order filed June 3, 1970, by the National Association of Educational Broadcasters (NAEB), asking that certain clarifications and modifications be made in the recently adopted amendments of the Commission's rules relating to FM and Television noncommercial educational stations (Sections 73.503 and 73.621), the FCC has postponed the effective date of the new rules from June 17 until August 4, 1970.

Adopted by the Commission on May 6, 1970 (FCC 70-487) the amendments deal with sponsorship identification, acknowledgement of donations, and the frequency of such announcements. In its Order postponing the effective date of the rules, the Commission said that while some of the suggestions made by NAEB appeared appropriate and quite simple, others require more extensive consideration and so in order to study the matter more completely "it is appropriate to postpone the effective date of these rules for approximately 45 days."

Land Mobile To Share 7 Channels With UHF

In a two-part program designed to provide additional space for land mobile radio services, the FCC has adopted rules providing for the sharing of one or two of the lower seven UHF television channels (14 through 20) in the ten largest urban areas, with land mobile radio, (Docket 18261) and the allocation of 115 MHz, of spectrum space in the 900 MHz area for land mobile use (Docket 18262).

The Commission said its actions would "meet to a substantial degree the immediate needs for land mobile communications in and near our larger urban centers and set the regulatory framework for the future development of both private and common carrier mobile communications systems."

AM, FM CP's To 12 Months

An amended rule extending the length of time permitted for construction of a television station to 18 months and for construction of an AM or FM radio station to 12 months has been adopted by the Commission, effective July 13, 1970 (Docket 18763). The new rule also requires a television permittee to file a progress report during the ninth month after the grant of a construction permit.

This action amends Section 1.598 of the rules, and was proposed in a rule making Notice adopted December 3, 1969. The Commission stated that most of the parties commenting on the proposed changes generally favored an extension to 18 months.

The present rule dates from the enactment of the Communications Act of 1934 and provides two months to begin construction and six months to construct. The two months' commencement period is deleted from the new rule. The Commission stated that it became "particularly aware" of the "inadequacy" of the construction period requirement during the so-called "idle" UHF proceedings (Radio Longview Inc., et al., 19 FCC 2d 966, 967-8 (1969) and Northeast TV Cablevision Corp., et al., 21 FCC 2d 442, 443-4 (1970). These were cases in which permittees requesting additional time to construct were required to justify their requests or relinquish their permits.)

They also explained that it adopted the modified rule not only to provide more realistic construction periods, but also "to make clear that henceforth only the closest adherence to Section 319 of the Act will be countenanced." (Section 319 gives the Commission authority over construction permits, and provides that a permit "will be automatically forfeited if the station is not ready for operation within the time specified or within such further time as the Commission may allow, unless prevented by causes not under the control of the grantee." Despite the language of Section 319, the Commission noted, courts have ruled that forfeiture of a CP requires affirmative action by the Commission, and is discretionary.)

In many cases of the larger and medium broadcast markets where no additional AM, FM or TV channels are unassigned, the Commission said that failure to construct promptly may be detrimental to the public and to the prospective applicants. The Commission said that applications for additional construction time will be carefully studied and granted only if "compelling circumstances" are shown indicating that extension is in the public interest.

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Beldfoil is a layer of aluminum foil bonded to a tough polyester film (for insulation and added strength.) To form an ISO-Shield, we apply it in any one of several unique ways to meet the requirements of different applications. (See Figures 1 and 2, for example). Each gives more physical shield coverage than braided wire or spiral wrapped (served) shields. And greater shield effectiveness . . . even after repeated flexing.

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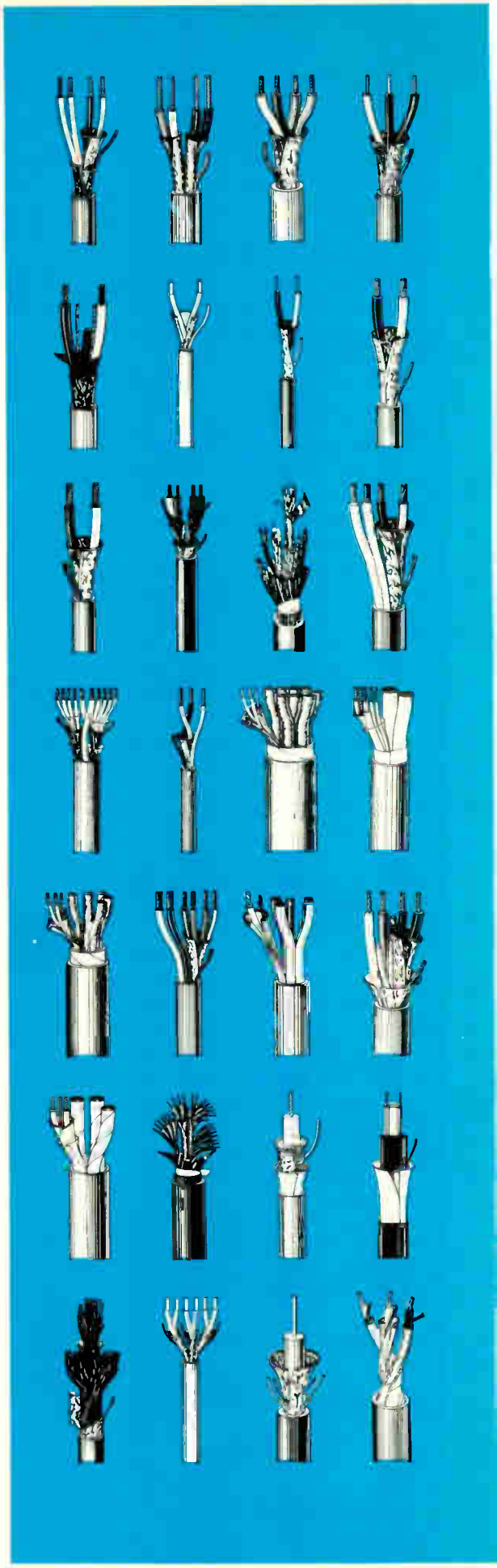
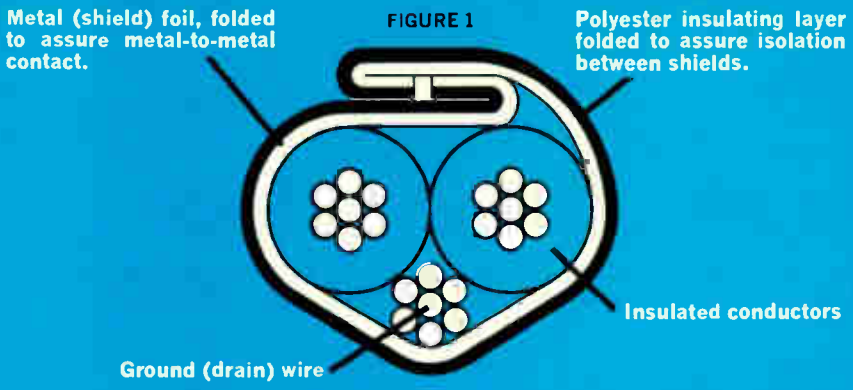


FIGURE 1



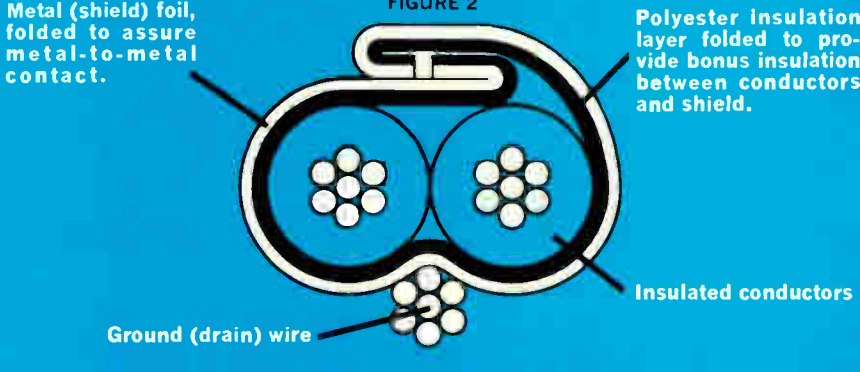
Beldfoil Multiple Pair Individually Shielded Cable

The Figure 1 cross-section shows Belden's exclusive Z-folded Beldfoil ISO-Shield. Note the metal-to-metal contact between the two edges of the aluminum foil. In essence, you have a continuous aluminum tube. And the polyester layer on the outside of the fold assures the isolation between shields so necessary for best performance in the field.

Technical Data

Nominal values for multiple pair individually shielded cables containing 3 to 27 pairs (including 8769 and 8773 through 8778 Series cables)
Suggested working voltage: 300 volts rms max.
Working voltage between adjacent shields: 50 volts rms max.
Capacitance between conductors in a pair: 30 pf per ft. nom.
Capacitance between one conductor and other conductor connected to shield: 55 pf per ft. nom.
Capacitance between shields on adjacent pairs: 115 pf per ft. nom.
Insulation resistance between shields on adjacent pairs: 100 megohms per 1000 ft. nom.

FIGURE 2



Beldfoil Shielded Single Pair Cable

The Figure 2 cross-section shows the exclusive Belden Z-fold with the polyester insulating layer inward. This makes use of the high dielectric strength of the polyester film as bonus insulation between the conductors and the shield. (The cable jacket provides the primary insulation of the shield from outside objects or adjacent cables.)

Technical Data

Nominal values for 8451 Shielded Pair Cable
Suggested working voltage: 200 volts rms max.
Capacitance between conductors: 34 pf per ft. nom.
Capacitance between one conductor and other conductor connected to shield: 67 pf per ft. nom.

BELDEN

new ideas for moving electrical energy

Circle Number 18 on Reader Reply Card

Site and design change pays off for small station

This is the record of a small station that went all out to improve their sound and their operation. Their unique total station planning has been "branded" a success.

By Fred L. Hildebrand,
Chief Engineer, KVOC,
Casper, Wyo.

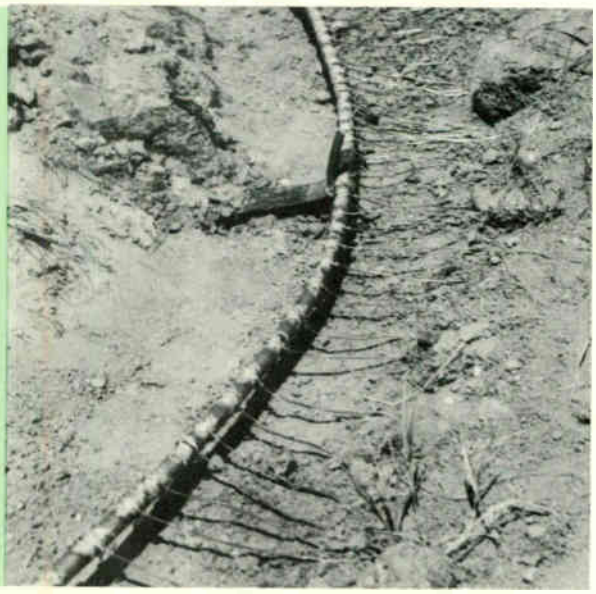


Fig. 1 Tie-offs of ground system were silver soldered to ⅞ inch copper tubing that encircled the tower base. Four two-inch straps run to the tower base, and an eight-foot was driven at each junction.

Can a small, one-engineer-station in a highly competitive market move its transmitter, tower and studios along with a minimum of new equipment, almost no off-the-air time, and still come up with a 100 percent improvement in sound and efficiency? The answer for KVOC, Casper, Wyoming was, Yes.

Amid the planning and execution of the many steps that KVOC required, was the need to keep the station on the air through all phases of the move. As a result, the only off-air time during commercial hours was a three hour antenna impedance measurement period, which was inescapable.

The first and often the longest step in any major move is the selection of a suitable location. In our case we were looking for a combined facility site. Since Casper is a sprawling city with a high sand and gravel earth content, a good site was not easy to find. What we settled on was a compromise. It was not in an

Fig. 2 Home modified farm subsoiler used to install the ground system.

Fig. 3 KVOC station layout. Wall areas in color indicate sound proof construction. Note that, as in other well planned layouts, the work bench is behind the transmitter and equipment racks.

ideal low, wet area, but it did offer easy access to the downtown business district. The ground was good, tight clay soil, a ground system prerequisite in this dry climate.

Ground System

To insure a good ground system we used extra long ground radials (225 feet compared to a radiator of only 150 feet.) In all, 34,000 feet of #10 copper wire was planted in a symetrical pattern which resulted in a measureable increase in fringe area signal and a definite decrease in lightning caused outages.

The ground system was installed using a farm-type sub-soiler which was modified in my home welding shop. The unit worked well even though the ground at the site had rocks and mica in it. The ground system was completed and readied for the tower installation long before we made our major installation and equipment move.

The most physically difficult problem was to move the transmitter, associated equipment, and the building which housed it. This was scheduled for a one-night move with the station sign-off at 6 PM and a promise to listeners that we would be on the air at 6 AM the following morning.

All went well at first. The equipment and transmitter were loaded onto the engineer's pick-up truck. The steel transmitter building was lifted from its old foundation with the aid of an "A" frame truck. Then it began to rain. Needless to say, we scrambled to vacate the rapidly soaking clay hollow as it became a greasy, slippery mess.

Initial Station Setup

Upon arrival at the new site, the power company was waiting to connect service to the transmitter building as soon as it was bolted to its new foundation. Then the telco people began the line equalization of already in-place lines. This was necessary since KVOC would be on remote control until completion of the main studio building. As it turned out, it took much longer for equalization of the program loop than planned, and it was after midnight before KVOC was able to start moving into a muddy building.

After much careful slipping and sliding, the transmitter and equipment rack were in place. Then I was left alone to decipher the smeared and muddy wires, interconnect the equipment and adjust the antenna tuner and transmitter. To shorten the story a bit, KVOC did sign-on at 6 AM as promised, but a few emergency repair measures were needed.

Antenna impedance measurements were completed the next day between 1 and 3 PM. After midnight sign-off the first night, the final tuning of the antenna tuner and transmitter, and clean-up of final wiring was completed. KVOC was then fully operational at its new site.

The New Studio Plan

Next was the completion of the main studio building and the move into it. This actually entailed four operations: wiring of main control after construction of console cabinetry; transmitter and associated equipment installation in the main building; moving administration; and installing and wiring of the production room.

The floor plan of the building shown in Figure 3 evolved from many sessions between the general manager, the engineer, and the architect. A contract was let for construction and our new studio construction program was underway.

When the time came to pour footings for the studio building, eight ground radials were rolled back from the building area. Then, as the foundation was poured, they

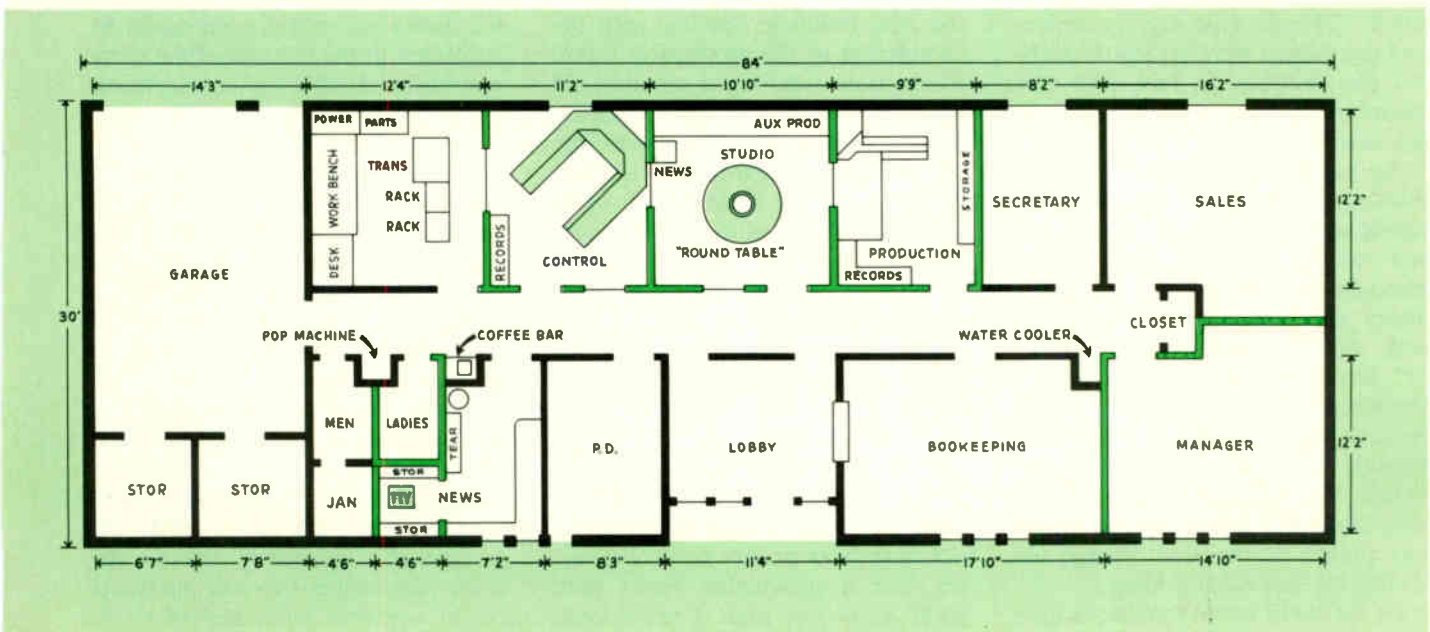


Fig. 4 Main control layout is tight and well organized.

were placed under it and bonded together with 2-inch copper straps. Number 10 copper wire pigtails were brought up through the station floor into each room which later would house equipment. These, plus the 2-inch copper straps between tower base and equipment room, resulted in a ground system so effective that our old problem of RF on audio tape machines was eliminated. "Home" type tape recorders and equipment were set up throughout the building. In fact, five new recorders were purchased for use in the new facility.

As construction of the studio building progressed, all inter-room wiring was installed so that program and net monitors could be used throughout the building, and any future requirements would be met with wiring already terminated in "J" boxes in each room. Control, engineering, studio, production and news rooms were tied together with conduit and bus-duct, allowing any future changes there to be made with minimum effort. An extra pair was pulled in the first wiring, allowing for last-minute ideas.

In the main control room, a new audio console and turntable were needed since the old ones would be used in the new production studio. Also, this would allow completion of main control before the big move, enabling change-over of control from old building to new to be accomplished in one late night move.

During this same week, administration materials were moved into the new building, leaving only the completion of the production room. Production was taped at the old building during the early moving period. After a completely rewiring, rebuilding and cleaning the console and turntables, building of cabinetry and wiring of the new production room complex, the "new sound" of KVOC radio covered central Wyoming. Numerous listener comments confirmed the many engineering decisions which produced a full, pure sound with "depth".

All efforts centered on the most faithful reproduction possible of both recorded and live material. This, in modern formats, requires not only near perfect control facilites, but a production room with good acoustics, plus a multi-track recorder, equilization control, echo and reverb, and all in a functional layout. These combine to enable station personnel to produce straight, comedy, or unusual spot announcements with ease. One easily accessable switch transfers audio output of either production or control rooms to the transmitter limiter input so that either room can be used for main control.

Turntable Layout

When you go into planning a whole new station, you may as well give everything a rethink. We did, and the result was a recorder-turntable positioning that we think is new. The reasons for working up this arrangement were purely functional. We didn't have a lot of extra space, so we couldn't let the equipment sprawl around the room. Perhaps the spacious approach to studio design and layout would be a bit more pleasing to look at, but experience dictates a tight setup for optimum DJ operations.

Tape recorder number 1 is above TT number 1, and recorder 2 is above TT 2. For operator convenience (proximity), the DJ can easily reach the machines and turntables, and on the board, the controls now have a meaningful relationship to the physical layout.

Back lighting was used behind the turntables. Once located inside, the turntables would never again be subjected to the hazards of the more conventional table top arrangement.

"All Talk" Setup

We also took a long look at the "all talk" studio. What we settled on was a circular "talk" table. An old, round, hollow pedestal dining room table was rebuilt for use in the studio. It is not only attractive, but the hollow center allows wires to go directly down into a floor conduit so there are no wires showing, and none to be accidentally kicked or moved.

The table is equipped with a speaker-phone. Up to six guests can be seated comfortably around the table and callers can ask questions of, or converse with, any of them.

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Circle Number 34 on Reader Reply Card

Fig. 5 Back lighting protects turntables and allows lower than usual control room light levels.

This provides the "round-table" type of talk show facility, while main control can be used for the talk show where only the announcer and caller are involved.

The main advantage of the speaker-phone / studio microphone combination, is that all studio guests and moderator have "live-mike" voice quality broadcast at all times, while the caller is identified to the audience by the telephone filter quality of his voice. This is the effect used on most good talk shows. What makes this system unusual is that there is no direct connection between the telephone company equipment and the station's. The caller's voice is fed to the studio mike via speaker-to-mike sound wave transfer.

Though this has often been considered taboo, bear in mind we are using a filtered sound source, coming from a speaker designed to reproduce this range of voice frequencies. Therefore, sound deterioration is hardly distinguishable.

There are other benefits. The entire talk show reaches control on one mike channel, making it easy to control or delay as desired. The only cost is the rental of the speaker phone itself. No hybrids or elaborate switching is required. Beeper tone is supplied by the telco beeper, and delay is accomplished by using the two Sony recorders in tandem. As one records the show, the tape proceeds directly to the second recorder which plays it back and feeds the limiter input. This also gives a normal speed tape of the entire show if reproduction of portions of it for news or information is desired.

A Standup Operation

Operation in control, production and news announce are designed for stand-up operation with two main objectives in mind. First, to get the full voice quality from announcers, and second, the live, well coordinated action and sound of an announcer who is standing, compared to the slow, lazy style which is apt to occur while sitting. Surprisingly, many announcers find standing less tiring than sitting.

Another unusual aspect of the completed station, is the absence of any patch panel. All input or output transfers needed are completed with simple rotary switches, these are much easier for personnel to decipher than the usual patch panel. Though patch panels may be necessary in many installations, the average station can adapt its transfer to switches which are easily labeled to show their function. Any of 12 remote line inputs, are available on one of two 6-position switches, so there is never a need for an operator to run down a row of terminals to find a remote feed. If it is in the building, it is on his switch.

A headset cue is available at the switches along with a regular cue at the console. An equalizer can be instantly switched into any remote line if needed. Much emphasis is placed on telephone line inputs, too, as the station is trying the new DDD remote broadcasts for out-of-state sporting events.

KVOC provides a network feed to many stations. This feed, at times, is not the same program being broadcast locally by the station. So the input to the network line amplifier is obtained by rotary switch from any remote line, main control, production, or either of two telephone lines.

Two recorders are used almost continually in control for delayed network recording, delayed sporting events, on-the-spot news, weather and other record/playback needs. The input of each is switchable to network, either telephone line, any of twelve remote lines, program output, or air monitor. This switching, as is the case throughout the station is completely isolated from other uses of the same signal within the station. So here we have another distinct advantage of switches over the usual patch panel: the simultaneous use of the same audio source at several different points. Of course bridging pads must be used at some points to prevent circuit loading, but this is quite easy to accomplish.

Almost all input sources (such as remote and telephone lines) are available in production for complete versatility. Network, telephone and program lines are also on the news

room tape recorder input switch, which allows newsmen great freedom. The output of this recorder can feed directly down a phone line for feeding news stories to other stations, or for playing a spec spot for a sponsor.

In production, a four-track stereo recorder is used with the outputs of each channel fed to separate inputs to the console, enabling the operator to prepare his music on one track, voice or sound effects on the other, and mix them at the proper levels for playback. This produces a much smoother mix of voice and music than is normally obtained with other systems where the operator cannot accurately determine the loudness of his music in relation to his own voice. Also it is perfect for those stingers that start a few words from the end of the spot, then come right-up-through the last word to signal correctly, the end of a good spot. The uses of multitrack machines in a production studio are only limited by the imagination of the operator.

As a final, personal touch to this new facility, registered Wyoming cattle, sheep, and horse brand owners were invited to a big "Branding Day" at the station. They actually branded the native cedar slabs which decorate the outside of the building. An usually large turnout testified to the success of this promotion, and KVOC became the first radio station in the world, to our knowledge, to be really "branded". The brands not only add to the decor of the building, but also have made the station an extension of all those who have a brand on it. The station is now a landmark. ▲

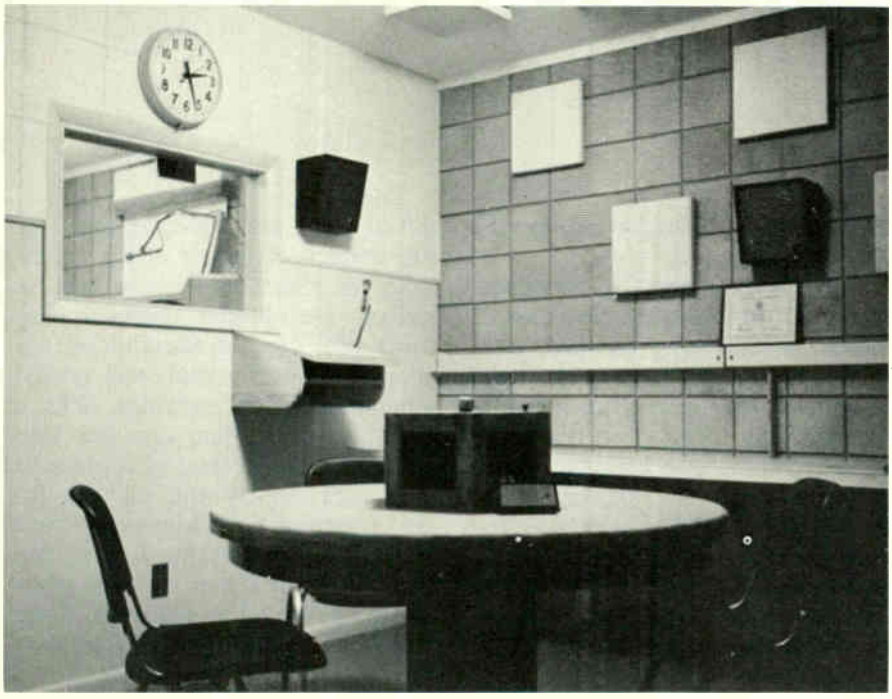


Fig. 6 "Round table" talk show table in the studio with stand-up news announce position in background. The window looks into the control room.

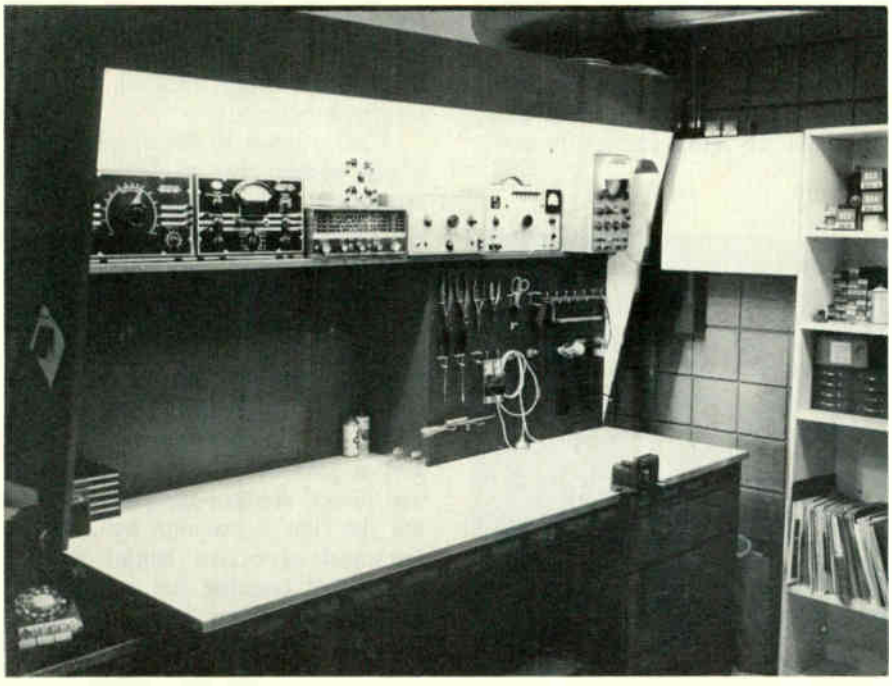


Fig. 7 Work bench and parts storage is in the equipment room behind the transmitter and equipment racks.

Editor's Note: Obviously, the staff at KVOC realized there were tradeoffs involved when they made some of their decisions in the planning stages of the "new" KVOC. However, this article tells loud and clear what can be accomplished when management relies on engineering, communciates with engineering, and then with confidence, challenges engineering.

We learn from KVOC the advantages of a complete station rethink, and we are, at the same time, reminded that a successful station is far more than neat wire bundles, efficient equipment, and bright towers.

A review of the design and operation of EVR

Part 1 of a 2-part series

By Peter C. Goldmark, Robert A. Castrignano, John W. Christensen, C. Russell Dupree, Bernard Erde, Dennis Gabor, William E. Glenn, Abraham A. Goldberg, Patrick F. Grosso, John M. Hollywood, Renville H. McMann, Ivan A. Purt, Robert B. Rhoades, Donald W. Ridley, Andrew A. Tarnowski, and John C. Wistrand*

EVR®, which stands for Electronic Video Recording, was developed by CBS Laboratories, and is described here in detail for the first time.

Through a unique combination of photography, optics, and electronics, EVR plays prerecorded video programs with sound through standard television receivers—truly a visual counterpart of the long-playing record. The nature of the medium lends itself to low-cost, high-volume production in monochrome or color.

The EVR program is contained in a cartridge measuring seven inches in diameter, one-half inch thick, and with its large center hole resembles a 45-rpm phonograph record. The EVR video signal is on a special photographic base, 8.75 mm wide and approximately three mil thick. The sound is recorded on two narrow magnetic strips on each side of the EVR film for stereo or for two independent audio programs. One cartridge can hold two black and white programs of 50 minutes duration (60 min. with European standards). A color program occupies both video tracks, hence half the playing time. As thinner film becomes available, the program duration per cartridge will be longer.

The EVR cartridge is reproduced in a player described here, where an RF signal carries the combined video and audio programs to the antenna terminals of a standard color or monochrome television receiver. Push-button operated controls take care of the threading, stopping, fast forward, and rewind operations of the cartridge. With a suitably coded film, one can stop at any particular part of a program and then display still pictures for any length of time. Manual forward or reverse browsing is provided for, which also can be used when stopping a motion sequence. Since each picture is exceedingly small—0.130 x 0.100 inch—EVR has a large built-in storage capacity with a significant potential for reference library or other types of visual information storage.

The film sensitometry in the EVR system represents an essential interface between Electron Beam Recording, printing and the playback process.

A major goal in the development of the system was to devise a film recording and duplication method that would permit large-quantity production of inexpensive film cartridges containing high-quality video programs. For high-speed duplication, a low-cost ultra-high resolution silver halide film was developed by Ilford Ltd., England, for EVR. The stringent quality and size requirements resulted in selecing direct electronography (exposing the film in vacuum by a finely focused electron beam) as the method of creating the master record. Modern, very fine grain films have a high capacity for information storage and are relatively insensitive to ordinary light, yet very responsive to the high energy pres-

*CBS Laboratories

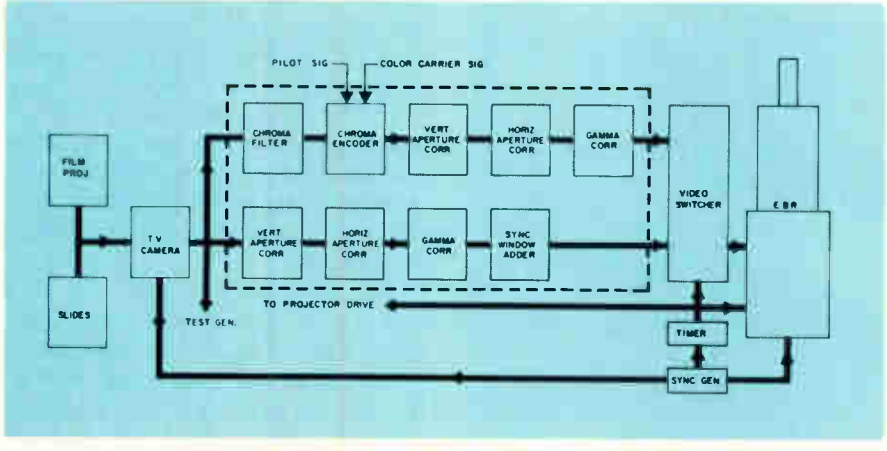


Fig. 1 Chroma and luminance components are enhanced through vertical and horizontal aperature equalization and both are gamma corrected.

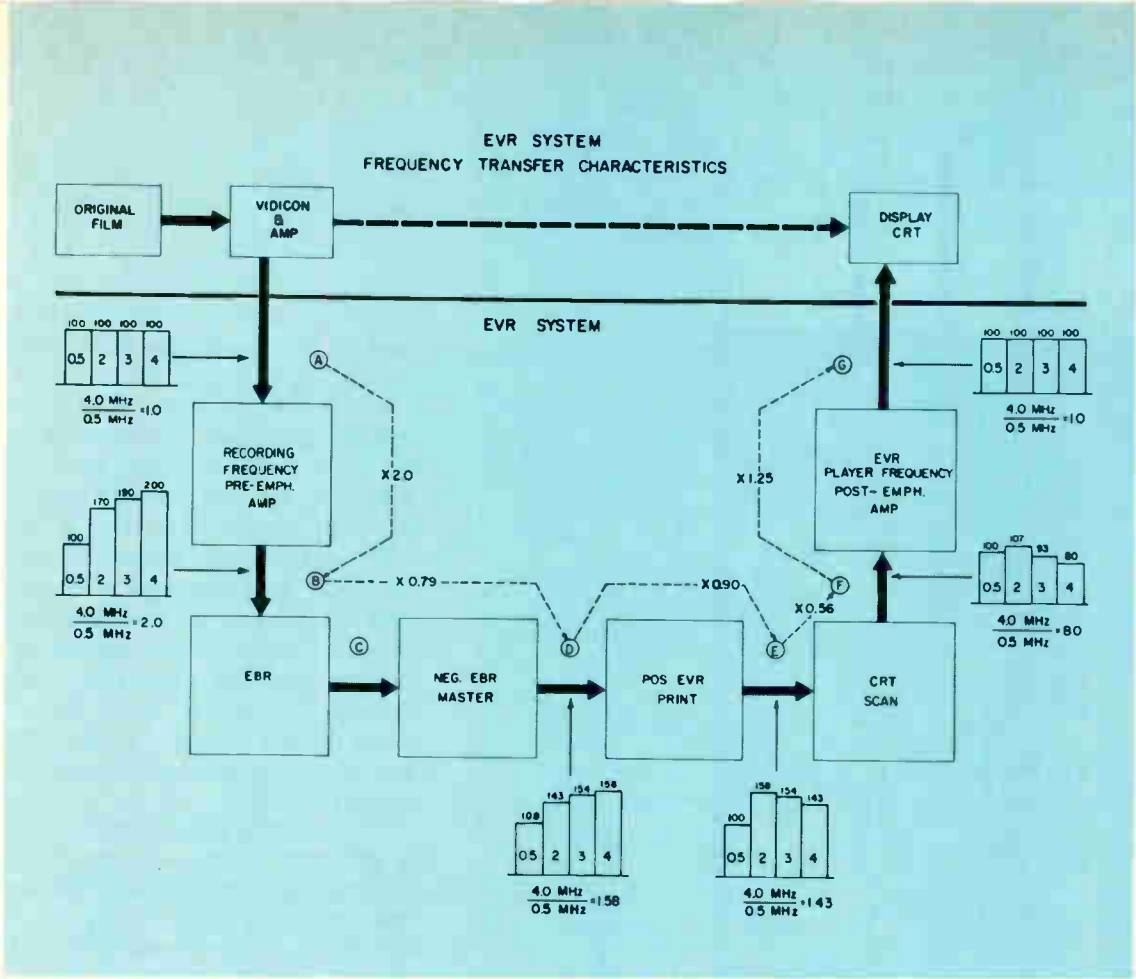


Fig. 2 Indication of the amplitude versus frequency characteristics at various points in the system.

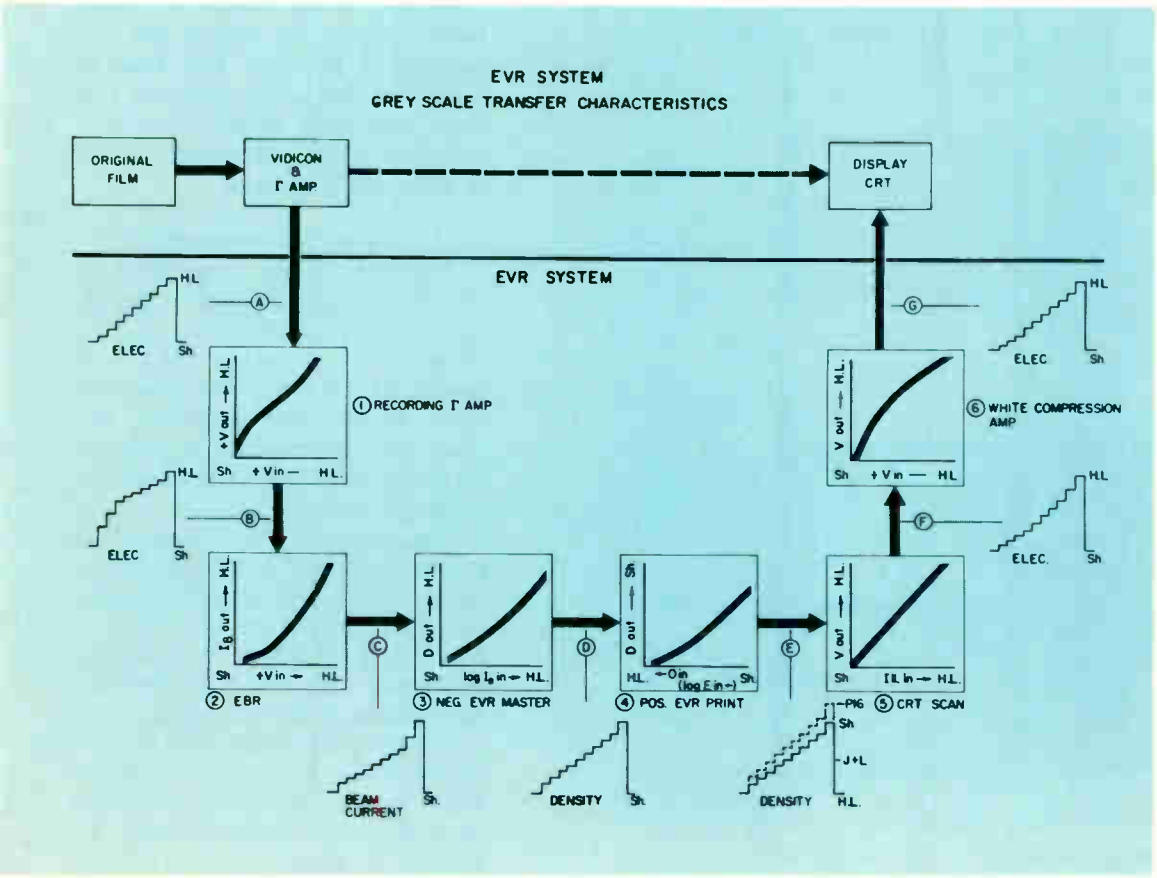
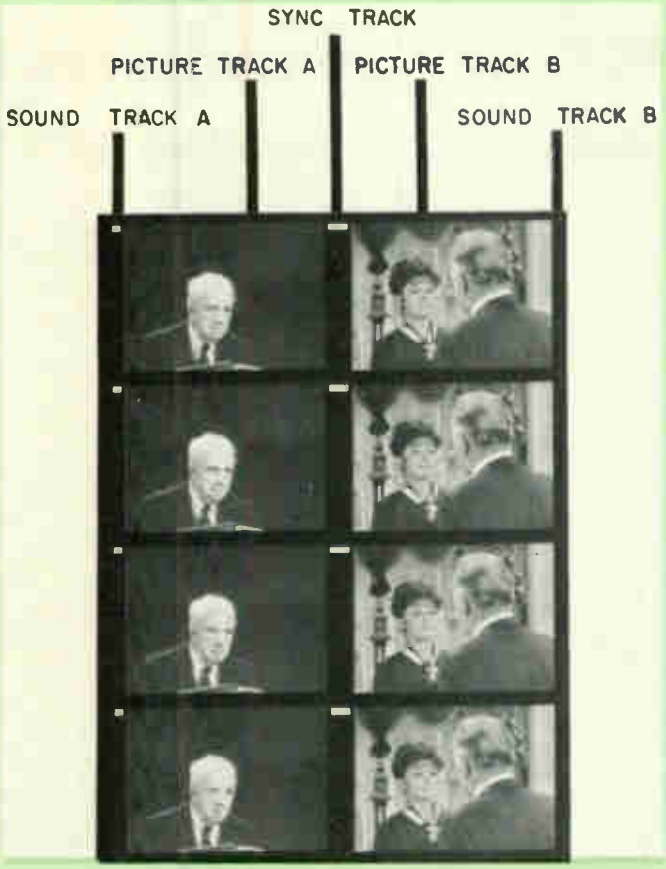


Fig. 3 Greyscale characteristics shown at various points in the system.



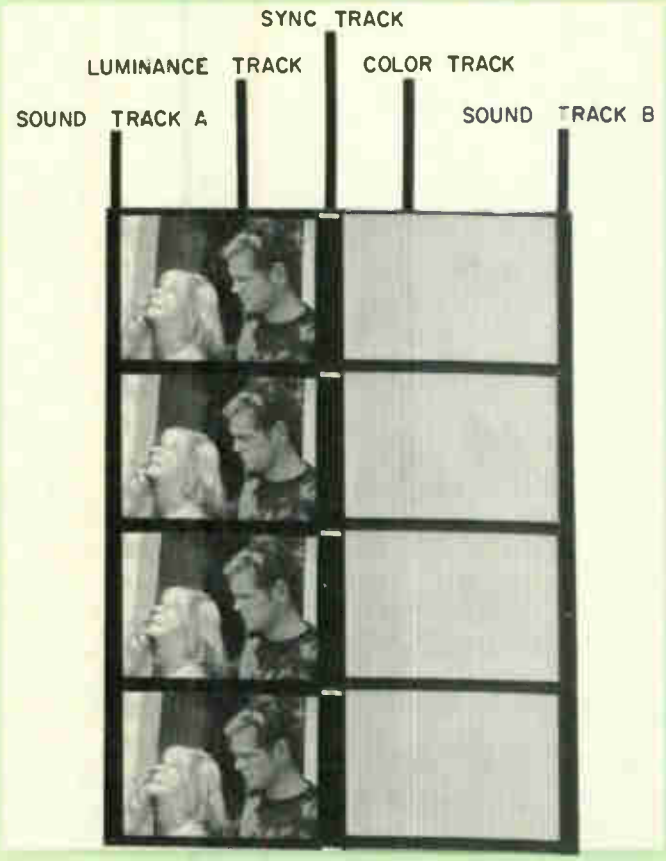


Fig. 4 A section from a monochrome and a color release print.

ent in an electron beam. The film used in the master stock for electron beam recording has a crystal size less than one-tenth of a micron and the definition obtainable is of the order of 800 line-pairs per mm. This film, too, has been developed especially for EVR by Ilford Ltd.

Processing the master through electronic recording makes it possible to produce a predetermined frequency pre-emphasis and to introduce grayscale correction while keeping the density range limited to the desired values. All these are not possible in a purely optical transfer system.

The resulting picture on the film is different in visual appearance from that of normal cinematography film, especially since color pictures appear in monochrome with the chroma content coded. A further difference is in the number of pictures per second. Through the use of extremely fine grain print material, very small images can be produced, which makes it economical to print 60 frames per second (50 in Europe). This leads to simplifications in the playback machine and tends to provide a high degree of visual integration of grain or other imperfections.

Basic Components

The three basic components of the EVR system are the recording apparatus for conversion of programs from films or tape to a master film, the printing process to mass produce the cartridges, and the player itself which is attached to the antenna terminals of one or more television sets.

The principal steps involved in producing the EVR cartridges are: the program preparation; generation of the master negative by electron beam photography; printing, processing and slitting of the films and loading of the cartridges.

The program preparation process electronically precorrects the video signal for any losses that will occur throughout the entire system, including the player.

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MD12RF4 Console provides 12 inputs, 4 outputs and 4 switchable equalizers for $10,470.

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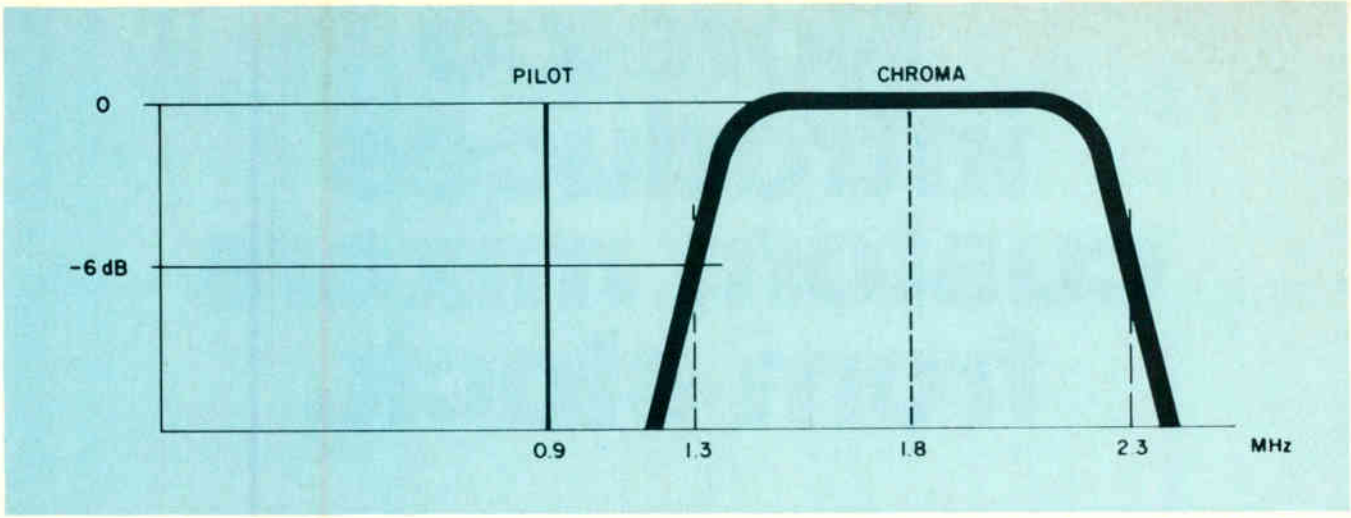


Fig. 5 Chroma and pilot carrier relationship shown with chroma sidebands.

As shown in Figure 1, the original NTSC Color TV signal is separated into its luminance and chroma components. Both signals are enhanced through vertical and horizontal aperture equalization and both are gamma corrected.

Figure 2 indicates the amplitude versus frequency characteristics at various parts of the system. Careful gamma control is employed throughout from recording to playback. Figure 3 illustrates the typical grayscale characteristics at various points of the process.

A synchronization mark, indicating the start of each frame, is recorded on the master film during the horizontal blanking interval. This line of clear windows provides synchronization in the player between the film transport and the CRT scanner.

Figure 4 shows a section from a monochrome and a color release print. Each frame is 92 mil high and 123 mil wide. The synchronizing window next to each frame is visible and the color information is recorded in a coded form on the frame adjacent to the luminance signal. It is essential to record the chroma signal in such a way that the reproduction is independent of the scanning linearity in the recording and playback system. The chroma frame contains a color carrier whose frequency is an integral multiple of the line-scan frequency. In order to provide a reference carrier for the color signal, an unmodulated pilot signal with exactly one half of the color carrier frequency is combined with the latter across the chroma portion of the EVR film. Scanning nonlinearity, raster size changes, film shrinkage, etc. will not interfere with the proper demodulation of the chroma carrier since the phase relationship between it and the pilot carrier is automatically maintained within the required accuracy. Figure 5 shows the chroma and pilot carrier relationship together with the chroma sidebands and Figure 6 contains typical oscillograms of the two carriers.

All synchronizing signals and the pilot carrier are divided down from the color carrier frequency. Because of the integral relationship between the color and pilot carriers and the Electron Beam Recorder (EBR) horizontal scan frequency, the pilot and chroma signals are recorded on the master film as a series of vertical bars, deviating in a horizontal direction only where color changes occur in the picture.

In the EBR color encoder the R-Y and B-Y signals are arranged to modulate phase and amplitude of the color carrier, which is then mixed with the pilot carrier. Preceding the chroma information, four cycles of the pilot carrier are recorded, which appear at the left side of the chroma area. This causes "pre-ringing" of the pilot extraction filter in the EVR player, thus rendering the transient invisible in the reproduced picture.

The Electron Beam Recorder

The diagram in Figure 7 shows the various vacuum chambers. Where the video-modulated electron beam exposes the film, the electron path from cathode to film is maintained in a pressure no higher than 10^{-5} torr to ensure satisfactory beam focus and cathode life. To achieve a pump-down time of a few minutes, a double vacuum pumping system is used.

There is virtually no loss of resolution in the actual process of electron beam recording because the diameter of the electron beam is 1/10.000 inch and the recorder is capable of a resolution of 400 line-pairs/mm.

Electron Beam Recorders for commercial production of EVR masters have recently been completed for use in Europe and for the U.S. For color EVR the same type machine carries a dual beam gun recording side-by-side the luminance and chroma signals. A 40 mm wide film is used for the master and 35 mm film for the print. The 35 mm format accommodates four 8.75 mm EVR films which can hold eight monochrome or four color programs. They are printed simultaneously and are subsequently slit.

Although the recording system could operate with real-time signals directly from TV cameras or film, an operational advantage can be derived by prerecording all programs on video tape.

The EVR mastering system is illustrated in diagrammatic form in Figure 8. The video signal generated from the video tape recorder (VTR) is separated into the chroma and the luminance components. The

luminance signal is divided so that one signal represents the direct signal, and the other is delayed by one field. The output from the latter and the undelayed luminance signal are independently applied to vertical and horizontal aperture correctors and gamma correctors. Both the delayed and the undelayed luminance signals are applied to a sampling gate operating at 14 MHz rate in such a way that both fields are synchronously recombined during 1/60 second (1/50 in Europe). Thus information corresponding to all 525 lines (625 in Europe) is recorded in each EVR film frame.

The chroma portion of the VTR playback signal is extracted from the luminance information by a comb filter and is then translated from the NTSC frequency standards to the EVR system values. The recombined luminance signal and the chroma signal are now applied through video amplifiers to the guns of the Electron Beam Recorder.

Field Delay Methods

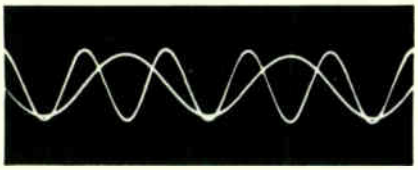
Two types of field delay methods are now available: magnetic storage disks and a quartz line. One magnetic storage system employs a recording and a playback head located 180° apart; in the other system the heads are 360° apart. The quartz line contains eight delay sections connected in series where temperature control assures maintenance of precise transit times.

The Recorder contains all the circuitry necessary for operating the electron gun as well as the vacuum system. As shown earlier, the latter consists of three chambers: one housing the film magazine, the second the film drive, and the third the electron gun. Figure 9 is a close-up of the vacuum chambers and the film transport. The film magazine capacity is 1800 feet of 40 mm wide film, sufficient for recording four hours of color or eight hours of monochrome programs without breaking vacuum.

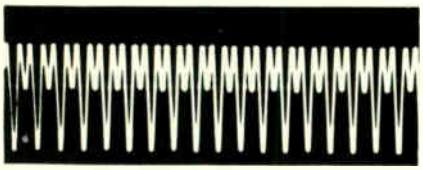
Recording on the film is accomplished with two electrostatically focused and deflected electron guns, located in the gun chamber. The latter can be indexed to four discrete horizontal positions, thus making it possible to sequentially record four dual tracks across the width of the 40 mm film.

The film drive provides accurately controlled continuous motion at 6 inches per second for the U.S. and 5 inches per second for Europe. An electronic servo system locked to the vertical scan and synchronized with the VTR drives the film at constant velocity.

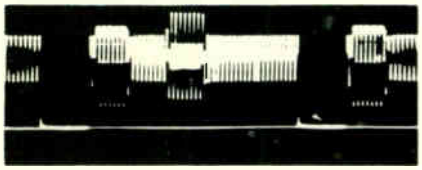
A special multi-head wet gate printer of entirely new design has been developed by Ilford Ltd. in



A Chroma subcarrier leads "doubled" pilot subcarrier by 90°



B Sum of chroma and pilot subcarriers



C Above phase relationship during –I test pulse

Fig. 6 Displays of the chroma and pilot subcarriers.

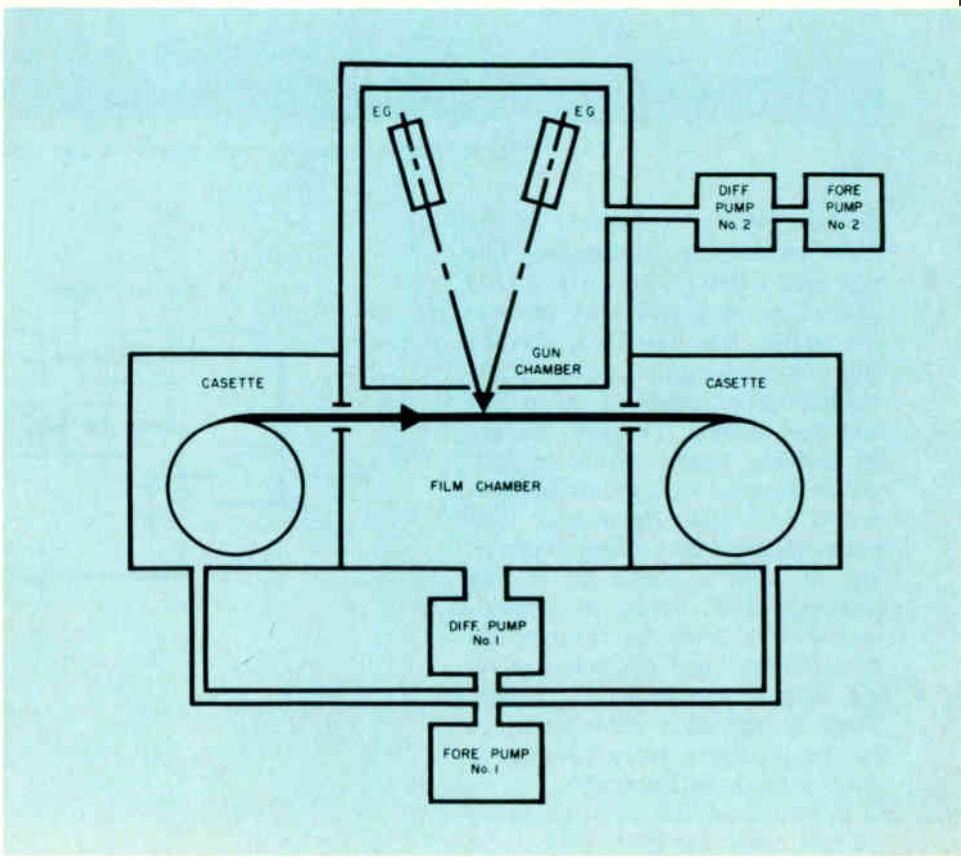


Fig. 7 Electron beam recorder vacuum chambers.

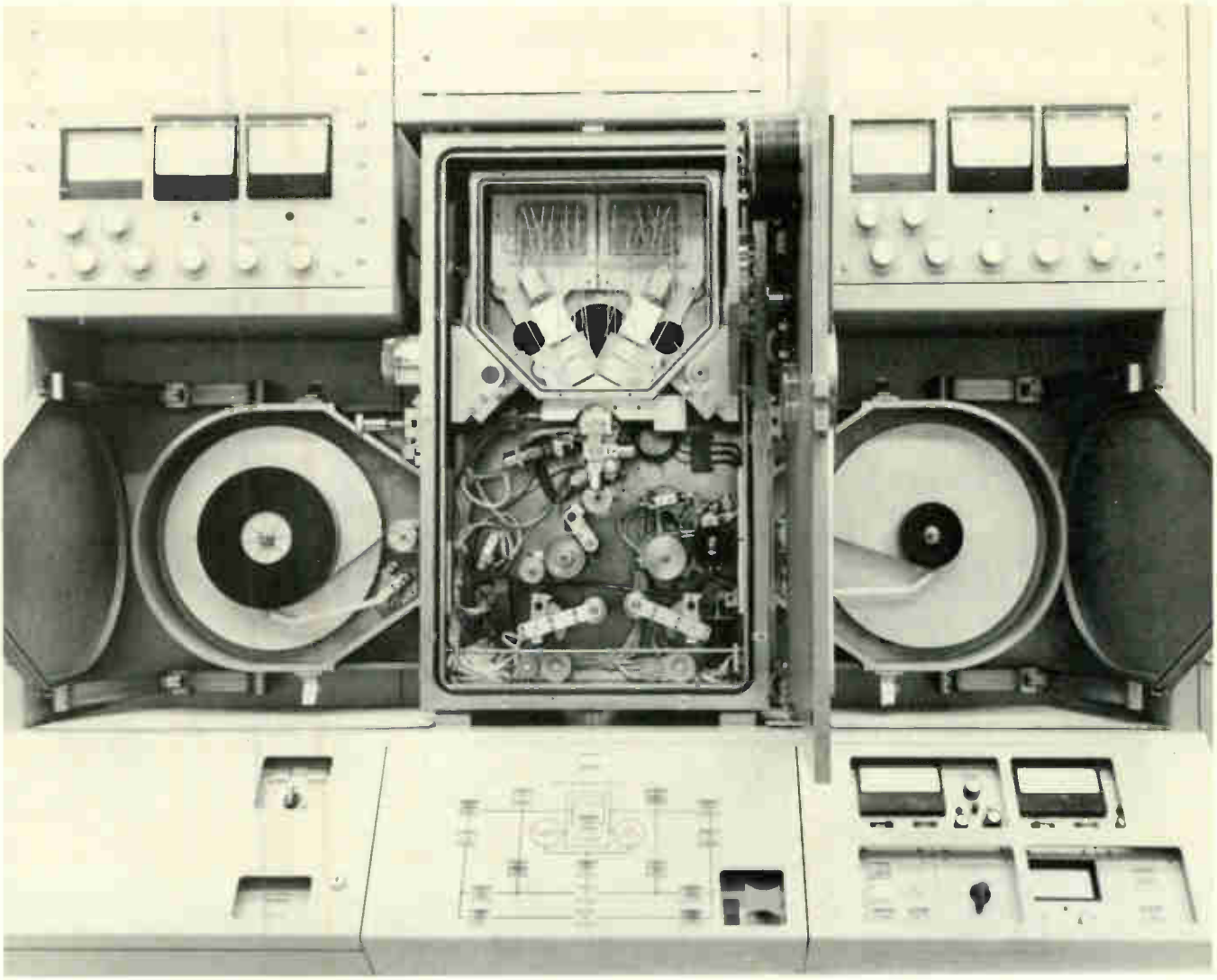


Fig. 8 Photo showing vacuum chambers and tape transport.

England who is a member of the EVR partnership in Europe. The wet gate EVR printer minimizes light dispersion and also protects the master film. The EVR printing and processing equipment is capable of running at speeds of up to 200 feet per minute. Through the use of multiple heads, 16 color programs together with sound are generated each time the master loop passes through the printing machine, and the rate at which the printer produces EVR copies is approximately 100 times (in Europe 125 times) faster than the actual playing time of the original program. Thus, a half hour color cartridge can be produced every 18 seconds (14.5 seconds in Europe).

In part 2 of this two-part series we will cover the EVR player, the chroma translator and audio. ▲

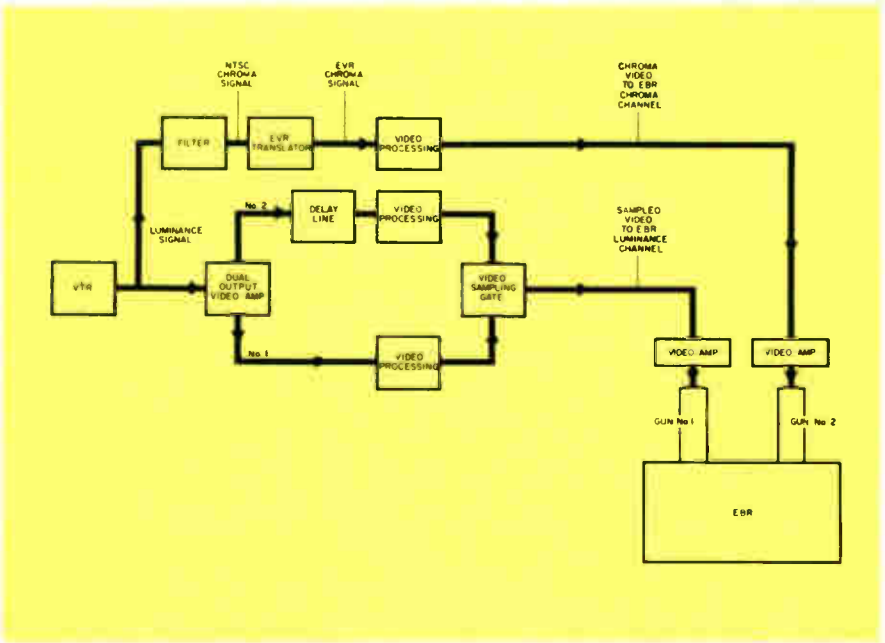


Fig. 9 Illustration of the EVR mastering system.

Sony keeps you off your toes.

Tall story? No problem. The facts are always within easy reach with Sony's remarkable new telescopic ECM-51 electret condenser microphone. The new ECM-51 is specifically designed for on-the-spot recording.

Sony's exclusive non-directional electret condenser capsule is set at the end of a telescopic wand. Its length can be extended from 7¾" to 17½", and therefore acts like an extension of a reporter's arm—increasing his reach by almost one-and-a-half feet!

Built to withstand rugged use, the ECM-51 operates up to 3000 hours with a standard internal battery. Used in conjunction with a battery-powered tape recorder, it gives you the edge in on-the-scene interviews.

The Sony ECM-51 is available at select Superscope Special Application Products dealers. For their names, as well as complete details and specifications, please write Special Application Products Division, Sony/Superscope, 8150 Vineland Avenue, Sun Valley, California 91352.

SONY SUPERSCOPE

NCTA Convention report

The National Cable Television Association met in Chicago early in June for their annual covention. They met under the banner of "CATV Comes of Age", but for all the great expectations that abounded, the convention operated under the same atmosphere that has prevailed in recent years: where do we go from, and how will we get there.

But as the 1970 convention stood at attention for the first sessions one important ingredient had been added—a semblance of security. And it came in the form of Chairman Burch and Sol Schildhause.

But for all the speeches and addresses it was apparent that the cable industry must continue to take its turns under the caution light. The "be patient" approach may be aggravating, but it is especially meaningful in view of the technological explosion that has blown across the face of the communications industry and offered cablecasters more options than they can pick up.

While cablecasters are required to originate local programming, they are being asked to consider system interconnection, satellite relay, automatic meter reading for the utilities, electronic mail, polling, home protection systems, facsimile, and instructional services. Most of these possibilities ride on the capabilities of two-way cable communications.

Meanwhile, cable operators must give a fair share of their time to finding ways and means to assist the FCC in pre-emption of state regulatory controls. And this must be done while they await FCC proposals on technical standards, cross ownership, and multiple ownership copyright. Despite the lopsided questions-to-answers ratio, despite the flashing caution lights reflected on bottomless chasms, cable operators rightfully begin their ride on the roller coasters of 1970 optimism.

The Alumni Day

Earlier in the week, two former FCC commissioners joined an industry panel whose task was to focus on the major issues confronting cable operators. Included were Fred Ford and Newton Minnow.

Ford wasted little time in getting off salvos aimed at recent FCC activity. Ford insisted that what the Commission urgently needs is a better understanding of the CATV industry. This, he said, could be accommplished by holding open hearings on CATV regulations before the rulers are set.

Seeing a need for better direct communications, the former commissioner said that the FCC has not called in cable operators to ask them what they want, what they need, and what they think their future should be. It was not a new stance for Ford, especially since his tour as head of the NCTA.

Newton Minnow, chairman of the board of WTTW, proposed second showing for network programs that are aired only one time. Recognizing the network one-to-a-city policy, Minnow offered a "time diversity" plan that would have VHF network programs replayed on UHF.

Then commenting on Cable TV and freedom of choice, Minnow stated that cable program originations that were concerned with community activities would be of great value to the younger generations. Local originations, he said, would help the youth identify with their community.

Sol Schildhause, acting chief of the CATV Bureau withstood the barbs of Ford and told the session audience "You're in for a lot of regulation."

Ford had earlier said that the FCC should slow down their efforts until they better understood the cable industry.

Comparing the CATV and Broadcast bureaus, Schildhause said the Commission has only 27 people in the CATV Bureau while there are

Newton Minnow . . . A time diversity plan for UHF.

Frederick Ford . . . Understand the CATV industry first.

Sol Schildhause . . . You're in for a lot of regulation.

AS OF NOW, IF YOU CAN'T FIND TECHNICIANS, YOU HAVE NO ONE TO BLAME BUT YOURSELF.

If you're in a business that in any way involves science, you know all about the technician shortage.

But did you know that The Advertising Council, the National Industrial Conference Board, and the Department of Health, Education and Welfare have joined forces and launched a campaign to end the shortage?

The advertising started running last May. Already millions of young people have got the message.

With your help, we think we can reach even more.

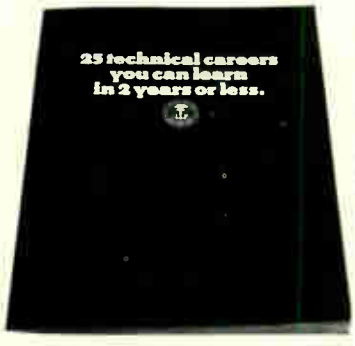
There are two principal ingredients in this campaign. The first is a booklet giving all the facts on technical careers, technical schools and financial aid.

The other ingredient is a poster, offering the booklet.

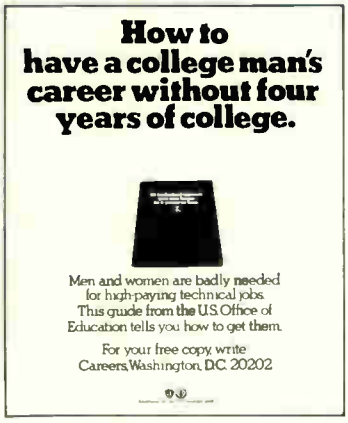
You can help by handing out the booklet—and seeing that the poster is displayed in high schools, churches, youth clubs, wherever young people hang out.

For samples of both booklet and poster, information on ordering quantity reprints, and information on getting your firm's imprint put on the booklet, fill out and mail this coupon. Do yourself a favor. Mail it today.

Advertising contributed for the public good.



Booklet



Poster

Technicians, P.O. Box 313
Radio City Station, New York, N.Y. 10019

Name_____

Firm_____

Business Address_____

City_____

State_____ Zip code_____

Bruce Lovett . . . Looking forward to pre-emption.

Bill Adler . . . Stepping down after a long, hard year.

250 in the Broadcast Bureau.

Bruce Lovett insisted that the FCC set licensing standards and take the role of the sole regulator of the industry. Pre-emption is necessary, he said, if the cable operators are to be saved from a jumble of regulations that would vary from state to state.

Schildhause had everyone's attention when he said that licensing is a two way thing: licensing also means the right of revocation. This follows the recent position of the Commission concerning broadcast renewals.

One finds himself saying, especially after a session such as this one, if we don't get our plans solidified we're headed for more trouble. However, if we rush to solve our problems, we may develop even greater problems.

Technical Sessions

Once again the NCTA chose to present most of its technical meetings in early morning eye opener sessions. Despite the fact that the cable industry may soon be facing a shortage of people they will need on both ends of the cameras for local origination, the deluge of vital technical information available keeps coming in at a time when too many delegates are trying to wake up.

The Move Toward Two-Way Communications

One of the major innovations in the cable industry could be its potential for two-way communications. J. D. Cauldwell, of HTV Systems, Inc., explained the basics of two-way amplifiers produced by his company simply as two separate amplifiers linked together by two diplex filters.

Cauldwell pointed out that their two amps within one casting are the trunk and sub-low amplifiers. The sub-low amp, along with a set of diplex filters makes two-way amplification possible.

The bandwidth of the sub-low amp is 6 to 26 MHz. With allowance for isolation, the VHF amp has a bandwidth of 50 to 220 or 270 MHz. The insertion loss of the filters is less than 5 dB for both the sub-low and the VHF ban.

According to Cauldwell, the bandwidth between 26 and 50 MHz is called the "stop band" and is tween the VHF and sub-low bands. Additional isolation between the bands is provided by the amplifiers. Total isolation between the bands is equal to twice the rejection of each filter plus the attenuation of the amps in the rejected band. These amplifiers can be cascaded as high as 50 units with a phase error in the color spectrum of only 2 degrees.

Immediate interest in two-way amplifiers of this type stems from their possible use in live local origination programs from any point within the system, remote meter reading, video telephone, facsimile machines, and for linking computers.

Along this same line of CATV technical expansion, Henry Marron of Jerrold Electronics presented a paper on system design considerations in a two-way transmission system.

Marron explained that two-way systems can range from completely dual systems including trunk feeder and taps (space division multiplex) to the other extreme of using a single trunk, taps and feeders (frequency division multiplex).

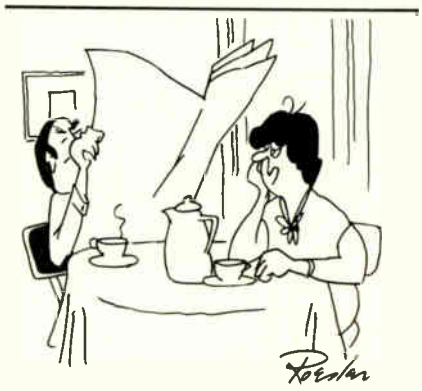
The first system has its obvious economic problems because of its cable complications, but it would eliminate many of the problems (crosstalk, group delay distortion, and loop feedback).

The second system may overcome the economic problems but present bandwidth problems. Then he added the dual trunk system. Since the state of the art demands solutions to problems in these systems for more than economic considerations, Marron discussed the design considerations needed to overcome crosstalk, group delay distortion, and loop feedback effects. He concluded that the single cable two-way system is mainly useful for limited access trunk usage and that the dual trunk system, using a translator unit, has greater flexibility in that access is available to the trunk from any desired feeder. The dual trunk system, as Marron sees it, is a compromise between the two extremes in current two-way design concepts.

Broadband Coaxial Systems

Some developments over the past several months dictate a renaming of the CATV system. Certainly a major trend today is the exploration of two-way systems, and somewhere within this trend is the need for development of broadband coaxial cable systems.

Skipping over the glamorous features of suggested broadband cable network features, Anaconda's Gaylord Rogeness explained that as cable TV moves into the larger metropolitan areas and as the two-way features are initiated, the transmis-



"WHAT MUST I DO?-GET F.C.C. PERMISSION BEFORE WE CAN COMMUNICATE?!"

sion system equipment must be of the highest quality and reliability. Anaconda is seeking to fulfill these requirements through the development of a bro... repeater amplifier, using ...d thin-film circuit.

...eness, these ...ility, package ...ction due to ...ant packages, ...ction, and they ne... obsolescence.

...ing ...mplifiers

... Sylvania Electric ...red an interesting ...plexing in cable TV ...rs. Lieberman said that di...xing would be necessary due to the attempt to put more signals within a restricted bandwidth. This would be especially true if 35 channels of 6-MHz bandwidth were used.

Diplexing, he said, also would facilitate accurate equalization of cable attenuation, eliminate second-order intermodulation products, offer bi-directional transmission over a common cable, work in a fault reporting system, and other special interest services. Information furnished on measured and calculated data of technical parameters related to the two-way system indicates that the technical requirements can be satisfied without undue system compromises. The approach is based on the modular concept.

Dr. Eugene Rostow . . . Stumping for freedom of the press.

Coverage Of Technical Papers Continues In The CATV Scope P. 22

Looking Ahead To Laser Systems

A frequency-modulated laser communications system that may substitute for microwave links in CATV systems was unveiled by Dr. William J. Thaler, president of Georgetown Industries, Inc. at the 19th annual NCTA convention.

Dr. Thaler pointed out that in congested areas around cities where frequency assignment is a problem, the laser system offers a unique solution. The system is highly linear and low in noise content. Intermodulation or cross-modulation is not expected to be a problem.

Dr. Thaler characterized the system as offering the capability of modulating bandwidths of up to 4 GHz. Because the light beam is FM, the effects of weather and atmospheric disturbances should be minimal and the high power of pulsed laser beams is not required.

Burch Sees Program Diversity

Facing The Issues

Chairman Burch, who arrived for the tailend of the agenda, told cable operators what they already knew, but coming from him made it sound believable. "The time is ripe," Burch said, "for a breakthrough for your industry. The Commission can and must show leadership in fashioning that breakthrough. As Chairman I hope to lead that effort."

"Now do not mistake me. I do not come before you in the cloak of a saviour of your industry; nor am I motivated by a pro-CATV philosophy. I am neither pro or anti-CATV or broadcasting. My standard is and must be the public interest and that is not a cliche. From you I would ask for a little more patience, understanding, and cooperation as we search for settlement of the questions that are plauging all of us."

Then he added, "In my view, any constructive progress requires a policy which insures the healthy growth of both cable and broadcasting, with the copyright owner fairly compensated."

Speaking of recent proposals, Burch said, "Although I do not think that we have an obligation arbitrarily to foster every last marginal UHF station, it is clear that no abandonment of the goals of the all channel receiver laws is in the offing. Perhaps it should be emphasized that pure economic protection is not what we are concerned about. A loss of audience or advertising revenue to a television station is of concern to the Commission only if the result threatens a net loss of television service to the public. That is not just my personal opinion but the law under which the Commission operates. Audience fragmentation, per se, does not necessarily chill me. After all, that is what diversity of service is all about."

Burch insisted that the January 1st kickoff date for local originations is still in effect. He went on to say, ". . . the risks which both the Congress and the Commission are willing to take in promoting the wider use of cable television are very likely to have a direct relation to the ability of your industry to prove that it will do more than merely shift the content of broadcast television on to wires, and at a price. We will not be moved to much excitement by program originators hustling for the same piece of pie now shared by television broadcast stations—using the same program sources, soliciting the same advertisers, and seeking the same mass audience."

Burch departed with a promise for action in a definite atmosphere of cooperation.

Ed. Note: For recent proposals by the FCC concerning CATV, see the Industry News section of this issue. Also, please note that the opening day for the local origination requirement has been changed to April 1, 1971 . . . a curious date to be sure, but it is official.

Principles and Practices
SCA multiplexing

Part 3 of 3 part series

By T. R. Haskett

Now that you've seen how to break the system down into its component parts (July issue), here are some specific SCA problems you may encounter. They are arranged by the following categories:

1. The audio origination equipment, including any Telco lines and AGC amplifiers.
2. The SCA generator.
3. The main-channel exciter and transmitter.

Equipment Grounding

Briefly review the grounding system in your transmitter plant. Improper or poor grounding of nearly any equipment can cause crosstalk in the SCA. Figure 9 shows a typical arrangement.

There should be only one main ground point. This is the point of connection to the earth (if you're on the ground floor) or to the building frame (if you are upstairs). If your tower is grounded you probably use it for the main ground point. Even if it's insulated (for instance, as an active AM radiator) you may use the ground rods beneath the tower as main ground. But if you don't use the tower as a ground, probably you should have ground rods beneath or near your transmitter. Note that it is often unwise to tie your RF main ground to the power company's AC ground. You can often pick up a lot of 60 Hz hum this way.

Between the tower and transmitter you should have a 3" or 4" copper strap. No other medium will work as satisfactorily as a main ground bus. This bus should extend into every other rack and cabinet in the transmitter room. Preferably it should be a single continuous piece of strap but not a closed loop. If you have to extend it, use silver solder and a torch, and solder the full width of the strap.

Program-Source Problems

The tape machines which supply the program material for the SCA subchannel should be cleaned and aligned periodically with a test tape, just as any tape machine should. Although SCA frequency response is only about 30-7500 Hz, this is no excuse for dirty or misaligned heads or distorted audio. The taped material should be clean and continuous, with no dropouts. Leased tapes are sometimes old and worn, with bad splices and dropouts. These sometimes cause blips of overmodulation or false SCA generator muting. While you cannot audition such tapes, it's well to monitor the SCA now and then. If you find a bad tape, mark it and ask the tape service to replace it with a new copy.

Incidentally, if possible, it's a good idea to restrict tape frequency response to 5000 Hz, 7500 Hz, or whatever you are using in the system. If you make up your own tapes, you might want to add a lowpass filter at the recording input of the machine you dub from discs with.

If you are storecasting or using voice tapes interspersed between music, be sure the sequencing pulses are clean and trigger the switcher properly. The switcher must be kept clean or it may jam and run 15 minutes of straight commercials and no music. That will annoy customers.

Set up AGC amplifiers and limiters properly and keep them in good condition. Set an AGC amplifier in the middle of its compression range, so that all audio peaks are compressed and all low passages are brought up somewhat. A AGC amplifier is mandat second optional but desirable. ably it is better to use two A amplifiers in cascade than o AGC amplifier and one peak lim iter. And due to the extreme volume compression you are using, some musical selections are undesirable for this service. You can't do anything about leased tapes, but if you make up your own, avoid any musical selections with very low passages, because the compressors will simply make the background noise more noticeable.

If the audio originating equipment is located at the main transmitter plant, you will have to de-RF every bit of it. It is easy for a tape-playback preamp or an AGC amplifier to pick up RF and detect main-channel (or stereo subchannel) audio. The audio may not be intelligible, but it is crosstalk.

The first step in getting rid of RF pickup in the audio chain is to make certain that each link in the chain is securely grounded for RF to the main ground bus. As mentioned before, watch out for an undesirable interface between an equipment chassis and the rack in which it's mounted. You may have to strap each chassis to the main bus. Bolt the strap to the chassis and silver-solder it to the main bus.

Even if the originating tape gear is not at the transmitter plant, the SCA generator is, and possibly an AGC amplifier. You will have to minimize RF pickup at their inputs.

The high-impedance circuit of a vacuum-tube grid or a FET gate is the usual point of RF pickup, but bipolar transistors will sometimes pick up RF also. Usually only the input stage of an amplifier is so susceptible. To check, short the grid, gate, or base to ground through a capacitor of

about .0001 uF. Remove SCA audio and deactivate SCA generator muting. Listen on the SCA monitor. Then try the capacitor; if Cx is better, you have found the pickup point. You will have to bypass the circuit to get rid of the RF. Usually a small value of capacitance to ground will drop out the RF without disturbing audio frequency response. Cut and try several values.

If you are transmitting music, or voice and music on the SCA, you will probably use the normal 30-7500 Hz response used by the SCA generator and receivers. But if you are transmitting voice only —news, weather, stock quotations, etc.—you may find crosstalk more of a problem due to the pauses between words and phrases. In this case, you can obtain better signal-to-noise ratio by deliberately limiting frequency response to about 100-5000 Hz. Male speech contains few frequency components above 5000 Hz anyway. More important is the bottom: if you drop out everything below about 100 Hz, you will eliminate much of the speech power without sacrificing intelligibility. This means you can increase the average SCA modulation level, and thereby increase the signal-to-noise ratio. Some SCA generator manufacturers can supply accessory plug in 5 kHz low-pass filters.

The speech filter should go ahead of the AGC amplifier, so compression occurs only on speech frequencies. To get the most out of the system, you may also want to use a speech filter at the audio input of the SCA generator, to avoid any hash pickup. As a final resort, you may also want to restrict the frequency response of the receivers to match 100-5000 Hz. Thus the receiver will be incapable of picking up spurious signals outside of the speech passband.

SCA Generator Problems

For best results, the generator must be installed and maintained following the manufacturer's instructions. Some generators (such as Gates and RCA) are designed to work only with that company's main-channel exciter and will drive another exciter only with some modification. Other generators will work with nearly any type of transmitter. Don't try to mix one generator with another type of exciter unless both manufacturers approve.

Be sure that the SCA generator muting circuit is working properly and set the time-delay threshold for the type of material you are transmitting. You can use a short delay with music if the tapes are clean. But with voice-only operation you'll need a longer delay to avoid false muting between words and phrases.

If you suspect the SCA generator is causing crosstalk, check it directly by the method outlined previously. Simply use the generator output to drive the SCA generator. With some types of SCA monitors, you may not be able to insert the 67 kHz SCA subcarrier at a panel connector; you may have to go inside the monitor. On the other hand, you can easily drive a piggy-back add-on SCA monitor which is normally driven by a main-channel monitor. The piggy-back gets 67 kHz from its main monitor, and you simply substitute SCA generator output. In any case, consult the manual.

Turn off the main exciter and PA during this check, to avoid any spurious RF pickup.

Transmitter Problems

Main-channel audio to the exciter should be clean but should contain no components above 15 kHz. This is normally the case with stereo transmitters, but not always so with mono rigs. Spurious products above 15 kHz in main-channel audio can cause crosstalk in the SCA. This is even more critical at a stereo station, since the upper stereo sidebands approach 53 kHz and anything above 15 kHz audio will mix with the SCA subcarrier.

Excessive harmonic distortion in the main-channel audio can easily cause crosstalk in the SCA. This is important at both mono and stereo stations, but very critical at stereo.

When the stereo signal is gen-

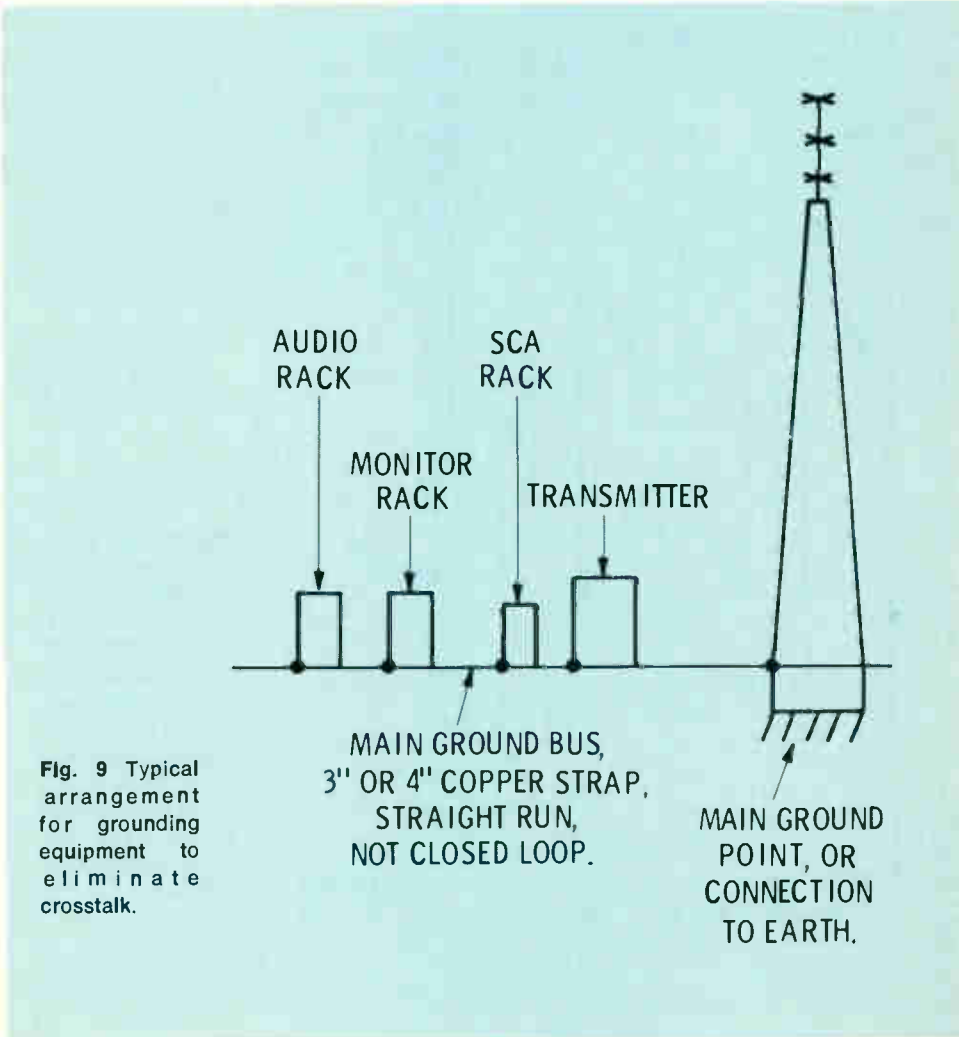


Fig. 9 Typical arrangement for grounding equipment to eliminate crosstalk.

erated, a balanced modulator produces a double-sideband, suppressed-carrier signal. The second-harmonic components of this signal are centered on 76 kHz and extend into the SCA region around 67 kHz, as shown in Figure 10. Obviously, any appreciable amount of second-harmonic products will cause crosstalk in the SCA. To obtain crosstalk of —50 dB on the SCA, the stereo DSB signal must have second harmonic distortion of only about 0.2 percent or less.

Therefore, although the stereo generator is not part of the SCA system, it can adversely affect that system. The generator must be kept in good condition and the modulator well balanced.

By the way, a quick check of a possible source of crosstalk is to measure harmonic distortion at 50 Hz through the main channel and stereo subchannel. If distortion is low, your SCA crosstalk figure is probably liveable.

You can check high-frequency response with a scope or an audio voltmeter. Using an audio generator, make a frequency run from 1000 Hz through about 30 kHz. Run these frequencies from the main-channel console through normal program circuits into the main-channel exciter. Select a few points to measure with the scope or voltmeter—console output, AGC amplifier or limiter output, and finally the modulator stage in the exciter. Everything above 15 kHz should be 60 or 70 dB below the 1000 Hz level. If it isn't, adjust until it is. You may have to use a low-pass filter at the exciter audio input.

As pointed out earlier, a high-frequency audio limiter is essential in the main-channel chain, for minimum SCA crosstalk. Follow the manufacturer's instructions to be sure the HF limiter is working.

If you are a mono station using 30 percent total SCA injection you can theoretically modulate the main channel up to 70 percent. But remember that all meter movements are inherently incapable of indicating true modulation peaks, due to pointer inertia—and the modulation monitor meter is no exception to this rule. The peak flasher lamp is more accurate in indicating true program peaks. Observe normal main-channel program material on both the meter and the flasher lamp and you will see the discrepancy. Set main-channel modulation so peaks only occasionally flash the lamp. Don't worry about the meter. Every time you overmodulate the main channel (or the stereo subchannel) you increase crosstalk into the SCA. By backing down a dB or two on the main channel you leave the SCA clean and usable. And main-channel listeners won't detect a dB or two less modulation.

The principal cause of SCA crosstalk in the RF portion of the exciter and main transmitter is undesirable phase nonlinearity. If any stage has narrow bandwidth or nonlinear response each side of center frequency, the FM carrier develops an AM component. This AM component causes crosstalk in the SCA.

The main sources of transmitter phase distortion are as follows, referring only to stages past the SCA injection point:

1. Improper coupling between stages.
2. Improper neutralization of any stage.
3. Regeneration of any type—such as between stages.
4. Old or defective tubes or transistors.
5. Mistuning of any stage.
6. Too narrow or nonsymmetrical bandpass of any stage.

All stages past the injection point should tune broadly and not be too critical. Generally, stages should have low Q. Remember that tubes or transistors usually cause phase distortion only when they affect tuned circuits. ▲

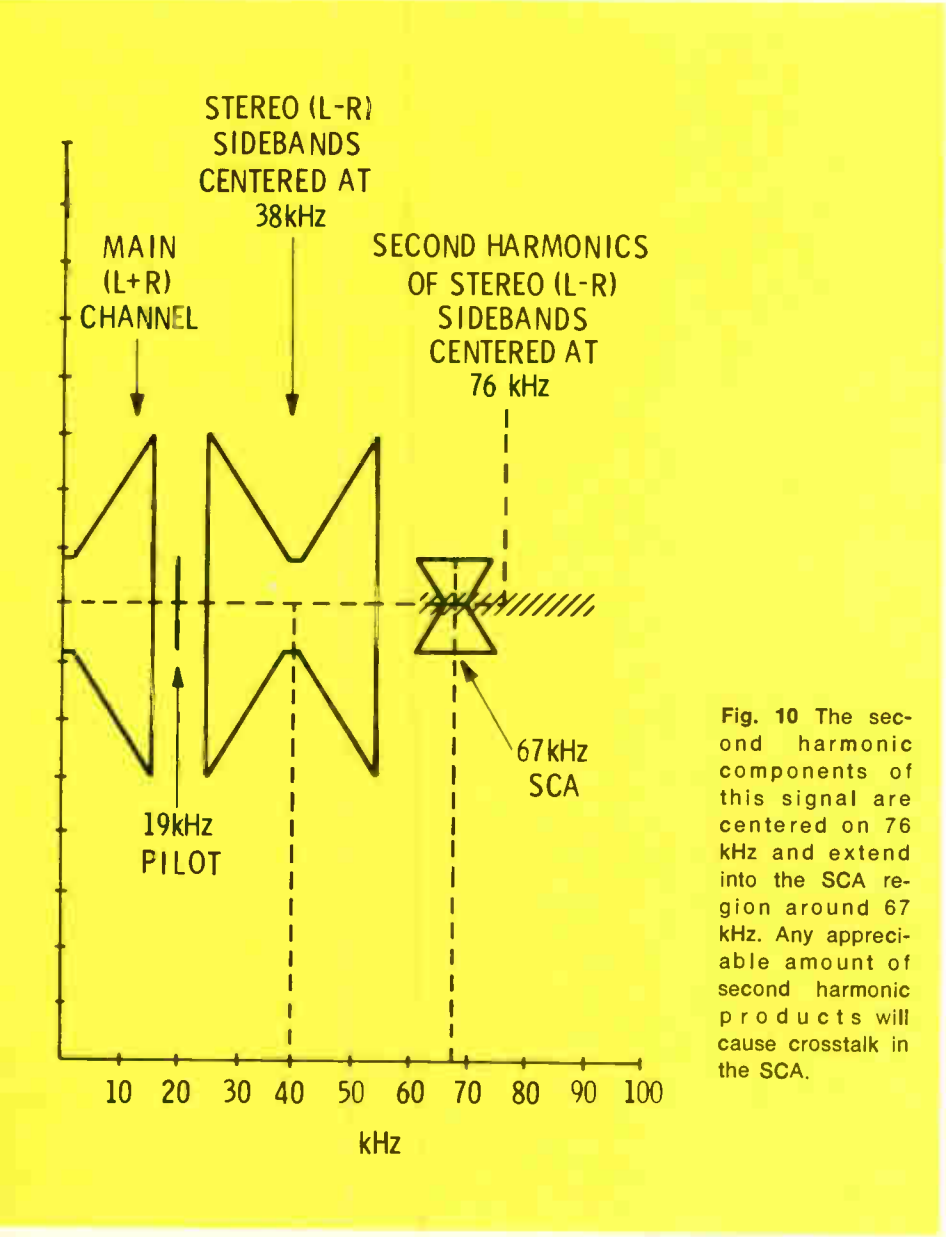


Fig. 10 The second harmonic components of this signal are centered on 76 kHz and extend into the SCA region around 67 kHz. Any appreciable amount of second harmonic products will cause crosstalk in the SCA.

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Keep track of those RF power tubes

Careful tracking of RF power tubes can help you to keep accurate cost per hour records and to gauge your general transmitter performance.

By Pat Finnegan*

A very important part of any transmitter is its power tubes. The output stages are most generally thought of in terms of power tubes, but the definition should be broadened to include some lesser tubes which perform as drivers, IPA and modulators. If you look on their operation as "set and forget", get set to pay.

Power tubes make a considerable contribution to two important aspects of transmitter operation: reliability and operating costs. Because of this, these tubes should be subjected to specialized care and handling procedures, and followed with accurate records.

Just how well and how long a tube will perform, depends not only upon the manufacturer, but also to a large extent upon the environment and use or abuse the tube gets.

As an operating cost factor, the basic cost of the tube can be prorated over its expected useful life to arrive at a cost per hour for the tube. For example, a tube may cost $1,000 and have an expected life of 8,000 hours. Thus, $1,000 divided by 8,000 hours will give a cost per hour of 12½ cents.

Tube life, then, not only bears upon reliability of the transmitter, but also upon operating costs. A long tube life will lower the operating costs, while short tube life will increase operating costs. In the previous example, the normal cost was 12½ cents per hour, but should the life of the tube drop to 2,000 hours, the cost per hour would rocket to 50 cents.

Tube Records

A life history of each of the power tubes is important and useful for many reasons. An accurate history will permit the engineer to determine many things about a tube: when to anticipate its failure, how it compares to other tubes of present and past use, how it compares in cost per hour, etc.

Generally, a record card should be kept for each tube that costs $50 or more. Each station should decide at what dollar figure to begin keeping records of tubes, based on the maintenance budget and the cost of all transmitter tubes used.

A card file system made up of 4 x 5 cards for each tube can serve the purpose well. The information on the card is optional, but certain data should be entered: tube type, serial number, date of purchase, dealer, filament hours, cause of failure. Other important information may also be added: test dates and results, dates in and out plus filament hour use each time, peculiarities of the tube etc.

Such a card file can be kept indefinitely. When a tube has been retired, whether it shorted on initial test or after a long useful life went to the happy electron hunting grounds, the card should be kept in a separate section of the files.

A review of the retired tube's record can often point to deteriorations in the transmitter itself. These changes may be so gradual as to go unnoticed for a long period of time. For example, records may show that a few years ago, tubes were averaging 7,000 hours, but now are only averaging 5,000 hours. Perhaps the cooling system is now less efficient and affecting tube life.

Accurate records thrive on good engineering habits. This is especially true when tube changes must be made in a hurry during programing.

*BE Maintenance Editor and Engineering VP of WLBC, Muncie, Ind.

You should make a habit of jotting down the serial number and socket in which the tube was placed as well as the readout on the running time meter. The information can be jotted at least on a scrap of paper or on the tube carton. This takes but a few seconds to do. When it is necessary to switch several tubes, your memory may be a poor substitute for written notes. Failure to get the information can result in a trip to the transmitter after signoff.

Inspection and Test

Whenever a new tube has been received, it should be physically inspected. This should be done even though there are no obvious signs of damage to the shipping carton. Any obvious physical damage should be reported to the shipping company immediately and a claim filed.

A few years ago I received a new, expensive tube in a carton that looked as though it might have been hand carried from the manufacturer. There wasn't a mark or scratch on the outside or the inside of the carton. The tube itself, however, was something else. All the plate cooling fins on one side had been flattened out as though the tube had been dropped onto the floor. The tube was returned immediately to the dealer and it was replaced with a new one at no charge.

The initial test is very important. You should not wait too long before running tests on the tube, because it is not uncommon for a tube to fail during the initial test. If the tube is not tested, you may be living in false security, because of the new spare tube may not work. If possible, the tube should be run in the transmitter for one full week, or at least one full day. Such a test will put the tube through its paces in normal dynamic situations rather than brief static tests.

Information on the tube's behavior during the tests should be entered on the tube record. Perhaps it requires a different bias adjustment. It may be several months before the tube is required for regular service. At that time this information on the tube record will alert the engineer that some setting changes must be made.

Warranties

The engineer should be acquainted with the warranty policies of the tube manufacturers. Warranties vary both as to manufacturer and to types of tubes. If the information and is not on hand, it can be obtained from the tube dealer or manufacturer.

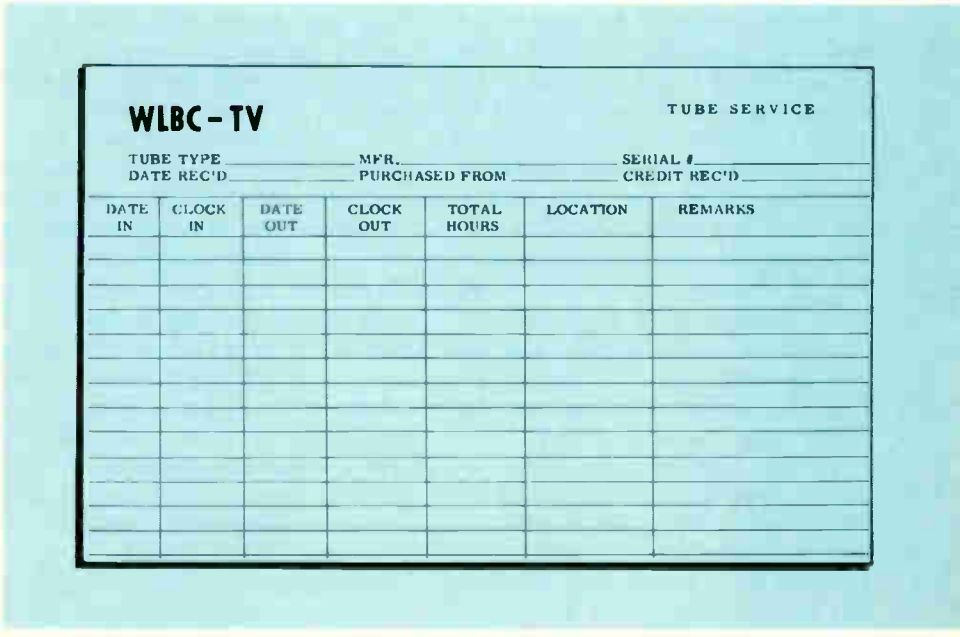
Generally, these warranties allow for 100 percent replacement for failure within a specified number of hours and a prorated percentage is allowed on the cost of the replacement tube. For example, the warranty may give 100 percent replacement or refund during the first 50 hours, then prorated from 50 to 1000 hours.

Recalling the earlier example used for a tube whose normal life expectancy would give an operating cost 12 cents per hour, suppose this tube lasted only 500 hours and the warranty allowed 50 percent for its replacement. As the original cost was $1,000 the cost for the tube that failed would be $1 per hour. That is, the total cost for the tube that failed was $500. This is a long way from the 12 cent per hour figure. Without the warranty, however, the cost would have been $2 per hour, which is worse.

One further word on warranties. Most of them are based on filament hours. Many lower power transmitters today do not have running time meters, possibly as an economy measure it building the transmitter. If the transmitter doesn't have a running time meter, the engineer should install one.

Physical Care

Tubes will get fingerprinted from handling. These should be wiped off the glass surfaces before the heat from the tube bakes the oils to the glass. Some tubes, such as klystrons, have special ceramic windows which should not be touched with the hands at all. These are not


WLBC-TV

TUBE SERVICE

TUBE TYPE _____ MFR. _____ SERIAL # _____
DATE REC'D _____ PURCHASED FROM _____ CREDIT REC'D _____

DATE IN	CLOCK IN	DATE OUT	CLOCK OUT	TOTAL HOURS	LOCATION	REMARKS

Fig. 1 Power tube service record card. Operational costs are only guesses if a record of this nature is not used. But to take advantage of this system, the transmitter must have a running time indicator.

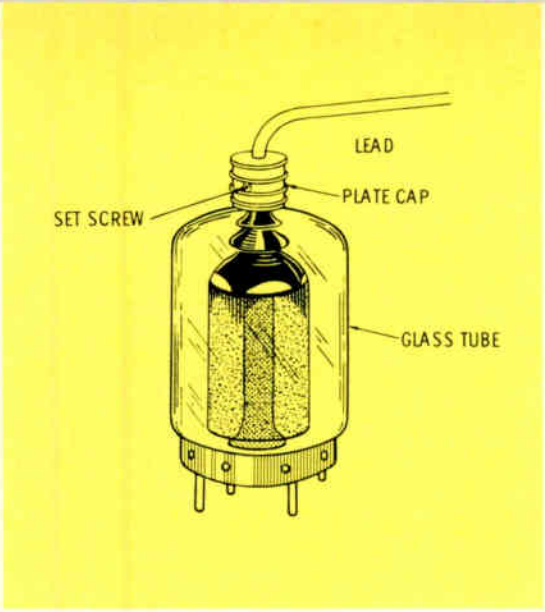


Fig. 2 Typical vaned plate cap for a glass power tube. The connector is tightened with a set screw.

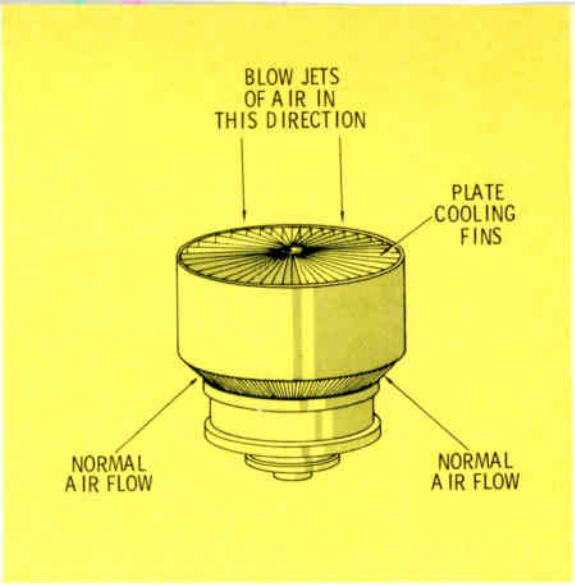


Fig. 3 To dislodge bugs, lint, and dirt, blow the forced air through the top of the tube. The tube should be removed from the transmitter when it is to be cleaned.

just insulators, but RF windows, and fingerprints can effect the RF value of the windows.

Contact surfaces are important, especially the tubes which are designed to fit into cavities or similar circuits. These use finger contacts or spring contacts in the cavity to press against the smooth contact surface of the tube. The contact is made through pressure. Such surfaces should be kept clean. Silver polish will usually do the trick. Don't use abrasive materials, such as steel wool, as this will remove the silver or gold plating on the tube, and lease an uneven contact surface.

Proper seating of the tube in the cavity is especially important due to the fact that once the tube is inserted, the contacts usually can't be seen. You need to develop a sense of touch for proper tube seating. If the seating is incorrect, even though the tube may work, the possibility of contact damage exists because of lack of pressure of the fingers to the tube surface. Such high resistant contacts can cause burning and this may damage the tube beyond repair. A similar situation can develop if the contacts are split.

In the type of tubes just discussed, mechanical tolerance is an important factor. You usually expect the mechanical tolerances of the tube to be correct, but this may not be the case. Once I received four tubes whose filament contacts were out of mechanical tolerance. The contacts were too small which caused difficulty getting the tubes to seat properly. This caused several burned tubes and other headaches. The test rig at the tube plant had slipped and several tubes got through before it was discovered. They were out in the field, and we had four of them. To avoid future problems, the chief mechanical engineer at the transmitter plant had a small go, no-go type gauge made up and sent to us. This gauge caught two of these tubes that slipped by the manufacturer's tube test.

Glass tubes, such as the 4-400A usually have a plate cap connector which uses a small set screw to keep the contact tight (See Figure 2). An engineer in a hurry to change a tube can break the tube glass unless this set screw is loosened.

Cooling fins on the plate cap of some tubes can become clogged with dirt, lint and bugs (See Figure 3). Obviously, this will reduce the cooling efficiency of the fins. These should be inspected from time to time and if cleaning is required, it should be done outside the transmitter. The best procedure is a blast of air in the reverse direction from the normal air flow. This will usually disoldge any accumulation that may be present. Remember, inefficient cooling will contribute to shorter tube life.

When changing tubes during an emergency, one should avoid touching the filament terminals. During such times, the engineer cannot give the transmitter a normal cooldown period as this takes too much time. The plate may be relatively cool because of its fooling fins and higher air flow. The filament, however, retains its heat much longer and you can be badly burned while you bobble and then drop the tube.

Another small but important point—save some of the tube shipping cartons. Even though a tube may be operating properly now, it may fail during the warranty period. You will need a suitable shipping container, and this carton is ideal.

Operational Techniques

Whenever possible, at start up time, apply the power and drive at reduced values, then slowly increase them. This "step start" allows the tubes to adjust to operating conditions after having been been idle. Some transmitters do not have provisions to do this with the element voltages, but at least the drive should be backed off, so that full power output is not demanded of the tubes immediately. Many of the large tubes that have many hours of service, can develop "gas pains" after standing idle all night. These require a slow start to clear up any gas and to prevent internal arcing.

Operating voltages and currents should be maintained as close as possible to tube specifications. Tubes that must operate near their maximums may exceed this when the line voltage fluctuates. If the overloads are set as they should be, this can cause outages.

Filament voltages are important to the life of a tube. High filament voltages will cause excessive emission and shorten the tube's life. The best practice is the use of **slightly** higher filament voltage than required to get the desired tube output. The tube will work easier and live longer. The use of slightly more than required voltage will take care of line fluctuations. If the line voltage drops, there will still be enough voltage, and if it increases, the increase will kick in the overload protection.

Voltages on the elements determine the current flow in these elements. Tubes are more sensitive to damage from excessive currents than excessive voltage. Voltage may cause arcing, which is bad enough, but excessive current can melt the more delicate elements within the tube. The grid and screen of the tube are more sensitive to damage this way than is the plate. Drive will influence the grid current flow, while the screen current is sensitive to changes in the plate loading.

Circuit breakers, particularly over the current plate and screen overload circuits and under bias protection circuits should be kept properly adjusted. The overload circuits are there for the protection of the tube, so they should not be misadjusted or bypassed while trying to get a stage tuned up. It is better to reduce the drive and voltages to the stage until the stage is properly adjusted.

Balanced stages such as push pull and diplexed types should use matched tubes whenever possible. It is difficult to match a tube with many hours against a new tube. Whenever it is possible, the old tube should be retired as a spare for some other circuit and two new tubes inserted in that have similar characteristics.

Bias voltages are very important, as these can change the mode of operation of the stage. The required voltage will depend upon the circuit and how it is intended to operate.

The Class B modulator, for example, can be shifted to a different mode and the result will be distortion of the audio (See Figure 4). Each stage should be balanced, and its bias set for the required static current in the plate circuit. With tone modulation applied, the final bias reading should be touched up for the best distortion figure as measured on a distortion meter. Incorrect bias voltages on the modulator will effect the audio input level to the transmitter, which is another check that the bias is near normal. The standard audio input specification for most transmitters is 10 dB ±2 dB.

A Class B linear stage as used in a TV transmitter is sensitive to voltage change or misadjustment on the grid. Non-linearity of the tube will compress either the blacks or the whites in the picture according to the modulation at that point in the circuit. This non-linearity can be made up by pre-distorting the video signal.

While discussing grid circuits, it would be well to point out another factor in stages that use a fixed grid bias. The grid current usually flows in the output of the bias supply resistors and/or zener regulators. If a stage is being driven very hard because of an inefficient stage following it, this grid current may exceed the wattage rating of the resistors in the bias supply. If the resistors burn out, the tube loses bias and the underbias protection is actuated. This would most likely shut the transmitter down.

Tuning and plate loading are important factors in RF stages. A stage that is mistuned will cause the operating efficiency to drop. Too much of the signal will dissipated in the tube causing it to overheat. This will shorten its life.

A broadband stage is less affected by plate load changes than is a narrowband stage. In a stage that is too broadbanded, and particularly in UHF service, the screen current can go negative. A small amount of negative current will not hurt the tube, but excessive amounts will trip out the overloads just as would positive currents. Reducing the bandwidth will help, providing it doesn't affect the correct video response.

A narrowband stage is sensitive to load changes, especially on the screen. Icing of an antenna, for example, will cause an incorrect load to be reflected to the output stage, and if the stage runs this way for very long, the screen may be damaged. The screen current is often a more sensitive indicator of changes in the plate load.

Summary

To sum up, inspect and test new tubes as soon as possible, operate them properly and keep good records. This will enhance the transmitter reliability, keep the operating tube costs to a minimum, reveal circuit component value changes, and help management project expenditures. ▲

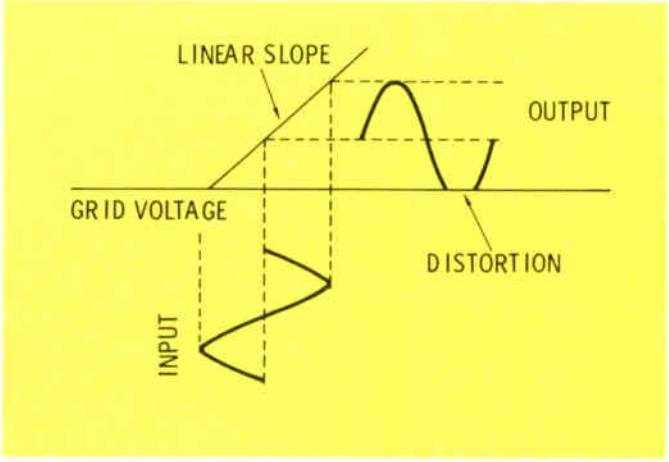
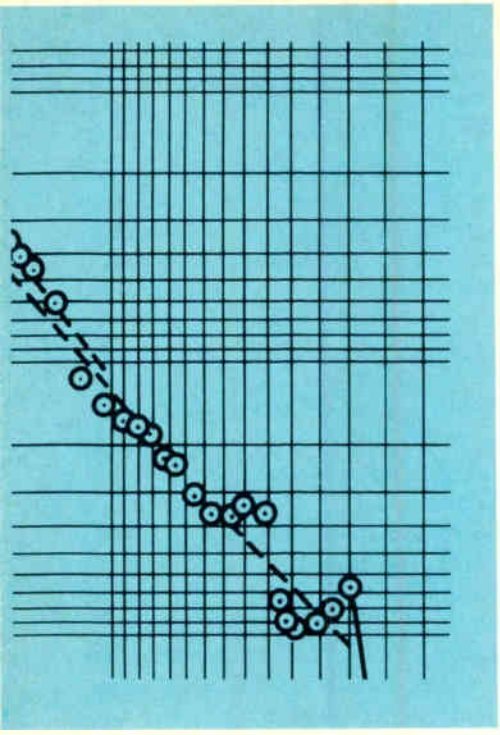


Fig. 4 Misadjustment of bias can cause the tube to operate in a different mode, causing distortion.



The conductivity graphs:

A product of ingenuity

By Louis R. du Treil*

In the course of investigation of an unusual propagation condition on a local AM broadcast station, the facts and procedures used in obtaining the present FCC groundwave curves were reviewed. Users of these graphs would be interested in their formulation since they are taken as "gospel" in most allocation cases, but are actually based on many simplified assumptions. The formulation of the conductivity graphs will be discussed first, then the particular case which prompted the study.

For AM broadcast work we are generally interested only in the groundwave field intensity, which in a relatively complicated way depends upon:

- Resistivity or conductivity of the earth
- Dielectric constant of the earth
- The frequency
- The height of the transmitting and receiving antennas
- The earth's curvature
- The distance from the transmitter
- Variation of refractive index of the earths atmosphere with height.

Of these variables, we need concern ourselves only with resistivity (conductivity is the reciprocal of resistivity), dielectric constant and the refractive index. The frequency, height of the antennas, the earth's curvature and distance from the transmitter are easily obtainable figures.

In order to make life bearable for the engineer, K. A. Norton, through his extensive propagation studies and that of previous investigators, took the following equation for groundwave propagation:

Esu=2 Eo A/d.

where,

Esu=field intensity of surface wave in same units as Eo

d=distance, same unit of distance as used in Eo

A=a factor which takes into account the effect of losses in the earth upon the surface wave, and depends on frequency, dielectric constant, conductivity of the earth, and the actual distance

Eo=a constant determined by the field radiated along the horizontal

By making simplifying assumptions that do not introduce appreciable error under conditions normally existing in practical radio communications, he reduced the factor "A" in terms of two parameters: the numerical distance "p" and the phase constant "b". A graph of these parameters is contained in the FCC Rules as Graph 20, Section 73.184. That graph and this formula are valid only for distances not exceeding 50 / (fmHz) ⅓ miles (50 miles at 1,000 kHz). Past this distance, an additional factor is added to account for the curvature of the earth, which produces a bulge that requires a bending of the surface-wave path. Some of the required bending is obtained as a result of refraction in the earth's atmosphere. The remainder of the required bending must be obtained by diffraction.

The variation of the strength of the surface wave with distance under these conditions is determined by wave length, the ground constants, and the effective radius of the earth (corrected to take into account the refraction in the earth's atmosphere). In order then to have a composite curve for propagation, the first method for "plane earth" is combined with the curve which approximates the losses caused by the curvature of the earth. It is from this basic information that the commission obtained conductivity graphs contained in the Rules.

There are further limitations on the use of the conductivity curves. The ground wave field is considered to be the vertical component of the electric field, a dielectric constant for 15 for land and 80 for water is assumed, the antenna is assumed to be at the surface of a uniformly conducting spherical

*Consulting Engineer, New Orleans, La.

earth, and the refractive index is accounted for by multiplying the earth radius by 4/3 in order to obtain a single correction for atmospheric refraction. This latter approximation for refraction attempts to average day to day, week to week, and year to year variations and also variations which are different in specific areas of the United States.

At this point it can be seen that propagation is complicated and we are able to make predictions of coverage for broadcast stations only because of many simplifying assumptions.

For the particular case which prompted this study, the field intensity measurement path from the station progressed from the transmitter site through rich, wet, loamy soil, which is at or below sea level for a distance of 7.6 miles, then traverses the brackish waters of a large lake to a distance of 21.8 miles, then passes over sandy, pine-forested country. For approximately 20 miles after crossing the lake, the terrain is relatively flat but gradually changes to hilly, heavy forested topography for the remaining distance. Based on literature concerning ground conductivity, it is possible from this description to estimate the ground conductivity for the various soils and topography. The wet loamy soil near the antenna would be expected to have high conductivity (10 to 40 mv/m). The lake with brackish water would be expected to have 20 to 40 mv/m conductivity, while the sandy wooded and hilly area should have a conductivity of 2 to 4 mv/m.

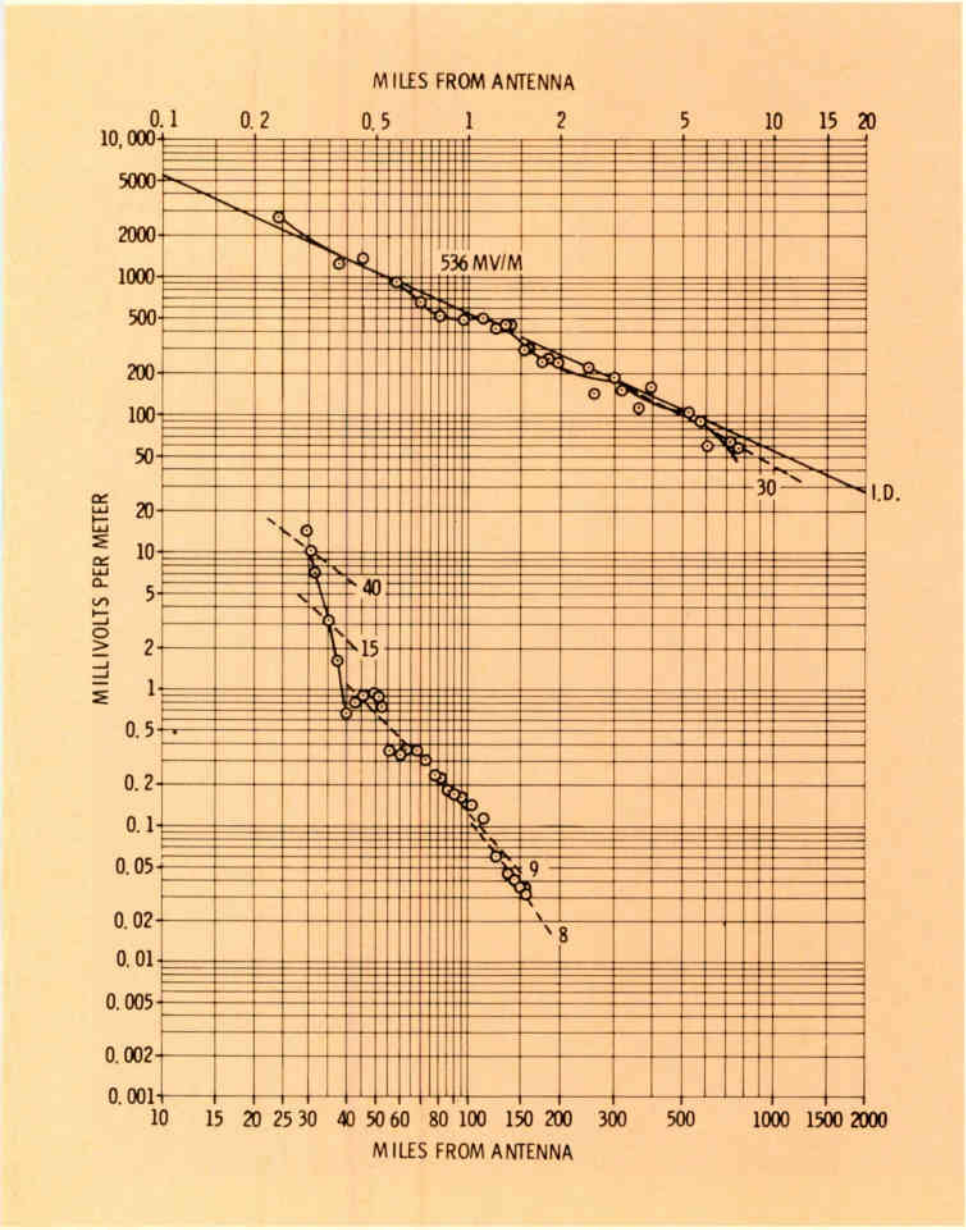


Fig. 1 Graph of field intensity versus distance for the station described in the text.

Study Figure 1, which is a graph of field intensity versus distance for the broadcast station on the path described in the preceeding paragraph. The measurements appear quite normal until we reach a distance of about 30 miles from the transmitter, where the fields drop dramatically and the measurements are 8 to 9 mv/m rather than 2 to 4 mv/m. Such phenomenon has been studied in ship-to-shore communications where it was found that the surface wave on the shore immediately adjacent to the water is of the order of 8 to 12 dB greater than the strength of the surface wave a mile or more inland. At least in part, this condition is explained theoretically on the basis that a portion (6dB) of the excessive attenuation that occurs within the first mile is the result of the land losses being sufficient to destroy the optical image of the surface wave that existed over the highly conducting water ground. This situation is evident in the measurements shown on Figure 1.

There is another effect that takes place when the wave moves across a discontinuity of conductivity or even along a uniform area of conductivity. As the electric vector moves from the antenna at the surface of the earth, it possesses a slight forward tilt. As a result, the vector has, in addition to the normal vertical component, a slight horizontal component parallel to the surface of the earth and lying in the direction of propagation. These two components generally have a phase difference, so the resultant electric vector is elliptically polarized. The FCC recognizes this effect and even suggests that "wave tilt" measurements be taken to determine and compare locations for taking field intensity measurements,

particularily to determine that there are no abrupt changes in ground conductivity or that reflected waves are not causing abnormal intensities. Since making "wave tilt" measurements is fairly complicated and time consuming, none have been filed with the FCC in recent years.

The measurements shown in Figure 1 also illustrate an unusual phenomenon which has not been noted previously. Note the oscillation of the wave as indicated by the solid line drawn through the measurement points. Such oscillations normally occur in UHF where antennas are elevated above the earth and a cancellation or reinforcement of the wave is caused by combining the direct wave with the surface wave. In this particular case it is assumed that the oscillation is caused not only by the measurement of a horizontal and vertical field component, but also by refraction from the atmosphere which is not accurately accounted for in the conductivity graphs for the area and station studied.

One final problem associated with the taking of field intensity measurements and their analysis involves the use of peak limiters which accentuate the positive peaks of modulation while limiting the negative peaks. Both Gates Radio and CBS Labs have such limiters available. It should be recognized that the field intensity meters used in broadcast work read correctly regardless of whether or not the carrier is modulated, provided the modulation is symmetrical. It would appear that stations which have modern transmitters and asymmetrical modulation will probably have higher field intensity than a similar station with symmetrical modulation. The effect however would depend on the program material and would be continuously variable. This subject is in further need of study and evaluation.

The conductivity graphs in the Rules cannot be taken as gospel. They are an allocation tool and not absolute; however, they are a compliment to man's imagination and ingenuity since the curves are generally quite good when we realize the number of assumptions made in their formulation. ▲

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NEW PRODUCTS

(Use circle number on reader service card for further information)

TASCOM On Stage

Sarkes Tarzian, Inc., which introduced the first computerized production switching equipment for television stations, unveiled a new system, "TASCOM," Television Automation System by Computer, at a seminar for top station management and engineers at station WTMJ-TV, in Milwaukee.

The new TASCOM system, according to Biagio Presti, Manager of the Sarkes Tarzian Broadcast Division, will be the key to full automation of all station functions from accounting and billing to information on station availabilities, ratings, demographics and other pertinent information as well as computerized production operations. The system will offer a central, national 24-hour, on-line computer automation system for television stations.

Presti also pointed out that the new TASCOM system will be available for all stations, large and small. He said that the new TASCOM system will allow broadcasters to adopt new methods, new approaches and new thinking to their operations without the substantial expense of installing, manning, programming and operating individual computers.

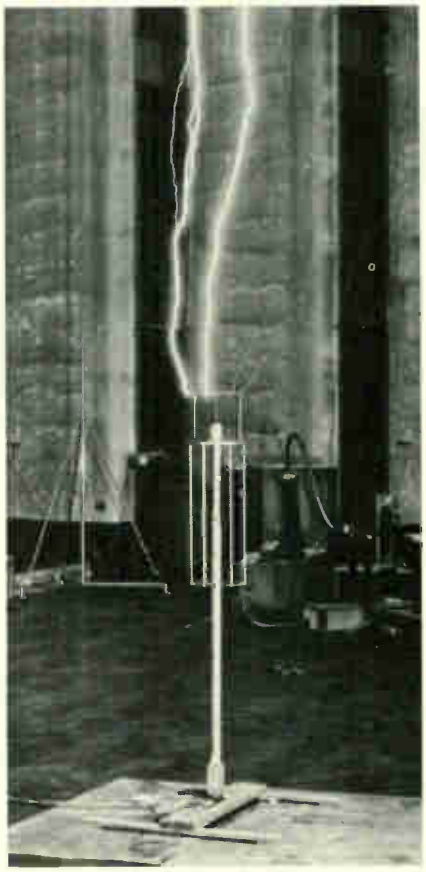
Each of the stations participating in the TASCOM program will be put "on-line" to an elaborate central computer installation—a massive storehouse that will accommodate any amount of information a station selects as part of its own confidential data base—which will supply instant information on any problem: sales, production, billing, confirmation, demographics, ratings, program costs, sales comparisons of programs, sales projection, sponsor protection or any of the myriad problems faced by station management today.

The heart of the TASCOM service is to be a twin installation of the IBM 360-50 computer to be operated by Sarkes Tarzian, Inc. Each participating station would be linked with the computer and supplied a total computer program suited particularly to its needs, the program being completely protected by security codes so no leaks or intrusions could occur.

Circle Number 50 on Reader Reply Card

VHF Receiver Ant.

A new active receiving antenna for the frequency range 100 to 156 MHz has been devised by Messrs. **Rohde** and **Schwarz,** together with the Electronics Department of the Technical University of Munich (Director: Prof. H. H. Meinke). All measurements and tests carried out hitherto have shown very good results and have proven the outstanding features and advantages of the antenna which is equipped with active elements. It is intended for use in air-traffic control. Its special advantages are: amplification of received RF signal (≈15 to 30 dB) and at the same time, low additional noise temperature, consequently high S/N ratio even with heavily attenuated cable between antenna and receiver, low cross modulation, immunity to lighting and other environmental influences, and a remarkable compactness.



Rohde & Schwartz Ant.

The safety requirement, which is essential for practical application and calls for protecting the incorporated electronic circuit against destruction by lightning, is fulfilled. In the center, below a circular plate of 30 cm diameter, a transistor amplifier is provided which is housed in a metal cylinder and connected to the top plate via a series resonant circuit with a very low series capacitance. The top plate is supported by two outer metal rods which at the same time are used for connection to earth and are permanently connected to the basket-shaped counterweight. The supply voltage is applied to the transistor amplifier via a coaxial cable run through the support tubing, which is also used for the transmission of the received and the amplified RF signals.

Electrically the antenna constitutes a highly capacitively loaded, double-folded monopole. The passive antenna portion (top plate) is designed such that the antenna itself acts as a band-pass filter in the operating frequency range. This obviates the need for filters between the passive portion of the antenna and the amplifier. The band-pass filter heavily suppresses mixture products and cross modulation by frequencies outside the operating frequency range. The arrangement of the active element (transistor amplifier) permits optimum matching to the antenna with the noise figure being at a minimum.

Circle Number 51 on Reader Reply Card

For Further Information On Ads & New Products Use Reader Service Card

CCTV Camera

Availability of a high-resolution television camera measuring less than 10 inches in length has been announced by **Cohu Electronics, Inc.**, San Diego Division. Designed for continuous duty operation, the compact Model 6130 camera may be specified with 16MHz or 32-MHz video bandwidth and scan rate of up to 1225 lines.

Featuring all silicon solid-state circuitry, the 4½ pound camera provides picture fidelity with a low-noise preamplifier and a wide-range automatic sensitivity circuit. A rack-mountable camera control unit houses circuitry for major video origination functions on modular plug-in cards. The Model 6900 camera control is also available in a portable desk-top version.

High-resolution capability makes the 6130 camera/6900 control system ideal for data transmission and close inspection applications or for image magnification in conjunction with a microscope. Specifications include aperture correction adjustable from 0 to +10 dB with negligible phase distortion; white peak clipping adjustable from 0 to 140 IRE units; 10,000:1 automatic light range and –20 degrees C to +50 degrees C operating temperature.

Circle Number 52 on Reader Reply Card

Audio Console

A 5 Channel Monaural Audio Console has been introduced by **QRK Electronics Products, Inc.**, Fresno, California, a subsidiary of **CCA Electronics Corp.**, Gloucester City, New Jersey.

Available through QRK dealers, the console, model QRK-5, has facilities for handling 14 audio inputs and mixing five into the single output stage. It is completely self-contained, mounted within a metal cabinet and has dimentions of 18″ x 7¾″ x 12″ and weighs 30 pounds.

Besides its application in broadcasting, the QRK-5 may be simultaneously used as a source for a public address system. It contains a 10-watt monitor amplifier and has cue positions in all faders. The console is 100 percent solid state.

Circle Number 53 on Reader Reply Card

Sync Generator

Telemation, Inc. recently announced the development of a second generation of digital sync generators—the TSG-3000 series.

The TSG-3000 Series features the same digital circuitry but has, in addition, the capability of programming pulse widths, a built-in bar dot generator and, in the TSG-3000GL genlock version, digital genlock circuitry.

All horizontal pulse transitions and the trailing edge of vertical blanking can be user-programmed to meet exacting system requirements. Horizontal pulses may be changed in 70-nsec increments, and vertical blanking in half-line increments.

The built-in bar dot generator furnishes a switch-selectable test signal for linearity adjustment and color convergence, including cross hatch and dots.

The TSG-3000GL features digital genlock—a radical departure from conventional designs, providing two modes of genlock operation: "ratelock" and "crashlock." Ratelock is constant rate and bi-directional to permit "on-air" locking without signal disruption. Crashlock provides for instantaneous vertical, horizontal and color lockup. Lockup mode is front-panel or remotely selected.

Circle Number 54 on Reader Reply Card

TSG-3000 Sync Generator

Channel Caster CATV Music System

A new automatic system for providing selected music programs to CATV subscribers has been announced by **Tape-Athon Corp.** Called the "Channel-Caster", the new system features the capability of automatically interspersing weather announcements, time calls, station ID, or other spots between music numbers.

An all-solid state system, the Channel-Caster is designed on a "building-block" basis to allow expandability when station requirements call for a more varied music format. The simplest form of the system is a two tape transport version to which can be added a third or fourth transport. With a multiplicity of transports, the system is capable of transmitting different moods or tempos of music for specific times of the day.

The Channel-Caster system is designed to accept up to six inputs of music and announcements, such as three music tape decks, and three tape units holding the time, weather, or other announcements. Programming of the music and announcement tapes is accomplished by an interspercer switching matrix.

Other features of the system include a fail-safe search and seek system which, in case the playing tape should break or preamp fail, immediately finds and operates another available tape. The system also contains its own 40 watt amplifier, a 24-hour clock to permit start and stop programming, and a monitor speaker.

Circle Number 55 on Reader Reply Card

Studio Control Console

GBC Closed Circuit TV Corp. has developed a complete console for TV origination in educational TV (ETV) and Cable TV (CATV) systems.

The heart of the console is a unique switcher-fader/special effects generator. This unit provides switching, fading, special effects and full EIA sync. It can be used to select any of six camera inputs, fade in, fade out, super-impose, lap dissolve or any of 11 different wipes.

The compact console is suitable for studio or remote operation. It includes six 5″ monitors and an audio mixer, all factory prewired to the switcher-fader.

Any of six camera inputs can be previewed. Special effects can be set up and then switched to the console output.

Circle Number 56 on Reader Reply Card

GBC Complete Studio

Solid-State Voltohmyst

A new portable all solid-state Master VoltOhmyst, especially designed for service, industrial and laboratory applications has been announced by **RCA Electronic Components.**

This portable solid-state electronic voltmeter is a high-quality instrument that can be operated either from internal batteries or from a 120-volt AC power line, according to J. J. Hemberger, Manager, Equipment and Devices, RCA Distributor Products. The many features of the Master VoltOhmyst, RCA WV-150A, make it suited for use at home, or on the service bench.

The WV-510A measures DC voltage from 0.01 to 1,500 volts, direct current from 0.01 milliamperes to 1.5 amperes, AC voltage from 0.2 to 1,500 volts, AC peak-to-peak voltage of complex waveforms from 0.5 to 4,200 volts, and resistance values from 0.2 ohms to 1000 megohms.

Seven overlapping ranges are provided for AC, resistance, and current measurements, and eight ranges are provided for DC voltage measurement. Accuracy for all voltage and current functions is ±3 percent of full-scale reading.

Circle Number 57 on Reader Reply Card

Color Monitor

The Institute of Radio-Television, Munich, Germany, Research and Development group for West German TV, has developed a new visual device for balancing color monitors to a consistent gray-scale and a color temperature of D6500°K. (the world standard). Bill Pegler, **T.E.A.,** Bayville, New York, should be contacted for information and demonstrations.

The IRT comparator permits quick and accurate adjustments by direct color comparison of the TV kine. The comparator (which may be hand-held or tripod-mounted) is presented to the face of the kine, displaying either a gray-scale or window signal. The operator, looking through the device's ocular, will observe a circular field where half of the area is a direct view of the kine face and the other half is the illuminant-D reference. The reference source is produced by the reflected light conversion filters and stabilized by a control to a constant current.

Circle Number 58 on Reader Reply Card

Monolithic J-FET Input Op Amplifier

Capitalizing on a technological breakthrough, **Fairchild Semiconductor** is now marketing a monolithic J-FET input operational amplifier that qualifies as the world's first.

Designated the uA740, this new linear integrated circuit is different in design from super beta or "punch through" operational amplifiers and operates with 200 pA maximum current into either input. Fairchild's FET-type product features equivalent betas of more than 15,000.

The uA740 is a simple two-stage design similar to that of the uA741 operational amplifier, but employing J-FET input transistors to obtain low input currents. Input impedance is remarkably high: 10^{12} ohms.

Circle Number 59 on Reader Reply Card

Solid State Multi-Media Programmer

A highly compact, 27-channel, punched tape multi-media control, the "Media Mix" programmer, has been announced by **Spindler & Sauppe, Inc.**, Glendale, California. The new solid state unit, which includes its own built-in 1,000 Hz synchronizer, is designed to control three complete S&S Dynamic Dissolve Systems, plus nine pieces of auxiliary equipment such as other A-V equipment, lights, curtains, and powered displays.

Standard eight-hole computer tape is used in the unit. Using combinations of holes, a total of 27 programming "channels" is created, six for each of three slide dissolve systems, and nine auxiliaries. It will be possible to program each dissolve system for four distinctly different dissolve speeds, the instantaneous "Cut", the 2½-second "Medium Dissolve", the 10-second "Slo Dissolve", and the infinitely variable "Lap Dissolve", in addition to the special effects functions of "Standby" and "Alternate". Each of the nine auxiliary channels may be programmed for either momentary pulses or on-off sequences.

Both local and remote manual controls are available for "live" presentation of programmed materials, and the built-in synchronizer makes possible completely automated presentations. This latter feature makes it possible to record pulses onto audio tape using any stereo ¼" tape recorder. Subsequently, the same synchronizing system will read these pulses back off the soundtrack tape for advancing any single or multi-screen program automatically.

Circle Number 60 on Reader Reply Card

Educational Production Center

Video Engineering Company, Inc. of Riker Information Systems, Inc., Riker-Maxson Corp., announces a new TV Educator Production Center which contains all of the pertinent components generally found in TV stations and required for educational and training television productions for schools, hospitals, industry and CATV systems.

The TV Educator Model 945 consists of: Video Tape Recorder, Two Viewfinder Cameras, Two Zoom Lenses, Two Tripods, Two Cam-Link TV Pan Heads, Two Camera Dollies, Three five-inch Preview Monitors, a Line Receiver Monitor, Switcher Fader Special Effects Control Center, EIA Sync Generator, Intercom System, Audio Mixer, two high quality low impedance, hum reducing lavalier type microphones, Patch Panel with an input-output system, AC Power Center, RF Modulator, Lighting Kit, Video Tape, Head Cleaning Kit and Console.

Among the added features of the TV Educator Model 945 are an intercom jack and easy view tally light with the solid state viewfinder cameras; an intercom system with three headset-boom microphones; an audio mixer capable of mixing up to four microphones and one line level input audio source; and a patch-panel system that ac-

TV Educator Production Center

cepts up to three cameras and audio source with audio input jacks for four microphones.

Circle Number 61 on Reader Reply Card

Mobile System

Arbor Systems, Inc. has announced the availability of a solid-state communications system designed for mobile television. Employing the latest solid-state switching techniques, the system gives the mobile operator a four-input, ten-output communication matrix. This includes a simultaneous program channel which is also switchable. These features allow the wide flexibility in IFB or intercommunication systems needed in mobile radio and television work. Coupled with the advantage that each self contained system contains preamplifiers, switching cards, power amplifiers, remote amplifiers, and power units, it could prove to be an invaluable programming tool.

Circle Number 62 on Reader Reply Card

16mm Scenes From 35mm Color Slides

Availability of the CENTURY DUPLIKIN III, a new accessory outfit which enables filming 16mm scenes from 35mm color slides, is announced by **Century Precision Cine/Optics** of North Hollywood, California.

Films taken with this precision instrument appear sharper than the original because of the 10-times reduction factor. Fits 16mm camera like any standard lens. Designed to give razor sharp and brilliantly saturated color results. Filtering and exposure variation are easily done. Enables missing "tie-in" shots to compliment a filmed sequence. Also useful for establishing shots, instructional films, location identification and dissolves.

Circle Number 63 on Reader Reply Card

Portable VTR

The Sony Corporation of America has introduced an advanced line of one-half inch format Videocorder® video tape recorders. Designated the AV-Series, the line consists of the AV-3400/AVC-3400 "VideoRover II", the AV-3600 Videocorder, and the AV-5000 Videocorder.

This series of video tape recorders conforms to the new industry standard for half-inch format VTRs.

The VideoRover II is a completely portable, battery-operated VTR system that can be carried and operated by one person. It consists of a hand-held video camera (with zoom lens and built-in electric condensor microphone) connected to a shoulder- or back-carried Videocorder video tape recorder. The camera's electronic viewfinder not only shows the operator his picture exactly as it will appear on a TV monitor while he is recording, but can also be used for playback to view the tape as soon as it has been recorded. An optional RF modulator is available that enables tapes to be played back on any regular TV set. An AC power adaptor (supplied as a standard accessory), which also serves to charge the VideoRover's battery, allows the unit to be operated on house current. Other unique features include stop action, audio that can be added after recording of video, and a recording and playback time of better than 30 minutes on one reel of tape.

Circle Number 64 on Reader Reply Card

Mini-Cable Assemblies For Color TV Cameras

New, easy-to-handle "mini-cable" assemblies for color TV cameras are available from **Boston Insulated Wire & Cable Company.**

The new TV-81 MiniCable is about half the diameter of standard cable, weighs less, and is easier to handle. Included in the assembly is the new TV-85C MiniConnector which is smaller, lighter, and shorter than standard yet mates with all 85-pin connectors. New color coding, a BIW exclusive, permits length to be determined at a glance. Unique guided pin entry assures fast, positive connections.

Circle Number 65 on Reader Reply Card

Head-End Demodulator

Availability of the first off-the-

air demodulator designed specifically for cable TV head-end systems has just been announced by **DYNAIR Electronics, Inc.**

Called the RX-4B DYNA-TUNE, the demodulator is completely solid-state and features a field-effect transistor front end with liberal use of the latest integrated circuits to ensure performance and reliability commensurate with today's color television requirements. The standard unit is supplied with a plug-in variable tuner which will receive any standard VHF or UHF television channel. An optional tuner module is available for crystal-controlled operation on a single preselected channel.

Utilizing completely new filtering and signal-restoration techniques, the DYNA-TUNE provides superior adjacent-channel color performance in either microwave-fed or demod cable television systems. These developments allow the DYNA-TUNE to improve the color signal in many critical areas over that produced by the broadcast RF transmission system.

Circle Number 66 on Reader Reply Card

Log And Verification Videotape Recorder

The first videotape recorder designed for program logging and verification by television stations has been placed on the market by **Ampex Corporation,** it was announced by Lawrence Weiland, vice president-general manager, video products division.

The new Model VL-7404 broadcast logging videotape recorder can record up to 38 hours of video programming on a standard 9¾-inch reel containing 3,000 feet of 1-inch wide video tape.

The new recorder logs all of the information needed by broadcasters to keep an accurate account of their station's programming. It directly records video, audio and time information so that the broadcaster can easily verify the time and content of each program, commercial or public service announcement.

The portable VL-7404 recorder is servoed to accept a standard video input. It can record directly from a studio's transmission output or from a regular television tuner. Previous video logging recorders were not designed to record off the air and operated only from the output of a camera synced to the recorder.

The VL-7404 records continuous audio and every 32nd field of video information. It operates at a tape speed of 0.24 inches per second in record or real-time playback, compared to 0.6 inches per second for compressed time (32:1) playback. The recorder achieves a bandwidth of 3 MHz in video and 2.5 KHz in both audio channels.

Tapes recorded on the new recorder can be played back in modes that include:

—Time compressed: In this mode, each video field is played back once at a field rate of 60 per second, thus speeding the playback by 32 times.

—Still frame: Single recorded fields can be viewed from up to 90 seconds without picture degradation.

Because the VL-7404 records a single field per scan rather than a frame as recorded on standard recorders, playback should be viewed on a short horizontal time constant monitor such as the Ampex TR-820 or an equivalent monitor.

The portable VL-7404 is 27 inches long, 16 inches deep, 12 inches high and weighs less than 100 pounds.

Circle Number 67 on Reader Reply Card

Ampex Model VL-7404

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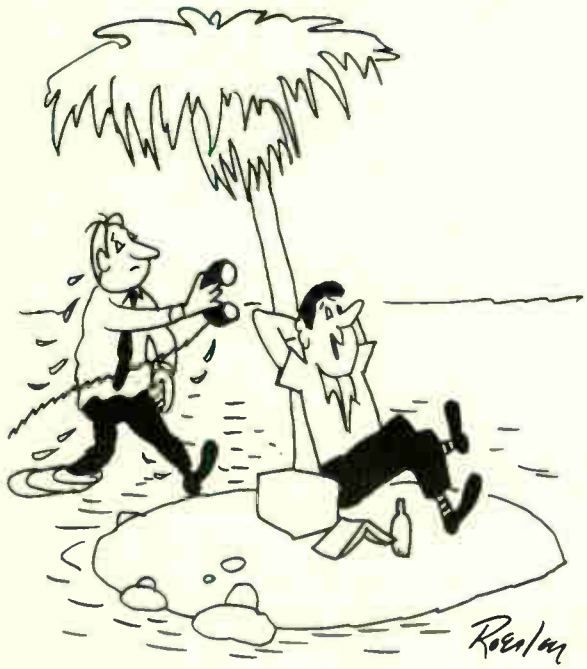

"HERE'S ONE VACATION THE STATION ISN'T GOING TO INTERRUPT!"

TECHNICAL DATA

For further information, circle data identification number on reader service card

100. **AMERICAN ELECTRONIC LABS., INC.**—A new 4-page brochure describing AEL's product capability and accomplishments in the Microwave Integrated Circuit (MIC) field is now available. AEL has long been an innovator in microwave components and its line of MIC products attests to the fact that it isn't resting on past accomplishments. New horizons for the system designer have been opened recently and AEL's MIC's help him to reach these horizons. Advantages of this line include improved electrical performance, reduced size and weight, higher reliability, and the ability to withstand more severe mechnical environments than conventional microwave circuits. Described in this colorful brochure with accompanying photographs are the how's and why's behind AEL's sophisticated and advanced techniques in the development of its line of MIC products.

101. **AMPEX CORPORATION**—A brochure, V70-2, describing features of the Ampex VP-4900C color and monochrome videotape player with built-in color corrector is now available from Ampex's educational and industrial products division. The VP-4900C is designed for playback of Ampex-recorded color and monochrome one-inch videotapes widely used in educational, business, industrial, medical and military applications.

102. **AMPHENOL INDUSTRIAL DIV. OF THE BUNKER-RAMO CORP.**—The most comprehensive line of electrical/electronic connectors, plugs and sockets is described in a new, 32-page catalog now available. The attractive, full-color publication contains photographs, line drawings, electrical characteristics and mechanical specifications for all interconnection products in Amphenol's newly expanded industrial line. A few of the cataloged products presently being introduced by the company: streamlined "Excellite" quick-disconnect audio connectors and all-plastic strain relief electrical plug caps. Complete line described includes standard and miniature industrial/commercial tube/relay sockets and bases; crystal sockets; standard and miniature power connectors; printed circuit board connectors; rack-and-panel connectors; test jacks and plugs; U1 outlet type plugs and sockets; microphone and audio connectors; and host of accessories, assembly tools and related hardware. A selection guide completes information necessary for finding the right component for any equipment or circuit application.

103. **ANACONDA ELECTRONICS** — A new, complete CATV product line catalog is now available which features the Anaconda Electronics Company's Head-end, Active and Passive CATV Products and associated equipment. The catalog has dividers for easy reference and describes design features and performance characteristics with complete technical specifications.

104. **BOURNS SECURITY SYSTEMS, INC.** — A new 4-page product brochure containing applications, features and specifications on their versatile line of ultrasonic intrusion alarm equipment is now available. The brochure also contains data on protection accessories which may be used as optional security devices on the ultrasonic sensors. These include high intensity quarts iodine lamps to panic an intruder; 115 volt AC and 12 volt DC sirens and bells as alarm devices; heat sensors; key lock switches for remote deactivation of a security system; and, magnetic door switches which may also be attached to windows for perimeter protection. Another section of the brochure discusses Cameras For Industry. This outlines security system cameras which offer custom combinations of surveillance and holdup/suspicion photography of public areas and recording of criminal occurrences. The ultrasonic intrusion alarm equipment in conjunction with the security cameras forms a unique and thoroughly dependable security system not available from any other manufacturer.

105. **COHU ELECTRONICS, INC.** — A new 6-page condensed catalog of detailed information on broadcast television is now available. The two-color catalog (6-545) contains photographs and brief specifications on nearly two dozen items — from production video switchers to color video encoders.

106. **COLORADO VIDEO, INCORP.** — The CVI Short-Form Catalog lists 20 unique video instruments including data display devices, video analyzers, video disc recorders, special effects, image enhancers, test and sync generators, and TV-to-computer interface equipment. Photographs and prices are also included.

107. **COMPUTER PRODUCTS, INC.** — A 6-page bulletin covers Computer Products' CR300 Series (12 separate models) CompuREED Low-Level Signal Switching Relays. This series of relays offers, in encapsulated, P C mount modules mercury-wetted or dry-reed contacts, in high or standard performance varieties. The most important feature of this product is extremely low thermal EMF (<0.1 μVolt @ 5% coil duty cycle). These relays are ideally suited for scanning or sub-multiplexing applications. Included in this bulletin are complete electrical and mechanical specifications plus brief application notes.

108. **DAVEN DIVISION**—McGraw-Edison Co. Delay Lines are the subject of a new 4-page, 2-color Buyer's Guide. Delay Line Bulletin #DL-270 discusses in detail seven prime parameters that must be considered in specifying a delay line: delay time, rise time, attenuation, impedance, distortion, temperature coefficient and package design. These factors are then related to determine varying delay line complexities and costs.

109. **DOW-KEY CO.** — A subsidiary of Kilovac Corp. A new 20-page 1970 General Catalog on their new line of vacuum coaxial and other coaxial relays is now available. The catalog contains detailed electrical and mechanical specifications completely indexed for ready reference.

110. **ELCO** — Revised and expanded to 56 pages, the 1970 edition of the Printed Circuit Connector Guide describes 26 separate series of VARICON™ metal-to-metal PC connectors (which conform to the newest requirements of MIL-E-5400, MIL-E-8189, and MIL-T-21200), as well as IC and test probe sockets. A 3-page illustrated foldout index simplifies connector selection. The connectors are available with contact spacings of .050″, .075″, .100″, .156″, and .200″, while standard connector sizes range from 2 to 152 contacts. The connectors are compatible with solder, wire-wrapping, crimp, taper tab, and taper pin terminating techniques.

111. **ELECTRO IMPULSE, INC.**—Catalog 704 covers a broad line of RF terminations, baluns, calorimeters, attenuators, power meters and cooling units. Included in its 40 pages are selection charts, dimensional drawings, specifications and application data.

112. **HEINEMANN ELECTRIC CO.**—A revised and simplified bulletin on their Series 1163 General-Purpose Circuit Breakers is now available. This is the first complete update in many years of technical information on this line of molded-case hydraulic-magnetic breakers, widely used in panelboards and original equipment. Bulletin 3412, superseding Bulletin 3411, is organized for quick selection of General-Purpose breakers in current ratings from 0.01 to 100 amp (AC and DC). One-, two-, and three-pole breakers are listed, as are model numbers identifying circuit modifications (e.g., relay-trip, shunt-trip, calibrating-tap) typical of all lines of Heinemann breakers.

113. **INTERNATIONAL RECTIFIER**—A cross reference of IR universal replacement transistors and popular universal rectifiers in convenient pocket size is now available. The guide folds to a handy 3″X5½″ size, small enough to fit into a shirt pocket, and serves as a ready reference on the distributor, dealer, and electronic technicians levels. The most popular transistor and rectifier types used in professional servicing jobs, hobby projects, and technical experiments are listed in numerical order and cross referenced for replacement by International Rectifier's line of quality

(Continued from page 69)

universal semiconductors. Transistor and rectifier specifications, for the IR devices listed, are presented in a quick reference tabular format.

114. **INTERSWITCH**—a division of the Purdy Group of Companies. A new 4-page, 2-color condensed Catalog No. 708 describing the the company's complete line of programming modules and matrices is now available. The Catalog describes the matrix board's role as a fundamental programming method for thousands of different kinds of instruments, computers, machines, and control systems, offering many important advantages, which compares to other programming methods in programming ease and flexibility, high panel area and volumetric density, and visual presentation of the circuit linkages. It also describes how the matrix board can be programmed in two broad classes of operation—as a patchboard, connecting circuits on a one-to-one basis; and as a coding, or other logic performing device to link circuits on a many-to-one, one-to-many, or many-to-many basis. The data programming module, one of many matrix board programming elements available from Interswitch, accomplished binary coded decimal programming by simple insertion of the appropriate decimal-numbered keys into a standard switch body, mounted on or plugged into a standard switch body, mounted on or plugged into a matrix board.

115. **ITT CANNON ELECTRIC**—a division of International Telephone and Telegraph Corp. A completely revised catalog on their hermetic connector lines is now available. The catalog lists circular and rectangular configurations and MS, high-density, miniature, and subminiature types.

116. **PLASTOID CORPORATION** — A new 4-page technical brochure that provides complete specifications for over twenty-three 11/U, 59/U and solid seamless aluminum sheathed CATV/MATV/CCTV coaxial cables is now available. The brochure also features eleven new 100% shielded 59/U and 6/U type cables that are suitable for direct burial or aerial installations. These cables provide lower attenuation loss than previous designs.

117. **PRODELIN INC.** — The new "Rigid 800" Coaxial Transmission Line Catalog contains complete electrical and mechanical specifications on a full line of 7/8", 1 5/8", 3 1/8", 6 1/8", 8 1/8" and 9.166" copper and aluminum transmission line. In its illustrated 36 pages, included also is a complete listing of accessory items along with the unique field installable Spir-O-lok connector.

118. **RCA ELECTRONIC COMPONENTS** — RCA power transistors and thyristors (SCR's and triacs) in molded-silicone-plastic packages are available in a wide range of power-dissipation ratings and a variety of package configurations. This Note provides detailed guidelines for handling and mounting of these plastic-package devices, and shows different types of packages and suggested mounting hardware to accommodate various mounting arrangements. Recommendations are made for handling of the packages during the forming of leads to meet specific mounting requirements. Various mounting arrangements, thermal considerations, and cleaning methods are described.

119. **RHG ELECTRONICS LABORATORY, INC.** — A new data sheet describing their double balanced Microwave Integrated Circuit (MIC) mixers is now available. The company designs and manufactures a complete line of microwave receivers, transmitters, RF and IF amplifiers and mixer-preamplifiers. The new sheet describes and illustrates their "DM" series. These mixers employ a unique balun configuration (patent pending) on an alumina substrate and offer frequency coverage from 015 to 12 GHz in one unit. All models, octave and multi-octave, offer low intermodulation distortion. Low noise performance coupled with typical LO to RF isolation of 25 dB, and up to 12 GHz instantaneous coverage make these new mixers ideal for surveillance and ECM applications.

120. **SYLVANIA ELECTRIC PRODUCTS INC.**—A new guide to thick film hybrid circuit design is now available. The guide contains hybrid design guidelines; packaging information, and data on active de-

vices, substrate materials, capacitors and commercially available inks. Sylvania has listed typical parameters of key hybrid materials and given visual representations in the guide to afford the user a comprehensive source of information. The chart folds to a convenient 8 X 11 size for filing or opens to 15 X 22 inches for mounting on wall or desk top.

121. **TELE-WIRE SUPPLY CO., INC.**—A newly revised price list and new illustrated brochure feature the latest developments in telephone wire, cords, cable, coaxial cable, pole line hardware and supplies, protective and terminal equipment, nicopress sleeves and tools, Sherron & Gladwin telephone booths, other telephone and CATV construction accessories, cable, equipment and supplies of leading manufacturers. The literature provides all necessary details including number of pairs and conductors, size, gauge, jacketing, REA specifications, etc.

122. **TEXSCAN** — A new 16-page catalog covering Texscan's CATV Test Equipment line is now available. The illustrated catalog lists specifications, features and prices. The 9500 Summation Sweep System; 9500 Transmitter/Sweep Generator; 9500 Receiver/Display Scope; 9300 Sweep & Spectrum Analyzer; 9900 System Analyzer; Rotary Attenuators; VHF Attenuators and Reflection Coefficient Bridges are some of the products listed.

123. **TRW SEMICONDUCTOR DIVISION**—A new 10-page Application Note on a series of Hybrid Power Darlingtons in single TO-2 packages is now available. The paper is concerned with Class B amplifiers, solenoid drivers and switching or series regulators employing 10 Amp 50V Darlington hybrid microcircuits in either dual or complementary configuration.

124. **VANGUARD ELECTRONICS** — A new 4-page brochure on improved high-temperature encapsulated RF chokes is now available. All included on military QPL, the high-reliability Vanguard RF chokes are designed to meet MIL-C-15305, Grade 1, Class B. Included in the two-color brochure are complete specifications on Series 101, 102 and 103 Chokes, which provide inductances ranging from 0.1 to 4700 uh and standard inductance tolerance of ±5%; and the Series S, M and L, with inductance tolerances of ±20% for the 0.1 to 1.0 uh inductance range and ±10% for the 1.0 to 10.0 uh range. Also included are specifications on Vanguard Series SMS, equivalent to MS 18130; Series MMS, equivalent to MS 75008; and Series LMS, equivalent to MS 91189.

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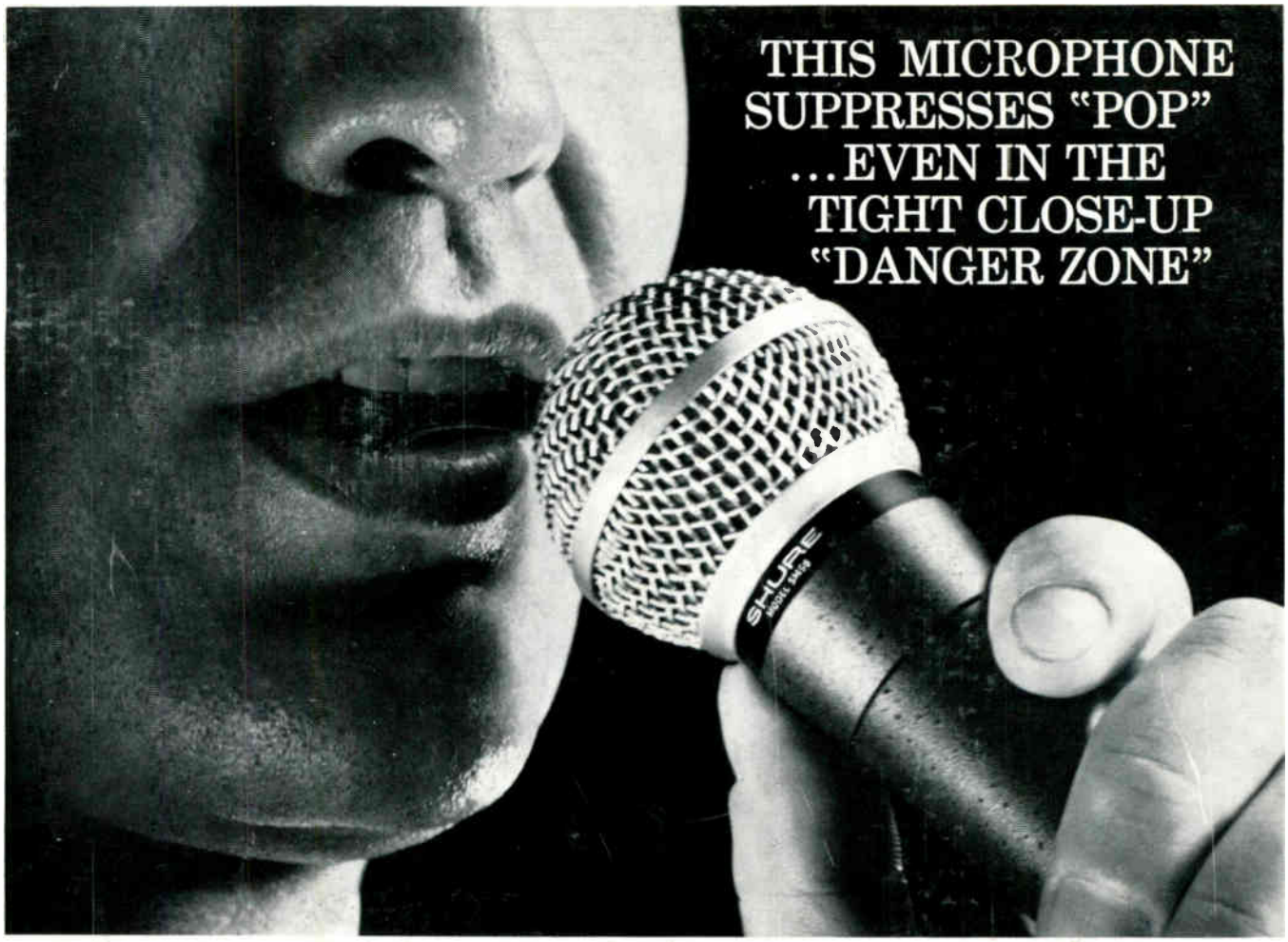

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