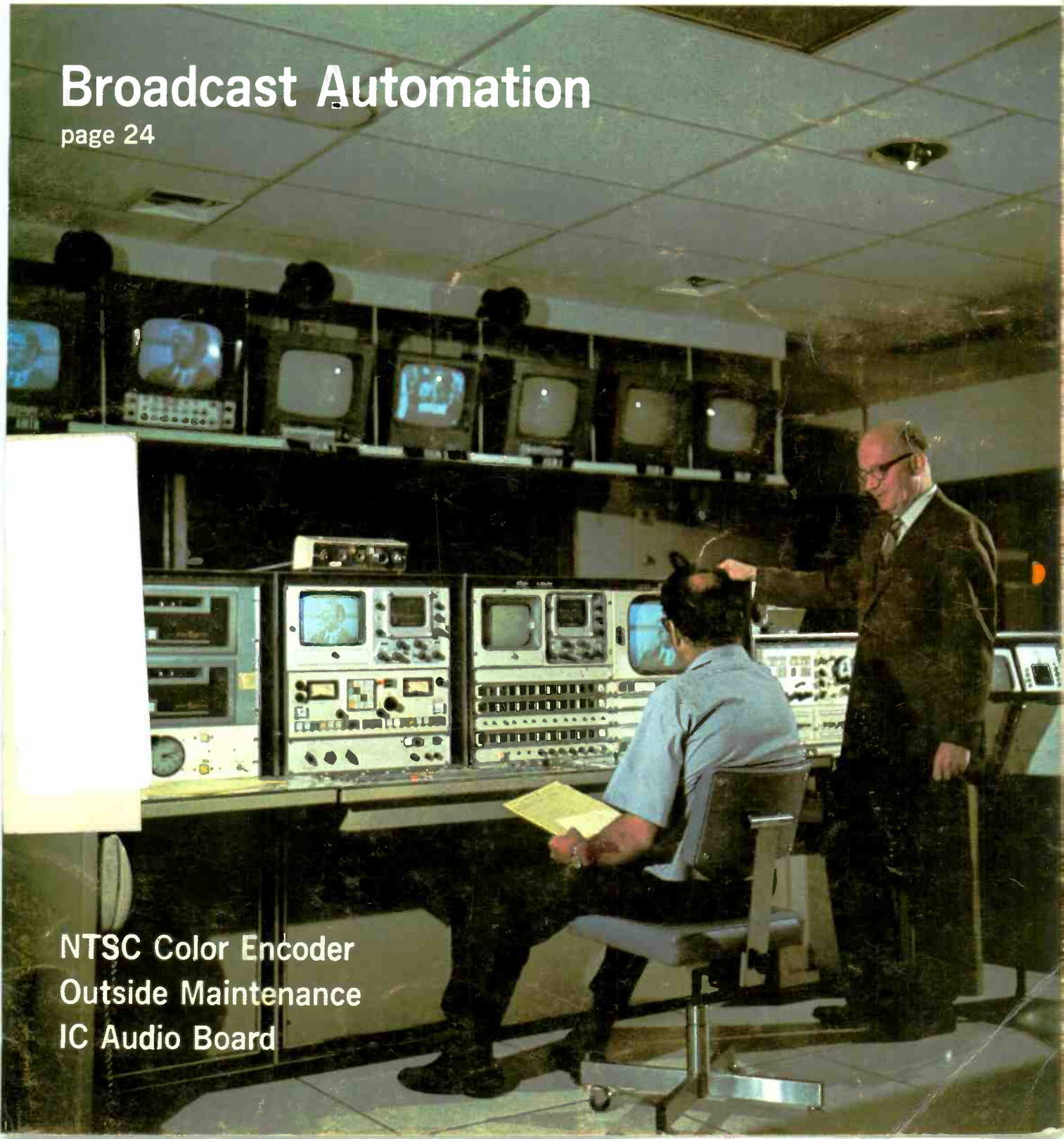
September, 1970/75 cents

Broadcast Engineering®

the technical journal of the broadcast-communications industry

A HOWARD W. SAMS PUBLICATION

SAVE



Broadcast Automation

page 24

NTSC Color Encoder

Outside Maintenance

IC Audio Board

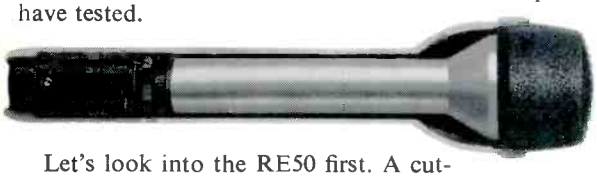
How do you pick up sound without noise?

Pick up the new RE50 and the new RE85 quiet microphones.

Model RE50 omnidirectional dynamic $120 list. Model RE85 lavalier dynamic $133 list. Less normal trade discounts.

Introducing two microphones that aren't "microphonic". That are unexcelled for hearing air-borne sounds, but shrug off contact noises. The new hand or stand RE50 and the lavalier RE85 dynamics.

Small, light, and just barely larger than the smallest microphones of their type. Yet both use a unique double-wall construction that is more effective in reducing microphone noise than any other we have tested.



Let's look into the RE50 first. A cutaway shows that inside each RE50 nestles the familiar 635A, case and all. It's shock-mounted at top and bottom to the outer case. Even the connector is isolated from the actual microphone. And the problems of mass and resonance have been worked out (with the aid of our computer) so that contact noises and cable rustling never reach the Acoustalloy* diaphragm.

The result is remarkable isolation from all but air-borne sound, even in hand-held applications where microphone movement is uncontrolled. And when you add the extra protection of the built-in Acoustifoam* blast and pop filter, this is one of the quietest omnidirectional microphones you can find. Yet response, output level, and polar pattern are essentially the same as the 635A (one of the most popular professional microphones of all time).

But if noise can be a problem with hand-held and stand microphones, it is a plague to lavalier types. Clothing rustle, cord noise, and accidental contact with hard surfaces are common troubles. Except with the new RE85. Again, we have created a microphone within a microphone. But we've gone even farther. A special low-noise grille, for instance. And even the hard, smooth paint finish was chosen to reduce small rubbing noises.

The result is virtually noise-free operation even with inexperienced performers. And at no expense to sound quality. Like all E-V lavaliers, output of the RE85 is peak-free and natural. Each RE85 comes complete with neck cord, tie clip, and a belt clip to help control the cable. The RE50 is supplied with a Model 300 stand clamp.

Both the RE50 and the RE85 are now available at your E-V microphone headquarters. In this noisy world, it's a relief to know that help has quietly arrived.

*E-V Trade Mark

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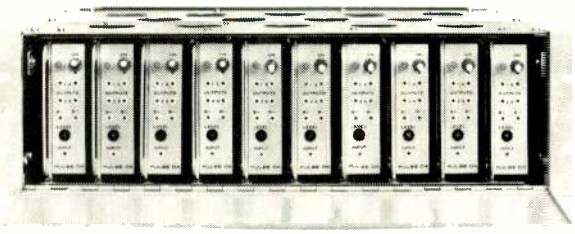
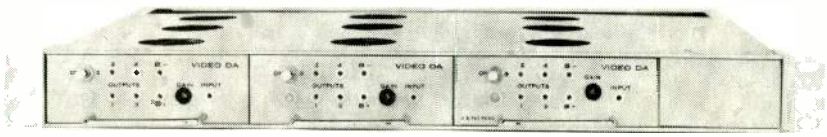


STANDING UP



or lying down

Integral power supplies and solid-state plug-in modules mean these Cohu distribution amplifiers—9800 Series—assure system reliability and provide full flexibility.

You can order any combination of SDA, VDA or PDA circuit modules for easy insertion into a vertical—5¾"—or horizontal—1¾"—frame. Each front panel has an on/off switch with indicator and quick access test points.

The subcarrier distribution amplifier amplifies and distributes the 3.58 MHz subcarrier. Amplitude is adjustable; fine and coarse phase adjustments from 0° to 360° range continuously adjustable over 90° range in four switch selected quadrants.

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The pulse distribution amplifier regenerates and distributes horizontal, vertical, blanking and sync pulses for monochrome or color studios. Output level is adjustable from 3.5 to 4.5 volts with an output delay of less than 60 nanoseconds.

For full details contact your nearest Cohu representative or call Cohu's TV product line manager in San Diego.

SUBCARRIER, VIDEO & PULSE distribution amplifiers from

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September, 1970 ■ Volume 12, No. 9

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

This month's cover was taken in the MCR at WTMJ-TV, a leader in the implementation of broadcast automation. Standing is CE James Wulliman and engineer Dino Guidotti is seated. For another informative article on automation, see page 24.

DEPARTMENTS

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Robert E. Hertel, Publisher

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HELICAL SCAN VTR PROCESSOR SYSTEM

940H PROCESSING SYSTEMS RELIABLY REPLACE ALL SYNC AND BLANKING PULSES MISSING DURING THE PERIOD OF THE HELICAL SCAN (SLANT TRACK) VTR DROPOUT. BY INSERTING STANDARD PULSES INTO THE VIDEO SIGNAL, DUBS TO OTHER HELICAL SCAN OR QUADRUPLEX MACHINES CAN BE MADE. IN ADDITION, SYNCHRONIZING PULSES AVAILABLE FROM THE 950H SYNC GENERATOR CAN BE USED TO DRIVE CAMERAS AND SPECIAL EFFECTS SYSTEMS FOR TITLE INSERTION, ETC.

FOUR SYSTEMS ARE AVAILABLE, ONE FOR MONOCHROME AND THREE FOR COLOR. MODEL 940H-4 COLOR SYSTEM EMPLOYS A MODEL 955 COLOR LOCK AND COUNTER TO PROVIDE THE USER WITH A COMPLETE COLOR SYNC GENERATOR SYSTEM WHEN PROCESSING IS NOT REQUIRED.

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MODEL 940H-1 (Monochrome)	$1,390
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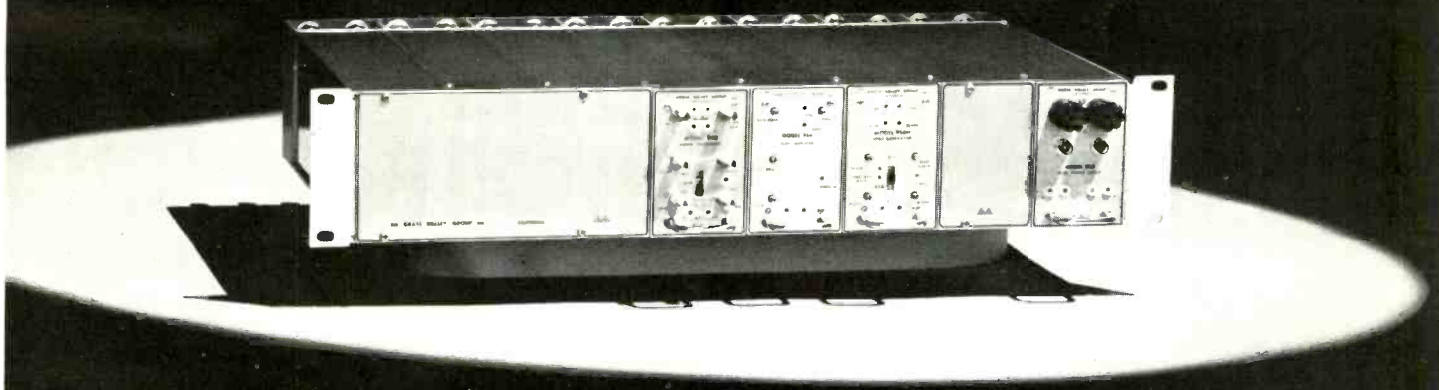
GVG PROCESSORS CARRY A TWO YEAR WARRANTY AND ARE AVAILABLE ON A 30-DAY TRIAL.



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DIRECT CURRENT FROM D. C.

September, 1970

By Howard T. Head

Commission Studying Reductions in Operator Requirements

The Commission, responding to proposals by the National Association of Broadcasters (NAB) and others, has announced an inquiry into possible reductions in operator requirements for AM and FM radio stations. Principally affected would be AM stations employing directional antennas, which are now required to have a first class operator on duty at all times when the directional antenna is being used. Similar operator requirements are in effect for FM stations with transmitter powers more than 25 kW and AM stations with powers more than 10 kW.

NAB has proposed that routine operation for all classes of AM and FM transmitters be permitted for holders of third class licenses, the requirement now in effect for lower power AM and FM stations and non-directional AM operation. The Commission has indicated its agreement with the proposition that changes in the operator requirements may be in order, but has also raised a number of questions which it feels must be answered before new requirements can be adopted.

These questions revolved principally about the routine operation of AM directional antennas and directional antenna maintenance procedures at the station level. The problems are complicated by the fact that there has never been complete agreement as to the procedures to be followed either during regular operation or maintenance, although it has at last become evident to almost everyone that the operator on duty (of whatever grade) should not make changes in the directional antenna controls simply on the basis of phase monitor and antenna current indications alone. Experiences with faulty sampling systems are common, and any indication of out-of-tolerance phase or current operation should be verified by suitable field strength measurements before any attempt is made to change phases and currents at the control panel.

Adding to the complications is the lack of established procedures for either routine or emergency directional antenna maintenance by station chief engineers, and this is further complicated by the fact (acknowledged in the Commission's Notice) that directional antennas vary widely in complexity.

The Commission will welcome comments on the numerous questions raised in its Notice of Inquiry in this matter. For copies, write the FCC, Washington, D. C. 20554 and ask for a copy of the Notice of Inquiry in Docket #18930 (FCC 70-825).

(Continued on page 6)

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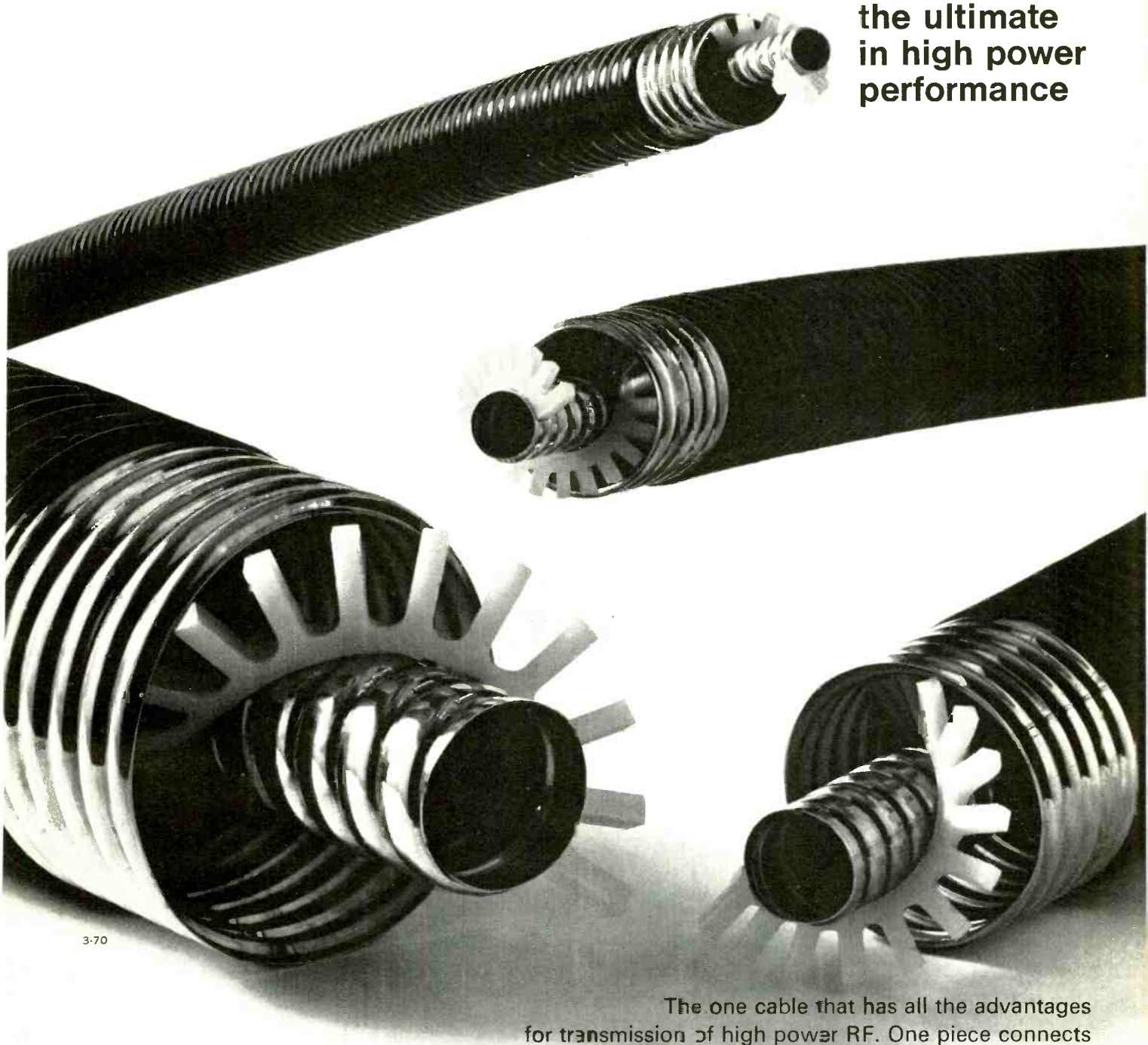
the ultimate in high power performance



3-70

The one cable that has all the advantages for transmission of high power RF. One piece connects transmitter to antenna. Eliminates the numerous flanges and bul ets of rigid systems. HELIAX is easiest to plan. Easiest to install. Most reliable. Corrugated conductors eliminate the differential expansion problems. Cable can be clamped directly to tower, buried directly in earth. Standard types and sizes up to 8". Communicate with Andrew.

ANDREW

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(Continued from page 4)

UHF Television Begins in Canada

The first UHF television station in Canada has commenced operation in Toronto. The station, operating with an ERP of 250 kW on Channel 19, is an educational station operated by the Canadian Broadcasting Corporation for the Educational Television Branch of the Ontario Provincial Government.

Educational television allocations have been established in Canada for some time, but acceptance of UHF has been slow because of the shortage of all-channel receivers. This situation, however, is changing with the adoption by the Canadian Government in July of last year of all-channel receiver regulations similar to those in the U.S. Growth is expected to be slow, however, and no commercial UHF applications are being actively pushed in Canada at the present time.

Court Orders Commission to Consider Signal Quality in Passing on CATV Exclusivity

A California U.S. Court of Appeals, in reviewing a Commission order providing for program exclusivity on a CATV system, has directed the Commission to consider the actual signal quality in establishing exclusivity requirements. The television station involved had requested exclusivity on the system, which had been ordered by the Commission.

The CATV system, however, successfully argued before the Court that the station's signal, although of predicted Grade A level, was actually of poor quality because of terrain conditions and considerably inferior to that of a more distant affiliate of the same network. The Court remanded the case to the Commission stating that the Commission must establish both the present and potential quality of both signals at the cable system head-end.

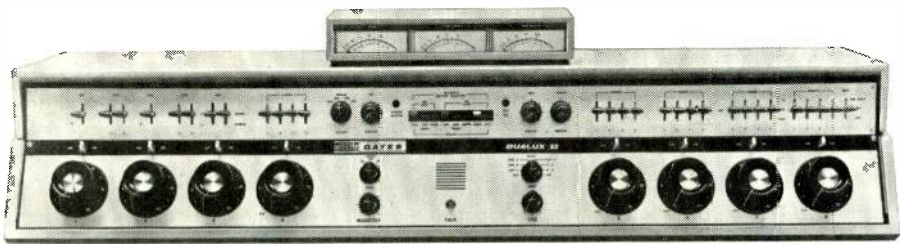
In another case involving CATV carriage, a Commission examiner has ruled against the use of new UHF propagation curves proposed by the Commission some years ago, but never officially adopted. The examiner indicated, however, that actual signal measurements might have influenced the outcome of the case.

Short Circuits

As predicted (April 1970 Pompous Predictions), a proposal has been filed by Western Union for a domestic satellite system which would provide up to ten channels of television service on a nationwide basis, including Hawaii and Alaska. Sufficient capacity is included to provide free channel service for educational television if this should be required by the Commission . . . NAB will shortly propose a general overhaul of Part 74 of the FCC Regulations . . . The Commission will now accept UHF television translator applications for Channels 21-69 . . . The Rules governing experimental operation of non-commercial educational FM stations have been brought into line with those for commercial FM stations. . . . NAB is preparing to ask the Commission to relax the present requirement that a transmitter not visible from the operating position (but in the same building) be subject to the remote control rules . . . The Commission has proposed to extend from Feb. 1, 1971 to Feb. 1, 1976 the time by which CARS must vacate the 12.2-12.7 GHz band.

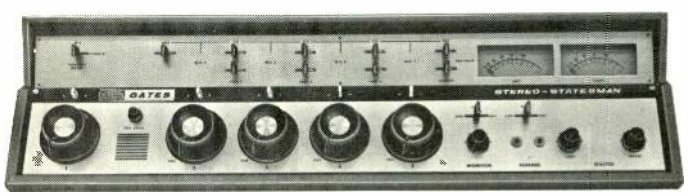
For the largest selection of solid state audio consoles . . . look and listen to Gates

Gates offers the largest selection of transistorized audio consoles to meet every broadcasting need. For more information about these four or any of our many other audio consoles, write today. Gates, 123 Hampshire Street, Quincy, Illinois 62301.

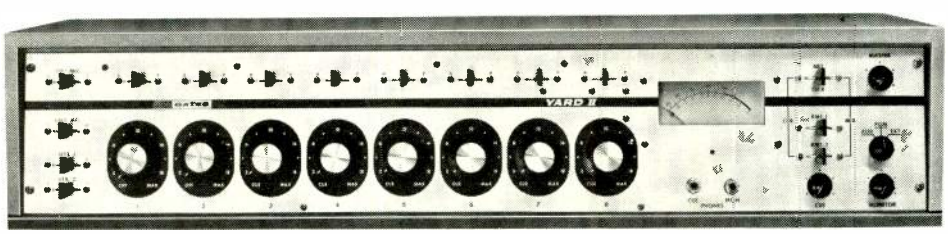


The Dualux II. Eight channel solid state mono and stereo audio console. 13 mono and 6 stereo inputs, plus two automation program sources and one SCA channel—totaling 22 inputs! Built-in cue/intercom. Virtually flat response 20 to 20,000 Hz.

The Gatesway II. Eight channel mono audio console. 18 inputs. Built-in cue/intercom. Variable equalizer for special effects and line corrections. Frequency response ± 1 dB. Complete monitoring facilities. 100% transistorized.



The Stereo Statesman. Five channel solid state stereo audio console. 9 stereo, 2 mono inputs. Response 20 to 20,000 Hz, ± 1 dB. Complete stereo monitoring facility. All channels are full stereo.



The Yard II. Eight channel mono console. 12 inputs. Frequency response ± 1 dB, 30 to 15,000 Hz. Compact. Lightweight. Ideal for small to medium size stations. 100% transistorized.

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Circle Number 7 on Reader Reply Card

LETTERS TO THE EDITOR

Exam Examined Again

Dear Editor:

I think your "steamed engineer" (June issue) ought to cool off and take a realistic look at the problem of finding capable engineering personnel for the broadcast industry. After the ink has a chance to dry on his new ticket he may see the shortcomings and limitations of any licensing system of this type.

No chief engineer in his right mind ought to hire new personnel on the strength of a First Class license alone—if he does, he deserves who he gets!

As long as there are examinations, there will be those who make a living helping other people to pass those exams. I'm all for updating the current FCC examination, and I'd like to see the addition of some sort of psychological testing to find out how well the applicant can function in emergency situations, something not unknown in most broadcast stations.

But you've got to look farther than any one test in judging technical qualifications, and especially in broadcasting—let's not ask the Federal Government to do it all for us.

William R. Seabrook
Annapolis, Maryland

Passing The Exam Is No Real Guarantee

Dear Editor:

In the June issue of **BROADCAST ENGINEERING** there is an opinion listed that I can't completely agree with. This is dealing with the FCC First Class exam. This exam, according to the FCC, is designed first of all not to be passed, and to those who do pass, it is a job well done. The argument I see is that if a person has the ability to pass this exam, he in return could master the duties of radio and television engineering, with time and practice. No exam, FCC or any other, pertaining to any kind of work guarantees that a person can walk in and just sit down and take over; it takes time. This is the other side that I justly believe should be heard. By no means am I condeming the views of your readers, I am only giving mine.

Joseph A. Dentici
Engineer
WENN/AM-FM
Birmingham, Ala.

More Questions Needed On IC And Logic Circuits

Dear Editor:

I have held an FCC First Class license since June, 1969, and since early September I have been employed as engineer at a 27,000 watt educational stereo FM station, as well as a college-owned local origination CATV facility. In the past year I have realized how obsolete the requirements for FCC licensing really are.

The test for Second Class is fairly general, as it must be to encompass all phases of two-way, as well as broadcast communications. There should, however, be more coverage of solid-state circuits, especially IC's and logic circuits.

The test for First Class, as of last June, contains no coverage of camera circuit or color TV circuits, other than identification of parts of a composite video waveform. There is no coverage of VTR's or effects generators, both of which are indispensable in the modern TV station. There is no material relating to emergency power generators found at nearly all larger broadcast stations.

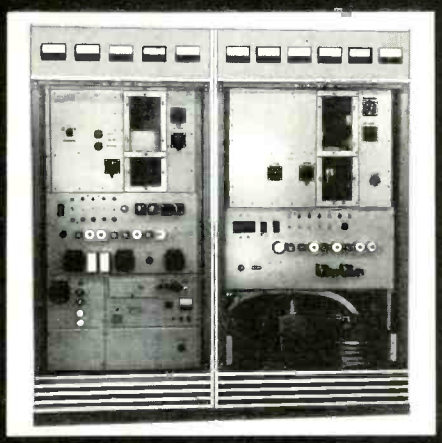
I realize that a major revision of these tests would involve extensive reorganization of the present testing system; however, I feel that something must be done to help alleviate the problem of technically unqualified license holders. I would like to propose that the Commission

(Continued on page 10)

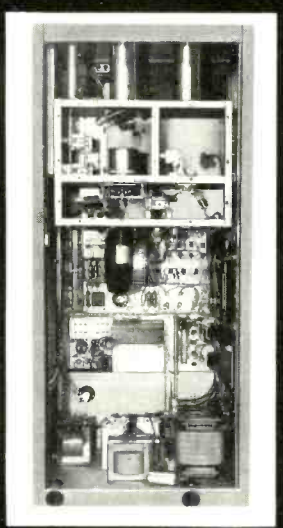
CCA ELECTRONICS

Announces a 25 KW FM AIR COOLED TRANSMITTER... WITH INDEPENDENT 3 KW DRIVER AND ONE POWER AMPLIFIER TUBE

FRONT VIEW:
The CCA FM-25,000DS is self contained in (2) two modern cabinets. No external parts — An independent 3KW transmitter which serves as a driver and a 25KW Amplifier. Total floor space less than 18 square feet.

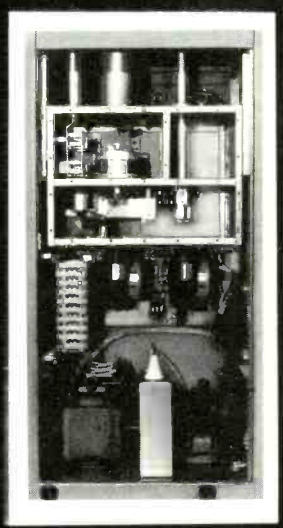


**FRONT VIEW—
DOORS AND FRONT COVERS REMOVED:**
Note full access to all controls and parts. All controls are calibrated and all parts are standard and can be obtained from local sources.



REAR VIEW 3KW DRIVER:
Independent 3KW Transmitter can be used as emergency cutback. Normally only produces 1.5KW drive.

REAR VIEW 25KW AMPLIFIER:
Only one tube, a zero bias 3CX15000A7 triode is used in the FM-25,000DS and produces 25KW with less than 30KW input. (85% efficiency) No neutralization—Simplicity, stability and reliability.



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(Continued from page 8)

adopt a new Television Endorsement, whereby upon passing the test, a First Class licensee would have the exclusive authority to operate and maintain television transmitting apparatus. He would, in addition, have the technical knowledge necessary to maintain, troubleshoot, and operate related studio and signal processing equipment.

Although a modification of the FCC exams is not a "cure-all", I feel that this proposal would be advantageous from the managerial as well as from the engineering point of view.

Michael D. Harmon
Engineer
KCMW-FM/TV
Warrensburg, Mo.

KPEN Needs SCA Whistle Eliminator

Dear Editor:

Your series on SCA has been of particular interest to us at KPEN as we are planning a new installation at this time.

Experiments so far have revealed a major difficulty that is not discussed in your articles: a whistle at approximately 10 kHz is perceived on high quality stereo tuners when both stereo and SCA are operating. The source of difficulty appears to be a beat between the third harmonic of the 19 kHz pilot and the 67 kHz SCA. The transmitter manufacturer (Collins) has advised us that this difficulty can be eliminated by proper tuning of the transformers in the exciter; however this has not eliminated the problem.

We have spoken to two other stations with this equipment who describe exactly the same difficulty and likewise have found no solution. The whistle is noticeable only during periods of low main channel modulation and only on excellent quality receiving systems. I wonder if the author or any of your readers have experienced this difficulty and found solutions.

Lawrence Gahagan
Peninsula Broadcasting Corp.
Mountain View, Calif.

Ed. Note: There must be an answer out there somewhere. Since our lab is not set up for SCA testing, we'd like to hear how other engineers have solved this problem. As you know, there's a world of information that has never been written, and BE readers can usually put together some good answers in these areas.

In fact, this is why this magazine carries an Engineer's Exchange column near the back of each issue. When you know you've come up with a good answer for a tough dog problem, send in your findings and we'll run it in the column and we'll pay you for it.

Meanwhile, if you can help the staff at KPEN, drop them a line at: 2550 El Camino Real, Mountain View, Calif., 94040.

BE Readers Reminded Of Comments Request

Dear Editor:

I would like to remind my fellow broadcasters of a pending change the FCC is now accepting comments on that would effect every AM station using audio compression circuits ahead of the transmitter to obtain positive peaks in

excess of 100 percent. This amendment to part 73, Sections 73.55 and 73.14, if made into law may very well mean each station would have to limit positive, as well as negative peaks to 100 percent or below.

It has been our experience, using both the CBS Audimax and Volumax, that negative peaks stay well within the 86-100 percent limit and at the same time our positive peaks range from 110 percent to about 115 percent on some music passages. It should be noted at this point, at no time does WCSS interfere with other stations on adjacent channels and we never had trouble of this type from other stations, nor has anyone else to my knowledge, as long as negative peaks are below 100 percent.

Limiting positive modulation would reduce the signal range and would consequently not be in the best interest of the listening public WCSS or any other station serves.

All stations who now use compressors or similar equipment and who do so to maintain good quality of signal strength and with regard to proper engineering practice, should let the FCC know of their views on this matter as soon as possible.

Lloyd Smith
Chief Engineer
Radio Station WCSS
Amsterdam, N.Y.

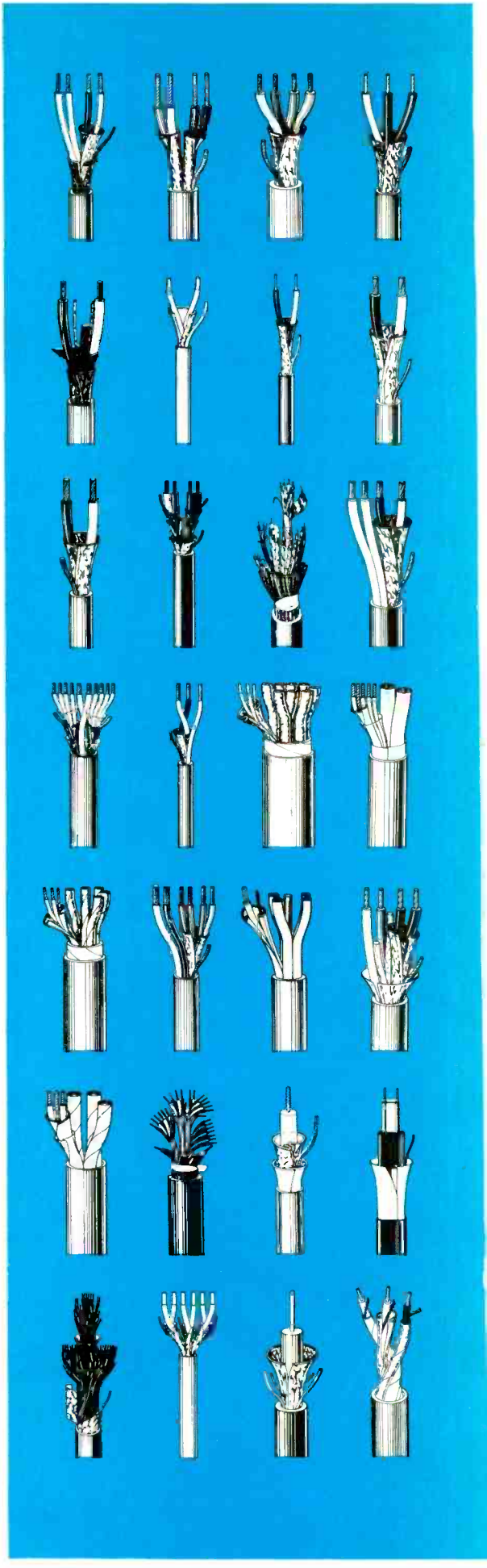
end your signal pollution problems

Beldfoil® ISO-Shielded™ Cable

It's the cable with virtually perfect shielding. It's a Belden exclusive. Beldfoil ISO-Shield is like a continuous metal tube enclosing each pair of conductors in a cable. It locks out crosstalk or interference . . . whether from outside sources or between shielded elements in the cable.

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.

Beldfoil ISO-Shielded Cables are small, lightweight. They terminate easily. They're modest in price. Your Belden Distributor stocks a wide variety of standard Beldfoil shielded cables as listed in the "Belden Electronic Wire and Cable Catalog" (ask him for the latest edition). And, should you have specifications no standard product can meet, ask him to quote on a specially engineered design. Or, if you choose, contact: Belden Corporation, P. O. Box 5070-A, Chicago, Ill. 60680. Phone (312) 378-1000.



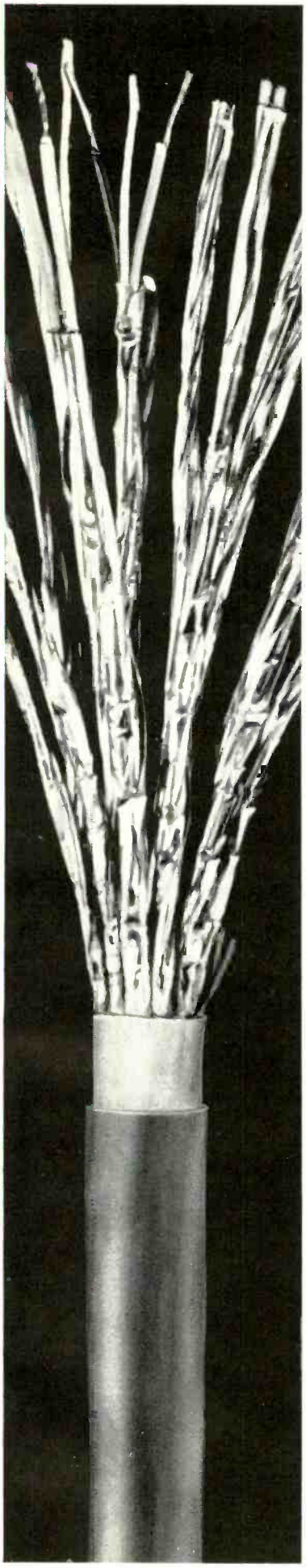
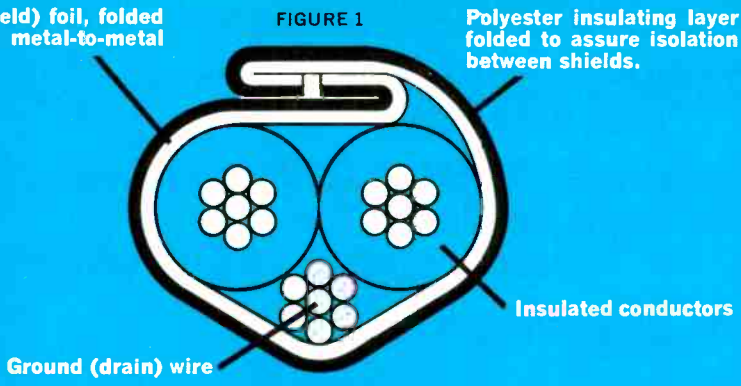


FIGURE 1



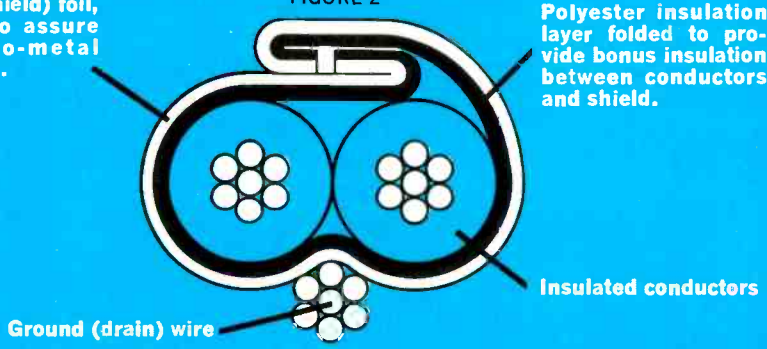
Beldfoil Multiple Pair Individually Shielded Cable

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

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INDUSTRY NEWS

A Cable Assist

FCC Amends CARS Rules

Rules for Community Antenna Relay Station (CARS) (Section 74. 1003) have been amended by the Commission to allow use of FDM/FM (frequency-division-multiplexed frequency modulated emissions) in addition to the AM VSB (amplitude modulated vestigial side band emissions) now permitted.

The Commission action was in response to a Laser Link Corp. petition for partial reconsideration of the Commission's Report and Order (FCC 69-1241) released November 14, 1969 adopting rules for a Local Distribution System (LDS) for distributing CATV signals locally by microwave. The Commission denied the petition for reconsideration but adopted a Notice of Proposed Rule Making based on a proposal for a local distribution system by Laser Link.

The primary aim in authorizing LDS was to permit CATV operators to use microwave relay links to span short distances where use of cable was impractical, the Commission explained. Anticipating the possible use of FDM/FM relay equipment for this purpose, the Commission said it wished to encourage development of LDS now by making frequency space available and by providing technical standards for both AM VSB and FDM/FM systems of transmission.

Comments in response to the rule making were submitted by Laser Link Corp., Mid-Hudson Cablevision, Inc., and the National Cable Television Association, supporting the proposed amendment; from Microwave Associates, Inc., supporting in part; the TelePrompTer Corp., opposing.

Microwave Assoc. Inc. suggested the Commission reject the LDS channel allocations proposed in the new rule and instead divide the CARS band, 12,700-12,950 MHz into three sub-allocations, 83, 84, and 83 MHz in width, permitting the use of any type of modulation within these sub-bands. The Commission noted, however, that supporting technical standards such as permissible power, frequency tolerances, and out-of-band emissions were not presented and consequently rejected the Microwave Associates suggestion.

In answer to the Commission's proposal for rules applicable to a possible baseband channelling arrangement suitable for FDM/FM multiplex operations. TelePrompTer urged a uniform basebend channelling scheme be adopted and Laser Link suggested that baseboard arrangements be left open at this time. Noting that the benefits of uniformity would be interchangeability of equipment of different manufacturers and an optimum use of the radio channel, the Commission said interchangeability was not of primary concern because few manufacturers are in the market at this time. It also pointed out that under Commission proposed bandwidth restrictions, systems designers will be encouraged to develop the most efficient baseband channelling arrangements technically possible.

Since, at this time, no compelling reason for adoption of a baseband channel allocation for FDM/FM systems was presented, the Commission said it decided to adopt rules permitting LDS stations to use either AM VSB emissions or FDM/FM emissions because either system may provide economic or spectrum-conserving advantages helpful to CATV operators.

CATV Scope

On Page 18

In This Issue

FCC Releases CATV Study

A study on the problems involved in the proposed expansion of CATV into the central cities of major TV markets and the possible impact of such a development on the television broadcast system has been released by the FCC.

Prepared by the Research Branch of the FCC's Broadcast Bureau and titled "The Economics Of The TV-CATV Interface", the study was part of the material considered by the Commission in preparing its proposals for CATV in Docket 18397. The Commission said it was releasing the study in order to assist interested parties in making comments on the Commission's proposals in the proceeding.

The study points out that the question of impact on local stations is not a simple one, since a number of variable factors are involved such as whether the station is VHF or UHF, a network affiliate or independent, the number of competing stations, its share of the market, the assumed CATV penetration limit in its market, and other data. The study offers a formula to estimate impact on specific stations, considers the problems of program suppliers and copyright owners and lists basic data on programing expenses.

Copies of the study may be obtained from the FCC Office of Information, Washington, D.C. 20554.

Equipment List Issued

The latest listing of Radio Equipment Acceptable for Licensing, dated May 11, 1970, has been issued by the Federal Communications Commission.

The list includes equipment for the Domestic Public Radio Services other than Maritime Mobile; Radio Broadcast Services; Experimental, Auxiliary and Special Broadcast Services; Stations on Land in Maritime Services; Stations on Shipboard in Maritime Services; Public Fixed Stations and Stations in the Maritime Services in Alaska; Aviation Services; Public Safety Radio Services; Industrial Radio Services; Land Transportation Radio Services; and Citizens Radio Service.

The transmitters listed are considered acceptable for licensing in the various services provided that their operation is in accordance with Commission rules and the specifications for this equipment are not exceeded. The list also includes frequency and modulation monitors that are type approved for use in the radio broadcast service. Equipment is listed alphabetically by manufacturer and numerically by type number.

Inquiries about equipment listing may be addressed to Technical Division, Technical Standards Branch, Federal Communications Commission, Washington, D. C. 20554 (Telephone 632-7093, area code 202). Copies of the list are available for reference at the Commission offices at 1919 M Street N. W., in Washington, D. C., and at FCC field offices. Copies may be purchased from Cooper-Trent, 1130 19th Street, N. W., Washington, D. C. 20036 (Telephone FE 8-3800, area code 202).

Experimental FM Rules Change

The Rules have been amended to extend experimental operation time for noncommercial FM station. Section 73.562 of the Rules has been amended by the Commission to extend for one hour the time in which noncomercial educational FM broadcast stations can use for experimental purposes. The new times are from 12 midnight to 6:00 a.m., prevailing local time.

Previously, experimentation was permitted from 1:00 a.m. to 6:00 a.m. local time. The Commission said after review of its 1967 decision which relaxed limitation for experimental operation of commercial FM stations, and in view of the letters and requests for waiver and relaxation of the rules with regard to noncommercial educational FM stations. It found "no valid public interest or other reason for continuing to make conditions for experimental operation of educational FM stations more restrictive than for commercial stations and that permitting educational FM licensees to conduct experimental operations under the same conditions as commercial FM licensees may be equally beneficial to them and should be permitted."

Provisions were also made for experimental operation during other time periods upon prior notification to the Commission, and under specific conditions, as well as for experimentation with other than a standard FM signal. The amendments, which will become effective July 17, 1970, "will permit greater consistency in regulation of commercial and noncommercial educational FM stations," the Commission added. (By Order)

Sponsor Identification Waivers Are Granted

Requests for waiver of the sponsorship identification requirements of Section 317 of the Communication Act in certain non-commercial sustaining announcements by member stations of the Utah Broadcasters Association and the New Mexico Broadcasters Association have been granted by the FCC. (Section 317 (d) authorizes the Commission to waive identification requirements when it determines that an announcement is not required in the public interest.)

The two state associations notified the Commission of plans under which they would accept contributions from non-profit organizations for assistance in the preparation and distribution of public service announcements.

Similar requests for waiver have been granted the Southern California Broadcasters Association, the Kansas Association of Radio Broadcasters, and the Wyoming Association of Broadcasters.

In granting the waivers the Commission pointed out that it was concerned with the possibility that some of the non-profit organizations may be prompted to contribute to the Utah and New Mexico organizations by a belief that they will be discriminated against if they fail to contribute. The Commission told both organizations 'it' is expected that in such eventuality you will take effective action to dispel any such misapprehension."

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All Stanton Calibration Standard cartridges are guaranteed to meet the specifications with exacting limits. Their warranty comes packed with each unit —the calibration test results for that individual cartridge.

For complete information and specifications write Stanton Magnetics, Inc., Terminal Drive, Plainview, L.I., New York.

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SCANNING THE CATV SCOPE

By Leo G. Sands

Sands joins staff

Leo G. Sands, of Leo G. Sands & Associates in New York City, takes over as CATV editor in this issue. Leo has written a number of articles for BE over the years, the latest being a Sands Associates project that accounted for most of the articles in the June CATV local origination special issue. And since his company is located in New York City, we suggest at if you have questions or comments on this column that you send them to 250 Park Ave., ZIP code 10017.

Who needs an order wire?

An order wire for a CATV system is costly. An order wire system which will provide direct communications between the head end, the office, the maintenance shop and all line and distribution amplifier locations is a complex operation. But without it, downtime is often excessive, and maintenance costs are higher than they should be.

Order Wire Systems

There are several ways a CATV order wire can be provided, and they include:

(1) As a minimum, a subscriber telephone at the head end which can be dialed from any common carrier telephone.

(2) Also as a minimum, a leased telephone circuit between the head end and the office or maintenance shop.

(3) A leased party-line circuit with telephone jacks or weather-proof (locked) telephone boxes at every amplifier location, with the line serving telephones at the head end and office and/or maintenance shop.

(4) The equivalent of (3) above, but utilizing a privately owned telephone pair paralleling the coaxial cable network, connected to telephones employing magneto ringers.

(5) Or, in the rare case when the CATV system is equipped for bidirectional transmission, a carrier telephone system with dial signaling.

(6) A mobile radio system comprising a base station at the head end and at the office and/or maintenance shop, mobile units in all maintenance vehicles and walkie-talkies for all field maintenance personnel, and even a repeater station.

An order wire can serve as more than a two-way voice communications circuit. It can be used for remote control of the head end. When a leased telephone circuit is provided between the head end and the office and/or maintenance shop, it can be equipped at each terminal with a magneto telephone plus an encoder or decoder, as shown

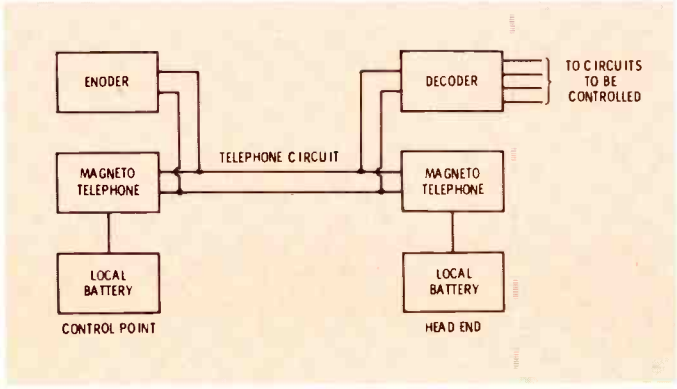

Fig. 1 Combination order wire and remote control circuit.

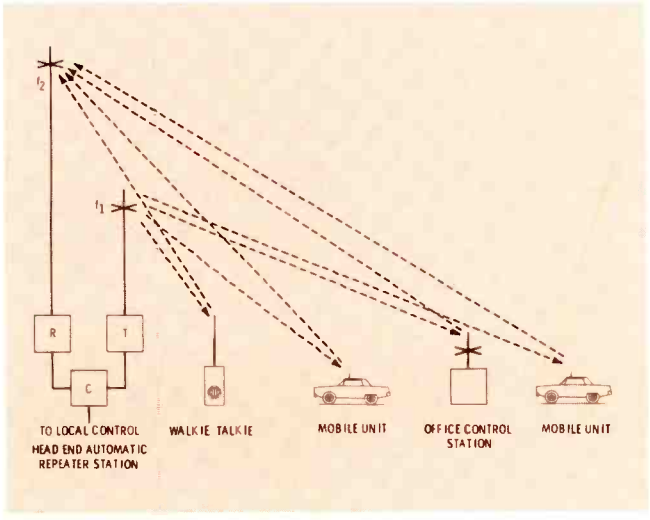

Fig. 2 Example of mobile relay system for CATV operation.

in Figure 1.

The encoder can consist of a bank of tone transmitters whose code combinations can be selected with push buttons. The decoder at the head end can consist of a bank of tone receivers, each controlling a specific function or feeding a matrix or relay tree. Or, the encoder can consist of a single-tone or dual-tone transmitter coded by a telephone dial. And, the lead end decoder can consist of a single- or dual-tone receiver which drives a bank of dial-pulse selectors (such as Secode) or one or more stepping relays. Electronic scanners can be used on one tone channel.

Such an arrangement will enable remote control of such head end functions as: cut-off of a malfunctioning channel; activation of a test pattern on any of the TV channels for which the system is equipped; start-up or shut-down of a videotape player; operation of a film chain or slide projector; voice access to any or all TV sound channels or FM channels; etc., in addition to two-way voice communication.

A private telephone pair, paralleling the cable system, provides even greater capability. In addition, a maintainer at any amplifier location, where a telephone box or jack is located, can be used to communicate with all other such locations, as well as the head end and/or office or maintenance shop. Furthermore, by means of an encoder, any malfunctioning line amplifier can be temporarily by-passed until it has been repaired or replaced.

Those unfamiliar with telephony may wonder why magneto telephones are suggested. Here's why. A conventional telephone depends upon DC and ringing current from a central office. On a private line circuit (even if leased from the telephone company), you're on your own—central office facilities are not provided. It is necessary to provide DC for carbon microphone excitation (dry cells) and ringing voltage (magneto) at each telephone. To signal a specific telephone, it is necessary to crank the magneto to send a code consisting of so many rings of any length, or so many short and long rings. All phones on the same party line ring—but only the phone whose code is transmitted should be answered.

Remote control signals need be only of short duration. Thus it is possible to use the circuit for voice communication while transmitting control signals. These signals will be audible at the telephones unless they are filtered out. If the signal tones are all below 300 Hz, or above 2700 Hz, they can be rendered inaudible at each telephone by installing a high pass or low pass filter. Or, when dial-type or scanner-type remote control is used, a notch filter can be used.

Radio Relay

The most flexible order capability can be provided by installing a mobile radio relay system. It can consist of a repeater station at the head end, a control station at the office and/or maintenance shop, a mobile unit in every maintenance vehicle, and a walkie-talkie for every maintenance technician.

The CATV system operated by Hunter-McLean in the Toronto area, for example, utilizes a 450-470 MHz band repeater station for relaying transmissions from mobile units and control stations at fixed location to other mobile units and control stations.

Such a mobile relay system can be licensed in the United States in the Business Radio Service, but only when the repeater station is located more than 75 miles from a metropolitan area with a population in excess of 200,000.

Since the head end is usually on a hill or has a tall antenna tower, the head end site is often an ideal repeater station location. When there is no need to communicate in the direction away from the CATV network, directional antennas can be used at the repeater station which will cover the required area.

A mobile relay system operates on two frequencies (a paired channel). Mobile units, walkie-talkies and control stations transmit on f2 to the repeater station which retransmits the intelligence on f1, which is usually 5 MHz lower in frequency than f2. All mobile units, walkie-talkies and control stations are equipped to receive on f1, the repeater station transmit frequency.

For example, a technician on a pole, servicing an amplifier, or even in a subscriber's home, can use his walkie-talkie to communicate with any mobile unit, control station and any other walkie-talkie in the system, as well as with personnel at the head end. The repeater station at the head end site, although fully automatic, can be provided with a microphone or handset and a loudspeaker to enable use of the repeater as a manually controlled base station. All units of the system can intercommunicate with each other, as illustrated in Figure 2.

Even greater flexibility can be provided by interconnecting a control station to the telephone system. This enables the user of any walkie-talkie or mobile unit to also communicate directly via radio and the telephone network with subscribers, suppliers, his own home, etc. If the control station location has a telephone switchboard, communication

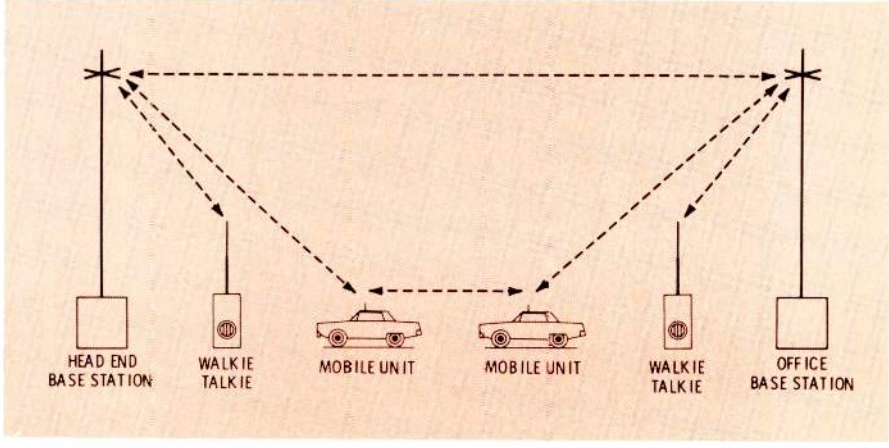

Fig. 3 Conventional mobile radio system for CATV

with persons at any of its extension telephones is possible.

When the CATV system is nearer than 75 miles of a metropolitan area with a population greater than 200,000, a repeater station may not be used. In such cases, a base station can be installed at the head end and at the office and/or maintenance shop for direct intercommunication, and for communication with mobile units and walkie-talkies.

Only one frequency is required. All units transmit and receive on the same frequency, as illustrated in Figure 3, in the 25-50 MHz, 150-174 MHz or 450-470 MHz band.

The communicating range between walkie-talkies will be shorter than with a repeater station. In most cases, however, the range will be adequate. When the range between walkie-talkies is inadequate, messages can be relayed manually via one of the base stations. Or, if the system operates on a paired channel (two frequencies) in the 450-470 MHz band, the operator of a base station can temporarily patch his receiver output to his transmitter input to convert the base station (lawfully) into a manually-controlled repeater.

Generally, either type of system is operated on an "open" basis with no means for alerting other units except by voice calling. An FDM (push button tone selection) or dial type selective signaling encoder can be added at each base station to enable selective alerting of any one or group of mobile units. Although selective signaling is mainly used where it is desirable to keep all mobile unit loudspeakers muted except when signaled by a base station operator, in CATV operations it might be advantageous for all to know what is going on.

In CATV operations, selective signaling can be used to alert a specific mobile unit by sounding its horn. For example, a line crew or maintainer away from the vehicle can be alerted to respond by radio when the vehicle's horn is sounded.

A selective signaling encoder at the office or maintenance shop base station can (with FCC permission) be used to remotely control various functions at the head end. A multifunction decoder, of course, is required at the head end base station receiver.

Equipment Choice

The CATV system operator has a choice of the following types of mobile radio systems in order of cost: single-frequency simplex in the 25-50 MHz, 150-174 MHz or 450-470 MHz band, two-frequency simplex in the 450-470 MHz band—or in areas where permitted, a 450-470 MHz mobile relay system.

Where cost is paramount and interference can be tolerated, CB (citizens band) equipment can be used. For not much more money, AM equipment for use on Business Radio Service frequencies in the 25-50 MHz band can be purchased. Comparable in price is higher-powered 30-50 MHz and 150-174 MHz band FM equipment. In all of these categories are both tube-type and solid state equipment. All current-model walkie-talkies, however, employ solid state equipment.

An order wire facility, whether wire or radio, should be indispensable to CATV operations. Downtime can be reduced and high quality system performance can be maintained more easily when operating and maintenance personnel can communicate with each other.

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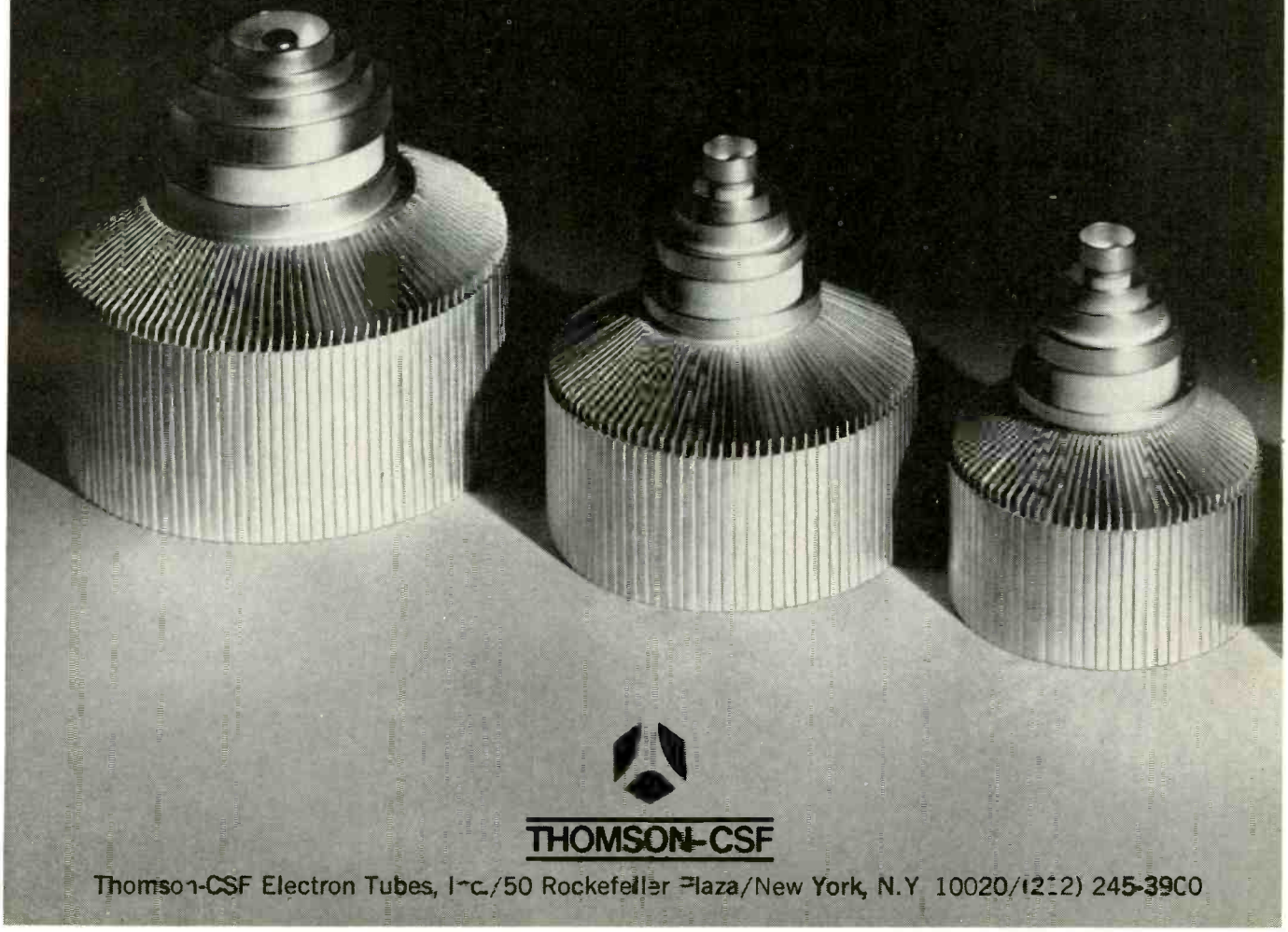
TH 331	3500	1.8	50	1000
TH 290	3500	3.0	100	2000

*THREE-TONE TEST **peak sync level in class A operation.



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Circle Number 16 on Reader Reply Card

Automation: a means to an end

Above all, the goal of broadcast automation is the efficient use of people and equipment to achieve smooth, revenue producing programming.

By Morris Courtright*

TECHNICAL OPERATION REAL TIME	ROUTINE	BUSINESS OPERATION BATCH PROCESSING
Time Keeping -true time -program duration	**Traffic** -schedules -sales -equip. status -inventories	**Accounting** -invoices -profit & loss -cash flow -depreciation -payables
Equip. Control -source switching -source control -transmitter control -display control	**Operations** -programming -avails -edit schedule -film, tape sched. -staff schedule -sales reports	**Personnel** -payroll -work schedules -taxes
Equip. Monitoring -switch confirmation -source monitor -transmitter monitor	**Sales** -availabilities -contracts -schedules -make goods	**Sales** -confirmations -discounts -commissions -histories -forecasts
Operations Log -on air		**Operations** -equip. usage -maintenance -cost control -crew schedule
		Legal -contracts -logs -tax statements

Fig. 1 The tasks that automation can perform at a station are generally divided into technical and business operations. These are further sub-divided by time priority. The real-time tasks require on-line instantly available equipment.

As evidenced by the growing diversity of equipment available, automation means many things to many people. Webster defines automation as an "automatically controlled operation of an apparatus, process or system by mechanical or electronic devices that take the place of human organs of observation, effort and decision". In a sense, then, the station installing a cartridge machine that cues up, plays and automatically speeds up to reach the next spot has embarked on a path to automation. A trivial case, perhaps, when compared to a computor controlled television station, but it does underscore the wide range of automation.

Broadcast automation has two general functional categories: "business data processing" for traffic, scheduling, accounting and associated tasks, and "automatic process control" for the engineering and technical operation of the station. The business and technical operations are further classified by time priorities (See Figure 1).

The real-time tasks must be performed with a high degree of precision since they directly control the revenue producing commodity called air-time. Computer control of these tasks must be on-line and instantly available. An automated swticher, a dedicated process control computer, or a high priority interrupt capability in a time sharing computer system are methods of performing the real-time tasks. The priority of routine tasks depends largely on the goals and requirements of the particular station and vary from near real-time to once or twice daily. Usually such tasks will be performed several times a day and may be accomplished on dedicated unit record equipment, general business computers, or a time-share computer service. The batch processing tasks are those items needed once or twice a week or less and may be run on an in-house system, or even by an external data processing service center.

The Business Side

The major difference in automating a broadcast operation as compared to other business activities is the nature of the commodity sold. Revenue is earned in real-time and by airing program material, which does not lend itself to any data processing technique except on-line control. Pricing of the com modity is non-linear and depends on a complex calculation affected by time of day, demographics, and sometimes, the state of mind of the sales manager.

Program content and placement of commercials are stringently regulated and require certified records of performance; billings are subject to a maze of package arrangements

*BE Automation Editor

and discount structures; and what's more, the broadcaster must maintain facilities with both high first capital costs and high operating costs whether revenue is being produced or not. These factors apply to all stations, both large and small, and vary only in the relative importance and quantity of dollars involved. Thus, a broadcaster needs a highly flexible system with as little delay as possible from point of sale to revenue paid.

Automation Types

Physically, automation takes many forms. Generally recognized throughout the industry are systems such as the Schafer 800 shown in Figure 2. Basically a process controller, such systems are designed to accomplish the real-time tasks of engineering switching, equipment control, equipment monitoring, time keeping, and, frequently, operating log production. (Note that most operating logs produced by broadcast automation systems show what was scheduled and do not automatically verify what was actually aired. The Gates system is one exception, it does check codes on the cartridge cue track.)

Priced from $6000 (Broadcast Products AR-100) and $10,000 (Day Manufacturing AutoGram) to $50,000 (IGM 630-6) these machines vary in flexibility and capability according to cost. Each will do an adequate to outstanding job within its capabilities, but all will be satisfactory only if used within its capabilities.

The Cental Dynamics equipment shown in Figure 3 (WRGB) typifies equipment finding widespread application in television. Primarily process controllers, television automation is far more complex than radio automation, and each system is usually tailored to station needs and goals. Such systems may be free standing using punch cards, magnetic tape or paper tape for control of technical operation; a self contained indirectly controlled system for both technical and business functions; or a directly computer controlled operation in real-time.

The high capital cost of television automation dictates a thorough, far-reaching task analysis prior to hardware consideration. The lowest first cost route to full-time automation is installation of a free standing system with the capability of adding a direct on-line computer at a later date. The ultimate in flexibility and control, however, is achieved by using a small process controller for technical operation and interfacing with a larger, general purpose computer for the bulk of the business data processing. Central Dynamics, for example, has a variety of equipment designed in a modular form so that a system of the desired final complexity may be installed in a building block form over a period of time, and will interface with almost any commercial data processing equipment.

General Electric and Sarkes-Tarzian (TASCOM) have systems using a process control computer for local control and a remotely located large scale computer for time sharing the bulk data processing tasks. The ultimate, of course, would be to install a large scale computer in-house for data processing in general, and interface it with a process controller for the technical operation. This would guarantee complete local control and data privacy, but may be the most expensive method.

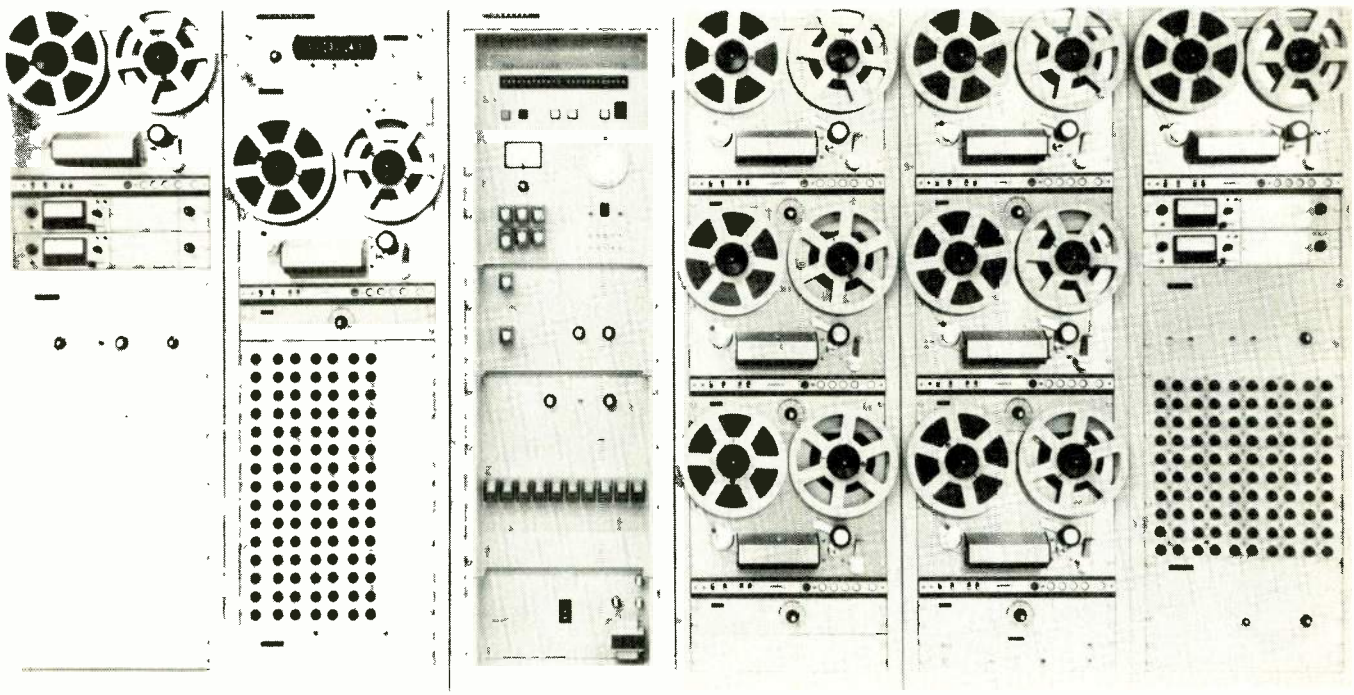

Fig. 2 The Schafer 800 program automation system is just one of the many systems now available to the broadcaster.

Automatic Logging

An automation task infrequently mentioned, but of great importance to the engineer and station technical operation, is that of transmitter logging. The Moseley ADP-220 in Figure 4 prints out the technical operating parameters every 10 minutes. It will handle up to 20 inputs with 0.1 percent accuracy and, if equipped with a tolerance alarm unit, will flag out-of-tolerance conditions and sound an audible alarm. Other systems log on magnetic tape or adding-machine-like rolls of paper.

The deletion of "eyeball parallex" from transmitter readings is an obvious advantage to the engineer who is trying to keep his equipment in top shape and anticipate failures before they are catastrophic. Automatic operating parameter logging is not one of the Commission's strong points at this time, and extreme care should be exercised to insure that the system purchased enjoys the favor of the Commission.

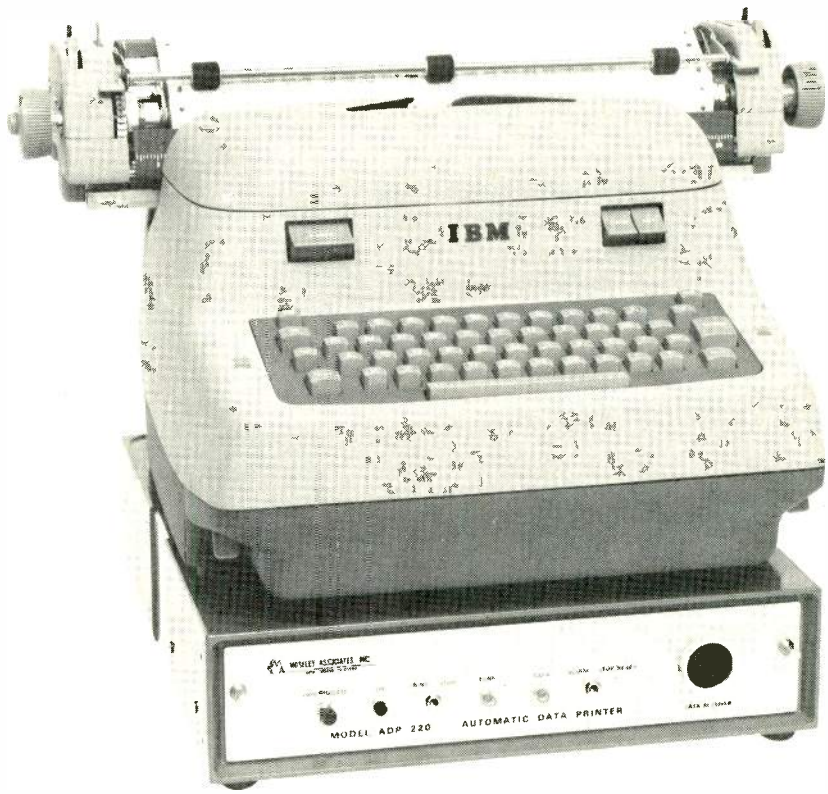

Fig. 4 The Moseley ADP-220 transmitter logger.

Selection Factors

Considering the range of selection available, the effectiveness of any automated system at a particular station depends on the care exercised in its choice. A careful analysis of managerial goals compared with the physical capabilities of the system is foremost if an optimum balance between performance, cost and growth potential is to be realized. What tasks are to be automated? What benefits will accrue? What is the cost? What side effects will occur? What is the ultimate goal?

Do not be misled into expecting that automation will reduce the number of people on the payroll. It may, in fact, increase them. However, automation will relieve them for more creative effort. Automation can also improve the on-air operation and reduce the number of lost spots. Above all, that is the goal of broadcast automation; efficient use of people and equipment to produce smooth, revenue producing programming. ▲

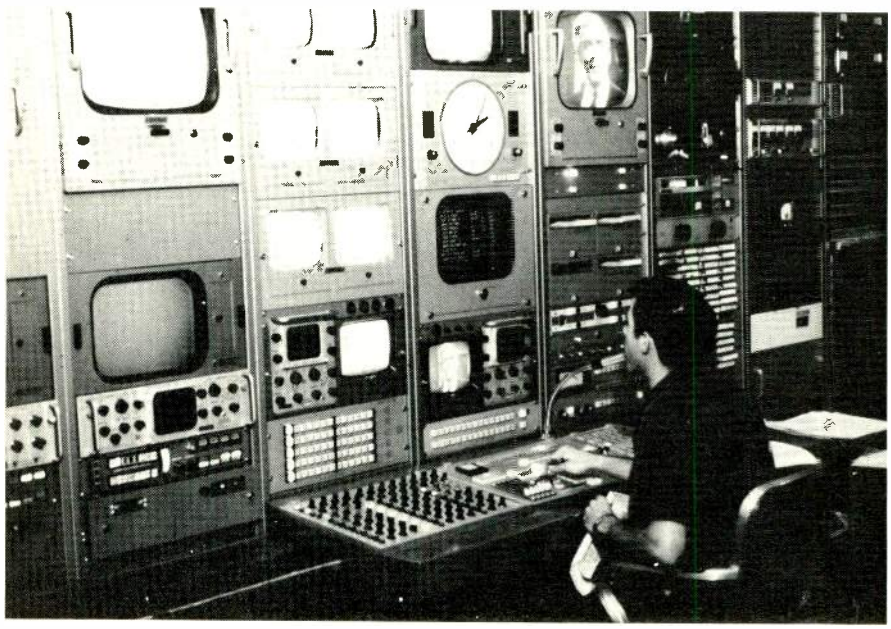

Fig. 3 Television automation equipment shown here was installed at WRGB by Central Dynamics.

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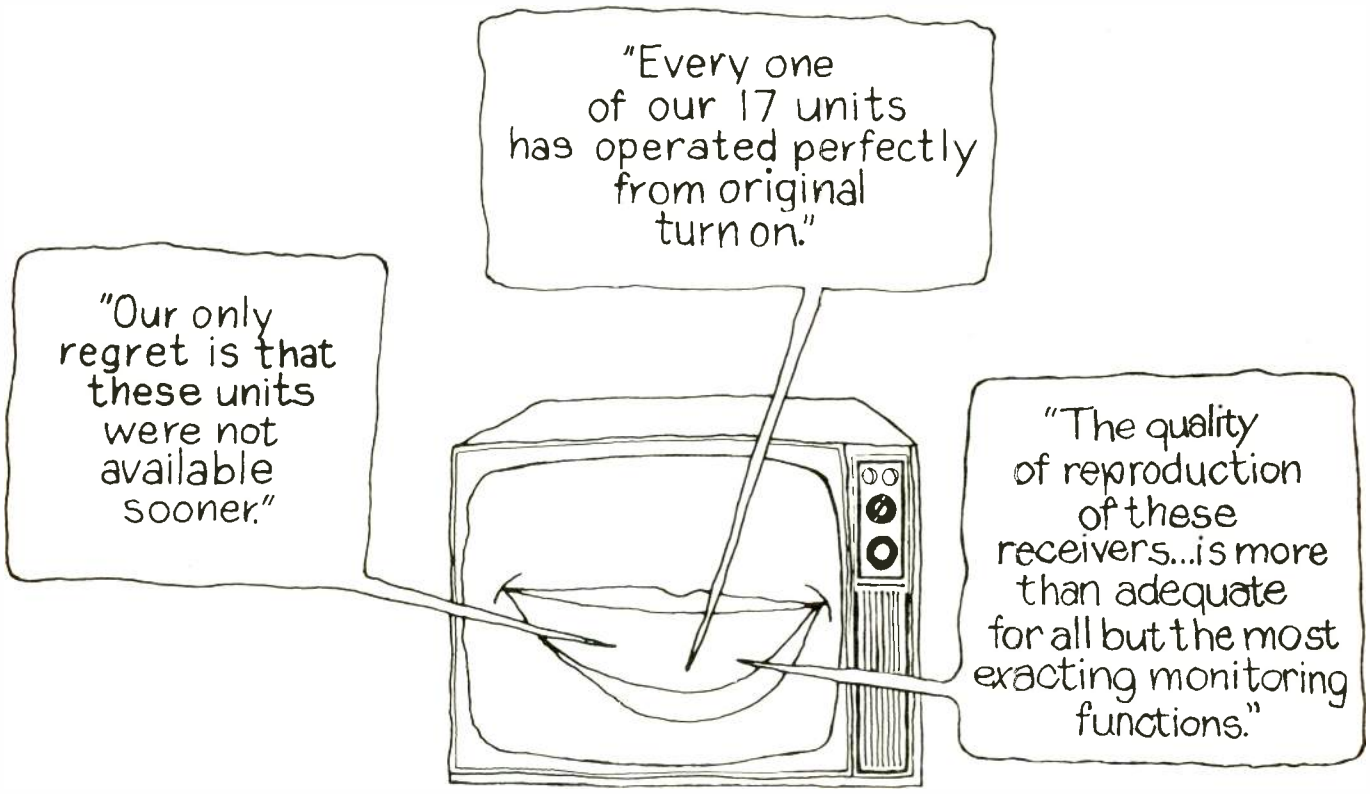

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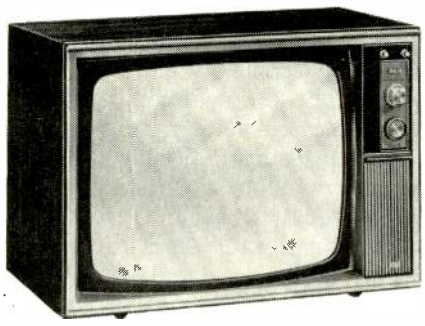

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A review of the design and operation of EVR

Part 2 of a 2-part series

By Dr. Peter C. Goldmark and staff*

In this second and last part of a series explaining the CBS EVR system, the film, player, chroma translator, and audio are discussed. Diazo film was selected for duplication purposes, but only after years of investigation and experimentation. But why Diazo film?

Diazo film is less expensive than silver halide film, is vitually grainless, and there are only two steps in the duplication process. The first is the exposure to ultraviolet light through the master film, and the second involves the conversion of the latent image into a visual one in a hydrous ammonia atmosphere. The Diazo film which has been specifically adapted for EVR use, is positive working, has unity gamma and is coated on a 2.8 mil thick triacetate base.

The EVR Player

The laboratory prototype color EVR player, on which the Motorola production players are based, is shown in Figure 1. In Figure 2 the cover is removed showing the cartridge deck. CRT, and associated circuitry. A cartridge is played by opening the small door over the well, placing a cartridge on the hub and closing the top. To the right of the well are six push-buttons for controlling the film transport functions. Pressing the Play push-button causes the cartridge leader to thread through the deck, and the player automatically starts to play. The large knob on the front permits the film to be removed backward or forward while viewing still pictures.

The CRT light output is kept constant throughout the life of the tube by an automatic brightness control. The P-17 phosphor decreases its light output as it ages so that the initial light beam current of 10 microamperes is gradually increased to about 80 microamperes without affecting the system resolution, thereby appreciably extending the useful tube life. This is accomplished through a photoresistor, positioned to view the raster and controlling the bias of the CRT through a closed loop automatic brightness circuit.

Optical scanning of the luminance and chroma tracks of the EVR film also employs the forward raster scan technique. At the start of the field the beam from the CRT scans the top of the first picture. As the film moves at a constant speed of six inches per second, the beam also moves in the same direction but at twice the velocity, or 12 inches per second. Thus, by the time picture No. 1 has moved to the position shown in the second strip of film, the light beam has completely scanned it and now rests at the foot of picture No. 1. At this instant, a vertical sync pulse, derived from light flashing through the clear window on the film, initiates vertical flyback. The CRT beam returns and comes to rest at the top of picture No. 2, ready to start the next scanning period.

Since the timing of the CRT beam is controlled by the film velocity, the film speed can vary

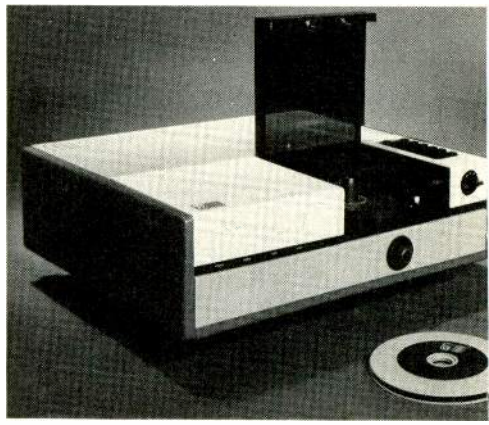

Fig. 1 A laboratory prototype color EVR player.

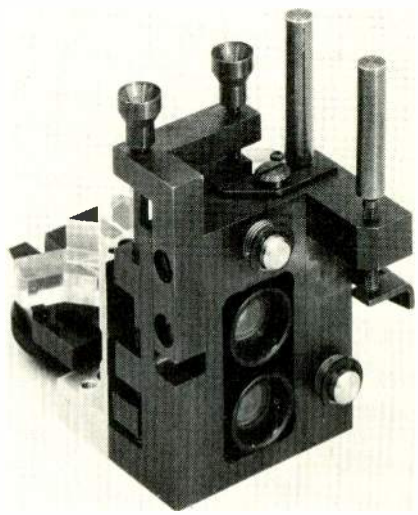

Fig. 2 Cover removed to show the cartridge deck.

*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 of CBS Labs.

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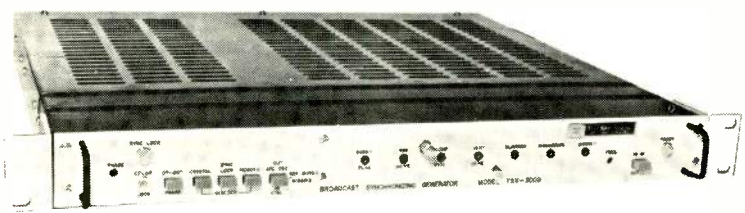

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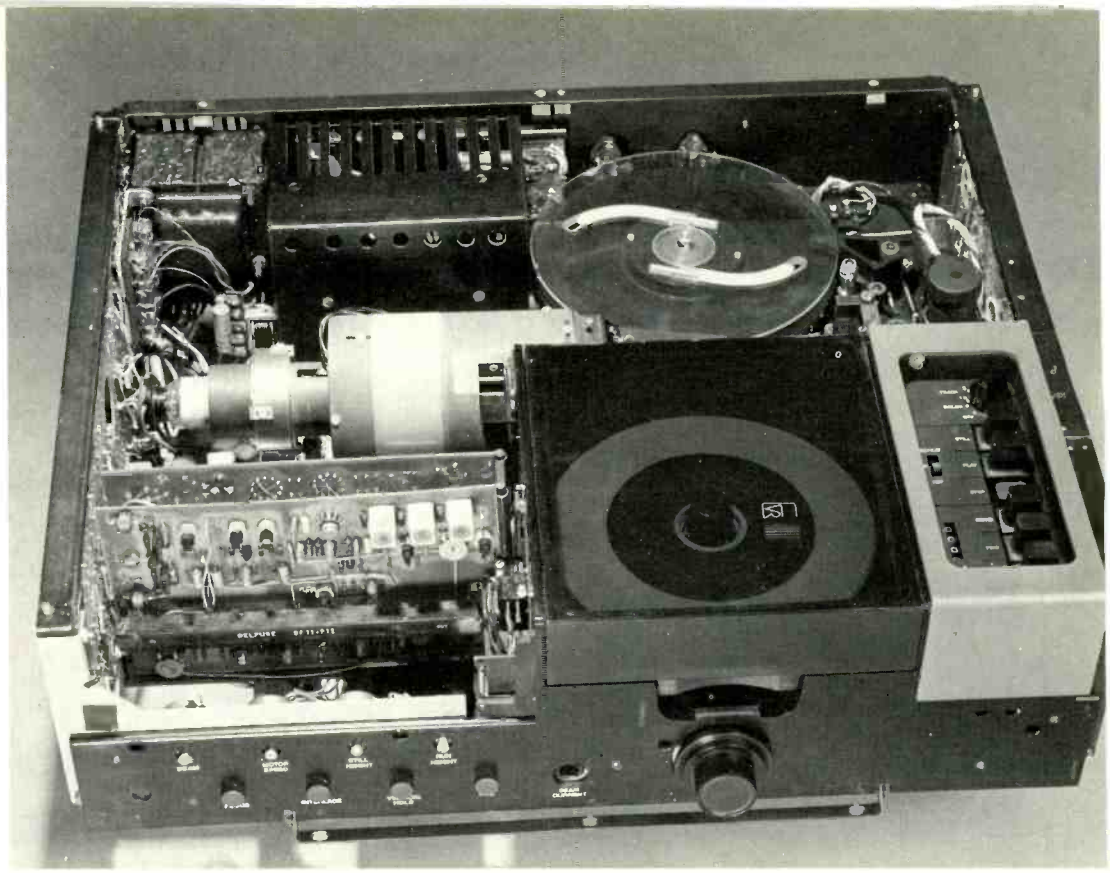


Fig. 3 Mechanical assembly of the imaging optics shown from the CRT side.

within a certain range without affecting the vertical steadiness of the reproduced television picture. The film drive is servo locked to the 60 Hz mains by comparing the speed of the recorded field pulses with the mains frequency.

The luminance and color frames of the color EVR film or the two program tracks of a monochrome film are scanned through a dual optical system. The imaging optics consist of two lenses, two rhomboidal prisms, a lens mount and a film gate which holds the film in a cylindrically curved image plane. Each lens images the 1.5″ x 2.1″ CRT raster onto the film gate forming two identical images with centers .14″ apart and reduced by a factor of 11.3.

Both lenses and prisms are designed to have optimum performance for the spectrum of the P-16/S-4 (CRT and photomultiplier tube) combination with peak energy at .385 microns. Each lens and prism combination is designed for a flat object field and for an image field spherically curved with a radius of 6″. This provides the best practical match to the cylindrically curved gate having a radius curvature of 3″. Factory adjustments for centering and focusing of the lenses are provided. The two small prisms, which permit greater separation of the lenses, require no adjustment.

The mechanical assembly of the imaging optics is shown from the CRT side in Figure 3. The other side showing the two apertures in the curved gate uses two lucite light pipes and the positions occupied by the photomultipliers.

Each lens has a focal length of 15 mm and will resolve in the film plane 60 line-pairs/mm with 60 percent response relative to 5 line-pairs/mm at an effective aperture of T/2.3. Registration of the luminance and chroma images is relatively easy because the low resolution color image, already containing all primaries, is superimposed on the high resolution luminance picture.

Chroma Translator

Color EVR divides the picture information into two frames; one for the luminance, and the other for color. It was mentioned earlier in relation to Electron Beam Recording that EVR chroma is composed of two color difference signals, modulating a suppressed carrier in quadrature phase to each other. The color carrier frequency is 1.8 MHz and the width of the color difference signal sidebands is ±0.5 MHz.

The EVR film is scanned without line tracking and each luminance frame is composed of 525 lines (625 in Europe). To avoid the need for line tracking during playback, the chroma subcarrier has to be a series of vertical lines rather than interleaved dots. Therefore the color carrier must be a multiple of the line scan frequency Fh. Again it should be emphasized that the width and linearity of the recorded images and of the CRT raster cannot be uniform enough in all parts of the picture to assure constant frequency and phase values for the chroma subcarrier. Therefore, a continuous 0.9 MHz pilot signal is added to the chroma carrier during recording to make the system self-correcting on playback.

The maximum EVR color difference signal bandwidth is the same as the Q bandwidth in the NTSC system: –6 dB at 0.5 MHz. In EVR, the I and Q bandwidths are equal because nearly all color television receivers are designed for the same bandwidth color difference demodulators. It is simple to convert EVR color to NTSC directly by frequency translation without demodulation to baseband color.

As shown in the block diagram of Figure 4, the combined chroma

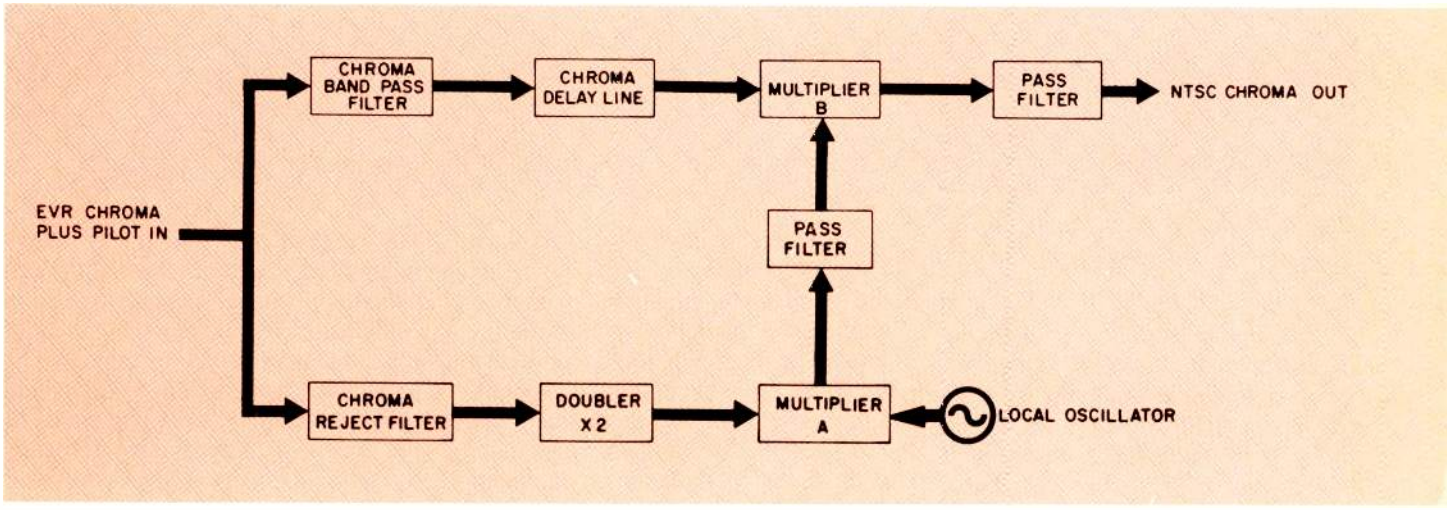


Fig. 4 The combined chroma and pilot signal from the film is first separated into its two components by frequency filters.

and pilot signal from the film is first separated into its two components by frequency filters. The 0.9 MHz pilot carrier is doubled to 1.8 MHz and applied to mixer A together with a locally generated 3.58 MHz signal. The 5.38 MHz sum signal output of mixer A is selected by a bandpass filter and applied to mixer B together with the EVR chroma signal centered around the color carrier at 1.8 MHz. The difference frequency of 3.58 MHz from mixer B is extracted by a bandpass filter and now becomes the NTSC chroma signal. An analysis will show that regardless of a shift in EVR chroma frequency, the frequency of the translator output signal will remain constant at 3.58 MHz.

Blanking, synchronizing and signals are added to generate the composite NTSC signal. The color burst is obtained by gating the 3.58 MHz locally generated signal with a burst flag pulse. Prior to this, the 3.58 MHz is set to the correct phase by the player's hue control.

A color killer is employed in the player to disable the color circuit whenever a monochrome cartridge is played so as to avoid spurious beats in the picture. During monochrome film, the absence of the pilot signal is sensed and both the chroma and color burst are removed from the outgoing video signal. This will activate the color killer in the color television receiver, which can be important when color and monochrome images are intermixed on both tracks for certain educational applications.

Audio

Magnetic recording has been chosen for EVR in order to provide good quality sound yet low cost in the player. The edges of the film carry a magnetic track on each side so that for monochrome cartridges each picture track utilizes one magnetic stripe. Color cartridges can use the two magnetic tracks for stereophonic sound or for multi-lingual presentations. The audio frequency response is essentially flat from 60 Hz to 10 KHz.

Direct audio outputs at 600 ohms impedance are available at the rear of the player. A single channel audio signal is also applied to a 4.5 MHz FM oscillator to generate the intercarrier sound for the RF link.

Finally a few details about the cartridge itself, which is the most important item as far as the user is concerned. You may remember the first illustration displaying the assembled cartridge. Now the last picture (Figure 5) shows the simple construction, consisting of the two half shells held together by a coil spring and a plastic lock washer. When not in use the cartridge remains automatically closed and the film is totally protected by its plastic leader. ▲

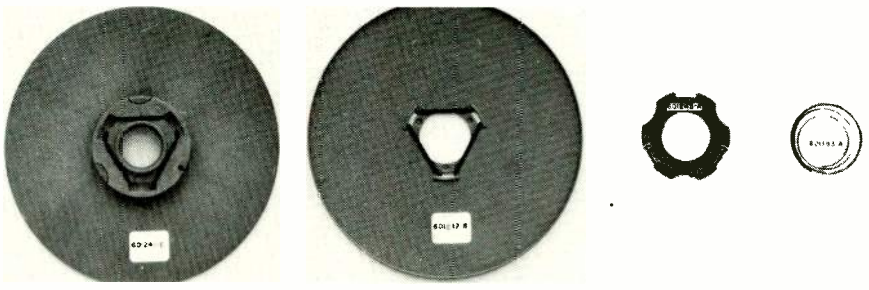
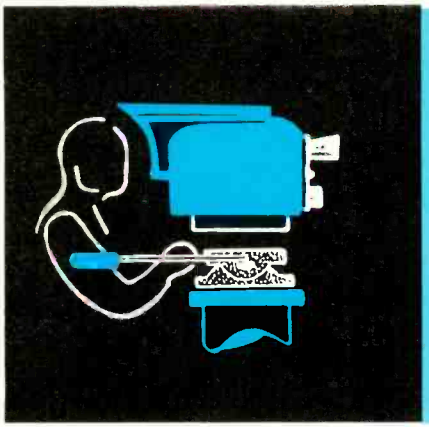


Fig. 5 Cartridge parts include two half shells held together by a coil spring and a lock washer.



A TV camera encoder for NTSC color

By Fred Hodge*

The key to studio origination of NTSC compatible color is the color video encoder. When color telecasting first started in the United States, the device was called a colorplexer. Some early color studios distributed red, green, and blue signals to a point near the sync generator where a single "colorplexer" was installed. As studio programming increased, the switching and distribution problems of three video signal channels made this approach impractical and the individual camera encoder came into use. The first ones were identical to the colorplexer; however, development of solid state circuits for video resulted in many improvements and refinements in the encoder.

Encoder Requirements

The color camera output consists of red, green, and blue video or red, green, blue, and luminance video signals which must be combined and processed into the NTSC I & Q color difference signals. These are quadrature modulated with two suppressed carrier balanced modulators[1] at 3.58 MHz and combined to form the chrominance signal. Luminance is matrixed from the red, green, and blue video inputs with three tube cameras or taken from the luminance video input directly with four tube cameras. Crominance and luminance are then mixed to form the composite NTSC color video signal. Several compromises must be made in the encoder to reduce bandwidth of the color difference signals so they and the luminance can share the 4.5 MHz of available bandwidth.[2] (See Figure 1.)

Unfortunately, this band sharing technique does not provide for full recovery of the original camera signals at the receiver. The theory behind this signal quality compromise sounded reasonable when black and white compatibility was the prime consideration, but at best, the NTSC encoded signal is a poor second to the original red, green, and blue video picture signals from a modern broadcast quality color camera.

Because of this, there is no room for any quality compromise. The color encoder must do a perfect job if it is to avoid losing any more of the picture quality than required by the NTSC bandwidth limitations.

General Description

A block diagram of the 3M color encoder is shown in Figure 2. Normal operation requires external inputs of 3.58 MHz subcarrier, sync and blanking. Burst flag can be supplied if desired, but it is usually generated internally by the encoder. Color video inputs of red, green, and blue from the camera control panel must be supplied, correctly timed and registered. (An additional correctly registered luminance signal input is required in four tube cameras.)

After clamping, the red, green, and blue signals are matrized in the section of the encoder we call the input processor to become I, Q & Y signals according to the formulas:

$I = -.28G + .60R - .32B$

$Q = -.52G + .21R + .31B$

and $Y = .30R + .59G + .11B$

Y contains all the brightness information and I & Q contain only the color difference signals. (This system of color signal transmission is referred to as the constant luminance principle.)[3] The I & Q color difference video signals are band limited by FCC regulation to 1.3 MHz for 1 and 400 KHz for Q. This band limiting introduces a delay in these signals so all the components of the encoder output signal must be delayed appropriate amounts to compensate for the delay of the Q filter. Modern network synthesis makes it possible to design an encoder so that this delay is less

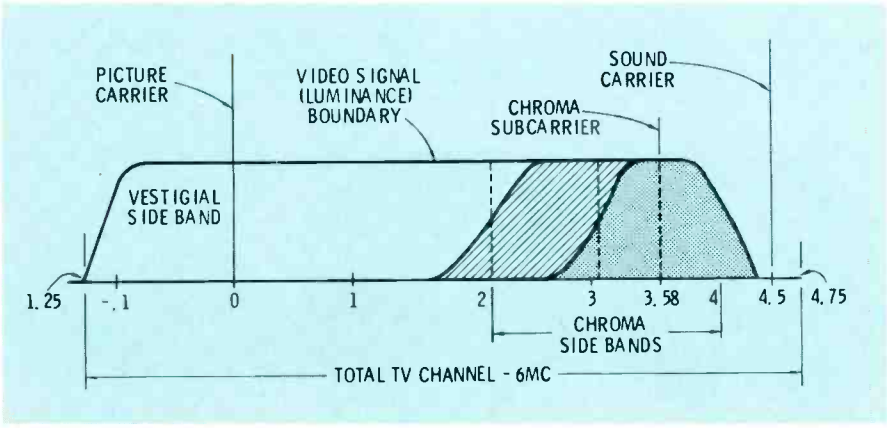


Fig. 1 Compromises must be made to reduce the bandwidth of the color difference signals so they and the luminance can share the available 4.5 MHz.

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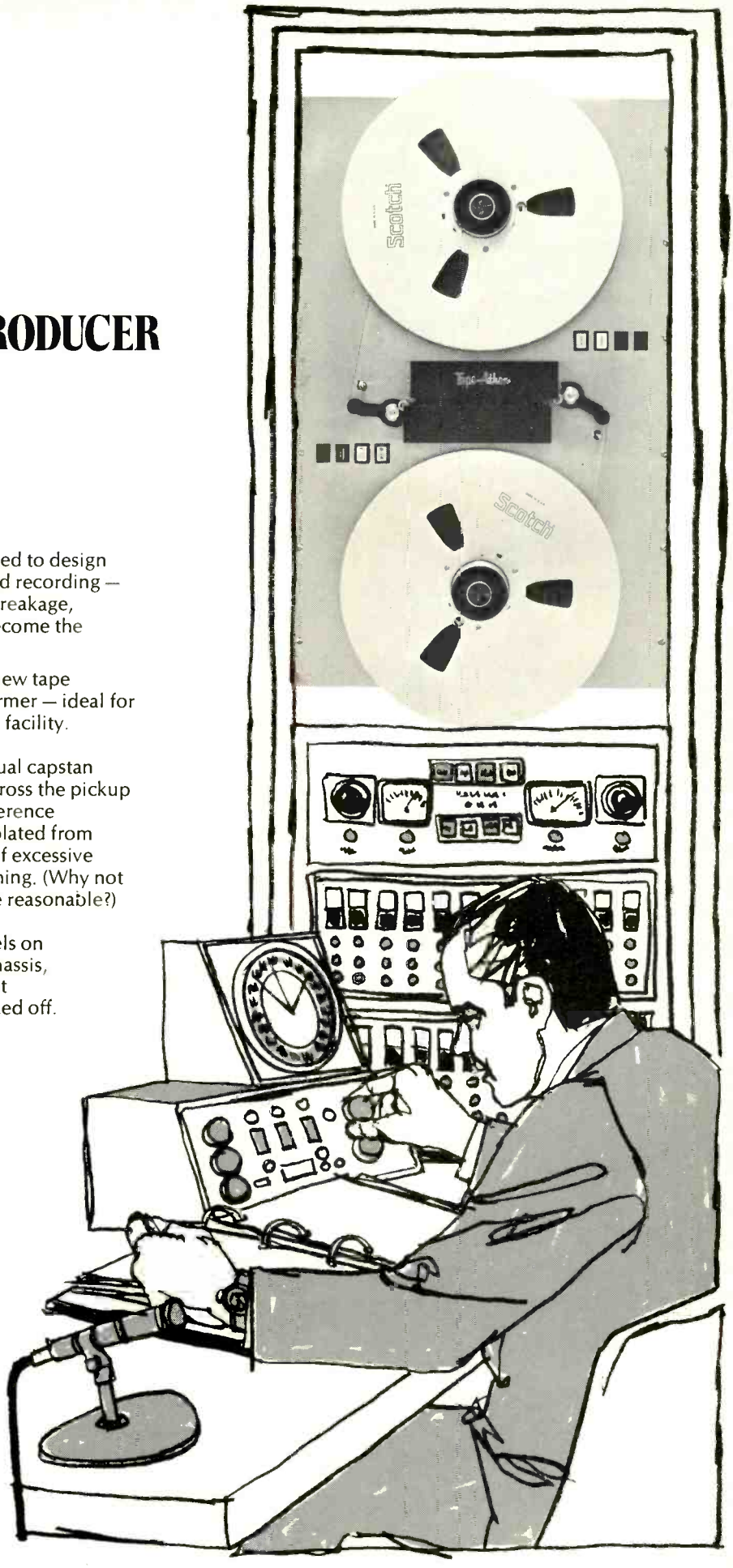

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than 800 nanoseconds.

In addition, to delaying the Y & I signals, the sync and blanking signal must be delayed before they are combined in the encoder output to form composite video. These delays make the encoder output 800 nanoseconds late in relation to the sync and video fed to it. An alternative is to use a sync generator with adjustable advance sweep drives to the camera so that each horizontal line of camera video can start 800 nanoseconds early at the encoder input. In this mode, sync and blanking can be inserted in time at the output of the encoder.

Part of the required delay in the luminance channel is taken up by the horizontal aperture equalizer. It is designed so that adjustment does not change the delay; otherwise, luminance color registration will shift in the output.

Internally generated color bar test signals are available to switch directly into the encoder inputs to insure that accurate adjustment on color bar test signals will give equally accurate results on camera.

Horizontal Aperture Equalizer

A horizontal aperture equalizer is included in the encoder. It compensates for the loss of resolution in the camera tube or imaging device caused because the scanning beam is a finite spot rather than a point of zero dimensions. This loss is a pure amplitude error without phase shift. Figure 3 shows this effect with a simple circular beam.

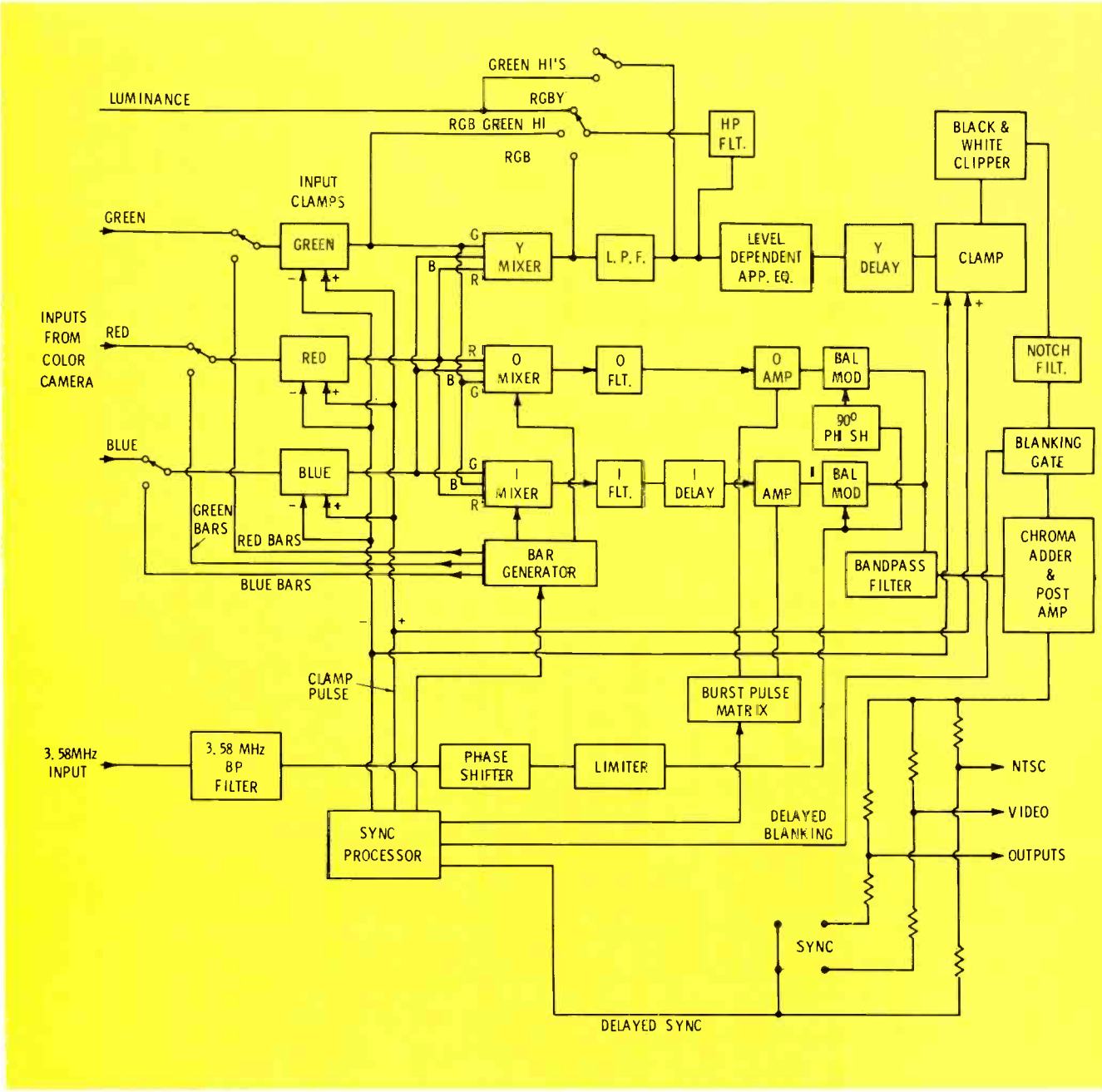

Fig. 2 Block diagram of the 3M color encoder.

If the scanning aperture or beam scans across a white to black transition, the output signal is not a square step response but has rounded corners. This apparent loss of edge sharpness can be somewhat compensated by the high peaking employed in most camera heads, but this also causes a phase shift.

High frequency peaking in the camera head electronics is intended to compensate for the capacitive roll-off occurring in the high impedance target pickup and preamp circuits of the camera. The waveforms of a transition at the output of the camera head should be carefully inspected for symmetrical rounding of sharp edge transitions. If they are not symmetrical, the high peaking should be reduced. The encoder aperture equalizer should then be used to symmetrically square both edge corners.

Broadcast quality live cameras have edge detail video signals well beyond 4.5 MHz. Because of this, a 5 MHz aperture correction frequency is useful if the segment of the audience watching on black and white receivers can be considered. The tri-color kinescope cannot resolve a significant amount of edge detail beyond 3 MHz. A 3.5 to 4.5 MHz aperture boost, particularly 4 MHz, is not recommended because it increases the level of 3.58 MHz luminance edge information and causes this to beat with the 3.58 MHz chroma subcarrier in the receiver color demodulator, which gives rise to the familiar edge crawl or beat of NTSC color. Studio monitors minimize this effect, but home receivers are very prone to it.

Because of image size, optical considerations, flare and film resolution problems, vidicon film chain type cameras have an aperture limitation at about 3 MHz and virtually no information but noise past that frequency. An aperture correction circuit centered at 3 MHz is best for this application.

The amount of aperture equalization that can be employed is noise limited because it will boost the intensity of high frequency dark current noise. This problem is minimized by making the aperture equalizer circuit level dependent. Signals below 20 IRE units, or very dark scenes, receive little or no aperture boost in the 3M Color Encoder. As scene lighting is brought up, aperture boost is automatically increased. This results in a very pleasing improvement in apparent picture quality. The effect is extended for even further improvement by arranging the design to provide a level dependent aperture attenuation as signal level decreases below approximately 20 IRE units.

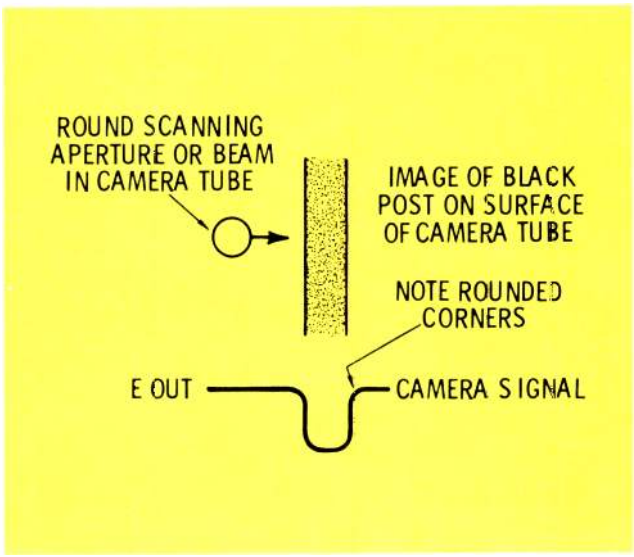

Fig. 3 Rounded corners are caused by scanning across a white to black transition.

The typical phaseless aperture equalizer implements the function:

$A = A_1 f + K (1 - \cos WT)$

Where $A_1 f$ = low frequency gain

A = total gain

K = circuit constants

W = frequency

T = delay line length in seconds involved in aperture equalizer circuit.

At each frequency where Cos WT equals +1, we have maximum boost from any such device so a 3 MHz aperture equalizer will also have a boost at 6 MHz, 9 MHz, etc. This produces excessive noise boost since no useful video is present at these frequencies. To eliminate this "2F return", as it is called, a separate filter could be added but this increases the delay of the aperture equalizer and tends to degrade the transient response performance. The 3M Color Encoder has a proprietary circuit design which does this automatically. This circucit also performs the amplitude dependent aperture attenuation below 10 IRE units.

Clamping

Some color encoders do not clamp the input video. However, the need for input clamping or clamping the input to the matrix should be obvious for several reasons.

The SMPTE color test film is an excellent example of one of these. In the film, when a girl's hand is passed slowly in front of colored bolts of cloth, you will note that the color of her hand changes as each bolt moves into view when the matrix input is not properly clamped. This happens because the relative APL on all three or four channels is different and is constantly changing, so it is impossible to AC couple the matrix system without some APL dependent error. DC coupling would be subject to drift. Camera cable ground loops can also introduce hum or tilt which appears on the matrix as a color difference error. To prevent these color errors, we restore the DC level at the matrix with a clamp system whose recovery is not APL dependent. To prevent color flashing on sudden changes, we use double acting clamps with symmetrical recovery to transitions which gives a steady matrix DC level control.

Bar Generator, Sync and Blanking Processor

Combining these functions in one

module and using digital design techniques makes possible an increase in accuracy for the bar generator, burst gate and sync and blanking delays. Furthermore, delays are adjustable and accurate, making greater flexibility possible. Delay cable used in early encoders changes delay with age and was a constant source of timing errors. No delay cable is used in this encoder.

Input sync, blanking and subcarrier are reprocessed and timed by the sync processor module. To do this, a self-centering 50 percent amplitude detector is used to reconstruct sync timing and completely new sync. Blanking and subcarrier are regenerated digitally.

Burst Adding Circuit

There are two basic ways to insert the color burst in the composite video. First is to sum it in at the output; i.e., after the composite signal is clamped and blanking is inserted. This can be done at the same point where sync is added. The advantage of this approach is that design is simpler and if the blanking adder is designed properly, all chroma channel noise and clamping transients can be removed from the blanking interval before burst is added. Burst will appear sharp and clean on the back porch. The disadvantage of this is that the chrominance information and the reference subcarrier have passed through different paths in the encoder and drift of relative color phase can occur between subcarrier and chrominance. Also, the procedure of gating the entire blanking area clean after the modulators hides a good place for the operator to spot errors in equipment and set up.

The second method of burst insertion (used in the 3M Color Encoder) involves introducing a separate burst matrix ahead of the modulators and inserting matrixed burst flag pulses in the I&Q color difference channels. The burst signal in this system shows the performance of the entire chroma channel at a glance and since it follows the same path as the picture chrominance, hue shift or relative phase drift beaween the two signals is impossible. Burst in this system has been band limited with the chrominance so the burst has a gradual rise and fall and several extra cycles must be provided to insure eight full cycles at the output.

Modulator

There are several ways to achieve the I&Q axis modulation required in an NTSC color encoder. Basic requirements for stable operation include accurately clamped inputs to prevent black balance error, wide dynamic range to prevent amplitude compression or clipping and hue distortion of high saturation colors, good linearity to provide correct position of all color vectors in the output, and inherently stable balance or carrier rejection (NTSC color requires a suppressed carrier modulator design) so that automatic black balance will not be necessary.

Automatic black balance is included in some encoder designs to compensate for drift or poor carrier rejection capabilities of the I&Q modulators. With automatic black balance, the modulator output is sampled during the sync interval and any carrier present is phase detected and fed back to appropriate rebalancing circuits in the modulator; a sample and hold detector must be used for this to be effective. If the system requires this feature, it means an error or correcting signal is expected. If this is so, the slow discharge of this error signal between line rate phase samples and the duty cycle change during vertical will produce a condition of differential phase across the line and also at a field rate because carrier balance interacts with the modulator output phase.

Luminance Enhancement

Early in the history of NTSC color, Hazeltine Corporation and RCA experimented with a concept called 'mixed highs'.[4] This work proved that the high frequency portion of the response spectrum from one channel of the system could be successfully substituted for the combind matrixed luminance which is deficient in edge resolution due to combining inaccuracies caused by camera registration errors. The response of the matrixed luminance is limited to approximately 1.7 MHz and high frequency edge information only is added from the separate luminance channel in a four tube camera. This reduces large area colorimetry errors known as Livingston error, but still gives the improved black and white picture sharpness claimed for four tube cameras.

The high frequency information is derived from the green camera tube when a three tube camera is used. The mixed highs feature gives a very significant improvement in apparent registration and improves the edge response considerably. The human eye is most sensitive to green detail, and cannot distinguish detail in red or blue. Because of this, contours from green, or a green highs picture, should look more lifelike even if no other system limitation such as registration error were to be overcome.

The author wishes to extend special thanks to Ralph Barclay, Engineering Supervisor for 3M Video Products, for his superb work in designing the encoder and furnishing much of the background of the material for this article. ▲

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2. Fink, **Television Engineering,** p. 9.25 to 9.27.
3. Ibid, p. 9.21.
4. Zworkin and Morton. **Television 2nd Edition.** New York: John Wiley & Sons, 1954, p. 817 to 825.

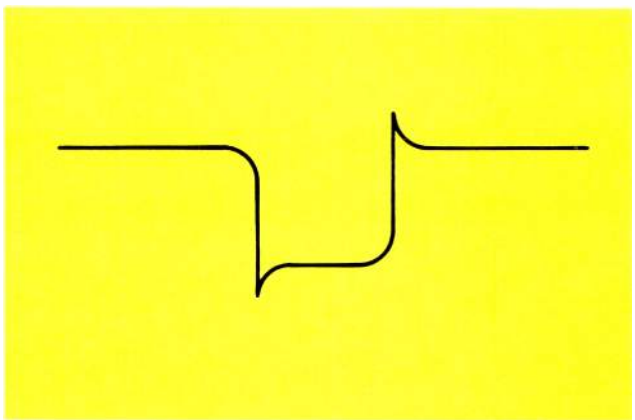

Fig. 4 High peaking in the camera head can cause a phase shift. Note that only one edge is corrected.

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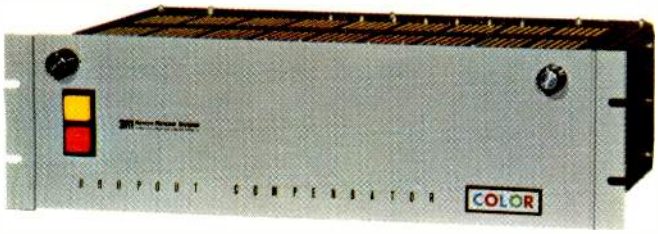

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Fig. 1 A typical guyed AM radiator with heliax cable to FM antenna bonded to leg at left side.

It's time outside

By Pat Finnegan*

The average station of whatever size or type service has more electronics within the station than outside of it. This inside equipment places a great demand upon the engineering staff's time to keep it in top operating condition. Equipment in use on the outside is more rugged in nature, more dependable and thus often neglected. These outside components, however, are a vital link between the station and its audience. In many areas of the country, September and October offer the last chance to inspect and repair outside systems before winter weather sets in.

The outside equipment can be roughly classified into three divisions: electronic, electrical and physical. Electronic equipment includes transmission lines, tuning units and antennas. Electrical equipment includes tower lighting equipment with its various components. Physical would include the towers, line support, and fences.

Part 17 of the FCC Rules spells out the requirements for tower painting and lighting. Station personnel should review Part 17 from time to time so as to keep up to date on its requirements. There have been several citations and fines levied against stations for neglecting the requirements of Part 17.

Basically, the Rules require the tower or towers to be lighted properly in a specific manner and during specific times. Inspections must be made of this required lighting, and the towers must be painted in accordance with the Rules.

Electronics

The transmission line is the most important link between the transmitter and the antenna. Air dielectric lines must be kept tight and

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again for maintenance

gassed to keep out moisture. The line should be checked for leaks when there are indications that a leak has occured. This indication usually shows up in increased consumption of gas, or by the constant running of your dry air pumps. A soap solution or a commercial product liquid leak detector spread over the line can help locate the leak. Once found, the leak should be sealed with new gaskets or the tightened belts. If any hardware is borderline, change it now.

Periodic inspection of the line should be made for physical damage. These need not be made too often, but if there are indications of high VSWR at the transmitter, an inspection of the line should be made. After you have weathered a severe storm, check the line for damage.

Damaged lines can show up as instability in AM directional systems, a VSWR increase in the transmitter monitor of FM and TV stations, and ghosts in the TV picture. Line damage will cause VSWR increase in most cases, and these high standing waves on the line can cause further line damage as well as damage to the transmitter output stages.

Large dents in the line, burned insulators or high resistance inner connectors can cause a change in the impedance of the line at that point in relation to the rest of the line. Any damaged section should be repaired or replaced as soon as possible.

Antennas

Antennas do require some maintenance. Here we are referring to FM and TV antennas. These should be checked for VSWR across the band pass. It is not so important to check FM antennas as it is the TV antennas. The FM antennas are more narrow band, and unless the VSWR indicators joint to something happening at the antenna, maintenance is normally confined to physical maintenance inspection of the antenna, itself. The TV antenna must have a 6 MHz bandpass, so there is no room for standing waves to appear in the sideband area that will not necessarily show up on the VSWR indicators. The reason for this is that the carrier is the strongest power element and the indicators are usually showing what is happening at carrier.

The TV line and antenna should be checked out at least once a year with test equipment. Opening the line and terminating it is not always necessary or desirable when making line checks. This is both costly and time consuming. A checkout of the line terminated with the antenna is enough. When there are indications of problems which show up as high VSWR, then the line may be opened for a separate check so as to isolate the problem to the line or antenna.

Painting of antennas should be done with care. Insulators, radomes, slot covers should not be painted, and the actual radiating elements are seldom painted. In most cases the radiating element is stainless steel or copper and those need no paint. And remember that painting insulators and slot covers can cause detuning of these areas of the antenna.

When de-icers are used they should be checked out in the fall before bad weather sets in. All elements in the de-icers should be working, otherwise, there will be uneven melting of ice on the antenna. Uneven melting is worse than no melting at all. Any defective unit should be replaced before winter.

Tuning units in AM systems should be inspected at frequent intervals. This can be done during the weekly calibration of remote meters with the antenna meters. In most cases, a visual inspection is all that is needed, but be on the lookout for burned contacts on coils, leaking capacitors, disceleration of parts due to heating, and burned contacts on RF relays. If the power is off, check for loose connections. One

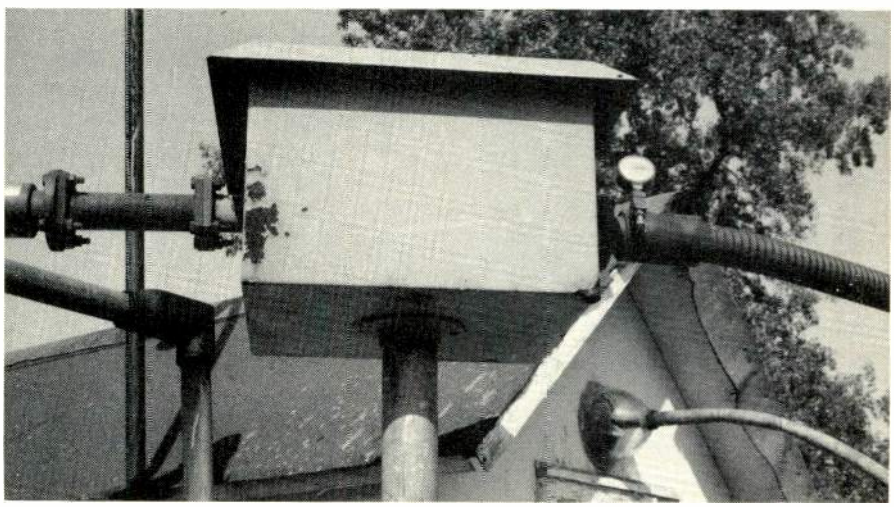

Fig. 2 FM isolation unit showing how weather can deteriorate equipment. Paint at left side was repainted after this shot was taken. A simple task during warm months, painting during the winter can be a real problem.

should also look for evidence of rodents in the tuning box. Plug up any holes that would allow them to enter. More than one station has been knocked off the air due to mice getting into the tuning units and them shorting out.

Electrical

With the tremendous increase in air traffic these days, it is more important than ever that the towers be kept properly lighted.

A quarterly inspection of the lighting equipment is required by the FCC Rules. During this inspection, all the lighting equipment should be examined, and this includes relays, chokes, flashers, isolation coils, as well as the lamp sockets. This is a basic preventative maintenance procedure that will help forestall any impending failure of the lighting components. The date of this quarterly inspection must be entered into the transmitter maintenance log.

In the busy periods, three months can slip by quickly. Maintenance logs are a thick pile by this time. It is easy to forget—and to get cited. Some type of memory jogger should be used. In one system, a calander can be marked for the whole year, so that as the pages as turned up, the notation will be there as a reminder of the required inspection. Another method is simply a card with the date of inspections as they are made. This card should be hung on the wall in plain sight. There is still another method. Make the inspections on a monthly basis. It is easier to remember more frequent inspections.

A number of small tower service companies abound today. These companies will sell a service contract to a station for quarterly relamping and inspection of the lighting and will guarantee their work. While most of the small companies are dependable, some of the individual employees are not. When a station must use a borderline company, it is advisable for someone from the station to be present during the scheduled work to make sure it gets done.

On at least two occasions, we contracted with companies who sent a man who drove by in the evening, noted that all lights were working and proceeded on his way. A few days later, a bill was received in the mail for services performed. Needless to say, the bill was not paid until the required work was performed. Honest workers, however, will always let you know they are in town, will leave the old bulbs, and will even make the entry and sign the transmitter maintenance log, if you wish.

At Light Up Time

Photocells are the best switching arrangement for turning on tower lights. Timers work well, but they are actuated by a clock mechanism. The photocell, however, can sense sky conditions and turn the lights on when needed, not at a specific time of day. Quite often, approaching storms or other atmospheric conditions call for lighting and the photocell will do the job automatically.

When a photocell is used, it must operate according to the FCC Rules. It must monitor the north sky and turn the lights on when the north sky light intensity drops to 35 foot candles, and turn the lights off when the north sky light intennsity brightens to 58 footcandles.

Whatever type of automatic device is used to operate the lights, a manual system should be available to turn the lights on and off when the automatic device fails.

Flashers are required when code beacons are required. Almost all towers of any appreciable height use one or more code beacons. Flashers are merely a motor driven switch arrangement to turn the beacon on and off at a prescribed rate. Each beacon will be drawing approximately 8.3 amps of current, so the flasher contacts work hard. A flasher which uses metallic switch contacts, should be inspected at frequent intervals as these contacts will arc after a period of time and will continue to get worse. Spare contacts should be kept on hand and burned contacts replaced when they can't be kept serviceable. The most popular flasher uses a mercury switch. The mercury is sealed in a tube and this tube is tilted back and forth, the contact is made through the mercury within the tube.

Regardless of the type flasher in use, spare parts should be kept on hand for the most vulnerable parts, such as relays, mercury switches and switch contacts. A highly recommended practice is to also keep a complete spare unit on hand. This is the inside mechanism, not the mounting box. When the flasher fails, the spare can be installed while the defective unit is repaired on the bench.

FCC requirement is that a code beacon flash not more than 40 times per minute, nor less than 12 times per minute. Most flashers are adjustable so it is not a problem to meet the requirement unless the flasher has become defective.

Reporting failure of the flashing code beacons must be done if they cannot be restored to service within 30 minutes. The report must be either by telephone or telegraph to the nearest FAA Flight Station or office. These will usually be found at larger airports where commercial airlines operate. If a new station is being built, the station engineer should research this information ahead of time so that the correct place to call from his location will be on hand when needed. This phone number should be posted in a handy place so that it is available when needed.

When the beacon has been restored to service, the FAA should again be notified. Entries in the transmitter operating log must be made when beacons are not operating and must show that a report was made to the FAA, and an entry made of the restoration of lighting and the report to FAA.

Daily inspections are required of the lighting operation. This inspection may be either a visual inspection or by an automatic indicator. When an automatic indicator is used, it must accurately indicate that the lights are functioning properly. A device that simply indicates power has been applied to the lighting will

not be permitted as a substitute for the inspection. Such a simple device would not indicate that lamps are actually lit or beacons flashing.

This daily inspection of lighting operation must be entered in the transmitter operating log.

Marker lights (side non-flashing lights) are used at various levels on the tower between beacons. When one or more of these lights fail, they should be restored as soon as possible. It is not necessary to report the failure of these lights. However, entries should be made in the log to indicate this condition. I have always preferred to report all lights that may be out. Lower flying planes often use the towers as landmarks, and even though only a side light is out, this may hamper identification of the tower location.

Spare lamps must be kept on hand for immediate replacement. Just how many you keep on hand is up to the individual preference. If a station has a service contract in which a company guarantees the lighting, only a few of the beacon and marker lamps need to be kept in stock. If the station is supplying the lamps, it is preferable to keep enough lamps on hand to completely relamp all the towers.

Code signal lamps are often a better choice than regular lamps. Regular lamp bulbs are not always reliable. For the marker lights, 100-107, 116 watt lamps (A21/TS) can be used. For the beacons, 500-620-700 watt lamps (PS-40/0) may be used. The 100 and 500 watt lamps are 1,000 hour lamps, while the 116 and 700 watt lamps are 6,000 hour lamps. The longer life lamp is more desirable because it insures greater reliability of the lighting system.

Lamp voltage should be at least equal to or three percent higher than the rating of the lamp. It is a poor practice to use higher voltage rated bulbs to try and get more life. For example, if the socket voltage is only 110v and the lamp is rated at 130v, the lamp will last longer but it will also be dimmer. If you want longer lamp life, use a higher wattage lamp rated at 110v. This will give both longer life and the correct light output.

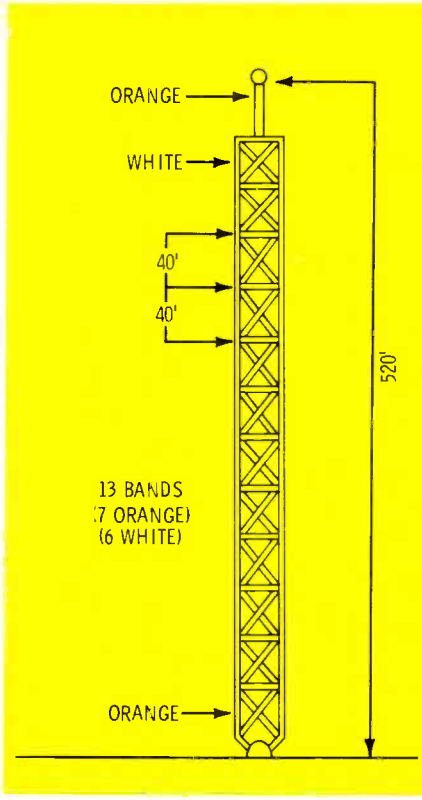

Fig. 3 Paint bands on a 520′ tower (including antenna). This requires 13 equal bands of orange and white. The top and bottom bands must be orange.

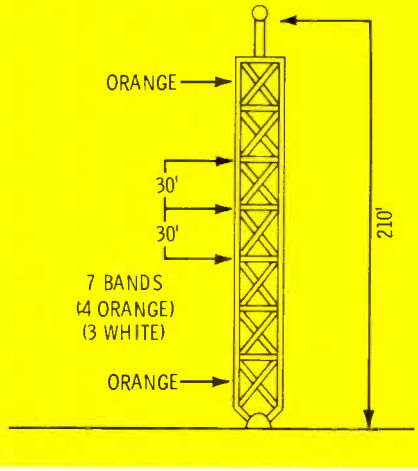

Fig. 4 A 210′ tower would require 7 bands, each 30′ high. Here again is another job that should be taken care of during the warm months.

Socket voltages should be measured so their values are known. A tall tower takes a long run of wire to reach the top lights. The beacons are drawing heavy current and there will be a loss in the wire. Thus, not all of the 120v at the tower base will be available at the top beacon.

Other parts should be kept on hand to repair the lighting fixtures. A few spare sockets for both the markers and beacons, gaskets for the beacons, etc. These can be selected from the parts list of the lamps. If a gasket leaks and allows water to get inside, especially during storms, the cold water splashing on the hot bulb will cause it to shatter. This means the old base must be dug out of the socket. After a few cases of this, the socket may need to be replaced.

Lightening rods should be maintained and bolted down tight. If the lightning rod is missing, one can almost guarantee that the top beacon will be knocked out in an electrical storm. Without the rod, the beacon itself then acts as the lightning rod and this is a heavy strain on the bulb.

Tower Markings

The tower must be kept painted to insure good visibility from the air. The FCC Rules spell out the marking arrangements and the colors. The paint must be Aviation Surface Orange and Aviation Surface White. These are not ordinary paints, but must meet certain specifications.

Banding must be done according to Rules specifications. The color bands must be equal in width (top to bottom of band), each band must not be wider than 40 feet or less than 1½ feet and there are to be seven bands. The top and bottom band must be orange. Tall towers require more than seven bands, as 7 x 40 would only satisfy conditions for a tower of 280 feet high.

If the tower is new or if it is one that still has the old style of unequal bands, one should compute the width and number of bands. For towers up to 280 feet, there will be seven bands, but taller towers will require more bands. One thing to remember, the number of bands must be an odd number, such as 7, 9, 11 etc. Otherwise, the top and bottom bands will not be orange There is always one more band of orange than white. It is preferable to use the widest band as this will

require less changing of paint colors by the painters as work progresses.

Painting The Tower

Tower painting can be an experience. Any of the fraternity who have been through it will know the meaning. Here are some hints.

Tower painting companies, and the painters themselves, are in a class of their own. Most often, they are high in promise (when trying to get the contract), but low in performance. Often, a couple of painters will note that the tower needs painting and decide to go into business for themselves—for that job, and offer a contract to paint the tower. Needless to say, such "companies" have no financial backing.

Put the job out on bids. Give the tower specifications so that the tower painting companies have a reasonable basis on which to bid. Most will want to inspect the tower. Have several companies bid on the job, and insist that the company winning the bid supply the station with a certificate of insurance that will cover property damage and workman's compensation. If the tower is located in a congested area, expect to pay more to get it painted.

Annual inspection of the tower should be made and the inspection should be entered in the transmitter maintenance log. During this inspection, the plumb of the tower should be checked with a transit. If guyed, the tension of the guys also should be checked. Any loose bolts or members should be tightened. Towers are subjected to severe stresses as the seasons change. Bolts sometimes loosen up. Obviously, too many loose will weaken the structural strength. A good wind storm could topple the tower. Loose members on an AM tower can cause noise in the signal due to arcing at the loose joints, and can also change the electrical characteristic of the tower.

The annual inspection is important. Spell out in the contract with the tower service company just what is expected to be done so that there is no question later on. Then, make sure that all conditions get satisfied.

Fencing around the tower base is another area often neglected which sometimes brings citations or fines. Some types of fence is required around the tower base to keep out unauthorized persons, particularly daring youngsters who may see the tower as a challenge. The fence must be kept closed and locked and in good repair.

One last note. If you have an outside location for your emergency power generator, don't forget to service it before winter sets in. During a winter storm, it might be nearly impossible to pull the simple maintenance you could have accomplished easily in the fall. You expect your car to start in the winter, and you usually prepare it for winter driving. Now, how about taking the same approach to the generator system.

The towers and the outside equipment are the final link between the station and its audience that is within the control of the station. So much can happen to the signal before the public receives it. The most the station can do is keep its inside and outside equipment in top condition so that it is reliable and delivers the best signal possible. Don't wait until November or December to bring your outside maintenance up to date. Work it into your schedule this week. ▲

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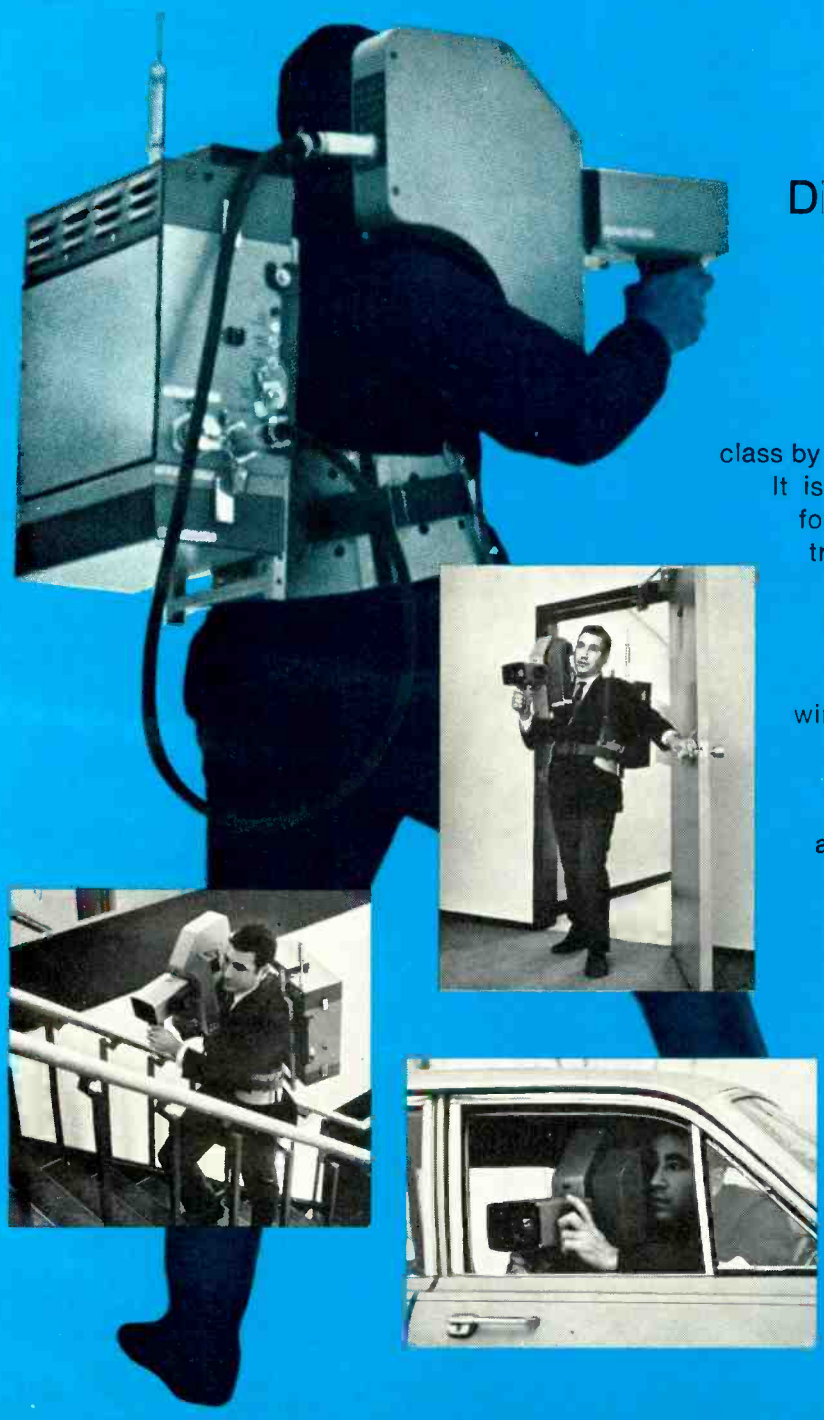

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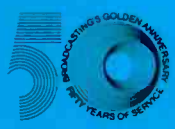


An IC audio board for your standup operation

By Ronald Pesha*

Until recently our station produced commercials in a production room outfitted with an antique, unwieldy control board. This board "produced" on its own . . . trouble, breakdowns, and heat. The once proud main conrol, became outdated.

In fact, any tube types are obsolete today, at least for audio. So we made the hop to state-of-the-art and fabricated our own board, using integrated circuits. This article describes the design and construction, emphasizing ways the configuration can be adapted to the specific requirements of any station.

Simplicity the Keynote

Some technicians apparently delight in complex wiring. If one relay will do, they find ways to use two. Sometimes the results produce knobs and lights impressive to visitors but confusing both to operators and to technicians who must troubleshoot the maze. Fewer parts and wires increase reliability, and mean easier repair when trouble does develop. Integrated circuits achieve a new order of reliability for active devices, so we designed for reliability throughout.

One channel plus cue suffices for most production room needs. The basic design presented here can certainly be used for two channels, but cost and construction time go up fast because of crosstalk possibilities. It may be better to build two independent boards, which also offers 100 percent redundancy.

Input on-off switches seem unnecessary with only one mixing channel, so none is used except for microphone control. Should your requirements dictate on-off switches, use a suitable key or lever switch wired to short the control's arm to ground as on the microphone input.

(Note, however, that switching inputs on and off in this manner causes a level change on the mixing buss because of non-constant impedance matching. Level changes caused by adjusting a control's setting are not as apparent to the ear as the sudden change caused by a switch).

Mixing

Basically, the board consists of several inputs mixed with common potentiometers (inexpensive and readily available) and fed to a program amplifier. The garden variety potentiometer controls wear out faster than quality constant impedance controls. But they replace easily and quickly. I used only five inputs, but more may be used with slight sacrifice of overall gain.

All inputs and outputs use standard phone jacks. Of course any connectors, including barrier strips or solder terminals, may be used. Dissimilar connectors, route warning lights, and the AC power input guard against damage from wrong connections.

Cue and Monitor System

Cueing requires a switch which closes rather than opens when the level control rests at minimum, the extreme counterclockwise position. Two brands of potentiometers offer such switches; these are listed in the Parts List.

These switches actually incorporate DPST contacts in an unusual configuration. One pole is off while the other is on. This makes possible a cueing system which shares the monitor amplifier. The monitor output, taken from the program amplifier, series feeds through the pair of contacts on each cue switch which remain closed when the level is turned up. Upon turning any level

*Chief Engineer, KFKA Greeley, Colo.

Fig. 1 Standup control board showing flush mounting.

control to its minimum or "cue" position, the first pair of contacts opens while the second pair closes. This second pair feeds the "cue" signal on this level control into the monitor amplifier while simultaneously disconnecting the program signal from the monitor amplifier.

Thus, placing any control in "cue" silences the program monitor and feeds the desired cue signal to the monitor amplifier. Operators must become accustomed to this system, but most like it. The program material does not mask the cueing, and the cue comes through the regular monitor amplifier and speaker, usually with higher quality than most separate cue systems. This system saves an amplifier and speaker, simplifies wiring, and requires one less set of muting contacts on a busy microphone switch.

Of course, conventional cueing with a separate cue amplifier and speaker may be used. Main control room operation, for example, often requires the operator to continue a record program while keeping an ear on the cue, waiting for a ready signal from a remote.

A series resistor in our cue system follows the program amplifier to reduce the program level as fed into the monitor amplifier. Choose the resistance empirically so that the program level approximates the average cue level. In my board, this resistor is 56,000 ohms.

At our station, we sometimes broadcast from the production room. The "Air Audio In" jack accepts audio from a tuner, with a front panel switch choosing between air audio or board audio.

The cue-monitor line mutes when turning the microphone switch "on" by shorting this line to ground. Use a shorting-type switch for this microphone switch so the cue-monitor line shorts before the microphone input opens. If you use a telephone-type switch, bend its contacts to get these same results.

Extra contacts connect to an external warning light circuit, but these contacts should carry only low voltage DC. Attempts to use the board's own power supply may cause clicks in the audio.

Auxiliary Inputs

Two "auxiliary" inputs accept any number of external sources. These sources may be patched in through an external jack panel. Other stations use rotary switches or pushbuttons. I used SPDT center off toggles, one for each source: tape, cartridge, beeper, etc. One input connects through a convenient front panel jack for patching in portable tape recorders.

You can add level set controls similar to the level set shown for the "Air Audio In" jack. Use screwdriver-adjust controls mounted adjacent to to their respective jacks. Controls of 500 ohms to 10,000 ohms are suitable. With all sources adjusted for proper average level at

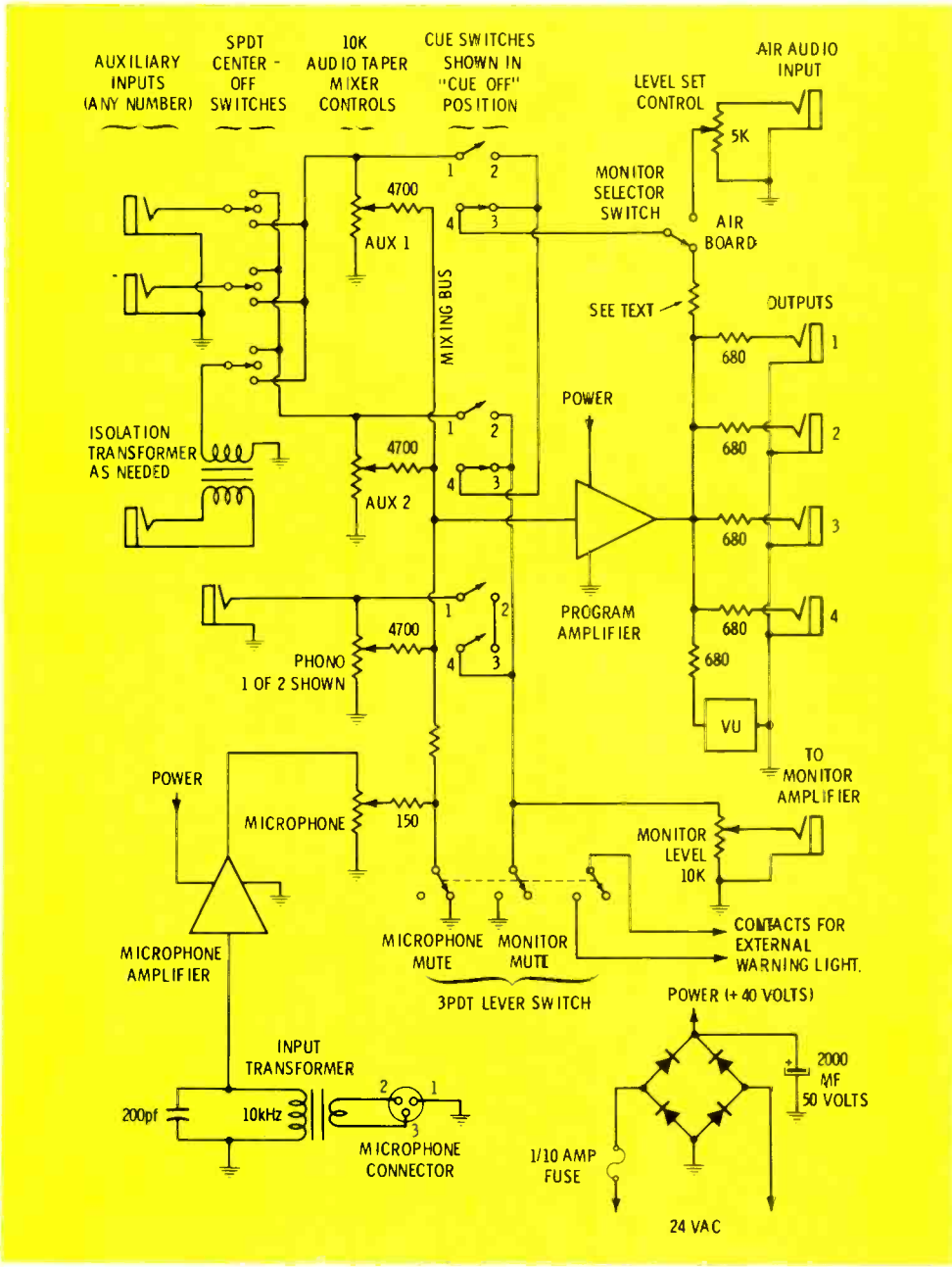


Fig. 2 Overall schematic for the audio board wiring. IC section is shown in Figure 3.

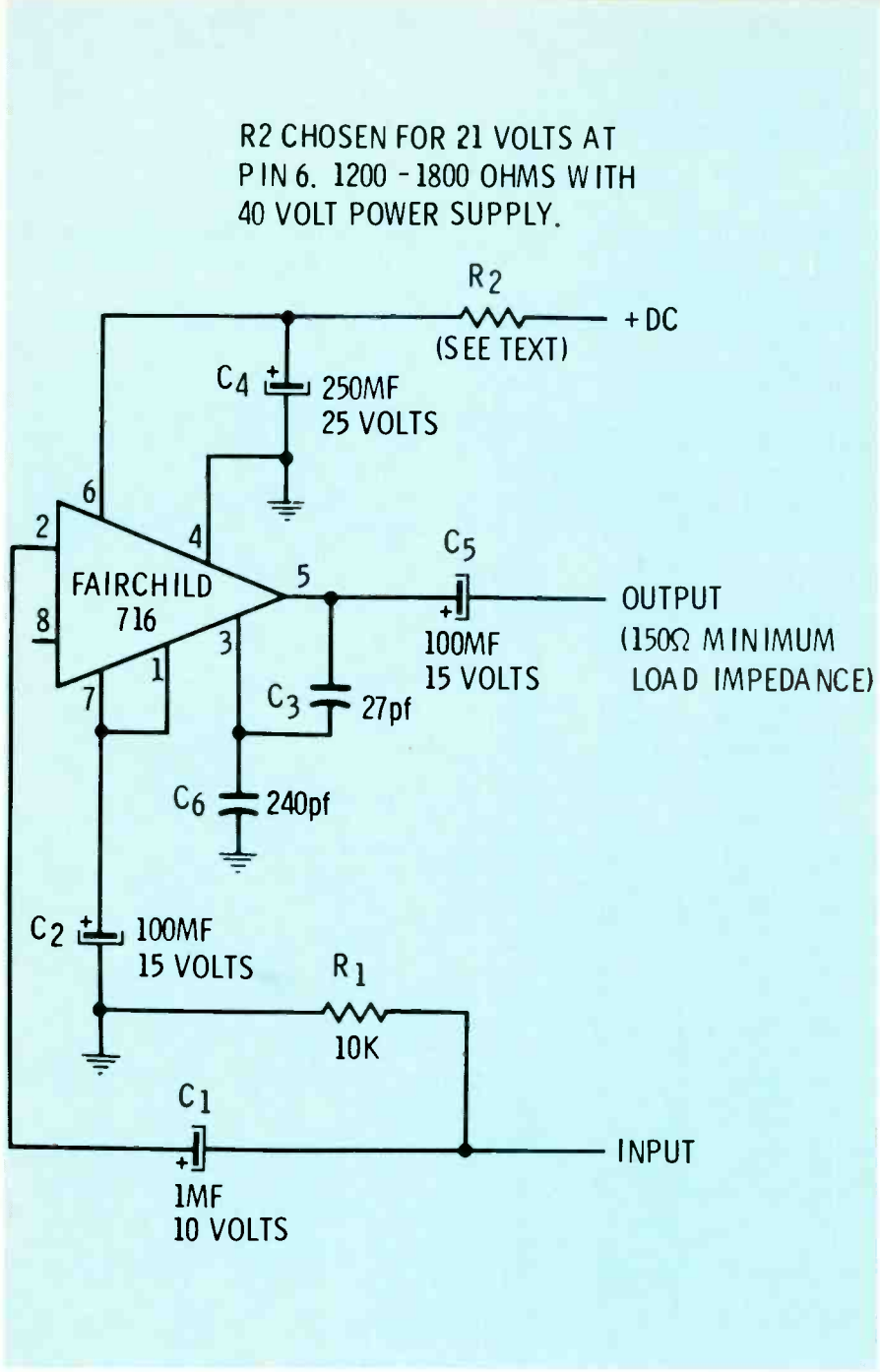


Fig. 3 IC wiring schematic. On the Fairchild 716, pin 8 is the tab.

the front panel controls, no master level control is needed.

For accepting balanced sources, use 500 ohm to 10,000 ohm isolation transformers following the input jack. The jack for such a source must be isolated from ground by mounting it with insulating washers.

Chassis and Front Panel

I built the board inside a standard aluminum chassis, 3 x 10 x 17 inches. The chassis is inverted, with the opening on top. At our station the completed board mounts vertically with the front panel flush with the desk top. For more conventional mounting, enclose the board in a metal or wooden case. But retain use of the "upside down" chassis to allow exposing the board like a drawer with the opening on top. This makes all components readily accessible.

Larger boards with more inputs, larger knobs and meters, or other facilities require a larger chassis. A sheet metal shop can fabricate a suitable chassis, and even include a sloping front panel if desired.

I used a standard 3½-inch high aluminum rack panel for the front panel, sawing off the end slots for a finished length of 18 inches. The ⅛-inch thick panel affords a solid feel to the board, and the separate, pre-painted plate eases drilling and labelling.

Plan all front panel control and switch locations in advance. Then drill holes for any two widely separated controls. Temporarily mount these controls through both the main chassis and the front panel. This holds the two parts in alignment while the remaining holes are drilled.

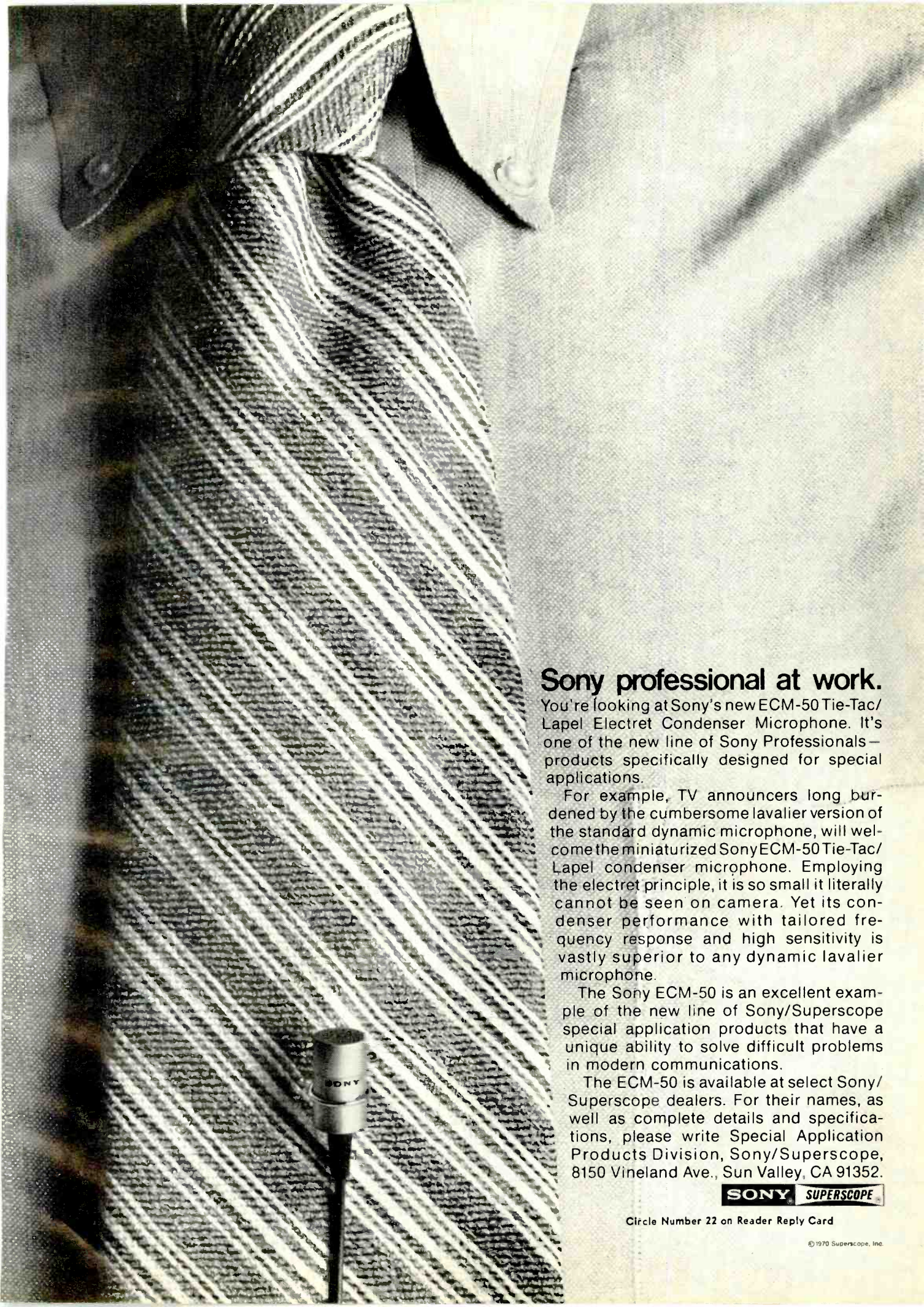
Most radio station employees and visitors are not technically oriented. They judge equipment solely on the basis of appearance. Therefore I consider time spent on quality front panel lettering well worth while. Once all holes are drilled and burrs smoothed, paint if necessary then commence labelling.

Electronics suppliers sell electronic decals and the more modern dry transfer lettering. Dry transfer alphabets can be purchased, in a vast array of type faces and sizes. Ask for "dry transfer lettering." Applying the lettering is tedious but easier than decals. Once applied, coat with clear plastic spray in several light layers (heavy layers can dissolve the lettering). Unless baked, the finish will chip. My 18 inch long panel fit easily into a kitchen oven set at 150°.

Amplifier Design

I used separate modules for this board's amplifiers; you may substitute other amplifier designs. I also used Fairchild's ua716 integrated circuit as the active element of each amplifier. This device, available through Fairchild distributors, is also widely sold as simply the "716" in a blister package. These 716's may come from a lower tolerance run than the ua716's, but in my experience with several dozen 716's all offer quality amplification at low cost.

In the circuit shown, the 716 offers voltage gain of 100 (40 dB) over the entire audio spectrum with distortion under 0.25 percent at up to 50 milliwatts output. Input impedance is 10,000 ohms; output



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SONY SUPERSCOPE

Circle Number 22 on Reader Reply Card

source impedance, 1 ohm. The load must not be less than 150 ohms. I used series resistors of 680 ohms immediately following the amplifier's output to avoid shorting the integrated circuit's output. With separate outputs taken through individual series resistors, the IC's 1 ohm source impedance results in excellent isolation between any two outputs.

The same amplifier suffices for both microphone preamplification and program amplifier duty. With only one amplifier type in the board, it becomes practical to build a spare or two for emergency replacement. The components most likely to fail are the electrolytic capacitors; they occasionally open or become leaky. The IC will probably never fail if protected from output shorting and oscillation. The 10,000 ohm resistor, R1, across the input prevents oscillation. R1 may be left out if your units show no tendency to oscillate.

Like most bipolar solid state devices, the IC rectifies strong RF fields. If operated near a transmitter, install small ceramic capacitors in the picofarad range across the input, in parallel with R1.

A microphone-to-10,000 ohm input transformer, mounted near the microphone connector, feeds the amplifier when used for preamplification. I used a small bypass capacitor across the transformer secondary to eliminate noise; this is shown on the overall schematic.

The output feeds unbalanced lines of 600 ohms nominal impedance or higher. If you need a balanced source, follow one of the 680 ohm resistors with a line-to-line transformer.

Amplifier Construction

I made etched circuits on photosensitive copper clad phenolic boards. The simplicity of the circuit allows easy duplication by hand, laying out the pattern on unsensitized copper clad board with tape resist or liquid resist.

After etching and cleaning the board, solder components in place following the arrows shown on the plan. Observe polarity of electrolytics. Note that the integrated circuit's index tab coincides with pin 8, which is not connected in this circuit.

Note that components are located on the same side of the board as the etched copper "wiring." The integrated circuit's pins will not line up properly if small holes are drilled through the board for component leads as in conventional etched circuit modules. Attaching components on the same side as the copper simplifies mounting and circuit tracing.

Using a small pencil type soldering iron, deposit a drop of solder directly on the etched copper wiring at the proper point. Grasp the prebent lead of the component with long nose pliers and melt it into the solder drop. Just a touch of the soldering iron suffices.

As each soldered connection requires but a second or two of heat, there seems to be no danger of overheating the integrated circuit. If you prefer an integrated circuit socket, solder in place a Cinch 8-ICS, Motorola HEP-454, or similar 8-pin IC socket. Take great care never to insert or remove an IC with power on. The transients generated destroy the device.

Drill a hole through each of the four square input-output pads to pass 6-32 machine screws. The module then fits 4 terminals of a Jones series 141 barrier strip. You will need 6-32 x ½-inch machine screws. If the etched circuit board is hacksawed to a width of 1 11/16 inches, the modules fit side by side on a multi-terminal barrier strip. For example, if your configuration requires 4 amplifiers, use a 16 terminal barrier strip.

The amplifier can be constructed

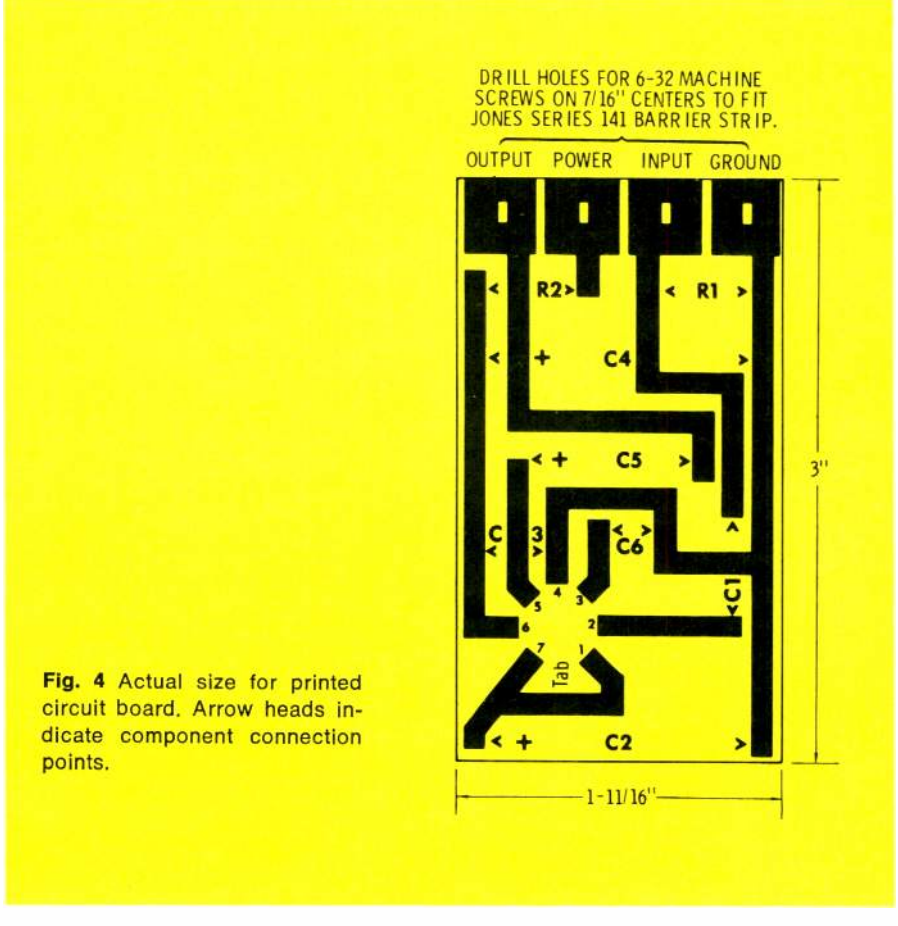


Fig. 4 Actual size for printed circuit board. Arrow heads indicate component connection points.

with conventional techniques, not using the etched circuit board. Take the usual precautions against coupling from output to input, and be certain that the output of the IC cannot be shorted or loaded with less than 150 ohms.

Power Supply

The amplifier modules operate Class A and offer a constant load which requires a simple non-regulated power supply. A common 24 or 25 volt transformer feeds a bridge rectifier, with a 2000 mfd. 50 volt electrolytic capacitor for filtering. The amplifier modules each includes additional filtering and power supply isolation.

I attached the four diodes to tie points for ease in replacement. However, diodes rated at 1000 peak inverse volts and 1 amp each should never require replacement. All power supply components mount inside the board except for the transformer. All attempts to mount the transformer inside caused hum. As constructed, power supply hum is below audibility.

I used point-to-point wiring throughout the board's interior. All audio wiring over about two inches in length is shielded. Connect the shield to ground at one end only. Rather than using a ground buss, I connect all grounds directly to the chassis at the nearest point. For example, the ground terminal of each level control is bent over and soldered directly to the control's case.

This works well if AC remains isolated from the board. This is a reason why the 24 volt power transformer mounts externally.

Standard phone jacks ground themselves. If barrier strips or solder terminals are used for input-output connections, connect each ground directly to the chassis. Ground each amplifier module to the chassis through the shortest possible patch. Above all, ground the minus terminal of the power supply's filter capacitor and the ground terminal of the bridge rectifier to the same point on the chassis.

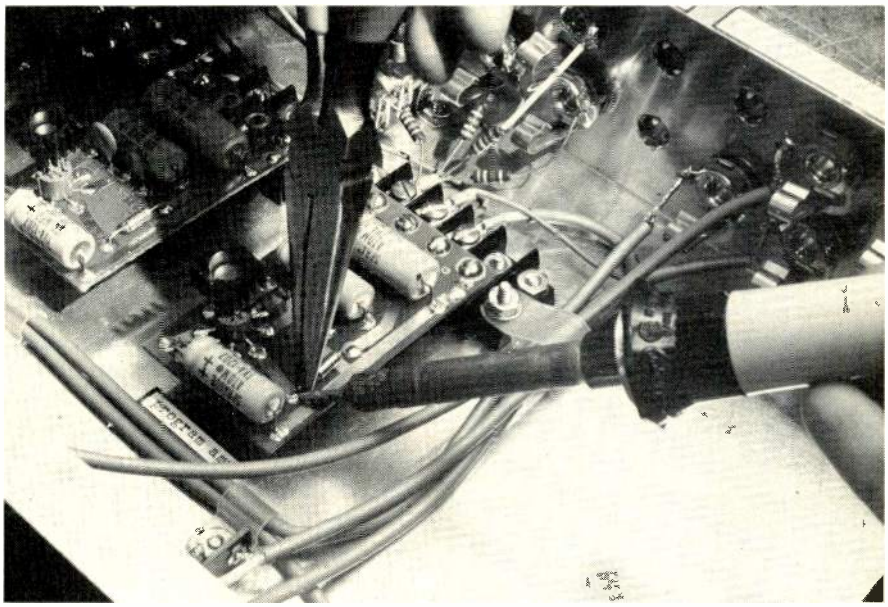


Fig. 5 When wiring to board, grasp component lead with pliers and hold against pre-tinned mounting point. Use a small tip iron.

The monitor amplifier is independent of the board itself. Use any high quality moderate power audio amplifier. Obviously, a solid state amplifier is preferred for esthetic reasons. Adjust its level control for a good range of level adjust from the board's "monitor level" control. Then mount the amplifier out of sight to avoid unauthorized tampering.

The happy combination of overall simplicity and integrated circuits results in an audio board requiring a minimum of debugging. All the amplifiers operated perfectly from the beginning, with characteristics identical from module to module. I installed the completed board overnight, and it has operated trouble-free ever since. Power remains on all the time; no on-off switch is provided. Power drain? Exclusive of the monitor amplifier, about ¼ watt! ▲

Parts List for Overall Schematic

Mixing Controls (Centralab F2-10K, KR-3 switch, or IRC Q13-116, 76-4 switch)
Resistors (150, 680, 4700 ohm; ½ watt, 10%)
Monitor Control (10,000 ohms audio taper)
Monitor Selector (SPDT switch)
Air Audio Level Set (5000 ohm audio taper control)
Auxiliary Selectors (SPDT center off toggle switches)
Auxiliary Input Transformers (Line-to-10,000 ohm)
Microphone Transformer (Microphone-to-10,000 ohm)
Microphone Switch (3PDT lever switch)
VU Meter
Filter Capacitor (2000 mf. 50 volt electrolytic)
Fuse (1/10 amp fast blow fuse and holder)
Rectifier (bridge rectifier, or 4 diodes 100 PIV at 100 ma. or better)
Power Transformer (24 volt filament transformer, 1/10 amp or better)
Connectors as desired.
Knobs, case, hardware, wire, etc.

Amplifier Parts List

R1 10,000 ohms, ½ watt, 10% (optional . . . see text)
R2 ½ watt, 10% see text for determining value
C1 1 mf 10 volt electrolytic
C2, C5 100 mf 15 volt electrolytic
C3 27 pf disc ceramic
C4 250 mf 25 volt electrolytic
C6 240 pf disc ceramic
Fairchild ua716 Integrated Circuit
8-pin Integrated Circuit socket, Cinch 8-ICS or Motorola HEP-454 or similar
etched circuit board . . . see text

ENGINEER'S EXCHANGE

Microphone and Extension Cable Test Box

On many occasions, myself or one of the station announcers has gone away from the radio station to do a multi-mike remote and found after setting up all mikes and extension cables that one or two of the mikes were not working. This almost always seems to happen just about twenty minutes before air time and with little time to spare and no time at all to run back to the radio station for either spare mike or cables.

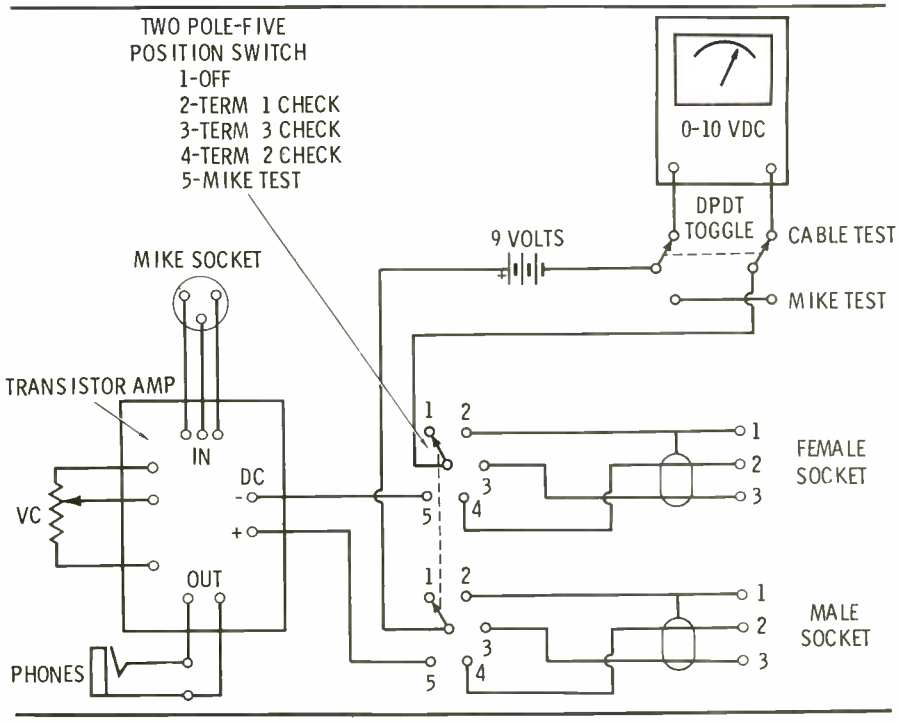
This can be rather bothersome, since invariably, even though you do have spare cable and mike, it is usually the last cable or mike removed for testing that is the bad one.

To get around this and save us all from becoming ulcer cases, I built up from station parts the circuit shown and referred to as the "Mike and Mike Extension Cable Test Box." The entire unit is built into a Bud CU-2106A mini-box measuring 5¼ x 3 x 2⅛ inches. All connectors used were of the XLR-3 type, but anyone desiring to build this test box would naturally use whatever type connectors are used by their station.

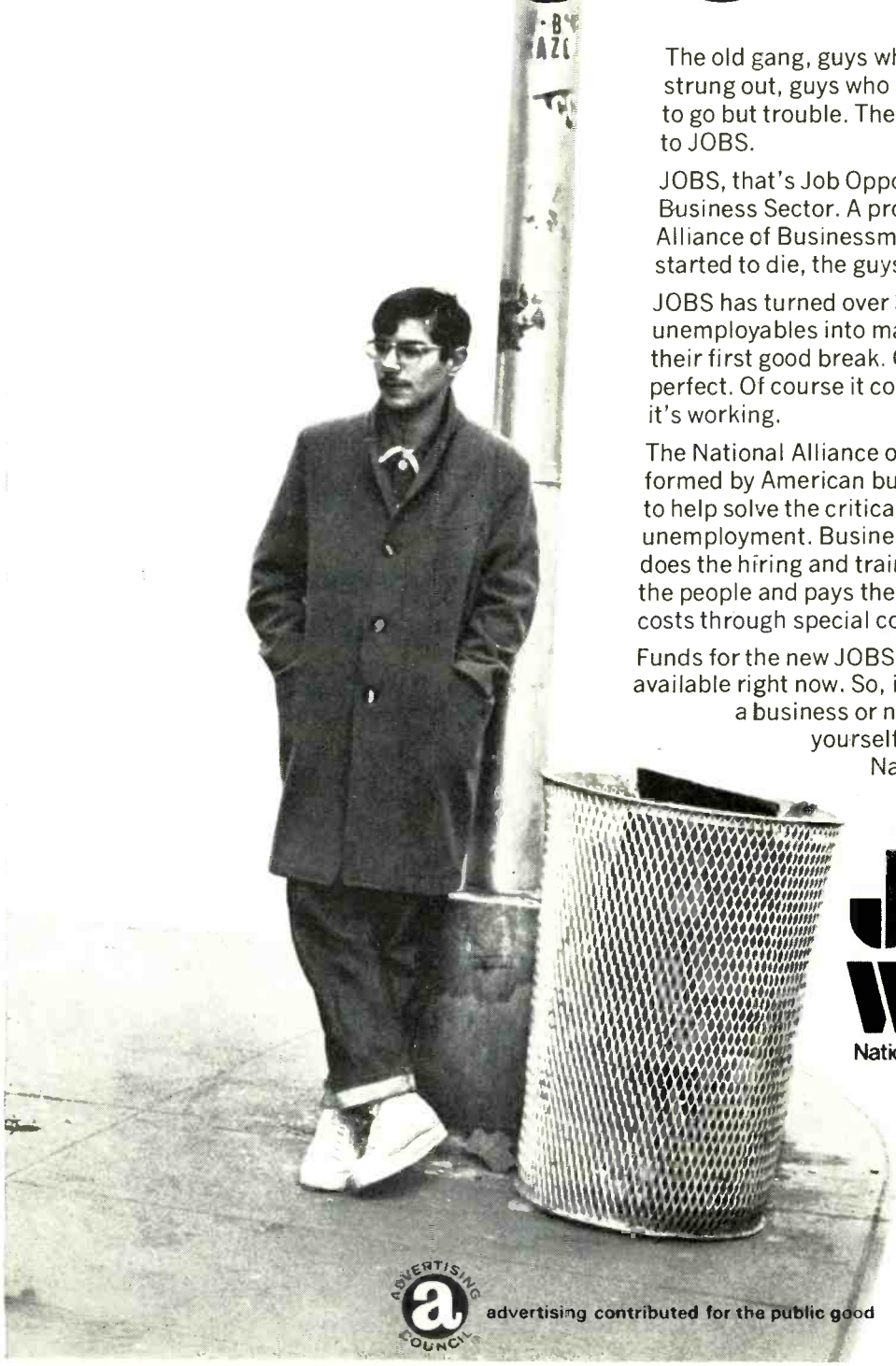
The meter in this unit was one of the Philmore mini-meters and this one measures 1¾ inches square. The transistor amplifier needed to test out mikes was manufactured by the International Rectifier Company, and is their model K-305. It is complete except for mike transformer and volume control.

The beauty of this miniature test box is the fact that all mikes and cables can be checked out before leaving the radio station to go out on the remote broadcast. The annoucer can do this himself as it requires no special technical knowledge to use the box. Here at Radio Station WHEB, it is common practice to check out all mikes and cables prior to leaving for a remote broadcast. Then the box is brought

(Continued on page 52)



JOBS is breaking up that old gang of mine



The old gang, guys who dropped out, got strung out, guys who hung out with no place to go but trouble. They went to work, thanks to JOBS.

JOBS, that's Job Opportunities in the Business Sector. A program of the National Alliance of Businessmen. The gangs have started to die, the guys have started to live.

JOBS has turned over 300,000 hard core unemployables into manpower. Given guys their first good break. Of course it isn't perfect. Of course it could be better. But it's working.

The National Alliance of Businessmen was formed by American business communities to help solve the critical problem of hard core unemployment. Business provides the jobs and does the hiring and training. Government finds the people and pays the extraordinary training costs through special contracts.

Funds for the new JOBS '70 contracts are available right now. So, if you're an employer for a business or nonprofit organization, do yourself a favor. Call your local National Alliance of Businessmen.

JOBS WORKS

National Alliance of Businessmen

ADVERTISING COUNCIL

advertising contributed for the public good

along with remote gear, just in case it is needed. Again, after the equipment is returned from the remote it is all checked out again, as invariably when a wire is broken, it is done during the time that the announcer is hastely tearing down the equipment after the broadcast. Most announcers like to disconnect mating plugs by yanking on the cable attached to plug, rather than pulling the plugs apart.

In use, one end of the mike extension cable is plugged into the female socket and the other end into the male socket, so that there is a complete circuit formed between the meter, battery and the two poles, five position switch, when the toggle switch is in the "cable test" position and the rotary switch is in either position 2, 3, or 4. If both pair of wires and the shield in the cable are OK, a 9 volt reading will be obtained in all three positions of the rotary switch. A no meter reading condition, naturally indicates an open circuit.

In the mike test position of the toggle switch, the battery is switched over to the transistor amplifier via position 5 of the rotary switch. The suspected bad mike is then plugged into the mike socket of the test box and its condition verified by listening on a pair of phones.

Antonio Vaccaro
Chief Engineer
WHEB-WPFM
Portsmouth, N.H.

Commission Closes In On "Open-Mike" Shows

Rules to provide for licensee control of matter broadcasting during telephone interview programs on AM-FM-TV stations have been advanced in a Notice of Proposed Rule Making adopted by the FCC (Docket 18928). The proposed rules amending Part 73 would require licensees to record their telephone interview programs and make them available for review by interested persons. The licensees would also be required to ascertain and list the names and addresses of persons whose conversation is aired and to make the lists and recordings available to interested parties for a period of 15 days. After that, if there have been no complaints or inquiries, the licensee may de-

stroy the lists of names and re-use the recording tapes.

The Commission pointed out that "open-mike" programs render a significant public service by providing a forum for ordinary citizens to express publicly their views about important issues of the day, and that the telephone interview format has generally been most successful where licensees have kept close control over the way the programs are conducted. Many licensees use a brief tape delay system so that obscene remarks, or irresponsible comments contrary to the station's policies, may be deleted before they can be broadcast, the Commission said, and noted that in order to protect against libelous attacks by anonymous callers, many stations require callers to give their names and telephone numbers which are verified before the comments are put on the air.

Listing other types of controls licensees use to maintain a reasonable balance between opposing views on controversial subjects (prescreening callers so as to avoid repetitious comments or domination of the program by organized groups, employing responsible moderators, etc.), the Commission said that even with effective safeguards, it is inevitable that "open-mike" programs will generate some listener complaints. It said while most of these complaints do not warrant any action on its part, it wanted to reaffirm the applicability of the fairness doctrine to telephone interview programs and to propose rules which will aid in enforcing personal attack requirements.

The Commission stressed that the fairness doctrine applies fully to telephone interview programs and said that the licensee is required to play "a conscious and positive rule in bringing about balanced presentation of opposing viewpoints." When personal attacks are aired during discussion of a controversial issue on a telephone interview program, it said the licensee has "an affirmative duty" to send copies of the attacks to the persons or groups attacked with an offer of time to respond (Sections 73.123, 73.300, 73.598 of the Commission's Rules).

Don't Miss Our Letters To The Editor, page 8-11

FCC Record Book Now Available

The 15th volume in the second series of Federal Communications Commission reports is now available to the public. The book, containing decisions and reports of the Commission from November 15, 1968 to January 31, 1969, may be purchased from the Superintendent of Documents, U.S. Printing Office, Washington, D.C., 20402, for $6.

Besides a complete reprint of decisions and reports, the volume contains memorandum opinions, orders, and other selected material. It also includes notations of Commission action (not printed in full), digests of Commission actions according to subject, and statutory and rule provisions.

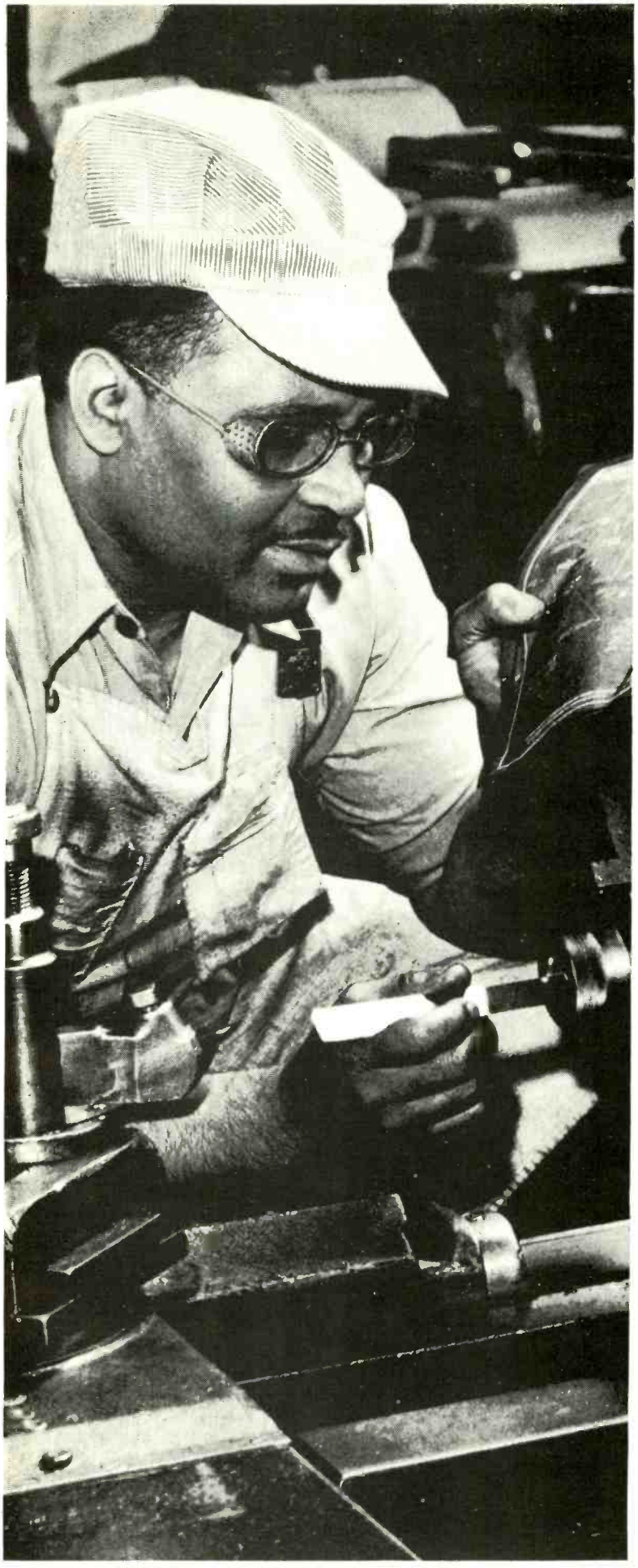
The first series of FCC Reports consists of 15 bound volumes dating from July 7, 1950 to July 9, 1965. The second series now covers the period from July 7, 1965 to January 31, 1969.

A cumulative index-digest of Volumes 1 through 15 of the Second Series, including tables of documents by title and main parties, by station call letters and by states and cities, as well as digests of Commission documents by subject, statute, and Commission regulation involved is available from the U.S. Government Printing Office for $7.50. A cumulative index-digest for the First Series, is now being prepared.

Tired of Hand-Me-Down Copies of Broadcast Engineering?

As a member of the broadcasting industry you probably qualify to receive your personal copy of B.E. FREE! We have enclosed a postage-paid reader service card for convenience—see back section of this issue. Just complete the card and drop it in the mail box. We'll do the rest.

If this is your personal copy of B.E., why not pass along the reader's service card to an interested friend? (Remember, he must be in the broadcasting industry).

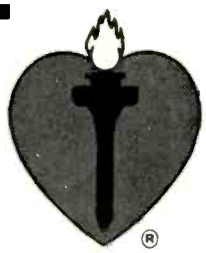


He's back on the job

He survived heart attack. He's back on the job because coronary care units, new drugs, and advanced methods of rehabilitation are helping doctors restore more cardiacs to productive lives. Most victims survive first heart attacks and, of those who do, four out of five now go back to work

Heart scientists predict even greater heart-saving advances in the foreseeable future, provided funds are increased for research, education and community services. Help make these predictions come true.

GIVE...
so more will live
HEART FUND



Contributed by the Publisher

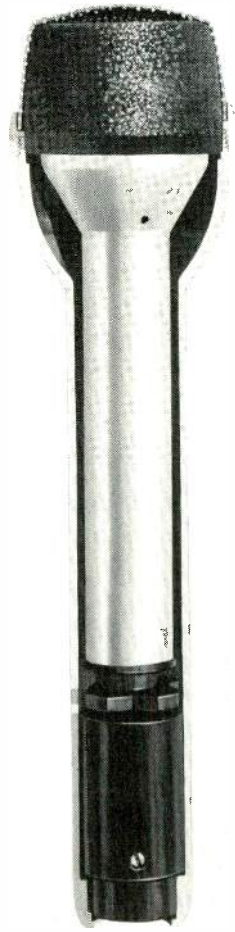
NEW PRODUCTS

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

New Mike Lines Available

A microphone designed for hand-held and sound reinforcement use that claims effective elimination of contact noise has just been introduced by **Electro-Voice, Inc.** Bearing the model designation, RE50, it is a specially shock-isolated, omnidirectional, dynamic microphone created for exacting professional applications.

The RE50 utilizes the exclusive E-V "case within a case" construction whereby two separate microphone cases, one inside the other, are isolated with a special shock-absorbing mount. The outer case of impact extruded aluminum will shrug off knocks and bumps, and the inner case, built of high-mass steel with the generating element suspended in highly compliant rubber, offers a high degree of isolation from shock. Even the microphone connector is isolated to eliminate bothersome cord conducted noise and allow free microphone movement.



Electro Voice RE50

A carefully designed, extra-size, integral windscreen and blast filter protects the RE50 from popping and breath sounds, and the four-stage filter also prevents dust and magnetic particles from reaching the exclusive non-metallic Acoustalloy diaphragm. The RE50 has a frequency response of 80 to 13,000 Hz with output of –55 dB.

Circle Number 55 on Reader Reply Card

Directional Cardioid Dynamic Microphone

A new directional-type cardioid low-impedance dynamic microphone—model 2203—has been introduced by **The Turner Company,** a subsidiary of **Conrac Corporation,** for use in broadcasting, recording, night clubs, public address, sports remotes, and applications where unwanted background noise creates a problem. The low-impedance (150 ohm) unit's directional characteristics are such that it is "live" to sound in front of it and "dead" to sound arriving from the rear.

Circle Number 56 on Reader Reply Card

Omnidirectional Microphone

A new professional ball head omnidirectional dynamic microphone that incorporates an integral filter to eliminate "pop" and "blast" resulting from explosive breath noises has been developed by the **Astatic Corporation.** The new design achieves a concentric polar pattern. This feature assures that sounds are sensed equally from all directions, providing consistent volume and clarity.

Available in two configurations, model 860s and model 860 the new is to professional uses. Included with all units is a broadcast type connector fitted with 18 feet of ultra-flexible, hum-free two-con-

ductor shielded cable.

The model 860s includes a convenient on-off DPDT switch, built into the swivel assembly to provide the performer with finger-tip control. The model 860, whose characteristics are identical to the 860s, has an exclusive stand mount that permits the microphone to be quickly and quietly transferred from stand to hand-held use. The swivel adaptor on both models tilts beyond 90 degrees and fits any standard desk or floor stand.

Circle Number 57 on Reader Reply Card

Equipment Enclosures

A new line of deluxe equipment enclosures—The MCS-7100 Series—has just been introduced by **McMartin Industries.**

Featuring contemporary design, the MCS-7100 Series provides an advancement in the styling of enclosures for desk and floor mounting.

Featuring brushed satin aluminum legs, Bangkok teak finish, black anodized trim strips and all metal interior construction, the 7100 Series provides the ultimate in reliability with pleasing appearance.

The MCS-7101 Turret incorporates a cantilevered design that emphasizes the bold styling to satisfy the most meticulous design requirements. The MCS-7142 and MCS-7143 are expendable and include locking rear cover panels. The warm appearance allows installation in lobbies and public areas.

Circle Number 58 on Reader Reply Card

Zoom Lens

Cosmicar is now offering a zoom lens especially designed for use with CCTV and VTR cameras. Designated the RZ-9015, the unit is made up of 15 hard coated lens elements that give a 22.5 to 90 mm focal length. The focusing range is from 5 feet to infinity.

The total (diagonal) angular coverage is 38 18′ to 10 2′. And the f-stop apertures are click-stop setting from 1.5 to 22.

The maximum outside diameter is 120 mm, and the overall length (maximum projection of the lens from the lens seating face) is 170 mm. The motors are driven by 30V AC through an attached control cable and control box.

Circle Number 59 on Reader Reply Card

Releasable Cable

A self-locking, releasable nylon cable tie capable of harnessing or bundling telephone, communication and electronic cables is now available from **3M Company's Electro-Products** division.

Called Scotchflex brand cable tie No. 760, it may be used separately or in conjunction with a foam adhesive-backed base assembly, Scotchflex assembly No. 790, to harness cable bundles up to 1¾-inch O.D.

Compatible with standard installation tools for high-speed tying, the cable tie meets 50-pound minimum pull-out test requirements outlined in MIL S-23190B.

Releasable by lifting the locking tab with long nose pliers, the cable tie has a compact shape which permits reuse of the tie.

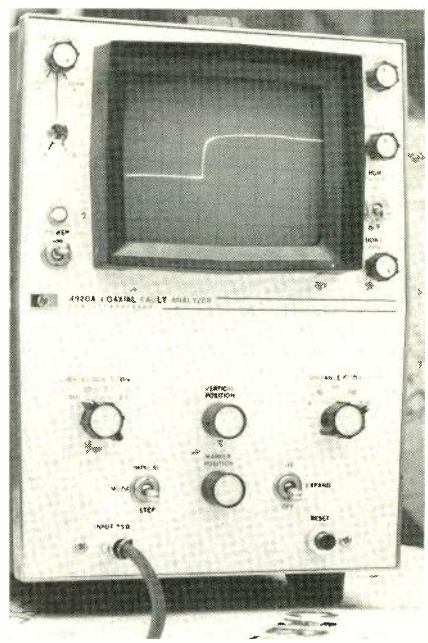
Use of the adhesive-backed base assembly increases the product's versatility. The base is installed by peeling back the protective line and placing the base on any clean, grease-free surface. Ties are released and removed from the base, permitting additional flexibility when cables are added or eliminated from the bundle.

Circle Number 60 on Reader Reply Card

Coaxial Cable Fault Locator

Hewlett Packard's TDR model 4902A is now available to the CATV industry. So what's TDR? It means Time Domain Reflectometry. Basically, the unit is a pulse generator coupled to an oscilloscope. By sending a pulse down the line in a coaxial cable and reflecting the returning pulses on a cathode ray tube (CRT), the unit will measure length of cable and spot any break or unusual resistance points.

Since the distance to the source of reflection is directly porportional to the time required for the pulse to make the round trip, the distance can be read directly from the CRT's horizontal axis.



Essentially, the coaxial fault analyzer is a field maintenance instrument. It is of rugged design in order that it may be used in the field, where it can be powered from the truck battery supply (working from 11 to 15 volts).

Although not as refined as some other fault locators built by HP, this unit will resolve down to one foot. Other more expensive units would not withstand the beating inherent in field maintenance.

Circle Number 61 on Reader Reply Card

Colorgard Meter

A new Colorgard meter will balance any variety of color monitors and jeeped receivers to a common gray-scale and color temperature. A product of Gardner Laboratory, the Colorgard III features three digital dials for external calibration which may be quickly positioned to

accurately compensate for monitor-phosphor variations. A separate three-cell probe wtih highly selected filter observes the white flag of a color bar signal, and the operator adjusts the monitor's controls until the instrument's meter nulls. Total operating time per monitor is one minute.

The new Mark III Colorgard weighs three pounds and a neck strap is provided for operator convenience and mobility. The instrument is battery powered.

For those stations wishing to adapt the world standard and SMPTE recommended practice for setting color monitor white balance to a color temperature of D6500°K., **T.E.A.** offers a choice of two color monitor comparators.

The Color-Trak comparator is a development of the BBC research group and was designed for both the broadcast and color receiver industries. A specially selected fluorescent lamp and three filters are enclosed inside a length of tough acrylic tube, with a rubber molded handgrip and end cap. The comparator produces a white reference at 21 ft. Lamberts, plus a three-step gray-scale with diminshing brightness and, when positioned adjacent to a color monitor, provides the operator with a visual reference so that the monitor's controls can be adjusted until the gray-scale on the monitor matches that of the comparator.

Circle Number 62 on Reader Reply Card

CATV Signal Generator

Tektronix, Inc., announces the 144 NTSC test signal generator, designed to provide high-quality television test signals for cable and broadcast TV systems. Combined in one compact, solid-state unit are: NTSC encoded color bars, full-field or split-field; Modulated Staircase with variable APL, 10% to 90% and fixed APL, 50%; Convergence Crosshatch; Vertical Interval Test Signals, staircase or color bars.

The 144 is not only a signal generator. It is a complete EIA Sync Generator with a temperature controlled color standard providing excellent frequency stability. Digital integrated circuits are extensively used to achieve stability, accuracy, and reliability. Outputs are subcarrier frequency, composite sync and blanking, vertical and horizontal drive, burst, composite video and the convergence pattern signal. The 144 is an ideal sync generator for local program origination.

The 144 also generates a composite color test pattern which is certain to be of interest to CATV operators. This pattern consists of a full field convergence pattern (crosshatch lines and/or dots) with VIDEO switch (staircase or color bars).

Circle Number 63 on Reader Reply Card

CATV Color Corrector

An electronic color television broadcasting device that enables CATV operators to correct color variations in programs as they are beamed to home television is being readied for production by **CBS Laboratories.**

The CBS Color Corrector, already in use by the CBS Television Network, makes it possible for studio engineers to adjust color variations in a television program after it has been encoded and at any time during its transmission to home receivers.

The Color Corrector was developed for the CBS Television Net-

work by CBS Laboratories in a joint effort with the network's engineering department. After extensive field-testing by the network, the device—the first of its kind for American television—was introduced to the broadcasting industry in April.

Circle Number 64 on Reader Reply Card

Send releases on new products to: Editor, Broadcast Engineering, 1014 Wyandotte, Kansas City, Mo. 64105.

Monochrome / Color Film Chain

A low-cost, broadcast film chain system for color or monochrome use has been placed on the market by **International Video Corporation.**

The two major components of the system are the new IVC-230 large image color film chain camera and the new IVC-4000 multiplexer, both engineered and built by IVC.

The IVC-4000 multiplexer accepts up to four projector inputs for use with either of two camera outputs. Projectors and the second camera may be of any commercially available model. Existing studio equipment—film and slide projectors and a color or monochrome second camera—are accommodated by the IVC-4000 without modification.

The IVC-230 is a three-vidicon camera that produces high resolution, excellent signal-to-noise ratio and good stability. A swing-out door facing the operator houses all registration controls. Special optics accommodate a large 3⅜ x 4½-inch image at the camera field lens, producing sharp pictures at both center and edge. An integral 9-inch monitor permits ease of optical and electronic setup.

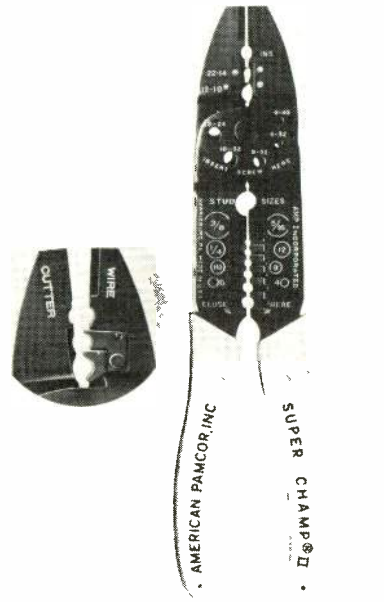
Circle Number 65 on Reader Reply Card

Hand Crimping Tool

All functions necessary for applying crimp terminals or splices to wire are included on the SUPER CHAMP II hand tool from **American Pamcor, Inc.** The "pre-loaded" wire cuter maintains its sharpness and provides positive cutting of even small size stranded wire. The wire stripping section is complete with a gage indicating proper strip length, and the crimping jaws are designed for use with wire ranging from AWG #10 to #22. Additional features include a bolt cutter and a stud size gage.

The SUPER CHAMP II hand tool is precision machined, austempered, high carbon tool steel with head-sealed insulating handle grips.

Circle Number 66 on Reader Reply Card



Professional Tape Recorder

You press a button and the 10½" reel of tape whirrs forward at high speed. Suddenly, it stops, backs up a few inches to the exact preselected spot on the tape, then starts to play the program. That's just one of the features built into the new **Sony** model 350, introduced by its American distributor, **Superscope, Inc.**

The new Sony model 850, a professional quality recorder with a consumer bracket price tag, has many features. Perhaps the most unique, however, is the automatic program scanner (APS).

After a tape is loaded and the APS button pressed, the machine will shift into fast-forward. When it reaches a pre-placed strip of sensing foil it will stop.

The fast forward motion carries the tape slightly beyond the preselected program mark so the recorder automatically reverses itself, and stops precisely on the foil. Then the machine automatically goes into the play mode.

Any number of sensing foils can

be utilized to divide the programs. With APS finding an individual program, a tape becomes easier than flipping over a disc recording.

Other advanced features include the 15 i.p.s. tape speed and completely modular electronics construction. Fully accessable bias and equalization adjustments make service and maintenance easy. The two-track and quarter-track head blocks may be interchanged in seconds with no need for head realignment.

Each head block contains one erase, one record and two playback heads so the model 850 will play back half-track, two-track and quarter-track tapes.

Circle Number 67 on Reader Reply Card

Mobile Generator

A rugged new combination AC-DC separate generator, specifically designed to be installed under the hood of today's heavy-duty, all-purpose trucks, has been announced by the **Onan Division** of Studebaker Corporation, Minneapolis, Minnesota.

The new generator provides 2,000 watts of AC power for electric tools and floodlights plus 55 amperes of DC electricity for battery charging. The 55-ampere DC capacity is claimed to be 25 amperes larger than most standard truck generators today—and guaranteed insurance the truck battery will be kept in peak condition for quick engine starts.

Circle Number 68 on Reader Reply Card

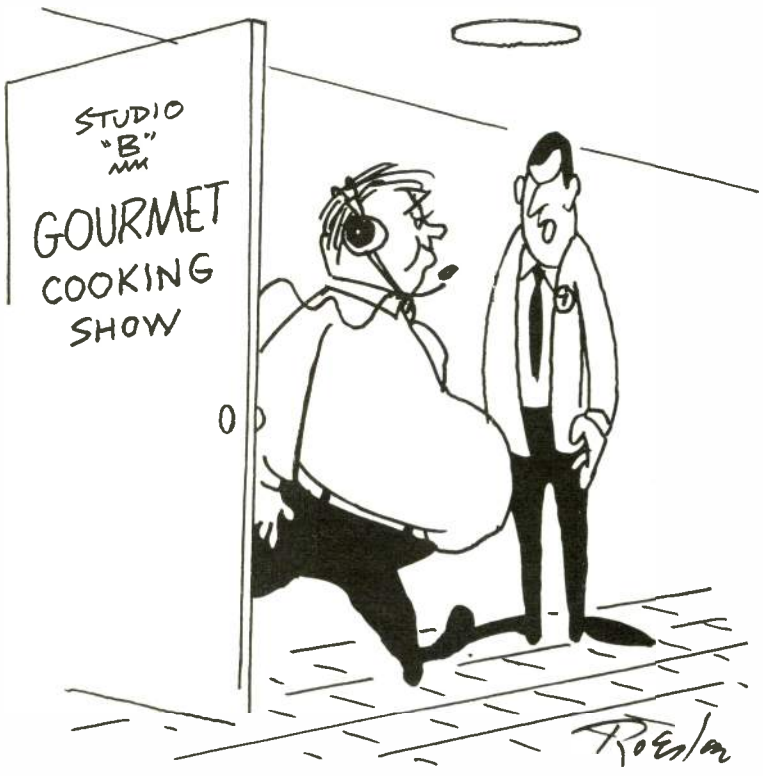
CATV Passive Devices

The Coltronics line of passive devices includes taps, splitters and transformers, are now available through **Pruzan.**

The CT-4 and CT-2 are four- and two-way plug-in directional taps. Band width runs 45-270 MHz minimum. Power passing capability on the CT-4 is 5A and it comes with a G-10 circuit board and F connectors, with throw-away terminators. The taps are easily changed from inline to pedestal mountings. Tap plates are color coded and seized center conductor connectors are standard.

The CHS-400 and CHS-200 indoor splitters are DC isolated and equipped with G-10 type boards and F connectors. Return loss on each is 20 dB and isolation is better than 30 dB. Bandwidth exceeds 45-300 MHz. For the CHS-200 two-way splitter, insertion loss is 3.3 dB and for the CHS-400 four-

(Continued on page 62)



"FROM NOW ON, LERSCH, -JUST AIR THE SHOW, - DON'T EAT IT!"

New Products

(Continued from page 61)

way splitter 6.5 dB.

The CLT-400 and CLT-200 indoor tap-offs are likewise DC isolated and equipped with G-10 type boards and F connectors. Insertion loss on the CLT-400 four-way model is 1 dB and on the CLT-200 two-way model ½ dB. The tap off value is 20 dB—1 dB and 19 dB—½ dB, respectively. Band width on each runs 45-300 MHz, return loss is 20 dB and isolation is better than 30 dB.

Circle Number 69 on Reader Reply Card

Film Chain Graphics System

AV Systems, Inc., has introduced a proprietary optical design allowing combinations of up to three projector inputs and one graphics stage input for television program origination. Fade, dissolve, superimpose various inputs in any combination. Title films or superimpose announcements using only large pica typewriter print.

The MEDIA-Plex film chain/graphics system offers: Three projector plus graphics inputs; No critical optical alignment required—will accept any camera without realignment; Color compatible without modification; Can be installed, operated, and maintenanced by non-technical personnel.

The system will accept any combination of 16 mm, Super 8 or slide projectors as supplied by AV Systems. The unit is modular in design so that additional projector functions may be added after original purchase. Because of its simplicity, the system is extremely reliable. There are no moving mirrors or motors to get out of adjustment or breakdown. The control panel is rack-mountable and can be located up to 100 feet from the system.

Circle Number 70 on Reader Reply Card

Phono Cartridge

Stanton Magnetics has developed and marketed the 500AL phonograph cartridge. It is an ultra-rugged assembly designed for the broadcaster whose requirements for extra ruggedness have not been totally satisfied. Featured also are diamond tips which, according to Stanton, combined with the ruggedness characteristics provide long life with a minimum of maintenance.

The lack of adequate operating and service personnel has uncovered the weakness in many broadcast operations. Significant is the delicacy of many styli in stations which feature "Top 40" hard rock. Unskilled operator/announcer broadcasters have been under a severe pressure from the changes in format and for this group the new 500AL has been designed to supply the missing link in the reliability factor of the operation.

Circle Number 71 on Reader Reply Card

Tape/Head Cleaner

A brand new cleaner formulated for VTR, audio heads, magnetic tape and photo film is now available from **Nortronics.** The new cleaner, designed especially for professional recording equipment, is available as both liquid and spray. In either form, the manufacturer claims, its use contributes to improved performance and extended life for magnetic heads and tapes.

The new cleaner can be used on cassette and cartridge tape recorders as well as conventional reel-to-reel equipment. Nortronics Tape/Head Cleaner preserves tapes and improves fidelity by eliminating accumulated dirt, film, and oxides. Since it is silicone free, it can also be used to clean guide parts, capstans, and pinch rollers. Most other available cleaners contain silicone, and therefore cannot be used for these applications.

Circle Number 72 on Reader Reply Card

Front Panel Square Button Switches

Attractive front-panel styling is now available in the new Push Button Switches from **Grayhill, Inc.** The square button (0.485″) in-bezel mounting complements front panel appearance. Small behind-panel dimension (less than 2″ from the mounting surface) allows you to compact your circuitry.

Switch features include DPDT (break before make) circuit versatility and wiping contacts to maintain a low contact resistance during switch life. The Series 46-230 and 46-430 are rated to make and break ¼ amp. for 250,000 operations.

The 46-230 is a momentary contact, and the 46-430 is an alternate action (push-on, push-off). The alternate action mechanism has been designed and extensively tested to insure positive lock down and positive release operation.

Circle Number 73 on Reader Reply Card

In Parting . . .

Tax Break Is Possible

Interested persons have inquired whether the Commission would issue a tax certificate, pursuant to Section 1071 of the Internal Revenue Code, 26 U.S.C. 1071, in the case where a broadcast licensee, owning interests inconsistent with the new policy established in the First Report and Order in Docket No. 18110 (FCC 70-310), disposed of any such interest(s) in order to come into compliance with the policy. The Commission hereby gives notice that it would issue a tax certificate in such circumstances.

The Commission generally adheres to the involuntary test set forth in its 1956 Public Notice (FCC 56-979) (and see H. Rept. No. 775, 85th Cong., 1st Sess., p. 29 (1957). It believes, however, that there can be situations where the certificate should be issued as ". . . appropriate to effectuate a change in a policy, or the adoption of a new policy by the Commission with respect to the ownership and control of radio broadcasting stations . . ." (Section 1071)—namely, where there is a casual relationship between the change in Commission policy and the sale of the broadcast facilities and the sale does effectuate the new policy.

In the situation described in the first paragraph, the Commission finds that there is such a casual relationship, since, in its long experience in this field, it has found that broadcasters in a market do not usually sell an AM (or FM) operation, retaining the TV operation (or vice versa); that the normal and well-established practice is to operate both the aural and television facilities in the same market. The Commission having found that this type of cross-ownership is inconsistent with the public interest (see First Report and Order in Docket No. 18110, FCC 70-310), it clearly serves that interest to facilitate sales which will bring about consistency with the new Commission policy. (The question of whether divestiture will be required remains an open one, to be resolved in the Further Notice in Docket No. 18110 (FCC 70-310); in short, FCC action is not based on the proposal in the Further Notice, but rather the new policy established in the First Report and Order).

"THERE THEY GO!-PIRATING OUR HELP AGAIN!"

TECHNICAL DATA

For further information, circle the product identification number on the reader reply card.

100. **AMERICAN ELECTRONIC LABORATORIES, INC.** — A new folder on AEL's line of filters is now available. AEL shows its series FBF 3000 Tubular Band Pass Filters ⅜" diameter which operate from 100 to 1000 MHz. Its series FBA band pass filters cover the range from 2 MHz to 1000 MHz. The FLA series low pass filters cover 2 to 1000 MHz. AEL's FHA series high pass filters cover from 2 MHz to 750 MHz. Also available are the FBV series bandpass filters, working from 500 MHz to 12 GHz. The series FMN-250 Diplexers operate in the 2200 to 2300 MHz telemetry range. These diplexers are designed to operate at altitudes over 150,000 feet. The AEL Filter Folder also details the AMC Series Multicoupler, the AFA Series of Attenuators (attenuator values from 1 dB to 20 dB) and the LMA Limiter; the receiver protection for frequencies between 2 MHz and 1 GHz.

101. **AMF ALEXANDRIA DIVISION**—An all-new, detailed catalog on their ultra-low noise Cybertran Series of preamplifiers is now available. This colorful six-page short form catalog contains the latest information concerning AMF's low-cost Cybertran technology. Complete specifications are included on their laboratory, modular, video and micro-powered instrument preamplifiers. AMF's capability for specials is represented by a page of specifications on typical amplifiers, preamplifiers and line drivers built to order.

102. **AMPEX CORPORATION**—An eight-page color brochure decribing the new Ampex Model AVR-1 "third generation" high-band color videotape recorder for commercial and educational stations and networks, television production companies and government applications is now available. The AVR-1 is the first high-band videotape recorder which is adaptable to station automation and provides an instant cue-and-take picture within 200 milliseconds. The operating features of the AVR-1 which permits unprecedented operational simplicity are described in the brochure, and complete specifications are given.

103. **AMPHENOL INDUSTRIAL DIVISION**—The Bunker-Ramo Corp. A new line of fully assembled "Excellite" (R) audio/electronic connectors — featuring streamline/molded ABS body construction, lustrous nickel plating and full intermateability with all industry standard latchlock types is detailed in a new, six-page publication now available. The attractive full-color brochure contains photographs, line drawings, electrical characteristics, mechanical specifications, recommended termination techniques, and application information for Amphenol's complete Excellite offering. The line includes straight cord plugs and wall mounting receptacles offering both plug and socket inserts in three-, four-, or five-contact configurations. A cross referenced selection guide provides complete information necessary for finding the right Excellite connector for any equipment, microphone or circuit application.

104. **C-COR ELECTRONICS INC.**—A new catalog for CATV is now available. The catalog describes C-COR's amplifiers, passive devices, antenna site equipment and related items for the cable industry.

105. **CHRONO-LOG CORP.**—Integrated Circuit Digital Clock Circuit Cards for OEM applications are described in new two-page bulletin. Original Equipment manufacturers can now purchase a complete IC Digital Clock in the form of a plug-in circuit card for inclusion in their digital systems. The bulletin describes the Series 50,000 OEM IC Clock Cards, giving specifications, technical details, interface data and mounting dimensions. Available options such as time and date ranges, various internal and external time bases, panel displays, logic outputs and manual controls are completely described. An associated price list gives pricing for each option and defines the model number for each of over 375 off-the-shelf models.

106. **COHU ELECTRONICS, INC.**—A two-color data sheet de-

scribing a programmable DC voltage standard that has 0.003% accuracy for 12 months is now available. The data sheet (15087) includes specifications and general descriptions of model 381.

107. **CONRAC CORPORATION**—A 24-page illustrated catalog describing Conrac's complete line of microphones and accessory equipment is now available. The catalog contains specifications and prices on Turner's line of professional, recording, broadcast and public address cardioid dynamic mikes; standard and transistorized mobile communications and base station communications mikes; tape recording and general purpose mikes; paging and public address microphones; stands, cartridges, and accessories. A section on "how to choose a microphone" is also contained in the catalog.

108. **CORNELL-DUBILIER ELECTRONICS**—A new technical bulletin covering their new SCR Commutating Capacitor line is now available. The bulletin provides complete product description, list of applications, dimension drawings, and a list of standard ratings that are available. The bulletin also includes an application specification questionnaire with space needed for description.

109. **DAVEN**—Div. of Thomas A. Edison Indust. A new means of building and expanding flexible intercommunication systems is described in Daven Bulletin FL-100: Flexicom®—A Family of Solid-State Modules for all Intercom Applications. The bulletin describes the electro-mechanical design and function of the system modules: Carbon Microphone Preamplifiers, AGC Dynamic Microphone Preamplifiers, Coupling Amplifiers, Switching Matrixes with Solid-State Crosspoints, 3-watt Monitor Amplifier, Interconnection Boards, Regulated Dual Output Power Supply Mounting Frame. The versatile system incorporates simplified fabrication and wiring with a capability for easy expansion. This is accomplished with inclusion of such features as transient free switching and space savings of up to 40% over existing systems. The bulletin will be subsequently followed with detailed specification sheets for each of the modules.

"JUST HOW BIG IS THAT TAPE YOU'RE ERASING, STANLEY?"

110. **DIALIGHT CORPORATION**—A new, multi-page catalog (L-181-D) on its line of readouts and caption display modules is now available. The lighted modules are designed for readout of 10 numbers and 10 letters. In addition, compatible modules displaying a wide variety of explanatory displays and captions are described.

111. **DYNASCAN CORPORATION**—A new catalog of B & K Professional Test Equipment for electronic servicing, school, laboratory and industrial applications is now available. Solid state design is dominant in the new B & K instruments, including a FET VOM, RF Signal Generator, Sine/Square Wave Generator and a Tube Tester with exclusive lockout push buttons that provide positive short indications. A solid state sweep drive is an added feature in the company's popular Television Analyst. This time-saving instrument now checks every stage of every TV set, color or black and white and solid state or vacuum tube design. Other instruments offered in the new catalog are Sweep/Marker Generator, Oscilloscope/Vectorscope, Capacitor Analyst, Transistor Equipment Analyst, Color Generators, Tube Testers, CRT Rejuvenator Checker, Transistor/FET Tester, VOM's and VTVM's. Probes, adapters and other accessories are also included. There is a large illustration of each instrument, charts, paterns and full descriptive details and specifications.

112. **ELCO** — Revised and expanded, the 1970 edition of this guide describes a wide range of low-cost rack-and-panel connectors. These rectangular, miniature, modular, and appliance connectors range in size from 2 to 140 contacts, with current ratings of 5 to 20 amperes.

An illustrated conector index, which shows the basic characteristics of each connector, permits immediate identification of the connector best suited for the application. The rectangular connectors use hermaphroditic insertable/removable VARILOK™ contacts suitable for crimp, solder, wire wrap, and tapered table termination (crimp contacts are available both loose and mounted on 1800-contact reels). Many connectors also incorporate polarizing pins and sockets that prevent mismating (36 polarity combinations are possible) and that can be reset by the user with a simple tool. Other options comprise actuating screws, covers, and cable clamps.

113. **FAIRCHILD SEMICONDUCTOR** — An 88-page, pocket-size catalog is now available describing their complete line of linear integrated circuits. The "Linear Integrated Circuit Condensed Catalog," which measures only 3½ by 6 inches, provides key information and pin diagrams for 31 linear IC products. These include operational amplifiers, dual op amps, AC amplifiers, comparators, communications devices, pre-amplifiers, differential amplifiers, stereo multiplex decoders, chroma demodulators, and other specialized functions. This hand brochure also previews a number of special Fairchild linear products that are scheduled for introduction late in 1970. Among these are some advanced circuits designed for memory interface, analog to digital interface, communications systems, and consumer applications.

114. **GBC CLOSED CIRCUIT TV CORP.**—A condensed catalog covering their entire line is now available. The new catalog includes the industry's widest selection of industrial TV cameras, viewfinders, outdoor cameras, wireless cameras, monitors of all sizes, projection monitors, lenses, sync generators, switcher-faders, special effects generators, video distribution equipment, housings, pan and tilt mechanisms, tripods and dollies, film chains, CCTV security equipment and consoles. The equipment in the new catalog is solid state and each GBC product carries a full year 100% unconditional guarantee.

115. **GENERAL INSTRUMENT** — Systematics/Magne-Head Div. The full line of SA 7000 Series Drum Memory Systems is described in a new easy-to-read brochure now available. Included in the brochure are new drum sizes with complete specifications. Single-drum capacities range from 10 to 150 million bits, with 256, 512, 1024 or 1536 tracks — each with its own read/write flying head. The SA 7000 Series Drum Memories provide outstanding data reliability for any computor—less than one error in 10^{11} bits under normal operating conditions. There are eight separate mass memory systems available to provide exacting memory storage requirements for new computer installations, or for additional memory capacity in existing systems. Ideal for process control, communications multiplexing, data processing, multi-display refresh, or numerical control applications.

116. **GRAYHILL, INC.**—Total information on enclosed push button and rotary switches and high quality termination hardware is now available in the new G-306-A catalog. The G-306-A is 40-pages larger than the previous edition. These pages contain many new products,

including decorative push button switches (momentary and alternate action), environmentally sealed push button switches, key-operated rotary switches, a build-your-own rotary switch kit, the smallest available 24-position rotary switch, spring return rotary switches, and isolated position (pull-to-turn or push-to-turn) rotary switches. The engineering data section of this catalog provides information on switch parameters and their importance when you are choosing a switch for your application. A push button switch selector chart and rotary switch selector chart allows you to determine readily the switch for your application, once you have considered these parameters. Another new feature of the catalog is the short-form listing of all Grayhill switches on the Qualified Product List for Mil-S-3786.

117. **ITT**—Two revised catalogs are now available. ITT Cannon Electric's new literature are a microminiature catalog (MMC-4) which, in addition to up-dating, describes a new microminiature printed circuit connector and a series that offers EMI shielding. The second is a revised audio catalog (AUD-5) which includes an XLR cross-reference mating selection guide.

118. **LENKURT ELECTRIC** — A 36-page, short-form products and services catalog is now available. The catalog describes each major system in Lenkurt's broad product line, including microwave radio, radio multiplex, trunk carrier, subscriber carrier, data and telegraph, supervisory and control, and auxiliary and test equipment. A descriptive operating and applications summary and a photograph of each product are included in the catalog.

119. **PRODLIN** — A new 2-Way Communications Antenna Catalog containing complete electrical and mechanical specifications on a full range of base station and vehicular antennas designed to fulfill virtually any private or governmental service is now available. In its illustrated 36-pages, included also is a complete listing of accessory items and informative applications enginneerig data.

120. **RCA** — Application Note AN-4242, "A Review of Thyrister Characteristics and Applications" is now available. Thrystors, both SCR's and triacs, are now widely accepted in power-control applications. With the emphasis in such applications placed on low cost, small package size, and circuit simplicity, thyristors satisfy these requirements with reliability exceeding that of electromechanical counterparts. This Note describes the operation, ratings, characteristics, and typical applications of these devices.

121. **SYLVANIA ELECTRIC PRODUCTS, INC.** — A 56-page microwave product guide is now available. The brochure lists all microwave products manufactured by Sylvania and gives key operating characteristics.

122. **TAPE-ATHON CORP.**— A new four-page brochure describing their model 1000 Recorder/Reproducer is now available. Containing a comprehensive description of the basic recorder, the brochure shows its availability in three versions, rack-mounting portable and studio console type. The recorder itself and its electronic section are also pictured wiht callouts to complete the descriptive text. A full set of specifications makes up the back page of the publication.

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AMPEX spare parts, technical support, updating kits, for discontinued professional audio models, available from VIF INTERNATIONAL, Box 1555, Mtn. View, Ca. 94040. (408) 739-9740. 9-70-EOM

Surplus audio and video patch panels and patch cords, 500 to 500 ohm repeat coils flat to 20,000 cycles. Send for list. Gulf Electro-Sales, Inc., 6325 Beverly Hill, Houston, Texas 77027. 9-70-tf

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GE 50 kw Transmitter BT-50-A1 complete with associated equipment including cabling, 3 ea. 280 ft. and 2 ea. 160 ft. guyed towers, transmitter shack, etc. To be offered for sale by public bid. Available late 1970 for disassembly and removal from location near Sacramento. Arrangements to inspect the facility, currently operating, and to request copies of the Bid form, contact immediately B. N. Brown, Sacramento Municipal Utility District, P. O. Box 15830, Sacramento, California, 95813. (916) 452-3211, ext. 576. 8-70-3t

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Position Wanted

First phone earned through formal training; NOT "quickie" course. Currently engaged in further training in Broadcast Engineering at thoroughly accredited and broadcaster accepted school with complete TV plant up to line out and student operated IKW FM radio station. Experienced troubleshooting tube & solid state gear, techwriting & complex testing. Married, age 44, personable, good health. Want work full or part time anywhere within an hour's drive of San Francisco. Werner L. Knoepp, 21 Eureka St., San Francisco, Cal. 94114. Phone 861-2149. 9-70-1t

Position Wanted (Cont.)

ATTENTION PROFESSIONAL ENGINEERS—Ready for more money? We have the contacts you need. 156 new positions open, some: Transmitter, Video, Audio designers $11-$18,000. Equipment Marketing & Sales $12-$25,000. Microwave designers $11-$15,000. Station, Assistant Chief engineers $11-$14,000. Studio & Transmitter, operation & maintenance $9-$13,000. CATV systems & product engineers $10-$20,000. Immediate, No resume needed, No placement fees. Contact The **ENGINEERS LOG** (personnel specialists for Broadcast Engineers.) #518 785-3840. Box 252, Latham, New York 12110. 9-70-1t

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Job Headquarters for all Radio and Television Engineers. Immediate openings exist in 9 western states and elsewhere for qualified engineer and technical personnel. All categories from trainees to experienced transmitter maintenance, chief, assistant chief, live color video maintenance and technical operations. Send us your complete resume now. The AMPS Agency, 3924 Wilshire Blvd., Los Angeles, California 90005. Telephone DU 8-3116. By Broadcasters—For Broadcasters. 11-68-tf

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SENIOR TELEVISION ENGINEER. Must have strong maintenance background with the latest solid state broadcast color television equipment. Send resume to: Ronald T. Lask, Chief Broadcasting Engineer, Television Section, University of Illinois, Medical Center, PO Box 6998, Chicago, Illinois 60680. 9-70-3t

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IMMEDIATE OPENINGS: Qualify for any of the following positions: RCA CCTV Equipment, monochrome or color. Salesmen — TV Systems Engineers — Project Engineers — Supervisors — Managers — Maintenance Technicians — Video Engineers — to work either New York, Pennsylvania, New Jersey or California area. Write: RCA Rep., P. O Box 268, New Hyde Park, New York 11040. 4-70-tf

Wanted

TELEVISION TRANSMITTERS WANTED: WE NEED USED HIGH AND LOW BAND TELEVISION TRANSMITTERS, ANY POWER. MUST BE EXCELLENT CONDITIONS. CONTACT BRUNO SCHWEBEL TELESISTEMA MEXICANO, S.A., AV. CHAPULTEPEC 18, MEXICO 1, D.F., PHONE: MEXICO CITY 5-18-56-74. 8-70-2t

HEARD THE LATEST?

A-24

- 4-track, 2-channel stereo
- All-silicon transistor pre-amps
- Pause control
- Digital counter
- Dual VU meter
- Fast winding
- Automatic stop at end of tape
- 0.2% wow and flutter (RMS)
- Frequency response: 40 to 12,000 HZ
- S/N ratio: 45 dB or more
- Crosstalk: 40 dB between adjacent tracks at 100 Hz
- Microphone optional

This is what happens when a big name thinks small. It's the TEAC A-24, and it's making cassette history. This deck is powered by a unique hysteresis synchronous outer rotor motor for compact convenience, powerhouse performance. And it comes complete with all the craftsmanship it takes to make a TEAC.

More exclusive features: a special end-of-tape sensing circuit which not only stops the cassette, but completely disengages the mechanism – releasing pushbuttons, pinch roller and idlers – to avoid "flats" and deformation of critical drive components. Two specially-designed heads for outstanding frequency response. Just about the lowest wow and flutter that ever came out of a cassette.

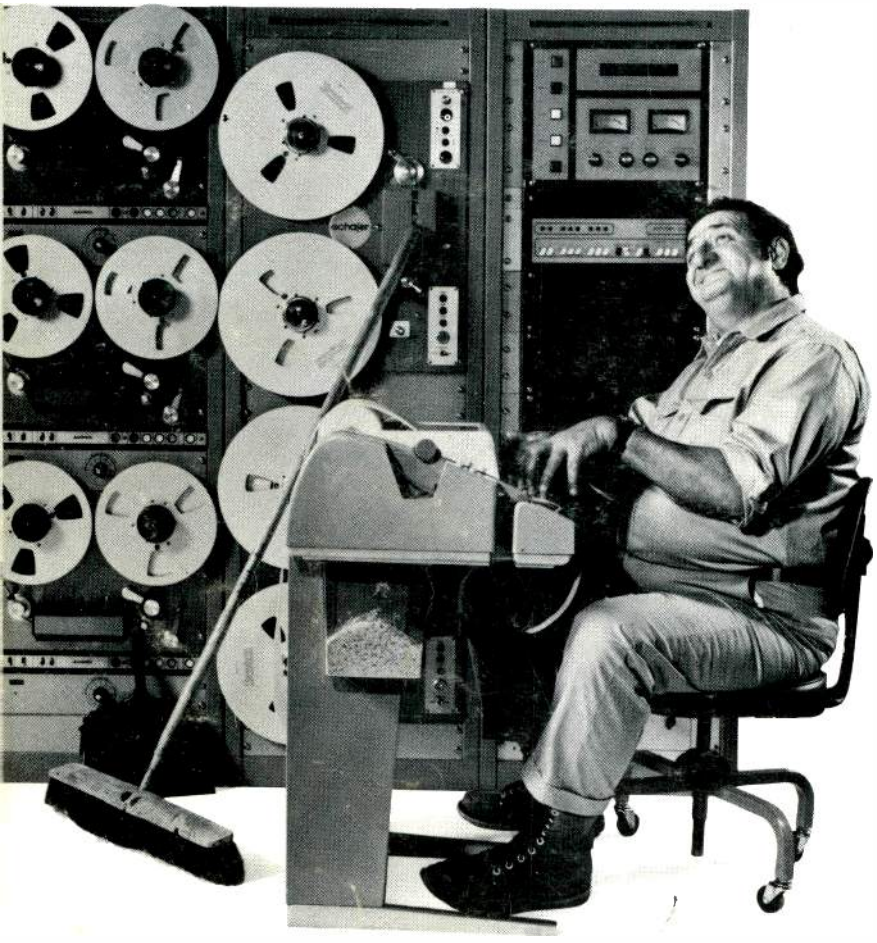
Of course, no sound system is really complete without cassette capability. So if it's time to round out your equipment, it's time to sound out our A-24.

TEAC

TEAC Corporation of America • 2000 Colorado Avenue • Santa Monica, California 90404

Circle Number 2 on Reader Reply Card

They laughed when he sat down at the typewriter. They didn't know he was programming the station for a week in advance!



We don't recommend that the night maintenance man program your station.

But he could—with just a few hours of training on the new Schafer 8000 Automation System.

Imagine. A system that gives you 21 times more walk-away—that can increase "people utilization" by 100% or more—that automatically types the program log. A system which you can't possibly outgrow.

Mind boggling but true. Because with the Schafer 8000 you can individually program each day of the week up to 7 days in advance. Then, without disturbing the basic structure, you can add, delete or change segments at will. Merely by typing a few simple commands on the system typewriter.

And don't let the word "computer" shake you. Ours is the size of a stereo receiver. It's about as simple to use as your office calculator. Simple yes. But far more flexible and expandable than any other system.

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Send me the new brochure describing the Schafer 8000

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Circle Number 3 on Reader Reply Card