February, 1970/75 cents

Broadcast Engineering®

the technical journal of the broadcast-communication's industry

A HOWARD W. SAMS PUBLICATION

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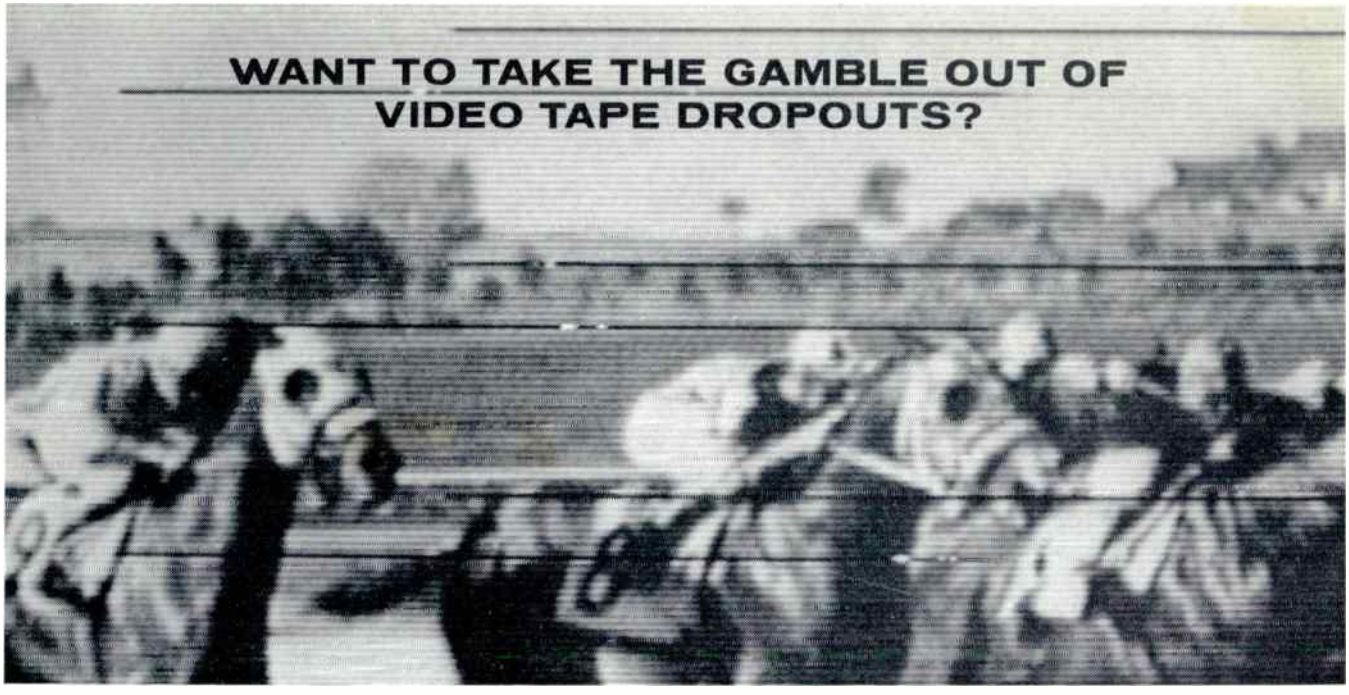

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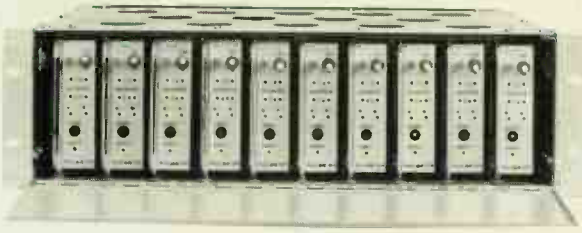

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February, 1970 • Volume 12, No. 2

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

Chief Engineer of KFMS Loads the card reader of the station audio control system. The highly automated equipment is, in effect, a specialized computer for programming. See article "Talking With Computers" on page 20. (Picture courtesy of IGM.)

DEPARTMENTS

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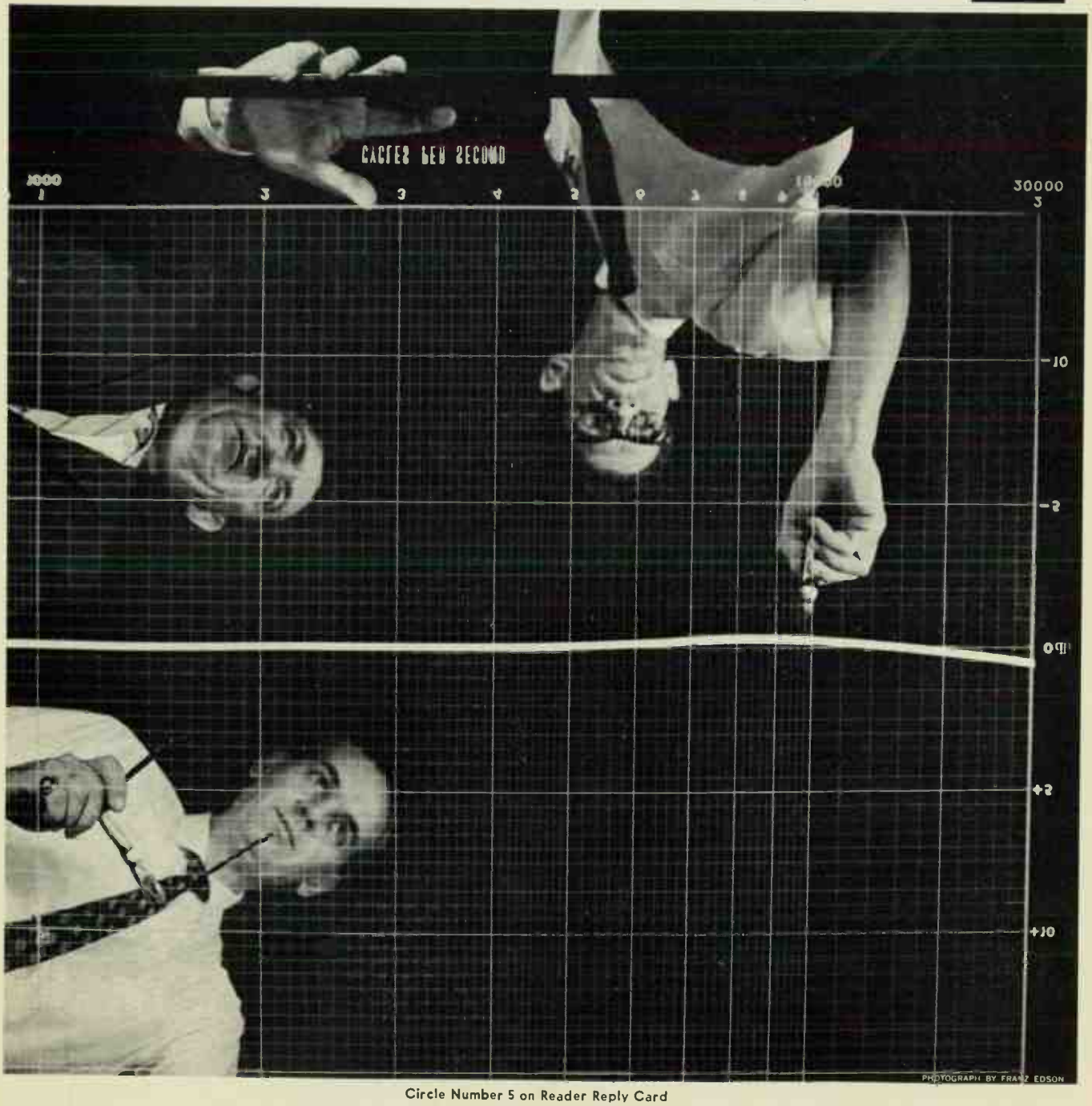

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DIRECT CURRENT FROM D. C.

February, 1970

By Howard T. Head

Mexico Fails To Ratify New AM Treaty

The Mexican Senate adjourned at the end of December without ratifying the new AM radio broadcasting treaty with the U.S. Ratification by both the U.S. and Mexican Senates is necessary before the treaty can enter into effect. The U.S. Senate has already ratified the treaty.

At stake are such matters as presunrise operation for approximately 200 daytime-only stations in the U.S. operating on Mexican clear channels, and power increases for Class IV stations on the local channels near the border. The use of the clear channels is also involved.

Reports from Mexico City do not indicate any opposition to the treaty in the Mexican Senate, but apparently there was not sufficient time to consider the treaty before the regular adjournment of the Mexican legislature at the end of December. The earliest date that the treaty can again come up for ratification is September, 1970, when the Mexican legislature will reconvene.

New First Class Operator Examinations in Preparation

The Commission's staff, working in close cooperation with an industry Engineering Advisory Committee, has prepared new versions of the examination for a radio-telephone first-class operator license. Particular emphasis in the new examinations has been placed on Element 4.

The new examinations are intended to assure that applicants for the license have an actual knowledge of practical radio engineering and, in particular, to make it difficult to pass the examination by simple rote learing.

Commission and industry engineers continue to grapple with the problem of assuring that station engineers who must operate and maintain standard broadcast directional antennas have an adequate understanding of directional antenna problems. There has been a sharp increase in recent years in citations for out-of-tolerance directional antenna operation, but there is still a critical shortage of station engineers qualified for directional antenna maintenance.

Sample Current Meter Calibration Curves Required

The Commission's engineers are interpreting Section 73.39(d) (vi) of the Rules as requiring the preparation of calibration curves in those instances where sampling line meter indications are read in lieu of base current meters for standard broadcast directional antennas. The rule was originally adopted to permit the sampling meter to be used as a remote meter (in lieu of a thermocouple type instrument) during non-directional operation. The present interpretation, however, applies the requirement to both directional and non-directional operation.

(Continued on page 6)

World Radio History

EARTH STATION ANTENNA

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World Radio History

(Continued from page 4)

Some phase monitors incorporate potentiometer adjustments which permit the sampling meter indication to be arbitrarily varied. Others, however, read the RF sampling current directly in arbitrary units. Attempting to change the sampling meter indication to track the base current indication often runs a serious risk of providing false indications of antenna adjustment, and should not be undertaken without the supervision of an engineer competent to adjust a directional antenna. This is particularly true in the case of towers taller than one-quarter wavelength, since the current at the tower loop usually will not track the base current directly.

Remote Control Signal to Activate Videotape Recorders

A request by Twin City Area Educational Television Corporation (Twin City), St. Paul, Minnesota, licensee of Educational Television Broadcast Stations KTCA-TV (Channel 2) and KTCI-TV (Channel 17), both in St. Paul, Minnesota, for authorization to utilize a remote control signal for the purpose of activating and de-activating video tape recorders located at various schools, during nighttime non-broadcast hours, for the purpose of recording educational programs for future use, has been granted by the Commission. The stations were authorized to operate the signal system under special temporary authority for the period ending June 30, 1970, with the condition that Twin City submit "a complete report on the operation and your investigation . . ."

The Commission said in its letter to Twin City that during this period, "investigation should be made of alternative methods of transmitting control signals (e.g. signals in the vertical blanking interval, inaudible pulses, super-audible SCA type signals, etc.) which could be utilized to activate video tape recorders. At the end of the period authorized, you will file a complete report on the operation and the results of your investigation as to other methods which might be utilized. Details as to cost, availability of hardware, relability, etc., are pertinent and necessary for the Commission's ultimate evaluation. It should be noted that this authorization in no way constitutes a determination that such an operation will be extended or authorized on a regular basis.''

Short Circuits

The Commission has ordered quarterly technical reports by several CATV systems on the West Coast who were slow to file progress reports relating to signal degradation on the cable system. . . .A Pennsylvania AM station has been admonished and given a short-term license renewal for using a promotion map which exaggerated the size of the station's 0.5 mv/m contour; the station was also emphasizing its coverage of a nearby large city to which it was not licensed. . . The Comission has officially recognized, in a New York suburb, the growing problem of AM pattern distortion arising from the construction of tall reradiating structures in the vicinity of the antenna.

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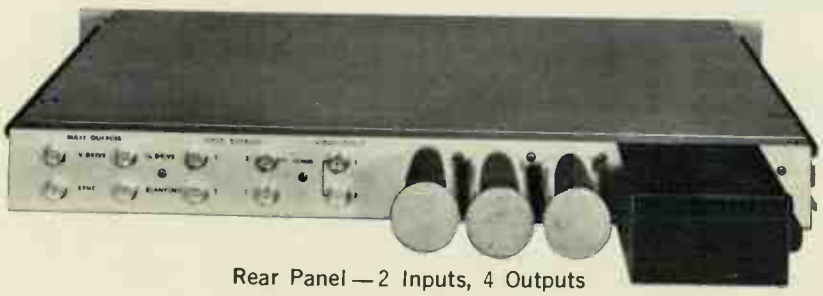

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BE Notes From Incoming Mail

This month we're pulling a real switch in this column. We usually run a sampling of our incoming mail on this page, but for February we're going to run a sampling of letters sent by the editor.

The BE Log

One of the questions I get from the field every week goes something like this: "I have not received the last two issues of **BE**; what happened?" And when we check to see what happened, we find that the writer has not renwed his subscription. You can renew your subscription any time by checking the appropriate boxes, signing and sending in the Reader Service Card located in the back of each issue.

Along this line, if you want extra copies or have a change of address to report, send your request to: Vince Ward, Circulation Dept., Broadcast Engineering, 1014 Wyandotte, Kansas City, Mo. 64105.

New Products

From time to time we get letters asking why we don't spend more time and effort testing new equipment. We're doing something about that. Our test bench complement of equipment is growing, and soon we'll be able to test a higher percentage of the products we cover. But we will never get to the point where we can test all of it.

And if you failed to send in your Reader Service Card for more information on new products and products advertised, drop us a line and we'll help you get the information you need. The cards can be used for about three months, depending upon when you get your copy for the month. For example, the card in this issue can be used until April 1.

Some of our advertisers do not include Reader Service Card reply numbers at the bottom of their ads. We suggest you contact them directly.

On The Air But QRU

Sometimes I get the feeling that nearly all station engineers and design engineers are ham operators. Yet I'm surprised that more are not involved in the experimental work that at one time was the long suit of the amateur ranks.

For years I puttered along toward a DXCC running low power to final tubes long since forgotten (a TZ-40 what?). Ham life became a matter of patience while standing in line to make a contact . . . and a matter of impatience while waiting for incoming cards from the bureau.

It wasn't until I made my appearance on the 6 meter phone band that I realized what had happened to me and too many others on the air. After lashing together a 5-element beam, I couldn't find anyone interested in helping me run on the air checks. I discovered the catastrophe of QRU.

At present, you can find me on 20 meter CW and SSB. Along with checking out Hallicrafters' new Cyclone SR-400, I'm still experimenting with antennas. Any contact with me (WΦOIZ) these days will be devoid of QRU.

The Incoming Mail

Since our readers know when we have gotten off an especially good issue, we do not clutter our column with letters complimenting us for doing our job. Fortunately, a great many of the letters to the BE editor concern hints and kinks in broadcasting. And if the idea warrants coverage and the schematic is readable, we run them in Engineer's Exchange. While the pay for exchange items is not high, there has always been keen interest in this column because it is one more place in our magazine where engineers can talk to engineers.

In some cases, we feel the writer has such a good idea that we return his exchange item and ask him to enlarge it into an article. If you have an exchange idea, send it in. And if you want to take a shot at writing an article, drop us a line and ask for a copy of our author's guide.

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INDUSTRY NEWS

Commission Proposes Rules For AM, FM, Translator ID's

A Notice of Proposed Rule Making (FCC 68-701) released July 9, 1968, proposed revision of the rules for broadcast of station identification announcements by AM and FM stations (Sections 73.117 and 73.287) in response to a petition for rule making filed by the Columbia Broadcasting System, Inc. The Commission proposed to conform Sections 73.587, 73.652 and 73.787 of the rules by amendment. These sections respectively govern the identification of noncommercial educational FM, television, and international broadcast stations.

The only change with respect to the prescribed times for broadcast of regularly scheduled identification announcements, the Commission said, is the elimination of the option of quarter-hour announcements.

Stating that it expects licensees to act "reasonably and in good faith" in arranging programming so as to make identification announcements at regular times without undue disruption of program continuity, the Commission emphasized that licensees are expected to observe the regular identification times unless there is a substantial reason in the form of undesirable interruption to program continuity for not doing so, and if an announcement at the regular time is omitted for this reason, to present it at the earliest opportunity.

Taking into account suggestions concerning the need for more than one deferred announcement where a regular ID is omitted, and for making a deferred announcement when a regular announcement is due shortly after the first opportunity for the deferred announcement, the Commission pointed out that a deferred announcement is to be made at the earliest opportunity (instead of both then and at the end of the program, as was proposed) and that it is not required if there is another, regular announcement within the next five minutes. "It appears," the Commission said, "that these simplifications can be made consistent with prompt identification of the station for technical monitoring purposes."

Sections 73.117, 73.287, 73.587 and 73.652 were revised to state: "See Section 73.1201." Section 73.787 was amended by revision of paragraph (C) to read: "International broadcast stations shall comply with the provision of Section 73.1201 (d) and (e) relating to the avoidance of program interruption for regular station identification announcement." New Subpart H of Part 73 has two sections: 73.1001, Applicability, and 73.1201, Station identification.

Translators

Television broadcast translator station identification requirements have been relaxed by the FCC in a Report and Order amending Sections 74.750(c) (7) and 74.783(a) of the rules (Docket 18568, RM-1367). The rule changes became effective December 19, 1969, although present forms of identification may continue in use until December 31, 1970.

By Notice of Proposed Rule Making (FCC 69-641, released June 9, 1969) amendment was proposed of Section 74.783 of the rules for translator stations with over one-watt transmitter power on a petition for rule making by the National TV Translator Association. Elimination of the identification requirement was requested, or change to allow compliance with the requirement by arrangements with the primary station to present the identification.

For translators of more than one watt but no more than 100 watts peak visual power, the Commission said that identification by the translators themselves is not necessary, provided suitable arrangements for their identification through the primary station are worked out and implemented. It added that since approximately 80 percent of the UHF translators authorized are in the 100-watt class, to make any relief meaningful, the new rules should apply to all translators up to

"FUNNY! THIS WASN'T FED INTO OUR AUTOMATED PROGRAMMING!"

World Radio History

(Continued from page 10)

and including 100 watts, except one-watt translators.

To achieve identification in place of the translator's own transmission, a two-part arrangement will be required. The primary television station being rebroadcast shall display twice during each of two periods of the day, a list of the call letters and location of translator stations rebroadcasting its signals. For TV stations operating from 12 to 24 hours a day, the list is to be displayed twice during the periods 7 to 9 AM and 3 to 5 PM (local time) daily, at intervals of not less than 30 minutes during each time period. Television stations which do not begin the broadcast day before 9 AM are to display the list four times a day during the hours closest to the periods 7 to 9 AM and 3 to 5 PM at the specified intervals. As a guideline, the Commission suggested that where a primary station lists numerous translators, not more than 12 should be listed on each slide and that each slide should be displayed for three seconds, or one second per translator listed on it, whichever is less.

FCC Proposes TV CP Extension To 18 Months

An extension of time from 8 to 18 months for UHF-VHF permittees to construct has been proposed in a Notice of Proposed Rule Making.

The proposal would amend Section 1.598 of the Rules, which at the present time provides that, "Each construction permit will specify a maximum of 60 days from the date of granting thereof as the time within which construction of the station shall begin and a maximum of 6 months thereafter as the time within which construction shall be completed and the station ready for operation, unless otherwise determined by the Commission upon proper showing in any particular case."

The Commission noted that actual construction techniques have altered, equipment for the stations has become more complex, and business decisions involved have multiplied. It said that one of the most complex tasks for a UHF permittee is negotiating for, and finding, either network or independent programming of the quality necessary to make a new UHF station competitive and able to survive. The remaining VHF channels are predominantly in small cities and towns with problems not dissimilar to UHF channels.

Parties commenting on the rule making proposal were asked to keep in mind that the Commission intends to provide additional time necessary to construct only when the permittee "pursues his task with due diligence."

Although the rule making proposal is specifically directed to extension of time for UHF-VHF permittees to construct, interested parties have been requested to comment concerning the problem for standard and FM services.

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NAB Stays Hot On Tariff Trail

The National Association of Broadcasters and the Intermountain Network have asked the Federal Communications Commission to reject as unjustified higher rates proposed by the American Telephone & Telegraph Co. for transmitting radio programs.

If the Commission decides against rejection, they said, it should at least suspend the proposed rates pending the outcome of hearings scheduled on the principles and factors governing radio and television program and private line transmissions.

NAB estimated in a previous filing that the higher rates proposed by AT&T would add $3.5 million annually to radio program transmission costs.

In a new petition filed jointly, NAB and the Intermountain Network said FCC itself gave "sufficient reason" for rejecting or suspending the proposal previously when it deferred its effective date for 90 days—from last Nov. 1 to next Feb. 1. At that time, they noted, FCC said if the higher rates were permitted to become effective Nov. 1 "the rights and interests of the public may be adversely affected."

"By suspending the proposed tariff for only a period of 90 days," the petition said, "the Commission has failed in its responsibility of adequately protecting the public. . . The three-month suspension is an inadequate, halfway measure which is contrary to the Commission's finding of significant adverse economic injury."

The petition predicted "severe and adverse results of a significant magnitude" if FCC permits the higher tarriffs to become effective Feb. 1.

"Regional networks and probably some national networks," their petition said, "may be required to curtail service and to revise affiliation agreements in order to reflect such higher line charges or to place the economic burden directly on the affiliate. Many stations, particularly those in remote sections of the country, will no longer be able to afford continued network affiliation.

"Many popular program features such as area and regional sporting events will have to be eliminated from the schedules of stations. The resulting withdrawal of network service will cause a curtailment of news and public affairs programming in communities where the local station may be the only source of national and regional news."

NAB and the Intermountain Network said AT&T has failed to date to "explain the reasons for these proposed changes or to show facts justifying the rate increases."

The petition said an examination of various AT&T reports shows a "revenue per circuit" of $485 in 1968 for all private line service, but $8,852 for audio, or a revenue for audio of almost 20 times the average. AT&T's "per circuit" revenue from audio, it said, was "almost 60 times as great as its return from telephone, six times as great from each Teletype and Telegraph, and twice as great as its return from Telpak."

On a "per pricing mile" basis, it said, the average return to AT&T last year was $9.00, while audio revenue was "twice as great."

Spotmaster

TP-1B Tape Cartridge Winder

This rugged and dependable tape winder fills a need in every station using cartridge equipment. No longer is it necessary to restrict your cartridge operation to stock sizes, or to tie up your conventional tape equipment loading cartridges. The TP-1B handles all reel sizes (up to 3600' of 1 mil tape), winds new or old cartridges in any length. Available with or without Spotmaster tape timer, providing precise minute and second calibration for creating exact-length tapes. TP-1B is $99.50, with Tape Timer $124.50. Lubricated tape and empty cartridges are also available.

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EDUCATIONAL BROADCASTING

Looking Inside Non-Commercial Broadcasting

MCI Proposes Microwave Plan

A low-cost educational communications network which would utilize facilities of customized microwave communications systems has been proposed to the Federal Communications Commission by Microwave Communications, Inc. (MCI).

MCI's plan would provide educational entities with an inexpensive national network over which they would have complete control, according to MCI. Non-commercial stations presently in the Public Broadcasting Laboratory network are dependent on the tariffs and scheduling offered by the Bell Telephone System, and ETV program time can be pre-empted for commercial broadcasting.

MCI would be assisted in this effort by Microwave Communications of America, Inc., a national service organization helping to establish a series of independent MCI-type microwave systems.

Under the MCI proposal, the MCI systems and existing CATV microwave facilities would be used to interconnect the 58 stations new in the PBL network, plus an additional 28 educational stations.

As an alternate approach, the MCI proposal suggests the present PBL network might be maintained, but expanded with the additional 28 stations interconnected by existing CATV systems. This could be accomplished at a cost of about $2-3 million, with operating costs running between $36,000 and $45,000 per month.

Audio signals for educational radio broadcasting can easily be superimposed on the video channels of the network, MCI points out, and the MCI national system would be willing to offer this service free of charge.

"In establishing this educational network, all the various facilities, carriers and entities should be interwoven with one another to form the most flexible and economical means of obtaining a national network for the educational broadcasters," the MCI proposal emphasized.

In addition to facilitating radio and television transmission for educational stations, MCI said its national system could also serve as a communications link-up among colleges and universities to tie together their various library, computer, re-

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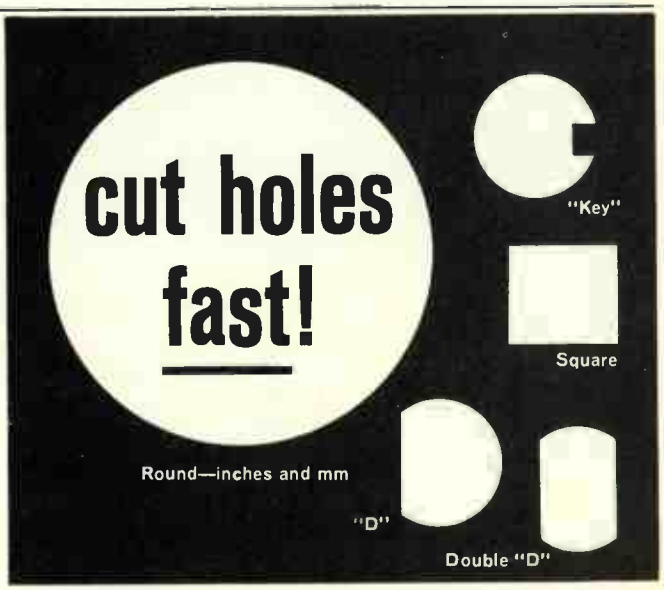

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search and other facilities. Use of the network for this purpose is now under consideration by Educom (Interuniversity Communications Council), an association of 100 universities which coordinates usage of university resources.

Since it would be under full control of educators, the MCI proposed network could be used during the time when there are no network programs for data transmission, computer usage or for taping programs. Future innovations to the basic network, MCI pointed out, could give local ETV stations the ability to distribute their programs over the network, to record programs for local distribution and to share a common computer facility.

Harley Continues NAEB Plea

William G. Harley, President of the National Association of Educational Broadcasters, testified in late November before the Subcommittee on Labor, HEW and Related Agencies of the Senate Committee on Appropriations and asked for approval of a $15 million appropriation for the educational broadcasting facilities program and $20 million for the Corporation for Public Broadcasting for fiscal year 1970.

"We urge your approval (for the facilities program) for the full amount authorized by the Public Broadcasting Act of 1967", he said. "Anything less will work a serious hardship in a program which has proven its effectiveness in many ways."

Harley reviewed the success of the educational broadcasting facilities program beginning with the Educational Television Facilities Act of 1962. "A total of $36 million has now been obligated since the first grant in 1963, in 190 grants to 177 stations in 47 states, the District of Columbia and Puerto Rico," he noted. When that program began there were 78 ETV stations on the air; today there are 185 stations broadcasting, with 26 under construction, he stated. "More than half of those now operating owe their existence to the assistance provided by the ETV Facilities Act," Harley declared.

Explaining the success has been accomplished "with modest Federal expenditures", the NAEB President said: "For every Federal dollar which has been spent on the initial capital investment in ETV facilities, the states and the communities to be served have pledged more than two dollars of their own. The cumulative figure for all sources of funds since inception shows a Federal share of less than six percent, a non-Federal share of 94 percent. The Federal assistance, then, has had a multiplier effect by a ratio, in fact of almost sixteen to one."

Harley said reports that the Department of Health, Education and Welfare "may be considering an actual expenditure for the facilities program of less than half the budgeted amount" would be a "tragic decision." He said that would be "of even more concern to us than the low level of the budget recommendations."

Turning his attention to appropriations for the Corporation for Public Broadcasting, he again urged the full $20 million appropriation. "We are aware that this request, too, is greater than the amount requested by the President. When the authorizing legislation was being considered by the Congress, the Administration recommended an authorization of only $10 million.

Citing what effect educational broadcasting can have in the schools, Harley said that with adequate appropriations it "can continue to improve and expand in services to the schools . . . It is an economical means for making a national effort to improve the instructional process for the benefit of all."

Harley Sums Up

He concluded: "It is because a well-equipped, widespread, adequately financed system of educational broadcasting can contribute so significantly to the well-being of our nation that the NAEB urges the Committee to recommend appropriation of the full amounts authorized by the Congress for the educational broadcasting facilities program and for the Corporation for Public Broadcasting."

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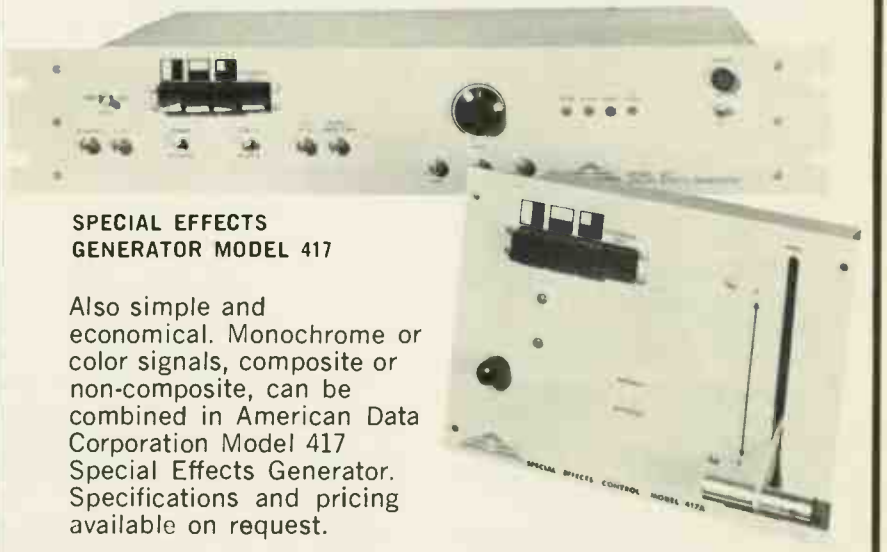

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SCANNING THE CATV SCOPE

By Harry Etkin

Who Will Fix That Receiver?

CATV has now developed in the major television markets with approximately six (6%) percent of all TV homes connected to a cable system. It seems likely that there will be at least 6,000,000, with an ultimate count of 17,000,000. subscribers within the next ten years.

With approximately twenty two (22%) percent of all TV homes connected to CATV systems in the very near future the major realistic problem would be, who is expected to provide service to the CATV subscribers' TV sets? The TV cable system technician or the local TV service company technician?

In the CATV training courses offering specialized training in CATV by NCTA, CATV technical schools and TV cable equipment suppliers, the CATV system operators, engineers and technicians are usually introduced to techniques of preventing signal loss at the TV receiver, knowing how much amplification to insert at a weak point and how much attenuation is inserted to reduce a strong signal that might be causing receiver overload.

The CATV technician or installer after installing the 75 ohm coaxial cable through the walls and providing a good grounding system for protection against lightning, will stop his work at the back of the subscriber's TV set. A 75 ohm coaxial cable from the subscriber drop is then connected to a transformer which changes the cable to the desired 300 ohm impedance necessary for the TV antenna terminals.

The subscriber at this point should have available 1000 uv of ghost-free signal on all the system channels. In some cases the CATV signal fed to the TV receiver may overload an aging TV set and will produec a distorted picture. Present CATV industry practice forbids the technician to touch anything beyond the TV set's antenna terminals. Troubleshooting for problems inside the subscriber's TV receiver must definitely be handled by a regular TV serviceman.

Adjacent Channel Rejection

Many TV receivers in the low to medium price class, especially the transistorized variety, do no perform well with adjacent channel CATV input. Many produce cross-modulation and adjacent sound beat and the need to reduce audio levels on the system to the point where some marginal TV receivers can scarcely reproduce audio signals.

Converters incorporating adjacent channel traps with a minimum of 20 dB attenuation completely overcome both problems at the TV receiver. In general, if every receiver were equipped with a converter, the audio levels in the system could be raised to the normal FCC specified level of −10dB instead of the −15 to −20dB level which most CATV systems struggle with.

Direct Pickup

This type of interference occurs whenever the TV signal arrives at the signal element of the first detector of the TV set by more than one route. The desired signal is fed by the cable, but the undesired signals arrive by leakage. Direct signal pick-up can definitely degrade the quality of the subscriber's picture.

Since many TV receiver tuners usually provide 14 to 20dB or more rejection of in-phase signals applied to the balanced input terminals, the problem is minimized by using a well-balanced balum transformer from the CATV system house drop to receiver antenna terminals. When the cable itself is free of direct pick-up, some CATV system operators have provided subscribers with a set top converter which changes the incoming signals to a single, locally unused channel.

To function more effectively with CATV systems, it would be advantageous for the CATV system operator to maintain a procedure so that the TV receivers could benefit from improvement in adjacent channel rejection and in immunity to direct pick-up. To achieve this standard will permit the CATV system to function as an essentially distortionless link between broadcaster and viewer.

Isolation of the interference can be accomplished by connecting a shielded TV set to the subscriber's drop. A battery operated portable, small-screen TV receiver mounted in a metal box with the picture screen only partly uncovered can be used for this purpose. The balum transformer is set up so that the drop cable shield is connected to the TV receiver's shield box. If it happens that there is a direct-pickup effect shown on the receiver screen, it is almost certainly due to cable system leakage. It is essential that the direct-pick-up leakage into the cable distribution system is isolated and corrected.

If the TV test receiver produces a picture free of direct-pickup, it may safely be concluded that any direct-pickup observed on the subscriber's TV set is in the receiver itself.

Statements of Policy

Comments included here on servicing were among those available at press time and offer a practical solution to this problem.

Thomas F. Wilson, NCTA Public Relations Department, has said:

"Although NCTA has no official policy on the question of servicing and repairing TV sets for CATV subscribers, the general consensus is that it is not a good practice.

"The rational behind the Fortnightly decision, was that CATV was performing a reception service. When system operators get into the business of leasing or repairing receivers, this is no longer valid.

"As you may know, earlier opposition to CATV by the receiver

World Radio History

service industry was muted by the fact that most systems operators chose only to sell a reception service.

"On the local level, servicing can often result in problems for the CATV operator. For instance, if a system employee on a service call goes beyond the terminal point in checking faulty reception and reception and removes the back from a set, and the set stops working for any reason, it could create a real headache for the system.

"Finally, we recommend that if a system operator's employees moonlight by servicing sets, the employee should not wear a company uniform on these calls. Possible unsatisfactory service by a person wearing the uniform might be identified with the system."

Firm "No" From Teleprompter VP John Barrington

"The answer is that we do not ever perform such services and, as a matter of policy, we do not believe it is in the best interests of the industry to do so except in most unusual circumstances (for instance, a very small system that could not exist independently of the service business).

"Our reasons are the obvious ones:

1. We'd rather have an independent service and repair (and for that matter TV receiver sales) industry as a friend rather than an implacable enemy. Some very successful CATV sales campaigns have developed through recommendations from and tie-ins with dealers and repairmen.

2. It's to our clear advantage to be able to isolate problems on service calls and to say, "Yes, this is a CATV problem," or, "Sorry, the trouble is in your set". We are thus enabled to concentrate on what we're supposed to be selling, and at the same time, we gain credibility with the subscriber by not specifying repairs or service that forces him to dig deeply into his pocket.

"I think it should be noted that, if present set manufacturers cannot, or will not respond to the challenge of broadband communications and if they refuse to acknowledge their basic responsibility to produce sets that are properly shielded against interference, ambient signal pickup and harmful emissions of x-rays, etc., the CATV industry will be motivated to develop satisfactory receiving units on its own. There already is considerable research in this area, as you doubtless are aware. Presumably the consumer outlets still would be dealers who were independent of the CATV industry, but it is a point worth thinking about."

Cox Cable's engineering VP, Douglas C. Talbott, also has said, "For several years our company has had the policy of not entering into the TV servicing in any of our systems. We find that set servicing not only complicates operations, but also creates PR with the local TV repairmen."

Ultimate Solution?

CATV was developed to sell sets, without question adjacent channel and direct pickup interference plagued CATV system operators. Relief was provided by the balum or converter transformers, but to accomplish the major solution TV manufacturers must offer the CATV industry a CATV receiver.

Many CATV operators have expressed the view that the TV receiver industry should or will soon come forth with a shielded multichannel TV set which will make converters unnecessary.

TV manufacturers indicate this may happen over a long period of time since the total number of CATV subscribers are but a fraction of the 70,000,000 television homes in the U.S.A. Therefore, they refrain from "loading" the other 90% of the market with costs of a new TV receiver. This does not presently justify the initiative and investment required by the industry to manufacture special CATV receivers. If they presently started and sold nothing else but these ideal CATV sets, it would take at least ten years to turn over the present inventory of sets in use.

Another question of the CATV industry is, what of a special CATV receiver to be leased to subscribers as a part of the services? Does the CATV industry really wish to get into the TV receiver business, and does it really wish to alienate the TV dealers?

Under the Wired City concept, the CATV receiver can be built to accept superior methods of distribution. With this type of cable tele-

(Continued on page 18)

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(Continued from page 17)

vision system the subscribers are uniquely provided a compatible transition from present TV standards to something better. Both the standard and the improved signals could be carried on the CATV system at one time. The subscriber would make the decision about when or whether to replace the standard receiver with a new model adapted to the special high quality cable signals.

An excellent example of the wired city concept is the Hong Kong case. It is probably the only area in the world which contains an all wired TV and aural programming facility. The CATV system consists of two TV channels and four sound programs. There are approximately 110,000 subscribers served by two coaxial cables and four audio pairs in a system operated by Rediffusion Limited.

Rediffusion controls the entire CATV system from studio camera to viewer's receiver. This simplifies the technical coordination. This CATV system operator operates and maintains all trunk lines, repeaters, subscriber drops and it sells and services the TV sets. The TV signal is distributed as directed video and the sound programs are fed into the cable at an audio level sufficient to operate a speaker. The most unusual aspect of the system is that the TV receiver sold to the subscribers has no front end tuner or I-F strip. It is the company's intention to also modify all the standard antenna/tuned type TV sets that are being used to pick up programs from the nearest TV transmitter.

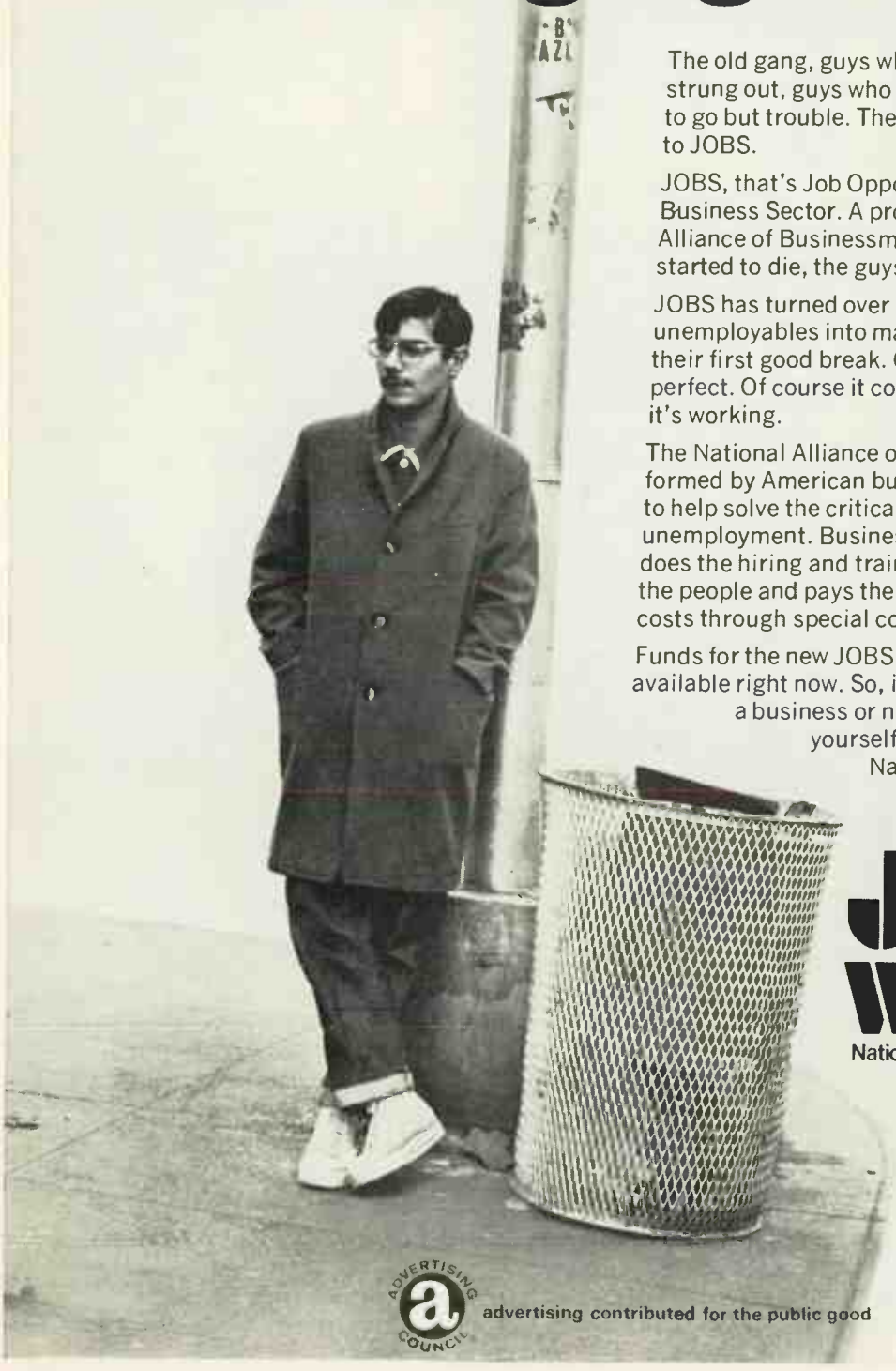
Test patterns are normally fed through the CATV system at scheduled periods during the day and the picture quality is monitored throughout the entire network. To keep the more than 80 miles of transmission cable and equipment in good operating condition, usually 80% of the engineering staff's time is devoted to network and subscriber equipment maintenance.

BE Invites Your Comments, Ideas

Send your comments on this and other CATV subjects of interest to: CATV Editor, Broadcast Engineering, 1014 Wyandotte, Kansas City, Mo. 64105.

World Radio History

JOBS is breaking up that old gang of mine



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Talking with computers

By Morris Courtright

Chatting with a computer can be a rather complex, sometimes frustrating and costly endeavor. And two things a broadcast station does not need are needless cost and frustration. The machine called computer, with its highly touted intellect, neither reads not speaks; unless you do so on its terms. A digital computer understands only the binary language of "ones" and "zeros", and all information for the computer must be represented by such binary combinations. Attempts to do otherwise can produce psychotic results in both man and machine.

Consequently a multitude of electromechanical devices, such as those in Figure 1, have been developed to convert the computers' electronic dialect into English. Known as Input/Output (I/O) equipment, such contrivances include magnetic tape units, card punches and readers, magnetic disk and drum, cathode ray tubes, printers, typewriter or teletype keyboards, and even optical or magnetic ink character readers. They all have the common purpose of providing the computer with information in a form it can understand.

The actual format of the binary digits (bits) varies, depending on the nature of the device and particular computer involved. In the binary system itself, a decimal number is represented by a series of 1 and 0 bits. (Binary is a numbering system with the base 2; the decimal system we are familiar with has the base 10.) For example, the number 25 is 11001 in binary, 2 is 10, 4 is 100 and 8 is 1000.

You can see that for simple numbers the binary equivalents are also simple, while they can soon become quite cumbersome for large numbers; $5000_{10} = 001001110001000_2$. Other numbering systems are also used, and they include Octal (base 8) and Hexadecimal (base 16). As an example, $10100_2 = 24_8 = 20_{10} = 14_{16}$. The important point, however, is that mathematical wizardry is not needed to work with modern day computers. The I/O device does all the conversion for you, just as the teletype sends out a coded pulse train when a key is depressed. Other than numbering systems or format, the major difference in I/O devices is the medium used to represent the data or information. The most familiar of these media being the punch card and magnetic tape.

Do Not Fold, Spindle or Mutilate

A punch card (frequently called "IBM" card) with the alphanumeric coding is shown in Figure 2 along with a typical keypunch machine. Depressing a key on this machine automatically converts the character to the proper Hollerith coding and punches the holes in the card. The computer then interprets these punches as the binary combination of ones and zeros representing the desired character. Keypunches may or may not print the corresponding characters along the top of the card

Morris Courtright

As the broadcast industry splinters into more diverse interests and areas of specialization, **Broadcast Engineering** magazine over the years has attempted to keep pace by drawing on the talents of those recognized as innovators and leaders who can bring to our readers the vital up-to-date information they need.

Beginning with this issue, we are adding an editor in the vast and mysterious area of automation. Already known to some readers for his articles "The Big Computer Mystery" and "Lighting The Scene", Morris Courtright is well qualified as an editor in several respects.

Closing in on his discharge after 20 years in the Air Force, Morris Courtright at present is the Chief of Computer Operations for the Satellite Test Center in San Jose, California. And if this isn't enough to keep a man busy, he is one of those rare Professional Engineers. In his "spare" time, Courtright puts his diverse background to work as a consulting engineer.

Some of his more recent assignments were at KPER-FM, KAZA, and KEGL. Earlier, Courtright had been on the engineering staff at WMEG.

An author of many technical articles, our automation editor has worked as an electrical engineer at Cape Kennedy, where he planned, developed and operated tracking systems for many of the Mercury, Gemini and Apollo flights. In fact, he has received awards for landing point prediction and radar system pointing system development.

Courtright's other accomplishments would make a long list, but some of the highlights include: EE Degree from University of Colorado; First Phone with radar endorsement; photo-radar interpretation; technical instructor; Commercial photographer; and even a stint at the Florida State Fire College.

After laying the groundwork for understanding automation and how computers complement station operations, readers can expect to see Morris Courtright launch BE into a series of articles that will pinpoint the state of the art and, perhaps, predict our future in this aspect of broadcast engineering.

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Fig. 1a Typical computer I/O devices include the magnetic disk pack.

Fig. 1b Cathode ray tube unit for controlling data.

depending on the model used.

The Hollerith code is named for Dr. Herman Hollerith, a Census Bureau statistician, who worked out the coding in 1887 to record data crosswise on long strips of paper. The coding system was adopted by IBM for its punch card system, and is so well known because it has been around for so long. This is the code you see used in so many commercial billing systems. (Take a look at the next one you receive, compare it to the code shown and find the punches representing your account number and amount owed.)

In practice, a line of information (record) is punched into each card, and the group of cards arranged in sequential order to make up the "deck" (file) to be fed into the computer. The terms data item, record, and file are names given to the way of organizing information to go into a computer. Information such as name, account number, quantity or price are called data items. The like items are always placed in the same area (field) of a punch card so that the computer will know where to look for it. The group of items that are related, or treated as a unit, is a record. A record may be all on one card or it may be on more than one card. The entire organized collection of information is a file. In a punch card system the group of cards comprising a file is referred to as a deck.

At The Station

For a broadcast operation, the deck containing a card for each program item is fed into the computer through a card reader. Each card is punched to include time, program, duration, source, type, etc. The cards may all be read immediately into internal storage for later use throughout the program day, or they

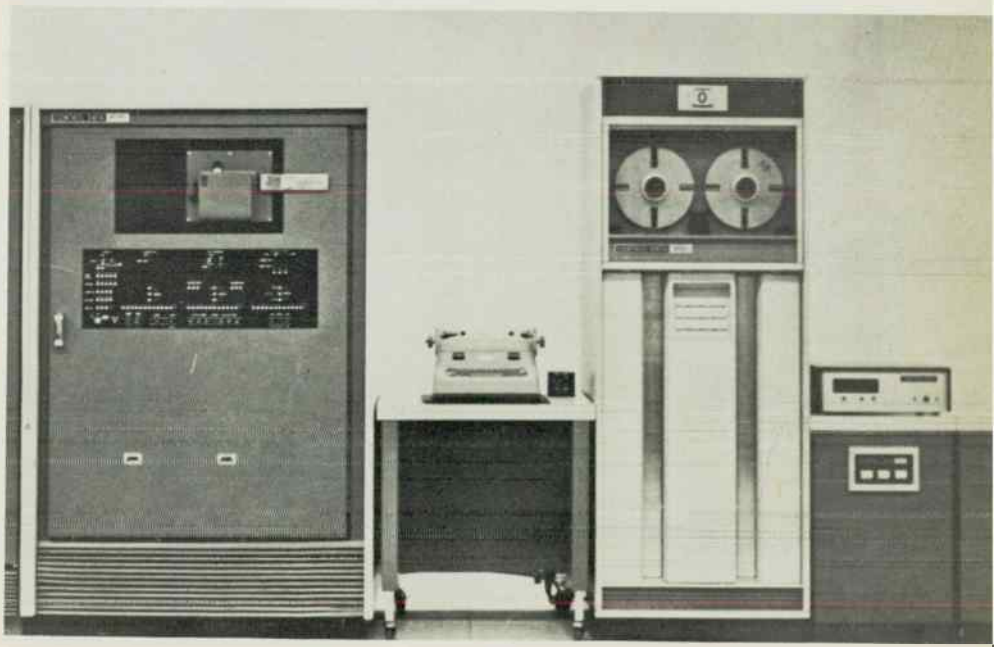

Fig. 1c A small, compact digital computer with typewriter, paper tape and magnetic tape.

World Radio History

may be individually read-in at the appropriate time during the day.

Cards may also be used by broadcasters to perform the clerical operations of log preparation without automating station operaions. Decks are assembled and listings (printouts) made for use as the program log or as a guide for pre-recording hourly tapes. These same cards can then be rearranged to produce listings by advertisers, program category, salesman, etc. The same equipment (usually standard business data processing equipment) can also be used to prepare customer billings, mailing lists, supply records, and even the payroll. Such use more properly belongs in the realm of bookkeeping and is not really broadcast automation.

Station Automation

One approach to broadcast automation is to start with business oriented equipment and, as one use, produce music listings and program logs for on-air use. The next step is to add the equipment for automated airing of the program material prepared from the listings, and eventually go into a fully automated system. This approach, however, may complicate a later desire to add a broadcast computer, because a change of media may be required and media changeover can be expensive.

In a punch card system the keypunch is just one of the machines that will be needed. The sorter is used to arrange the cards into the various sequences desired, is merely a handling device, and does actually connect to any computer. It is a necessary time-saving device if many cards are to be frequently rearranged. However, if the card deck is to be maintained in one basic sequence and only individual cards periodically replaced, the sorter is not needed. For example, if the basic program log is punched into cards and the deck arranged in time sequence, with the only spot cards to be changed from day to day, the job may easily be done by hand.

To rearrange the cards for listings of spots by advertiser and then restore the deck to program sequence will require a sorter, or many hours of manual labor. In a more sophisticated computer system the sorting can be done internally within the computer logic without physically rearranging the deck.

Fig. 2 IBM keypunch machine for punching codes to represent alphanumeric characters by combination of holes.

Magnetic Tapes

Information may also be recorded on magnetic tape for entry into a computer. Rather than punching holes in a card, small spots on the tape are magnetized. The format of the information may be that used with punch cards; however, this method is rather wasteful of tape area. As a result there are many other methods used to code the data and organize it in some sequence the computer will recognize. The particular one used depends on the machine involved, but in general consists of 1 and 0 bits written in a column across the tape to represent a character.

Reading and writing is done by heads similar to those on audio tape units. The major advantage of tape is the higher speed of data entry into the computer. In tape oriented systems, sorting and rearranging of data is done within the computer electronics. Magnetic tapes are widely used in business and scientific applications, but the high cost of tape units has restricted their use in broadcasting applications.

Another common method of talking to a computer is use of a typewriter or teletype keyboard. When a key is depressed the coded signals representing the character are entered directly into the computer instead of producing holes in a card. These units also have a paper carriage to produce a record of the data entered, and using signals from the computer, print out data from the machine.

Typically, this is the unit that produces the program log. Figure 3 shows the typewriter and card reader used with the IGM 600 system. Program information is entered via the card reader and the typewriter prints out the information from each card as it is read (and the material aired) to produce the FCC log. In the Schafer system, typewriter or teletype units are used to enter data directly into the computer as well as produce program and technical logs.

Direct input access via a typewriter or teletype generally indicates a more sophisticated, flexible system with more capabilities. It also indicates a more complex machine with perhaps higher costs.

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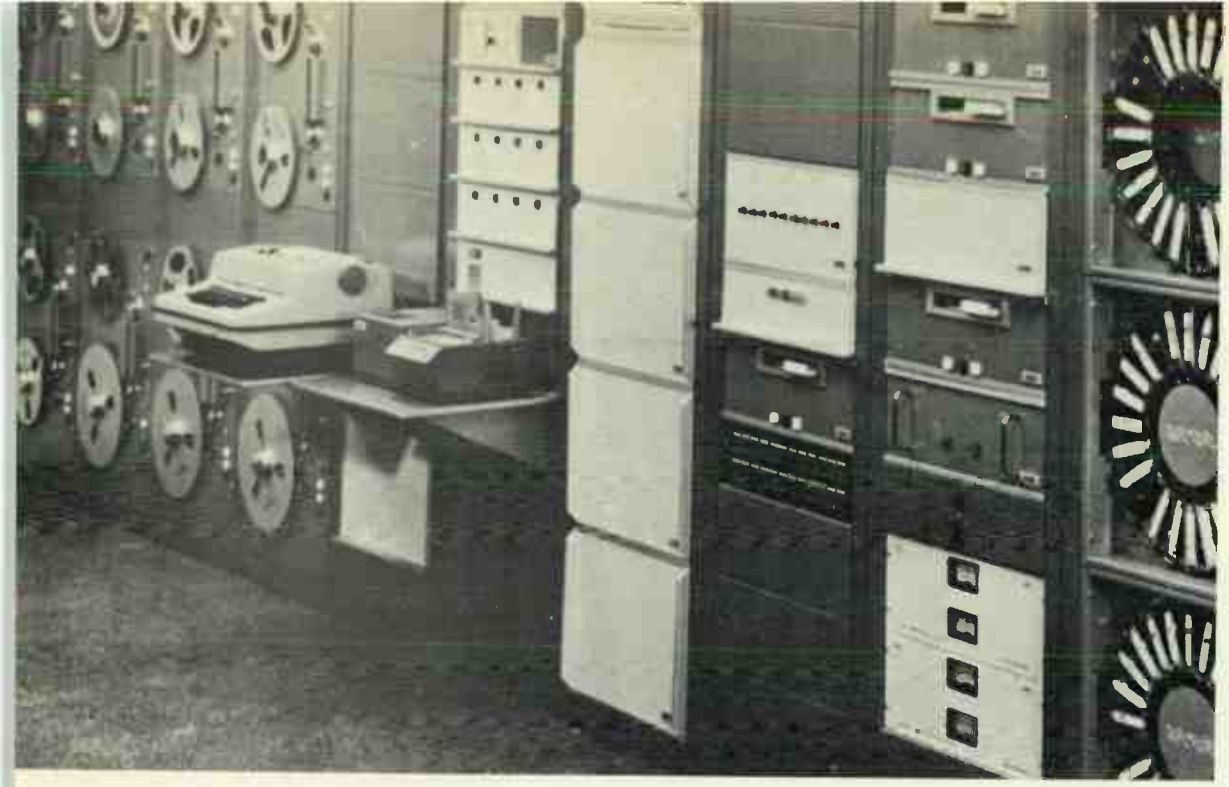

Fig. 3 The IGM 600 system uses a card reader to input program information. The typewriter produces a log by typing out the information on the card as it is read by the system. The typewriter also is used to make real-time changes or corrections to the log.

Only perhaps, because the less complex systems have assorted costs for manual operations that may be needed to work around the limitations of the system.

Time Sharing System

Of rapidly increasing popularity in the business and scientific world is the use of time sharing systems. A large central computer serves many customers via typewriter or teletype devices. The terminals are connected to the computer either by hard-wired circuits, or through the normal telephone by use of acoustic couplers. Since the computational speed of a large computer is so much faster, it can time share between the various terminals without the user realizing it.

Many other media are also used for data transfer to and from a computer. Punched paper tape, cathode ray tubes, magnetic disk or drum, optical character or magnetic ink character readers. Currently, most of these media have limited application in broadcasting. The Schafer PCS-1000, however, does use a high speed disk. The magnetic disk has the advantage of random access to data items, while tape or cards must be read sequentially to locate a desired item.

The conversion of station operations to computers is influenced strongly by the media chosen to converse with the computer. The media, in turn, depends on the flexibility and speed desired in the system. In any case, it is essential that the engineering staff become aware of the capabilities, and problems, associated with the various media available. It is also quite important for management to compare the benefits to be gained with the cost of the media. In general, the less sophisticated the system the higher the personnel costs to perform associated manual functions. This is assuming the attempt is made, as it usually is, to exceed the limitations of the system.

Conversely, the more complex the system, the higher the cost of the system and the cost for knowledgeable people to derive maximum benefit from the system. The exact point of maximum benefit for minimum dollar is determined by the tasks to be performed by the system, and varies widely from station to station. However, it can be safely predicted that shaving costs in the initial acquisition, and then expecting more from the system at some later date, will result in higher costs in the long haul.

System Economics

No hard and fast, simple rules are available to guide the decision. The reasons advanced for adopting a particular automation or computer system is, of course, influenced by the approach of the manufacturer involved. Generally, the sophistication of the system is directly related to the media used to transfer data. A particular method is better than another only as it pertains to your exact requirements. Basic to all, nevertheless, are the unforgiving laws of economics. Can your station afford the change? Both technically and economically?

A simple punch card system is relatively easy to adopt, and to understand. The point sometimes overlooked is that the workload on the traffic and clerical staff may actually go up, and more people may have to be hired. This is particularly true during the learning cycle when all are becoming familiar with the new media (punch cards versus pen and ink entries). A more complex system will do away with much of the manual work associated with punch cards, but will the operating staff be able to adapt to the new methods, and can the technical staff cope wih the idiosyncrancies of such a system?

Whatever the decision, choose wisely. Investigate the true capabilities of the media involved, realistically determine what you want the system to do both now and in the future, and carefully evaluate the full impact on total station operations. Conversing with computers can vastly improve your broadcast operation, or it can create more problems than it solves. Which can you afford?

World Radio History

Turning the Tables with Triacs

By Fred Moore*

Since turntables are probably the most used items in the average air studio, their location is a major factor in how easily the control room operates. In most contemporary music stations the turntable motors are switched off and on more than 30 times each hour. This makes the location of turntables and switches a major factor in the fatigue the announcer will feel after a couple of hours of air work.

With this in mind, the engineer should try and put these turntables in an optimum location. They should be where the announcer can start them easily, using the switches already built into them. To allow this, some engineers have located the turntables lower than the console deck level. Where this is not feasible we must provide remote switches in front of the announcer for controlling the turntable motors. An added convenience would be a lamp indicator to show which turntable is running. In our installation we also added the "cue" function to the start switches since these functions (stopping the turntable, cueing, then starting it always occur in sequence. If an announcer prefers to cue with the motor of the turntable on, he merely rotates the fader counterclockwise to the cue position as before.

The unit built at WQAM does not use relays. Most relays with a high enough contact rating to give long life while switching an inductive motor load, can cause noise that is easily picked up by the studio mike. The reverse-polarity "spike" is generated when a relay opens can cause troublesome noise in program circuits.

With this in mind, solid-state AC switches were used instead of a number of which would have been required. We used "triac packages" containing not only the triacs themselves, but also RFI suppression and commutating components as well. These are contained in an aluminum housing that serves as a heat sink for the triac. The General Electric S100G1 units we used will handle up to six amps of AC load current, so they are vastly overrated for this application. Our turntable

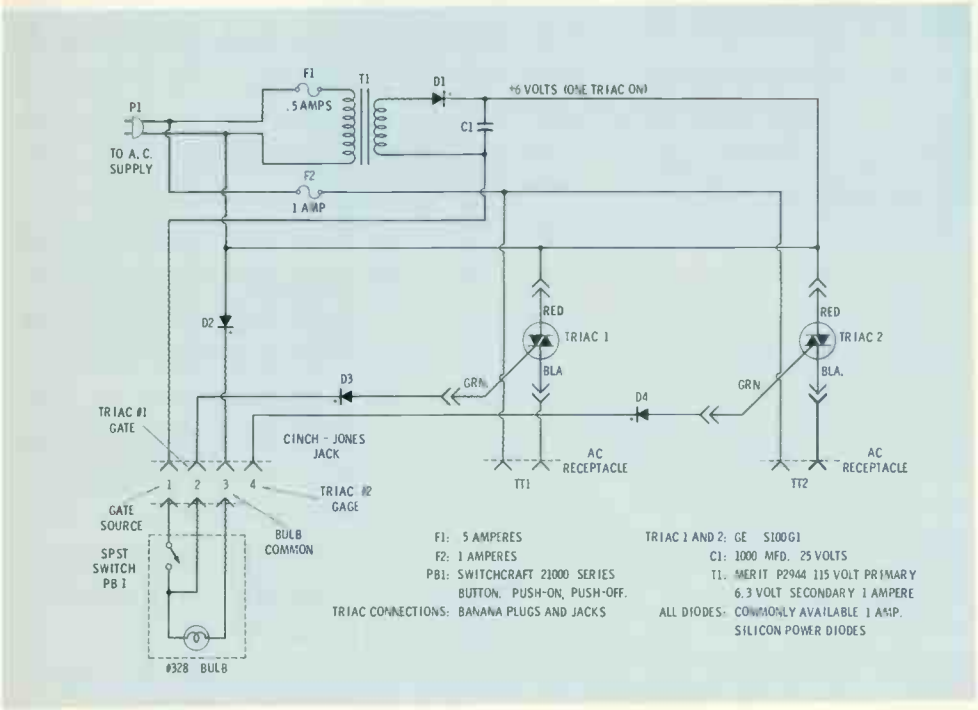

Fig. 1
Schematic for remote start TT Triac unit.

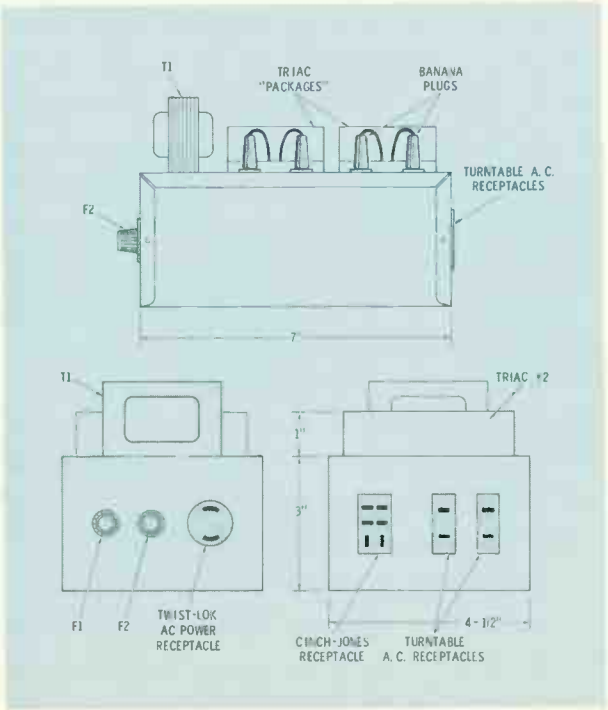

Fig. 2
Ends and top view of the remote TT unit.

*Chief Engineer, WQAM

World Radio History

controller switches static currents of well below one-half ampere. The "triac packages" cost about $5.70 each when we made the conversion.

Circuit And Functions

The triacs are gated by a simple half-wave rectifier power supply delivering six volts. The original model used no regulation elements since the triac packages contain a gate current limiting resistor to make the gate voltage rather non-critical However, a six volt zener diode could be used across the supply output to keep bulb brightness more nearly constant when both turntables are running.

Figure 1 shows the turntable controller schematic. The two turntable receptacles are the usual chassis-mount AC line type. To remote the turntables, the motors are simply unplugged from their outlets and plugged into the ones on the controller chassis. This allows the announcer to restore use of the tables in case of a blown fuse or component in the controller. He would simply plug the motors back into any wall outlet nearby.

When tables are used with the triac unit their local start switches are jumpered underneath the turntable body. It is best to use wire and a banana plug and jack so that the jumper can be unplugged for emergency operation (as explained before).

The turntable motors and the triac circuitry are fused separately since the motors draw considerably more current than the other circuits. Diodes D2, D3 and D4 prevent a series circuit through each #328 lamp into the triac gate when the start switches are open. The AC line plug P1 is polarized to connect the neutral side of the line to the triacs and the indicator lamps. This keeps line AC out of the start switches in case they are located inside a console, or in the event they have turntable audio on them.

In our installation we used Switchcraft 15000 series pushbuttons adjusted for latching operation, but lever switches would serve just as well. We also wired extra contacts on the buttons to connect the turntable preamp outputs to the cue bus when the buttons are in the "off" position. These buttons accept a T-1¾ type bulb which we wired to the gate of each triac. The bulb gets voltage from the same switch contact that supplies the gate of each triac which simplifies the switching. As an added convenience, we put banana plugs on each of the three triac leads to make replacing them easier in case of failure.

The triacs mount atop the chassis with #8-32 bolts through holes provided in the aluminum cover and each triac lead plugs into a jack. Both pushbuttons used for controlling the triac gates plug into the controller chassis by a four-pin Cinch-Jones connector.

This unit eliminates the nagging problems inherent in relays. Our unit has been in operation for almost a year now and has demanded no attention of any kind. Construction of the controller takes a bit more time than just wiring relays under each turntable, but once the controller is installed you can relax and let the DJ get on with his job.

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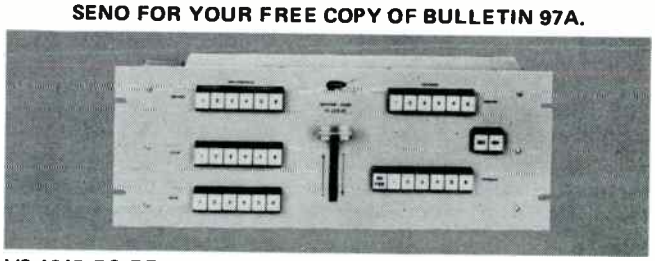

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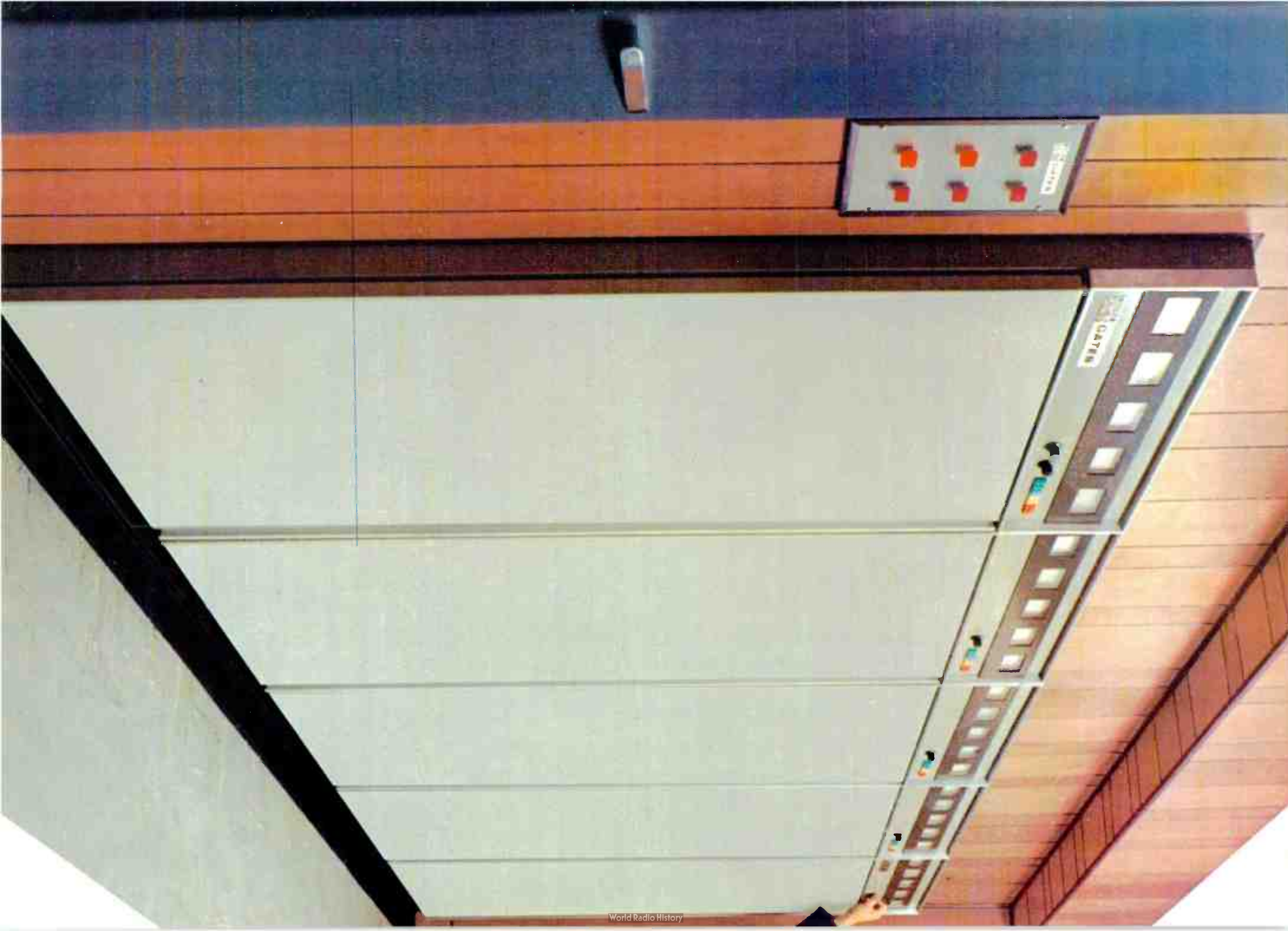

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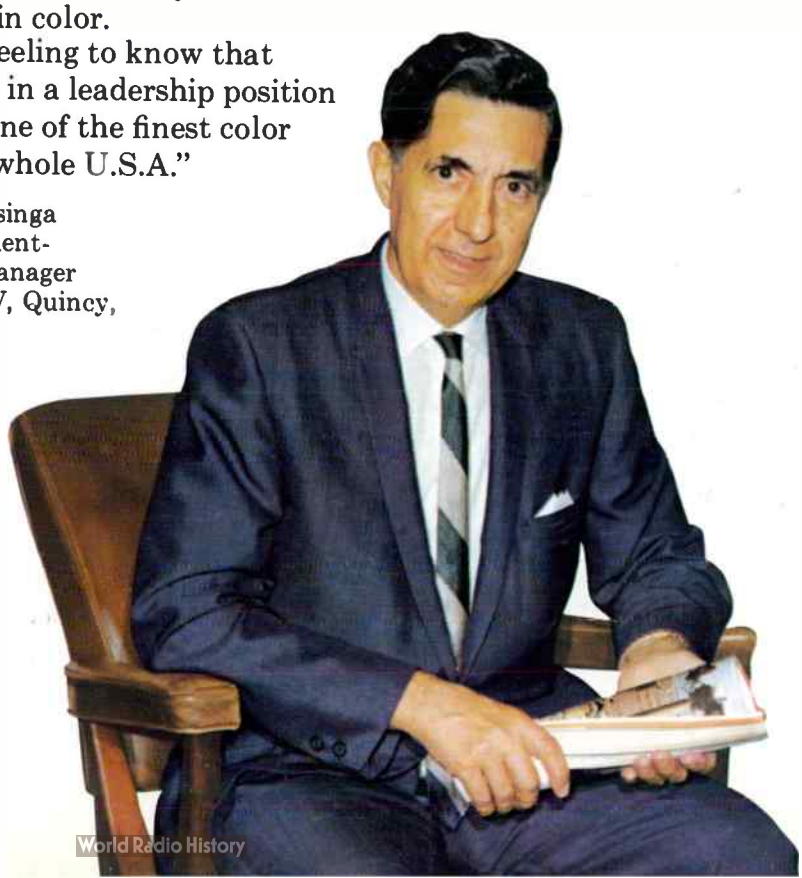

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Predicting UHF Coverage

By Pat Finnegan*

The amount of work entailed in predicting UHF coverage depends upon the purpose and the degree of accuracy desired. One who has only a casual interest can develop approximate figures by using the FCC charts and power/antenna height combinations. An operating station that may be considering an increase in power or another antenna location, will already have the major part of the basic information on hand. A completely new station, however, will have to start from the beginning.

Starting With The FCC Rules

Those sections of the Rules which are pertinent to these calculations will be found in Parts 73.683 (Field intensity contours), 73.684 (Predicting coverage), and 73.685 (Transmitter location and antenna system). The Chart 73.699, FCC Figure 9, is the one that is used for UHF.

The chart used for UHF is the same one used for the low band VHF channels. Consequently, for UHF usage it is not based on measured data. Actual signal coverage will be influenced by many variable factors also and may not be what the predicted coverage from the charts indicates it should be. It is well to bear in mind these limitations of the charts and other variables when predicting coverage.

UHF Propagation

According to theory, UHF travels in straight lines and the limit of coverage is the horizon. As with all theory, some exceptions enter the picture. Experience has shown that UHF is susceptible to skip. Temperature inversions have been known to funnel UHF signals into the most unexpected places. Generally, however, the most useful distance is the horizon.

The UHF signal is attenuated more than lower channels. The higher the channels, the greater the attenuation.

Hills and tall buildings will create "shadow areas" in the coverage. How much signal and in what direction it comes from will depend upon the transmitter power and what is reflecting the signals. In such shadows, the best signal pickup is usually with the receiving antenna oriented in a direction away from the transmitting antenna. When reflections are severe, sometimes the "Ghost" signal is the best signal.

In the very early days of UHF, one method used to predict coverage was a relief mock-up of the proposed coverage area built in sand. As near a replica of the terrain to be covered, along with scaled down buildings and other tall structures were included. The tower was located and a small lamp placed at that point. The light from the lamp represented the signal. Such a mock-up gave realism to what could be expected in the way of coverage. Enough experience has been gained with UHF over the years that such mockups are seldom if ever used today.

Factors Affecting UHF Coverage

There are three major factors which determine theoretical coverage of any area: the terrain, the antenna height, and the power radiated.

The terrain over which the signal is to be transmitted is the first important consideration. If the earth terrain were smooth, the only limitation would be the horizon and man made structures. Some of the flat areas of the midwest do approximate the smooth globe theory, but there are many other areas of the country where the terrain is far from this theoretical terrain.

Because the terrain is generally irregular, the signal over any particular section will find different land characteristics than that of a neighboring area. Consequently, the signal may travel shorter or longer distances from the antenna, depending upon what obstructions it meets in any particular direction.

Average elevation for the antenna site must be determined for the circular coverage out to 10 miles. This provides a basis for computing coverage for the whole area of coverage.

Antenna height above average terrain is the second important consideration. Generally speaking, the higher the antenna, the greater the distance the signal will travel. This will permit the signal to "look over" hills, buildings, and other obstructions. At the same time, the distance to the horizon is dependent upon the antenna height, and therefore the distance is farther with greater height.

Radiated Power is the final important factor. While the theoretical coverage is to the horizon, a weak signal may not get that far. Since UHF is attenuated more than low channels, it requires more starting signal. Just how effectively the distance to the horizon can be covered will depend greatly upon how much signal is radiated.

Secondary Elements

Secondary elements also effect coverage of any area. These may be both natural such as hills, mountains and deep valleys. Or they may be man made, such as water towers and tall buildings. All these will take their toll on the final actual coverage.

Transmitting antennas also will effect the final coverage. Almost all UHF transmitting antennas are high gain types. When the gain of any antenna is increased, the vertical pattern of the radiated signal may be affected, causing the introduction of null or weak signal points in the signal coverage.

Beam tilting, both electrical and mechanical, are generally used to more effectively distribute the signal and fill in some of the null points. While beam tilting does not effect the actual amount of power radiated, it does tilt the main lobe down to the horizon. This reduces the radiated power in the horizontal direction. The FCC requires that the figures used for power are those that are in the horizontal direction. Thus the figures used will be less

*Engineering VP at WLBC and BE Maintenance Editor

World Radio History

than the actual power that is radiated.

Directional Antennas

Directional antennas are not generally permitted, although in some particular cases they may be approved. UHF stations with radiated powers of less than 1 kw may use directional antennas if needed or desired. By directional antennas, the reference here is to the horizontal pattern shaping.

Actually there is only one required contour, and this is the signal level over the principal community. This signal strength must be 80 dBu (microvolt reference).

Signal strength for the Grade A and Grade B contours are specified as 74 dBu and 64 dBu, respectively.

The Rules do not provide protection for signals other than that provided for in the table of allocations. The contours are used only for the purpose of determining the correct amount of signal over the principal community to be served is being provided, overlap of signal considerations involving multiple station owners, and in recent years where CATV has become a dominant factor.

Average Terrain

In order to determine the antenna height, it is first necessary to determine the average elevation above sea level of the terrain over which the signal will be transmitted. All land elevations are referenced to sea level, which is given a value of zero.

In determining the average elevation of the antenna site, only eight radials are used. With the antenna site as the center, the eight radials are drawn from this site at each 45 degrees of azimuth. (See Figure 1.) The zero degree radial must point to True North.

Land elevations should be obtained from U.S. Geological Survey Quadrangle maps. These are topographical maps and can be obtained from the U.S. Geological Survey, Dept. of Interior, Washington, D.C. or one of their branch offices. If the area to be profiled has not yet been mapped, then the next best accurate topographical information that is obtainable should be used.

A profile is drawn for each of the eight radials. Only that segment of the radial 2 to 10 miles from the antenna is used to compute the average elevation for the radial. These radials must accurately show the land profile. Lay out the graph with the distance in miles as the abscissa (vertical lines) and the elevations as the ordinate (horizontal lines). The graph elevation intervals should be 40 to 100 feet, but if you are in a mountainous region, 200 to 400-foot intervals may be used.

The radial should be drawn on the map and the 2 to 10 mile segment evenly divided into 50 points. Each of these points should then be plotted on the graph. You may want to show some of the points from the antenna out to the 2 mile point for your own information, but this must not be included in the figures used to determine the average of the radial. Once each of the 50 points has been plotted on the graph, draw a smooth curve through them. This will complete the profile and show the contour of the terrain for that radial.

There are several methods of determining the average radial elevation. Here is one method. Total all the 50 elevation points in the 2 to 10 mile section. Divide this total figure by 50, the number of points, to obtain the average elevation for the radial. A dashed line for this average elevation figure may be drawn across the graph to illustrate it more clearly. Each of the eight radials should be done in this manner so that the average elevation of each radial is obtained.

The Tower Site

The tower site average elevation is then derived from the averages of the eight radials. To do this, add the average elevation for each of the radials together to obtain a total figure, then divide by eight. This will result in the average elevation

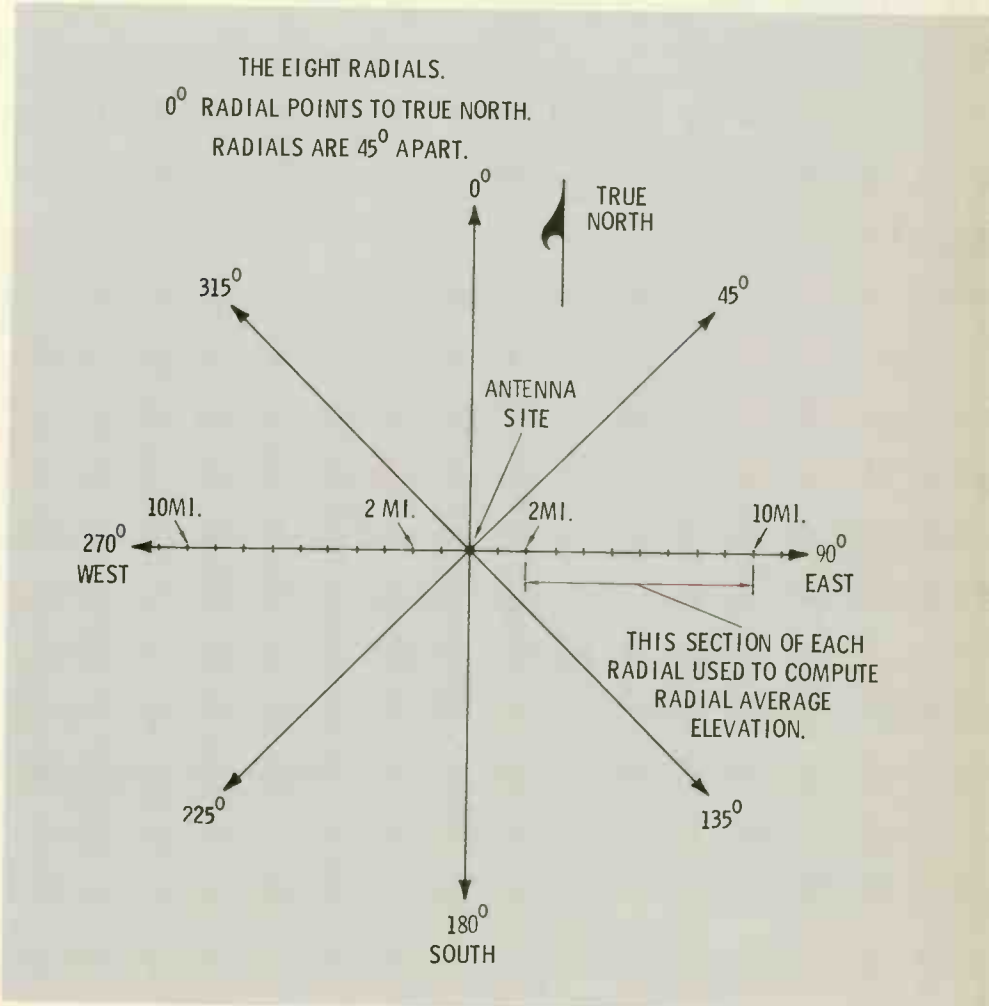

Fig. 1 The eight radials are 45 apart. The 0 radial points to true North.

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for the tower site. Remember that this is an average elevation figure and not necessarily the elevation at ground level.

Topography between the antenna and the principal community must be known. Should any of the eight required radials run through the center of the community, this information will have already been obtained from the profile of that radial. However, and this is often the case, the principal community may be more than 10 miles from the antenna or the community may be between a pair of radials. If such is the case, it will be necessary to run an additional radial from the antenna site through the principal community. This additional radial must not be included in the figures when determining the average elevation of the antenna site.

Antenna Height

Now that the average elevation for the antenna site has been determined, finding the antenna height above average terrain is a simple matter.

Add together the height from the average elevation to ground level, physical height of tower, height to the radiation center of the antenna. For example, the average site elevation above sea level is 950 feet, and ground level is 1,000 feet above sea level, tower is 500 feet, and distance to radiation center of antenna is 25 feet. Then 50 ft. + 500 feet + 25 feet = 575 feet the antenna height above average terrain. This is the figure to use with the FCC chart.

One should note that in all figures of antenna heights relating to propagation, the radiation center of the antenna is used. This is generally midway of the active antenna elements. The active antenna elements will depend upon the type of antenna. It may be on its own supporting structure or side mounted on a tower, or have another antenna stacked on top of it. While the actual physical height information is important to other studies or purposes, it is not used for propagation figures. If your UHF antenna is stacked on top of another antenna, the bottom antenna becomes part of the tower, as far as your figures are concerned.

Using the Chart

The FCC F(50, 50) chart, figure 9 of the Rules, is used to estimate coverage. The term F(50, 50) means that the field strength is exceeded 50% of the time at 50% of the potential receiver locations.

A study of the chart will reveal that the left hand vertical scale of the chart is given in decibels above 1 uv for 1kw radiated power. Along the top and bottom edge are scales representing transmitting antenna heights above average terrain for the radiation center of the antenna. The right hand vertical scale gives graduations for field strength in uv per meter.

(There is an additional page which has several sliding scales that may be trimmed out and used with the chart.)

The chart (Figure 3) is based on 1kw radiated power. Very few UHF stations use this low radiated power. Transmitting antennas have a fairly high power gain, so that even though the transmitter itself had 1kw output, the radiated power due to the power gain of the antenna could be anything up the 50kw. Therefore, to make the scale useful at other powers and antenna heights, several methods may be used for conversion. The easiest method is to trim one of the scales provided and use this. When this scale is used, all readings can then be taken directly from the chart and scale.

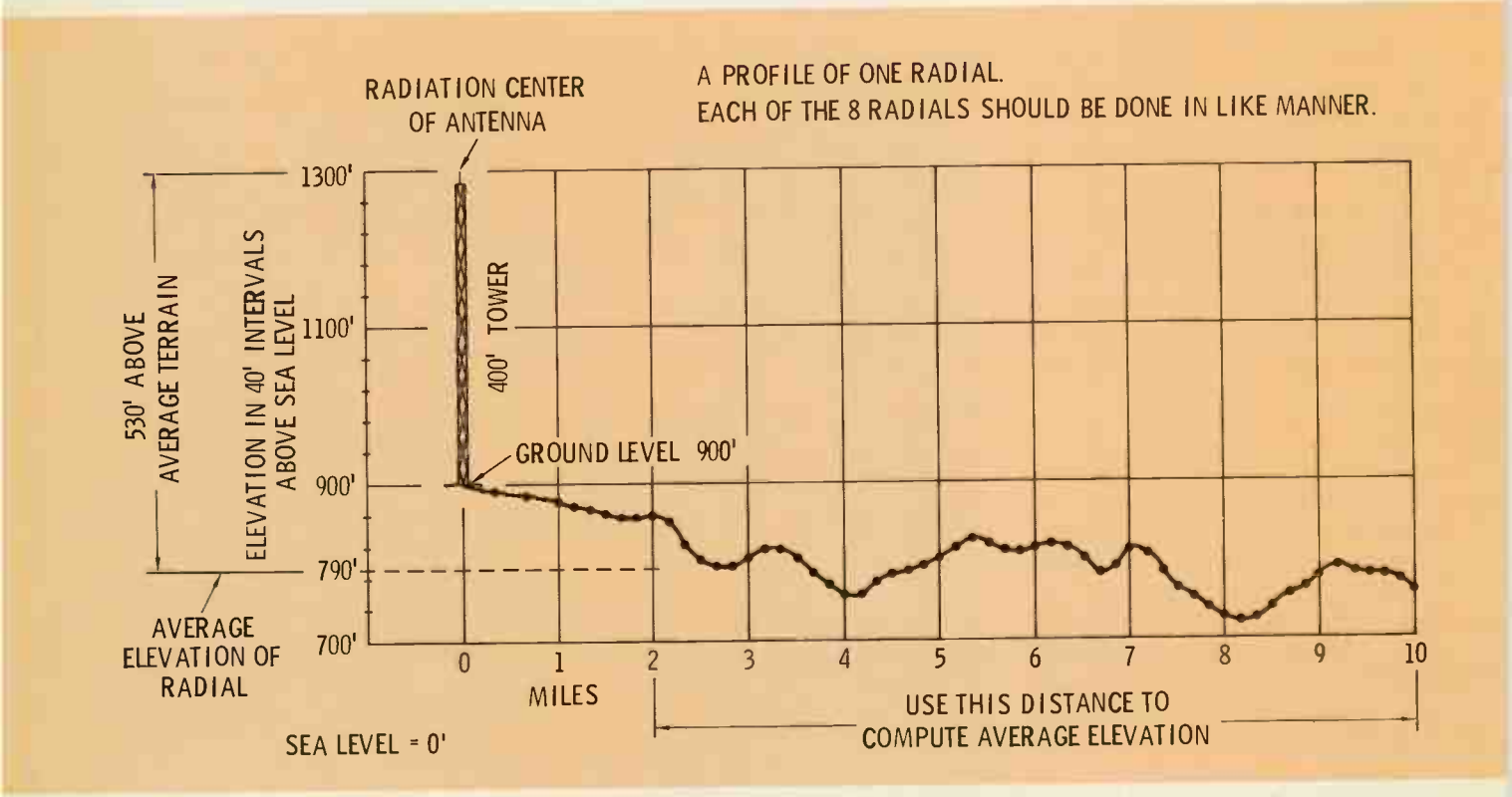

Fig. 2 A profile of one radial. Each of the radial's should be charted in this manner.

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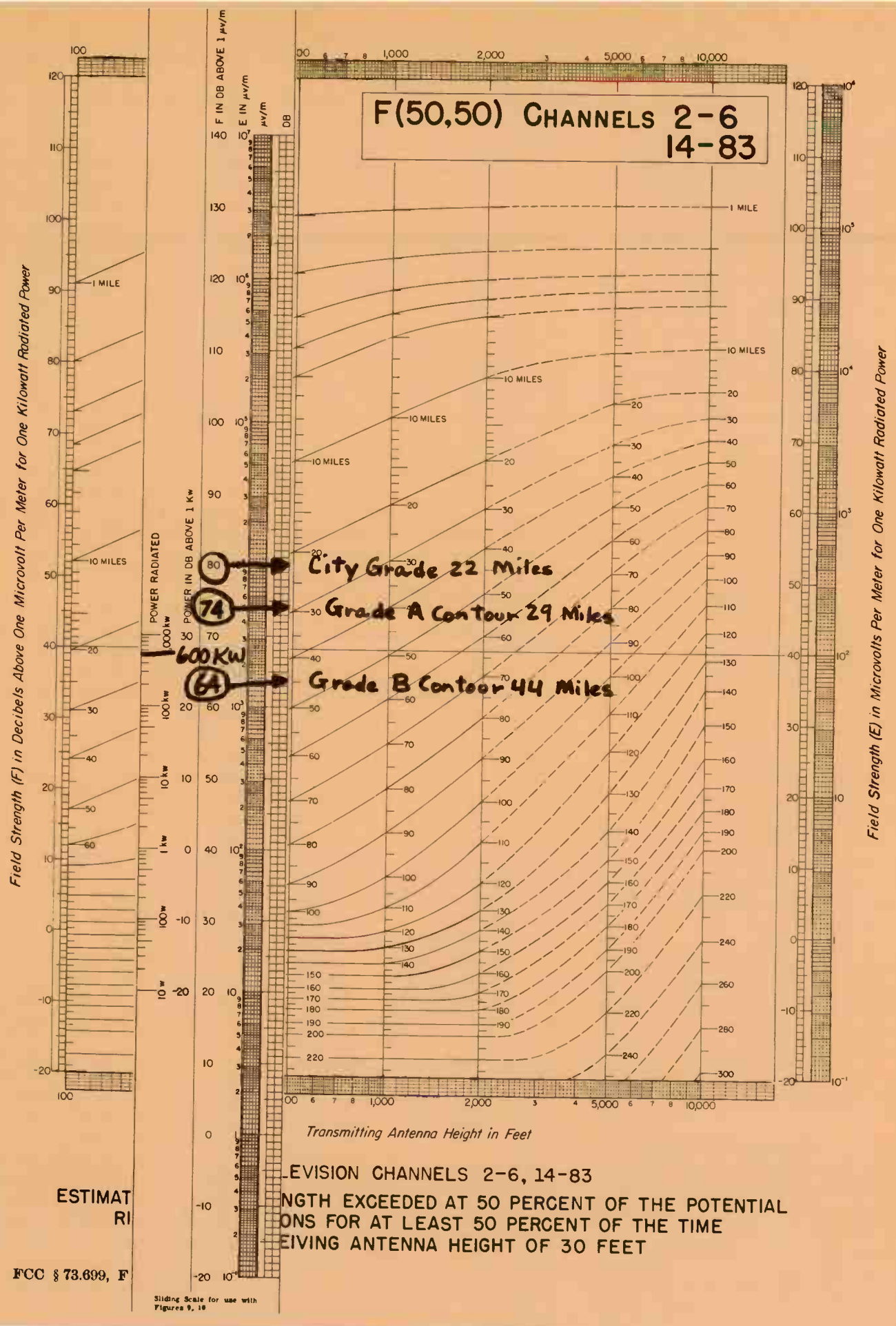

Fig. 3 FCC Chart 73.699 used with the overlay rule. In this section of the Rules, the FCC refers to this chart as Figure 9.

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Place the scale vertically on the chart so that the right hand edge lines up at both the top and bottom of the chart with the desired antenna height figure that will be used. Next, slide the chart vertically so that the desired radiated power as shown on the left hand edge of the scale is aligned with the horizontal 40 dBu line of the chart. The vertical scale now becomes direct reading for that antenna height and radiated power. The distance in miles to the 3 contours of City grade, grade A and grade B can be determined easily. When the figures fall between the curves of the chart, interpolation between the adjacent curves can be used.

The reverse information can also be easily obtained. One may want to know what power/antenna combination would be required to deliver the necessary signal strength to a specific distance.

New Station Plan

When a new station is being planned, the charts can be helpful in determining what equipment is required to get the signal where it must go. One may have options, or at least the availability of several sites, each with some advantages and disadvantages. For example, one sited may be an ideal location, but not enough property is available for a tall guyed tower and space for its guy anchors. If it was discovered that a very tall tower was not required, the space may be sufficient for a smaller self-supporting tower.

The average elevation for the most suitable sites would need to be determined along with the ground level elevation. By sliding the scale around on the chart, physical tower height needed, the antenna gains required and the transmitter power output can be determined.

Plugging The Holes

Remember that super high gain antennas can have many "holes" or null points that will require beam tilting to overcome. Also, beam tilting will reduce the power radiated in the horizontal plane. In the use of the charts, the power in the horizontal plane is required in the figuring.

Very tall towers require long runs of transmission line. Transmission line has appreciable loss at UHF, and this loss increases as the line is lengthened. The line diameter determines part of the losses: the larger the diameter, the lower the losses.

Thus, one may balance all the factors and, with the use of the chart and scales, arrive at a practical solution. In selecting a site, there are quite a few other factors that go into the final decision besides the important aspects of signal propagation. Many compromises are usually made as all the factors are balanced against the type of station planned and the cost factor.

Examples From The FCC Chart

Let's try an example coverage problem on the FCC chart and scales. A station is now operating from an antenna with a power gain of 25, with a radiation center 500 feet above average terrain (AAT). The transmitter output is 1 kw peak visual and transmission line losses are 20%. Effective radiated power (ERP) is then: 800 watts x 25 = 20 kw. (ERP is based on transmitter output power, minus line loss, times antena power gain.) The present coverage: City Grade 9.8 miles, Grade A 13.8 miles, Grade B 23 miles.

The station desires to increase transmitter power. For this example, we assume that both the transmission line and antenna can withstand the higher power. A 10 kw and a 30 kw transmitter is considered. A 10 kw transmitter will develop an ERP of 200 kw in this instance. Slide the scale on the chart so that the 200 kw on the scale is on the chart 40 dBu line. Read: City Grade of 80 dBu = 16.8 miles, Grade A of 74 dBu = 23 miles, Grade B of 64 dBu = 36 miles. Notice that this power increase has the effect of moving the new Grade A contour out of the old Grade B contour.

Perhaps the 10 kw transmitter would not be sufficient to do the desired job of coverage. A 30 kw transmitter will develop an ERP of 600 kw in this example. Slide the scale so that 600 kw on the scale is on the chart 40 dBu line. Read: City Grade = 22 miles, Grade A = 29 miles, and Grade B = 44 miles. Notice that this amount of power has the effect of pushing out the City Grade signal to the old original Grade B contour of 23 miles.

If the station is radiating a reasonably circular pattern the actual coverage would describe a circle. The distances just stated would then be the radii of those circles. If the average elevation along one or more radials is radically different than the rest, caused perhaps by a mountain ridge, the coverage in that direction would be restricted accordingly.

A new station that is not already committed to tower site, tower, antenna and line, is free to experiment on paper with various combinations of power, antenna, and tower heights and various size lines or waveguides to arrive at a final decision. Two things must be considered. Transmission line losses cannot be ignored and the actual physical height of the tower is generally different from the AAT figure.

A 500-foot transmission line, for example, will have a given loss figure for that length. If the same diameter line is used but a 1,000 foot run is considered, the losses will be doubled.

The ground level at the base of the tower could be, for example, 100 feet higher in elevation above sea level than the average elevation figure for the site. Let's say that an antenna is 50 feet long and its radiation center is 25 feet above the antenna base. To use the 500 foot antenna height on the chart, the physical height of the tower needed would be 375 feet.

Other elements may enter into particular cases. The material presented so far has been that which is generally expected in predicting coverage. There are areas such as on a sea coast, or near the border of another country, where different calculations must be used. Corresponding computations are spelled out in the FCC Rules.

The accuracy of the predictions made will show up after the station is built and the signal on your channel actually radiated. A field strength survey could be made to show what is actually being accomplished. How well and with what difficulty the receiving locations are getting the signal will be the acid test.

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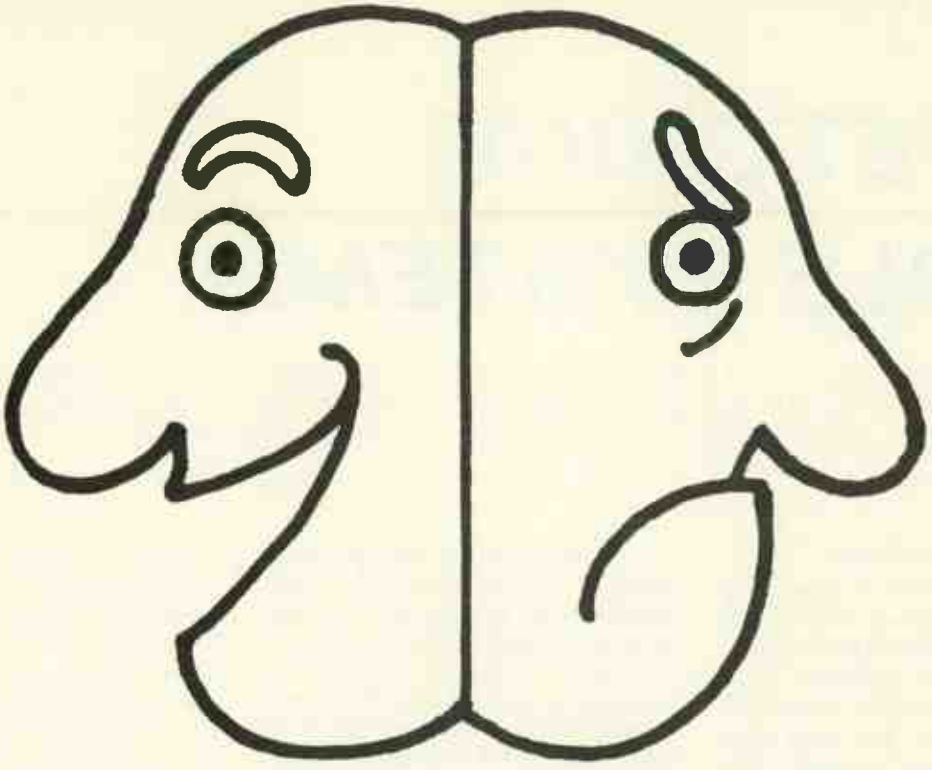
ARE THERE TWO OF YOU?



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STRETCHING CABLE SYSTEMS

By Leo G. Sands*

The CATV industry is faced with stretching problems—in both length and breadth. Conventional techniques limit system stretching. With 50 amplifiers in cascade, using 0.75 inch coaxial cable, the trunk line cannot be stretched to more than approximately 20 miles without running into picture quality problems. If the trunk line could be extended, a single head end could serve a cluster or series of communities, and reach into more remote areas than at present.

Since the attenuation of 0.75-inch coaxial cable, most commonly used for trunk lines, is around 50 dB per mile at 200 MHz, it is apparent that more amplification is not the answer. The attenuation must be reduced, or some other multiplexing technique and/or transmission medium must be used.

Attentuation can be reduced by using lower loss, but more costly cable, such as the pressurized type used in some Bell System installations. Attenuation can also be reduced by translating TV channel frequencies to lower frequencies at which cable transmission losses are much lower than at VHF.

Microwave can be used in lieu of or to extend a trunk line cable. In the future, waveguide (hollow pipe) will probably be used as the transmission medium for TV signals on an FDM (frequency division multiplex) basis, as is done presently on coaxial cable. Also, it is likely that PCM (pulse code multiplex) equipment will be used in the future for TV transmission through waveguide or coaxial cable. It has been predicted that a PCM system would be able to handle up to 200 color TV channels, using waveguide as a transmission medium with regenerative repeaters spaced 10 to 30 miles apart. And, undoubtedly laser beams will also be used for multichannel TV transmission.

Unfortunately, hardware is available at the present for only analog transmission of TV signals via video pair, coaxial cable and microwave. It is also unfortunate that CATV took off with an unsophisticated approach in this advanced stage of the electronics art. But, at the time the first CATV system was designed, only a David Sarnoff, Hugo Gernsback or Jules Verne could have foreseen today's needs and the tremendous future of cable television.

Cable Limited By Cable Techniques

The original basic CATV techniques are still predominantly used. As shown in Figure 1, the basic idea is to utilize a "community" antenna to pick up TV signals and to convey them to TV receivers through a coaxial cable distribution system. At the head end (antenna site), the TV signals are amplified for cable transmission at their original frequencies, or translated to other frequencies in heterodyne-type amplifiers, or by demodulating the signals and feeding them into TV modulators, operating at VHF TV channel frequencies. The outputs of the strip amplifiers (same frequency), frequency translators and/or modulators are combined and fed into the coaxial cable distribution system on an FDM basis.

When up to 12 (or 21) TV channels plus the FM band frequencies are transmitted through a single coaxial cable, the results are often surprisingly good. But, transmission is sometimes impaired by noise, ghosts, cross modulation and intermodulation. The picture quality at the furthest CATV subscriber's TV receiver is often poor compared to the picture quality at receivers located closer to the head end.

Although the frequency spectrum of coaxial cable extends from DC to about 1000 MHz, coaxial cable is not a perfect transmission medium. Its attenuation losses are low at video frequencies, and very high at VHF. Since transmission losses rise with frequency, equalization must be used and amplifier gain must be great enough to make up for cable losses at the highest frequency transmitted. Furthermore, cable impedance irregularities, taps and cable-inserted devices cause signal reflections. Nor, are the amplifiers free of distortion, but they can be unusually good considering the requirements they must satisfy.

Using conventional techniques, a trunk line amplifier is required at intervals of approximately 2000 feet, when using 0.75-inch cable. Line extender amplifiers are required at more frequent intervals, when using smaller diameter cable. Since each amplifier contributes distortion and noise, there is a practical distance limit between the head

*Leo G. Sands & Associates, New York, N.Y.

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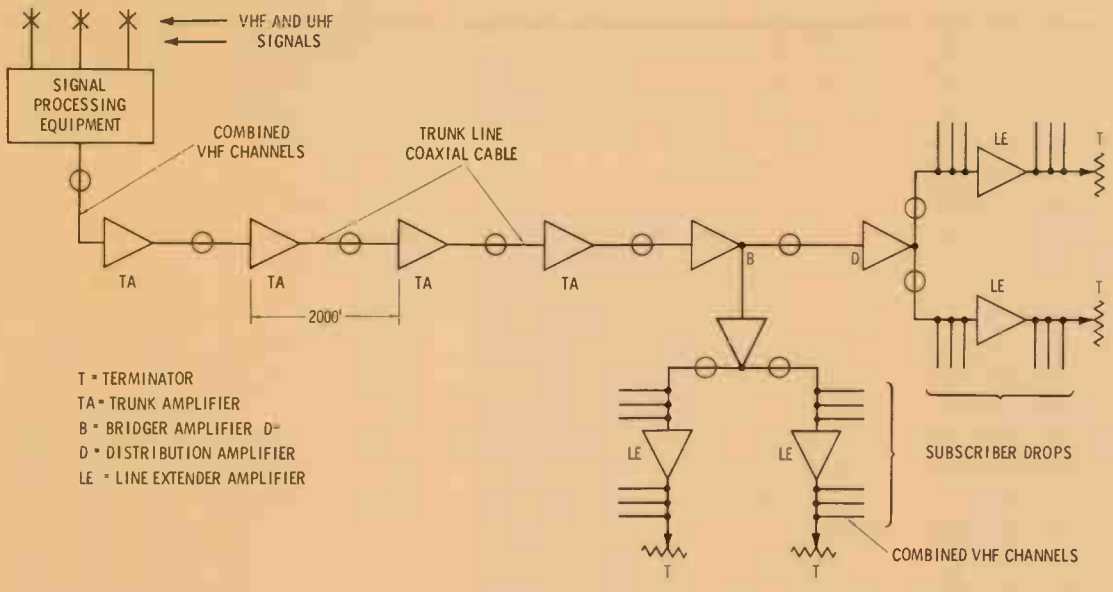

Fig. 1 Conventional CATV System.

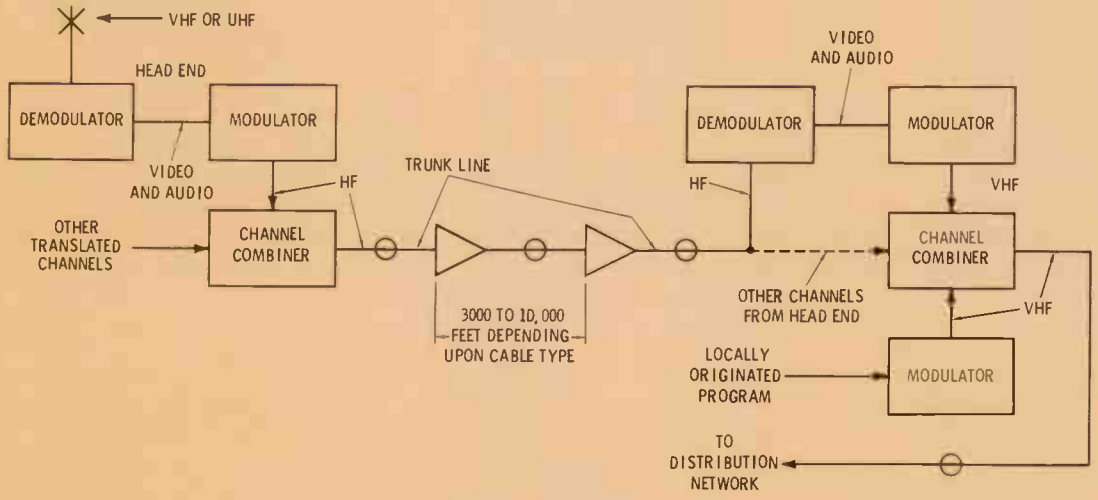

Fig. 2 System utilizing HF (sub-VHF) transmission through trunk line, including one off-the-air and one locally originated program.

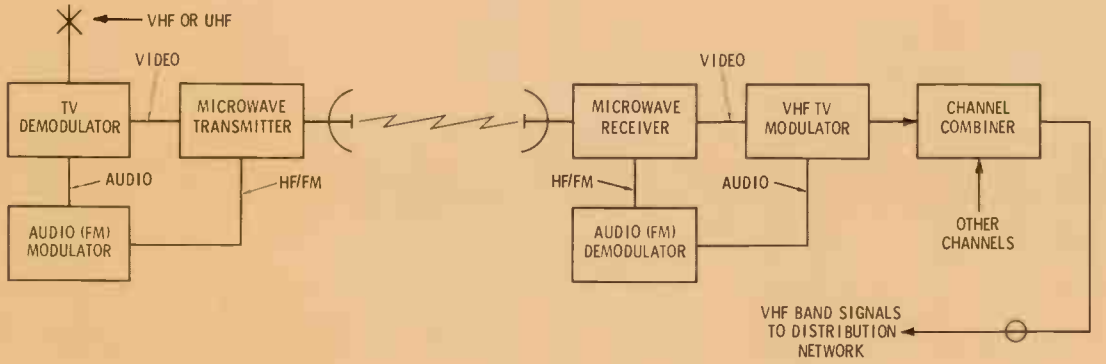

Fig. 3 Microwave trunk or extender system, using one TV channel per microwave channel.

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end and the furthest subscriber. This is the major CATV system limiting factor with regard to overall system length.

Because of this limiting factor, the head end must be located within a few miles of the community to be served. And perhaps a better head end site farther away cannot be utilized. Nor, is it always practical to extend the distribution network to neighboring communities in directions away from the head end.

Therefore, it is necessary to install more head ends than would be required if cable transmission distance could be extended. It would be economically advantageous to utilize a single head end to serve a cluster or series of communities.

The problems could be resolved by stretching the trunk line if that were feasible. It is being done now in some systems by translating signal frequencies at the head end from VHF and UHF to HF (also called sub-VHF) for transmission to the start-of-distribution point, as illustrated in Figure 2. There, the signals are translated back to regular TV channel frequencies. Instead of inserting locally originated programs at the head end, they can be fed into the system at this point which may be more accessible, particularly for live programming.

By transmitting signals through the trunk line cable at frequencies below 50 MHz, the trunk can be longer since fewer intermediate amplifiers are required. At 50 MHz, transmission loss is 43% of what it is at 200 MHz.

How About Microwave?

An alternative is to use microwave to feed signals from a distant head end to the start-of-distribution point, as illustrated in Figure 3. Since each TV channel requires one microwave channel, the limitation here is the number of microwave channels available to any one licensee. Microwave requires a line-of-sight transmission path (direct or via reflectors) and can be affected by aircraft and, in the 12-GHz band, by rain. Microwave antenna tower costs can be astronomical. But in some areas, where microwave channels are available, microwave can be the most economical and practical way to transmit signals from a remote head end.

Another technique, utilizing FDM through a single coaxial cable that is practical today was developed by the author's consulting firm. The task was to design a CATV system for a city with a population of approximately one million. At first, it seemed apparent that four or more independent CATV systems would be required, each serving their own areas and linked by microwave for distribution of locally originated programs.

It turned out that at the time there were not enough vacant microwave channels in the area for the head end linage system which would be required for transmitting several locally originated programs to the head ends. Instead, of four or more head ends, it was determined that only one head end should be used and that it should be in the center of the city. Instead of the usual single trunk line cable, there would be eight. The head end would be in the hub, as shown in Figure 4. Thus the intracity trunk lines could be kept within practical length limits.

Another alternative was proposed by the author's firm which was asked by a client to tell him how to transmit several TV channels to four communities outside the U.S. over a total distance of over 100 miles, without using microwave whose use is not permited in the country involved. In the future, the answer

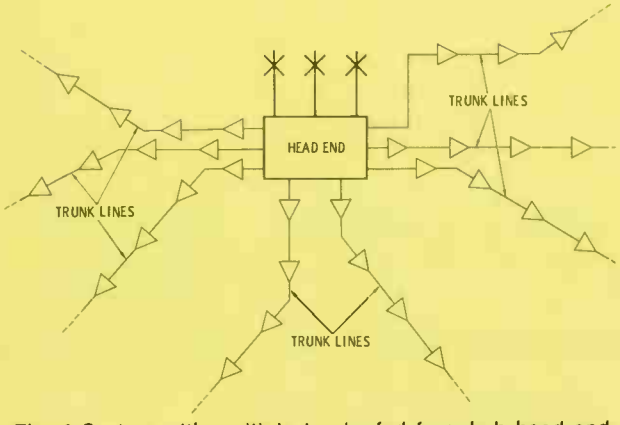

Fig. 4 System with multiple trunks fed from hub head end.

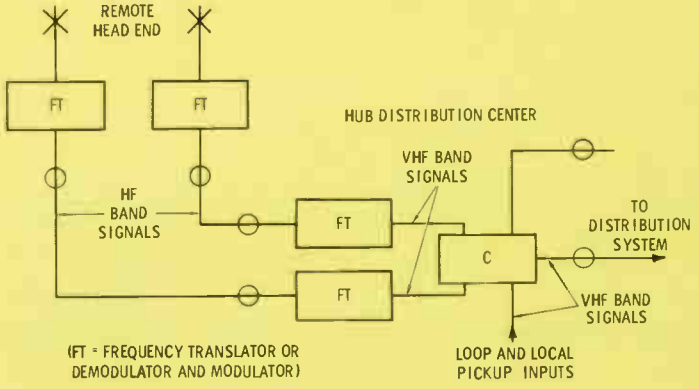

Fig. 5 System employing individual trunk cable for each channel.

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would have been PCM through waveguide. But, now, the answer was "use HF transmission through several coaxial cables or a multi-tube coaxial cable." The trunk cables would convey TV signals at HF to head ends at the four communities where distribution would be on regular TV channels.

A separate trunk line cable is used for each TV channel in a system designed by Ameco. At the head end, each TV channel, picked up there, is translated so as to occupy the 6-MHz space between 7 MHz and 13 MHz, and each translated channel is fed into its own trunk line. Instead of a requiring ten trunk line amplifiers, as would have been the case if transmission were at VHF, no amplifiers were installed for the 4.2 mile trunk line run.

The trunks feed into a distribution system hub, as illustrated in Figure 5. At the hub, locally received UHF TV channels and locally originated programs are combined with the signals from the head end, which are translated to VHF TV channel frequencies. The combined signals are then fed into a conventional FDM coaxial cable distribution network.

The DISCADE System

Since then, Ameco has extended this one channel-per-cable technique to encompass an entire CATV system. Known as DISCADE (DIscrete Cable Area Distribution Equipment), the system utilizes multi-tube coaxial cable for trunk lines.

Each cable within he multi-tube coaxial cable assembly (Figure 6) conveys only one channel, and each employs its own amplifiers which must have a bandpass of only 6 MHz instead of the 162 MHz or more required of conventional 12- to 21-channel capacity amplifiers. Furthermore, trunk line amplifiers can be spaced about one mile apart, instead of at approximately 2000-foot intervals, since each cable is used for transmitting only signals within the 7-12 MHz range, instead of within the 54-216 MHz range.

The multi-tube trunk line feeds into a pole-mounted area distribution center, directly or through two or more area distribution centers where each trunk cable is tapped through a directional coupler which introduces an insertion loss of approximately 1 dB. Each area distribution center can accommodate up to 24 subscriber drops.

Subscriber receivers are fed through individual coaxial cables with signal frequencies still within the 7-13 MHz range. Each receiver is equipped with an external channel selector unit which contains a converter that translates the 7-13 MHz signals to a locally unoccupied VHF TV channel. By means of the selector, a subscriber can select any one of the available program channels. The selector remotely operates solid state switches at its associated area distribution center.

The system is unique in that the intercepted TV channels are translated in frequency at the head end and each is transmitted through its individual cable tube at frequencies within the 7-13 MHz band. Locally originated programs are also transmitted in the same manner. The cable transmission frequencies are not translated back to a VHF TV channel until they reach a subscriber receiver. Only one channel is fed to the subscriber's external channel selector unit, whichever is selected

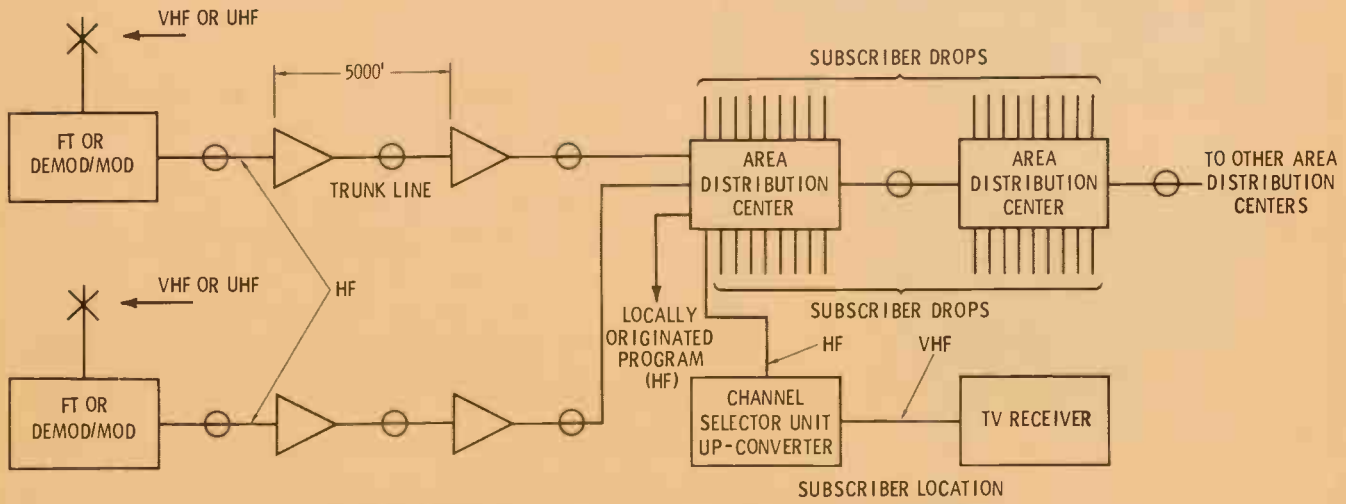

Fig. 6 CATV system using individual trunk for each channel.

World Radio History

by the subscriber. Thus, the receiver does not see a host of channels, only the one selected.

At 13 MHz, the transmission loss through each tube of the multi-channel trunk line coaxial cable is only 0.8 dB per 100 feet (42.24 dB per mile) at 72°F. Since relatively narrow band (6 MHz) amplifiers are used, they can be spaced about one mile apart. No amplifiers are required in subscriber drop cables unless they exceed 2000 feet in length.

Multi-tube coaxial cable is obviously more expensive than conventional single-tube cable. Although only 40 percent as many amplifiers are required per trunk line tube as are required for a wide band system utilizing a single coaxial cable. The total number of amplifiers required could be considerably greater. For instance, a 5-mile conventional wide band trunk line carrying 12 TV channels, would require from 12 to 14 amplifiers. The multi-tube HF system would require 4 to 6 amplifiers or a total of 48 to 72 amplifiers. But, the signal quality would be better. Ameco claims more than 100 dB of isolation between cable tubes which is much greater than the isolation between channels in a wide band system. Furthermore, failure of one amplifier would knock out only one channel, not all 12.

A variation of the Ameco scheme could consist of using individual single-tube coaxial cables to drastically cut both the trunk line transmission losses to about 10 dB per mile and the number of amplifiers required. But the cost of cable would be quite significant.

Developing PCM

The big stretch may not be economically feasible until PCM equipment for TV transmission becomes available. In PCM, the TV channel information is interleaved and transmitted serially, not in parallel as in existing CATV systems. At each repeater-amplifier the digital signals are regenerated; very little distortion is introduced. Hence, the signals at the far end of the trunk cable are of almost the same quality as they are at the head end.

Since TV receivers are analog devices, it would be necessary to convert intercepted and locally originated program signals into digitally-encoded form for trunk line transmission, and back into analog FDM form at the start-of-distribution point, as illustrated in Figure 7.

Development of PCM equipment is taking place at the Bell Telephone Laboratories and at Canadian Marconi Company, parent firm of Kaar Electronics Corp. which is based in the U. S., as well as elsewhere. Philco-Ford has developed a PCM picture transmission system for military use, but its cost is not in the CATV operator's budgetary ball park.

It is gratifying to note that CATV technology is not standing still while waiting for PCM and laser beams. Vikoa, for example, made news when it developed its "21-plus" amplifiers which, because of use of push-pull amplification and other circuit refinements, are capable of handling 21 or more channels on an FDM basis; 10 or more within the vast wasteland between 108 MHz and 174 MHz. And Ameco's DISCADE approach offers unique possibilities, not so much from the standpoint of increased channel capacity but, more significantly, from the standpoint of better picture quality.

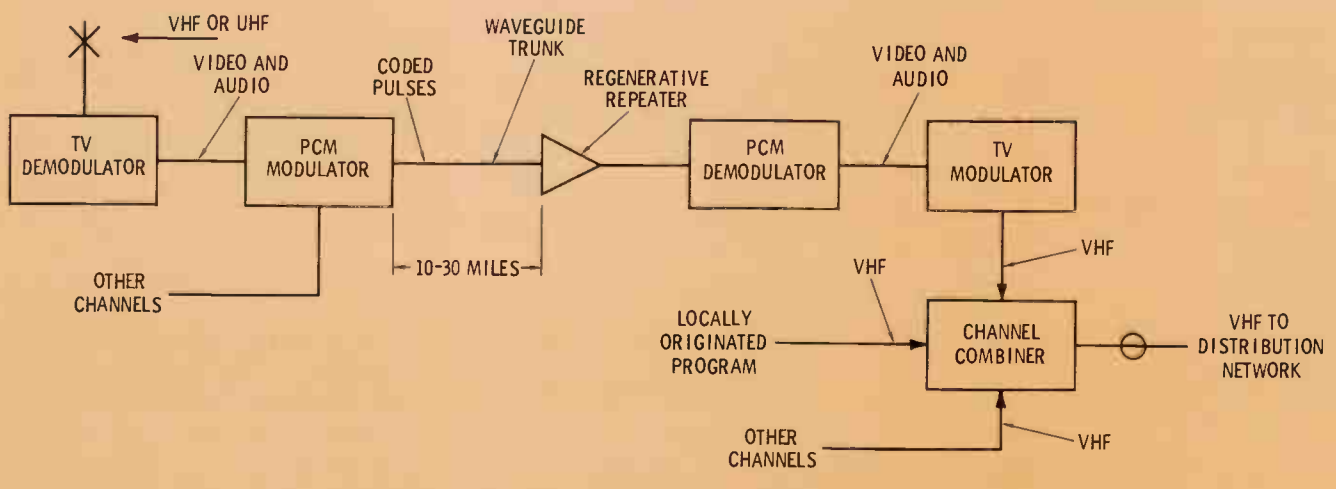

Fig. 7 System employing PCM and waveguide trunk.

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Closing the gap with OJT

By Dwain A. Christenson*

There is a considerable gap between the technical school graduate and the competent broadcast technician, which generally must be bridged by on-the-job training and experience. While larger broadcasting companies can afford to hire only highly skilled technicians with vast broadcast experience and to finance some supplementary training, the majority of the smaller stations must provide on-the-job training. So it is that many supervising engineers are faced the the responsibility of running an efficient operation and an effective work-training program.

The technician, experienced or inexperienced, who is not functioning at an efficient level represents a loss to the company. Each technician's operational aptitude and habits, his ability to diagnose trouble and make temporary repairs of defective equipment in an emergency, to set up equipment for optimum sound or picture reproduction, or even his personal appearance have a direct effect on the station's image and, in turn, affect sales. Thus, on-the-job training plays a significant part in an efficiently managed technical operation and is a vital element for the competitive local station which seeks a first-class operation.

An effective OJT program should help management accomplish at least three important goals. Proficiency of personnel in both operational and technical spheres is important because the majority of "troubles" are minor in nature—blown fuses, loose AC plugs, wrong video or audio patches, and minor adjustments on equipment. It is imperative that every engineer be a capable trouble shooter. Operations are certain to improve when personnel are technically alert. An efficiently organized and operated department, includes routine maintenance of equipment, equipment modification, and a workable system for remaining technically current in the broadcasting field. You must provide an effective basis for evaluation of personnel in the areas of ability, productivity, attitude and appearance. The following are some practical suggestions for on-the-job training which have been tried with favorable results.

*Medical Lake, Washington.

SWITCHER

Name John Doe

Shift 3 - 12 p.m.

Lunch 7:30 - 8:30 p.m.

Daily Operational Hours 3 - 7:30 10:30 - 12:00 p.m. Total 6

Daily Maintenance Hours 8:30 - 10:30 p.m. Total 2

Assignment for Maintenance	Time Period Allotted	Work Units	Initial & Date of Completion

Specific Duties:

1. Clean film projectors daily.
2. Check daily the operational condition of all projectors, film chains, color cameras, VTR machines, studio to transmitter links, and miscellaneous equipment which have a significant role in the operation.

Fig. 1 Technician's Assignment Sheet.

Departmentalization

By dividing the technical portion of the station into sections (such as film department, switch-loader, cameraman, radio, video and tape machines, audio equipment, TV equipment and miscellaneous, shop and bench repair, and transmitters) an efficient system can be set up whereby the need for direct supervision can be lessened. Each department would routinely submit to the supervisor brief periodic reports or checklists of what has been done for a given time period, and by whom. This report would also provide the supervisor with a valid evaluation of the individual technician's production and ability.

A basic work outline made up for each department could be used by experienced technicians in the department to assist in training new personnel, and it would also delineate job responsibility so that each technician would know exactly what is expected of him.

Work Unit vs. Man Hours

Charts can be made up covering each job assignment within the department, listing the specific duty and the corresponding time allotted to perform the task. This would provide management with an accurate reference to determine manpower needs, a blue print for use in determining specific job assignments for different men, and an effective tool for measuring each man's performance. If such a system is not al-

World Radio History

ready in use, it would also help management to account for present utilization of each man's time. Assignment sheets for each technician within the department could then be made up and posted (Figure 1). In Figure 1, this man would be able to devote 10 hours weekly to maintenance, 43 hours monthly and 516 hours yearly. Yet chances are that without constant supervision or a check list such as this the major part of those 516 hours might be unaccounted for because of mismanagement of time.

Supervisor-Trainer and Crew

A system which can also be effective is for the supervisor to assume the major responsibility for training new men. (This presuposes that he already has an efficient operational team.) His responsibilities would be to maintain a quality operational team, train new men, supervise maintenance of equipment and modification of installation as necessary.

D. Waymire, chief engineer at KHQ AM-FM-TV, Spokane, Washington, uses this system in his highly efficient operation. He schedules the majority of his men (except for a skeleton crew) during the day shift; assigns specific men to specific projects; assigns a team of two men (one experienced and one less experienced) to "float" to keep things running; creating an atmosphere which encourages discussion and freedom of expression; and brings in projects which expose and familiarize the crew with integrated circuits, transistors, etc. The personnel at this station have designed and built a number of highly sophisticated pieces of equipment as a result of this program.

Job Rotation System

Another system which works well in some instances is to assign technicians to various departments on a rotational basis for specific time periods in order that they refresh their knowledge of the over-all operation. Job assignment charts would be essential under such a system, both for covering operational duties and for regular maintenance of equipment.

Warren Pritchard, chief engineer at KREM AM-FM-TV, Spokane, has incorporated job rotation into his training program. He uses both day and evening supervisors. However, he utilizes the rotation method periodically to help both the employer and the employees become aware of individual interests and abilities, and then seeks to utilize these abilities to their fullest.

Pritchard feels men who have a grasp of the over-all system and have worked with it from one end to the other fit in as parts of an engineering team which can work together more efficiently. But he also seeks to maintain a rapport with his men which will allow them freedom to find their niche, to specialize and express some of their own desires and ambitions. He realizes that for the company's welfare as well as the individual, the employee must feel he is truly productive.

He also states, "This system has provided added benefits. Some of the key men in the production and program departments have worked up through the engineering department. Their full understanding of technical department capabilities has proven to be a great asset to the overall operation of KREM."

The Buddy System

This method works well for orienting new men and can also fit into the departmental system already outlined. A new technician would be assigned to an experienced man for a given time period, using a check-list of items to be covered. Under this system the new man is trained and the older man has an opportunity to refresh his knowledge.

Key Man Approach

Some personnel are more technically involved than others, and these individuals can be utilized to great advantage in OJT programs, equipment modification and keeping the company current with developments in the broadcasting field. Money invested in sending a key man to a school or seminar can be multiplied by having him outline the material covered and present it to the other personnel, either as a group or on an individual basis. This idea could be expanded to include research projects.

Warfield, Television Operating Center supervisor for Pacific Northwest Bell in Spokane, put it this way: "Over the past ten years of practicing OJT we have found much to be desired in the Buddy System due to such things as poor attitudes of older personnel and the threat of job security to the older men by the younger men. Since we switched to the Key Man approach, the dividends have been much better. We take a man we feel has supervisory potential and give him a practical problem, the OJT of new personnel. He undertakes the project with full knowledge that he is under consideration for management. We also give him some financial remuneration for his efforts."

Seminars

Seminars can be used in a variety of ways such as: (a) classes relating to a particular piece of equipment or explanation of a new system; (b) an individual study program utilizing taped audio or taped video programs on a particular subject, such as "Understanding Video Tape Machines" or "Test Signals Used by the Television Industry to Standardize Transmission." For on-the-job study assignments a written summary or oral quiz might be administered to test the trainee's grasp of the subject matter. Also, area seminars can be arranged where several stations might combine efforts and pool manpower to conduct classes or even engage qualified teachers, such as company representatives from leading equipment manufacturers.

Reference Library

This is an important aspect of an effective on-the-job training program. The library should be well organized, and some major areas to be included might be, equipment instruction books, books on electronic theory, such as "Wave Propagation", block diagrams and charts of all systems, current electronic magagines and copies of convention technical papers. Home study and some on-the-job study will be a natural outgrowth of an interesting, well-planned training program.

Visits to other facilities and plants which relate to the broadcasting business can also be effective. Such visits help to stimulate interest on the part of the men and often cause

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Name _____ Date _____

O-Outstanding S-Satisfactory NI-Needs Improvement

	O	S	NI		O	S	NI
Workman				Production			
A. Job Attitude	—	—	—	A. Time	—	—	—
B. Work Habits	—	—	—	B. Job Planning	—	—	—
C. Learning Ability	—	—	—	C. Quantity	—	—	—
D. Personal Appearance	—	—	—	D. Completeness	—	—	—
Technical Standards				Reporting			
A. Apparatus	—	—	—	A. Records	—	—	—
B. Circuitry	—	—	—	B. Reports	—	—	—
C. Wire Work	—	—	—				
D. Tools, Test Eqpt.	—	—	—				
E. Instructions	—	—	—				

COMMENTS

FOLLOW UP

Fig. 2 Periodic evaluation form.

them to take more pride in their own operation. And it also keeps them aware of advances in the field.

Another advantage is that they often get new ideas and find answers to problems they have been struggling with. To make such trips more effective, a discussion time allows the men to digest what they have seen and relate it to their own operation. This might be done at a luncheon or in some other relaxed setting.

Personal Appearance

There is a correlation between one's personal appearance and the pride one feels for his work. About three years ago Bill Vandermay, chief engineer at KATU-TV, Channel 2, Portland, Oregon, included dress shirts, ties, shined shoes and pressed dress pants as uniform of the day for his crew of engineers. He feels that as a result the men have gained a new sense of dignity and that morale is better. He states that many customers have complimented his crew members for their sharp appearance. The men have taken greater pride in their work as a result of this emphasis on their appearance. (Some plants also have a supply of shop coats or jackets with the men's names and station emblem for use as an optional part of dress).

Employer-Employee Relationship

Ron Valley, chief engineer with KSPS educational TV in Spokane states, "A man's job is very sacred to the individual and should be treated as such by the employer. After all, he is probably feeding four or five dependents and obligated for house and car payments. Many times problems compound themselves as an outgrowth of frustrations on the part of the employee, all due to a lack of tact or diplomacy by the employer in handling these interpersonal relationships." Valley places the employer-employee relationship near the top of his priorities, and he wants two things from his men, their respect and confidence. He emphasizes that a man must feel that he is important and accepted by the employer.

As an example, Valley cites a situation in which one of his employees who was offered a job by another firm came to him and volunteered this information. Together they discussed the matter and the man realized it was to his own advantage to remain with KSPS. Lack of communication could have cost him this advantage and cost the station a good man in whom many hours of training had been invested.

Every six months Valley gives each man a written exam and together, in the privacy of his office, they evaluate the results and the man's over-all performance. Conversations between himself and his men are of utmost trust and confidence.

Evaluation Plan

Evaluation by management of the program and of individual technicians' work is an essential part of an efficient operation. Personnel evaluation, as far as productivity is concerned, would be done on a regular basis from the work schedule charts, perhaps quarterly, semi-annually or anually. A periodic evaluation form (Figure 2) to be filled out by supervising personnel and discussed with the individual technician might also be utilized. Such information would also be valuable to new supervisory personnel.

Filing System

Orderly maintenance of records is a most important part of an efficient operation and training program. This should include individual personnel records, project assignments, equipment maintenance schedules, etc.

Most personnel are more satisfied with their jobs when they can see accomplishment resulting from their efforts. However, some trainees become frustrated and belligerent when management constantly complains about lack of productivity, heaps unrealistic assignments upon them without allowing specific time for completion, or conducts the operation in a poorly organized manner. They resent being held accountable for a poor system.

In conclusion, careful planning and consistent adherence to the program can result in a more efficient operation and in better staff relations. These factors all add up to higher profits in a highly competitive industry.

Editor's Note: Each station training program must take advantage of the individual talents available. And it is precisely this need and the desire for a low turnover, efficient staff that makes these OJT proposals vitally important. After a staff has undergone several personnel changes, problems can erupt because the old system does not fit the new people.

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GIVE...so more will live
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Fig. 1 A U.S. military policeman stands guard at the entrance of the main gate to the key AFVN station, which is located in Saigon.

Vietnam Network Moves On Automation

"S-Day" came in October in Saigon. Late in the afternoon the 19th, a button was pushed at the Saigon studios of the American Forces Vietnam Network. Instantly relays clicked, reels began to spin, and throughout the Saigon area red lights glowed on stereo FM radios. For the first time Americans serving in Vietnam received stereophonic music on their FM multiplex radio receivers.

The stereo sounds at 99.9 on the FM dial came from a Gates Automatic Tape Control system. AFRS-Vietnam staff, however, generally refer to the big machine as "The Monster" or "PFC Gates" because it can do almost anything a live announcer can do.

In the beginning almost all audio, transmitter and broadcasting equipment for AFRS was borrowed from U.S. and Vietnam military and civilian agencies. Spare parts and supplies were obtained from various military resources, and all military personnel operating the station were drawn from other units. The station was operated by a five-man crew and several volunteer announcers and newsmen. The first radio programs were transmitted for 18 hours a day. From this understaffed, and equipment-short, beginning AFRT Vietnam grew with the expansion of U.S. Forces.

Small 50-watt repeating transmitters were strategically placed throughout the Republic where the majority of American troops could pick up the AFRT signal with transistor radios. The number of these repeating transmitters also grew with the expansion of U.S. Forces.

In the autumn of 1964 AFRT Vietnam moved from the Rex hotel to larger and better-equipped spaces in the Brink BOQ, 101 Hai Ba Trung, Saigon. In early December of that year members of the Armed Forces Radio and Television Service staff made a visit to Vietnam to inspect AFRT facilities. Their report of this visit gives an idea of the situation at that time: AFRT broadcasts in Vietnam emanate from studio facilities in Saigon, and are rebroadcast by eleven relay outlets throughout the country. According to MACV estimates, 94 percent of the assigned and deployed U.S. military personnel in Vietnam are within range of radio broadcasts. The DOD team made personal observation at four of these outlets and found the coverage to be inadequate due to the technical impairment by equipment.

In February, 1965, radio programming was expanded from 18 to 24 hours a day. The installation of FM equipment in Saigon and the commencement of special FM pro-

World Radio History

gramming during afternoon and evening hours was another step toward expanded service. The biggest step made during this period, however, was made in March, 1966, when a new two-way Pacific link was made between Saigon and AFRTS, Los Angeles by underwater cable. This enabled AFRT Vietnam to receive West Coast programming 24 hours daily, and meant that major sports events, important speeches and top-rated special events programs could be broadcast in Vietnam as they are heard over the networks in the United States.

Television made its debut in Vietnam in February 7, 1966. Initiating the new service was a special program including speeches by Premier Nguyen Cao Ky, Ambassador Henry Cabot Lodge, and General William C. Westmoreland. This program was recorded on video tape in the airport terminal at Tan Son Nhut. Cables connected the cameras in the terminal with the Blue Eagle aircraft which was parked close by. Later a studio was set up in downtown Saigon to produce the video tapes used for each Vietnamese broadcast (channel 9). U.S. (channel 11) programming materials consisted principally of top U.S. TV network programs on 16mm film provided by AFRTS Los Angeles.

The Saigon station, in addition to housing its own personnel, is also the network headquarters for administration, supply and engineering. The main studio building has, other than office and storage areas, an AM master control, FM master control, news room, three radio production studios, record library, TV film library, telescine and kinescope room, TV master control, and one large television studio. Other principal structures in the compound include a transmitter building which houses two 25,000-watt TV transmitters (channels 9 and 11), a 1000-watt AM radio transmitter and a 1000-watt FM transmitter, and a generator building which has three 200,000-watt sync generators which provide power for the entire facility.

An 80-foot television antenna, specially designed to radiate signals on both channel 9 and channel 11, is mounted atop a 300-foot steel tripod tower. The design of this antenna gives an effective radiated power of 240,000-watts in the Saigon and surrounding areas.

As the television network build-up proceeded, plans for improving the radio signal in the country were moving toward fruition. Although the number of radio repeater transmitters had increased to at least 22, there were still areas of the country where an adequate radio signal could not be received. To solve this problem, plans were formulated for the installation of five large radio transmitters throughout the country. Three of these are 50,000-watt transmitters to be located at Cat Lo (for the Saigon and delta area), Pleiku and Cam Rahn Bay. The remaining two are 10,000-watt transmitters to be located at Qui Nhon and Da Nang. Once operating, these transmitters will provide a 5 millevolt signal throughout most of South Vietnam, and a minimum signal of adequate for the average small transistor radio.

On June 1, 1967, the 10,000-watt radio transmitter at Da Nang became operational, thus making Armed Forces Radio and Television, Vietnam a true network operation. Consequently, on July 1, 1967, the name, "American Forces Vietnam Network" was adopted.

The network's Officer in Charge, Army Lt. Colonel James E. Adams commented that, "Automated broadcasting systems have been proven successful in the States and we think they will prove equally valuable here in Vietnam. The machines will enable us to provide more and better programming to our listeners with a smaller staff."

Initially the automated Saigon FM system began broadcasting stereo music six hours daily from 6 p.m. to midnight. Plans are underway to extend the FM broadcast day in Saigon from its present 15 hours to a full 24 hours with the machine assuming much of the additional burden.

Fig. 2 Air Force S/Sgt. George Goldstein giving "PFC Gates" a daily inspection.

World Radio History

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Film Chain Over-Saturation

One of the minor problems associated with the operation of a four pickup device film chain is that of the relative color saturation between film and slides. This situation is caused by the difference in size of a 16 mm film frame and a 35 mm slide and is aggravated by stopping the camera lenses to obtain depth of field.

Regardless of the fact that you have accurately sized your film and slide sources at the test jig ahead of the relay lens, and even this is a compromise on slides because they are the wrong aspect ratio, the light rays forming the images are arrived at different angles. They start from two different size sources and diverge at different rates. Hence, when passing through the relay lens, they converge at different rates.

This can be easily demonstrated by holding a white card ahead of one of the four camera lenses and alternately projecting open gate film and slide light onto the card. The "balls of light" from the slide light source will be larger.

On our G.E. P.E. 240 film chain, it is factory recommended that you stop the R, B, and G camera lenses to F2.8 and the luminance (Y) camera lens to F5.6. This provides enough depth of field to accommodate various film thicknesses, front or rear emulsion, without constant light source re-focussing, equalization of light levels on vidicon face plates, and is a desirable operational convenience.

Now observe the "ball of light"/lens stop situation: On a film, the smaller "balls of light" pass through the R, B and G lens irises stopped at F2.8 and also through the luminance iris stopped to F5.6. On a slide, the larger "balls of light" also pass through the R, B, and G irises, but the smaller luminance iris opening prevents some of the light from passing through to the camera. Light can be seen around the outer periphery of the iris opening. Obviously then, there must be some reduction in the video output of the luminance channel from that which would be present due to a larger iris opening. With "open gate" conditions, this reduction amounts to about ten IEEE units. This condition, after matrixing, is exhibited by oversaturated slide or "thin" (low chroma) film reproduction, depending on the station setup procedures.

In the past, we have always set up our camera targets on the gray scale using open gate slide light as the standard. The rationale was this: somewhere, you must assign a light source to be the one against which others are referenced. We then color trim our film projector light sources "open gate" to match the slide light source temperature. Almost invariably, a .20 Green matches the film lamp to the slide lamp. This procedure, however, only matches temperatures—the relative amplitudes of the R, G, and B pulses as observed on the oscilloscope parade. The Y amplitude is a function of the aforementioned iris/"ball of light" situation and you will note that it is about 10 IEEE units lower on slides than on films.

Now, if the camera targets are set so that Y, R, G, and B are equal on slides, Y will be high on films and films are under saturated. We would set targets using film "open

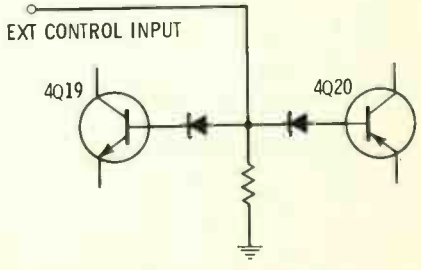

Fig. 1 Normal encoder with unity gain can take a control voltage at the input to control gain.

World Radio History

gate" light for Y, R, G, and B to be equal and allow slides to fall where they may, since we felt that films contain a better flesh tone standard of reference for the viewers than do slides. In addition, we run more films than slides.

This procedure led to a normal film, over saturated slide condition. Obviously, the reverse procedure—using slide "Y" rather than film "Y"—would lead to a normal slide, under saturated film condition. Either one is undesirable and the normal switching between the two sources gives rise to such questions as "Why it is that when I adjust my set for good color on films that the slides look 'runny' (too much color)?"

Some examination of the theory and circuitry of the PE-240 suggested a solution. The G.E. TV-112 Encoder provides for a remote chroma level control at the operating position. This control is for chroma gain and loss only, with the center of the control being unity gain. We felt that another knob for operators to turn would lead to more troubles that it would cure—but why not an automatic device to provide the necessary corretcion? A relay—plus two zeners and two resistors—one screwdriver adjust control and a minibox mounted on the encoder.

The slide projector tally lamp on the multiplexer (the lamp which indicates where the mirrors are) will close the relay and substitute a variable gain control when anything other than slides is in use. Now, with the Y channel target set up on slides for normal slide reproduction (this formerly gave an undersaturated film condition), switch the encoder to color bars and observe proper setup of the encoder on bars. Switch the multiplexer for film reproduction—this places the new variable chroma gain control in the circuit.

Adjustment

Adjust this control to cause the chroma amplitude of the color bars to increase ten IEEE units. Switch the multiplexer back and forth and observe that chroma is ten IEEE units higher on film than on slides; luminance remains constant. This ten IEEE unit chroma gain on film is just what is necessary to provide constant, normal film and slide reproduction and provides a very noticeable improvement on the air.

Dale Wolters
Chief Engineer
Station WZZM-TV
Kalamazoo, Mich.

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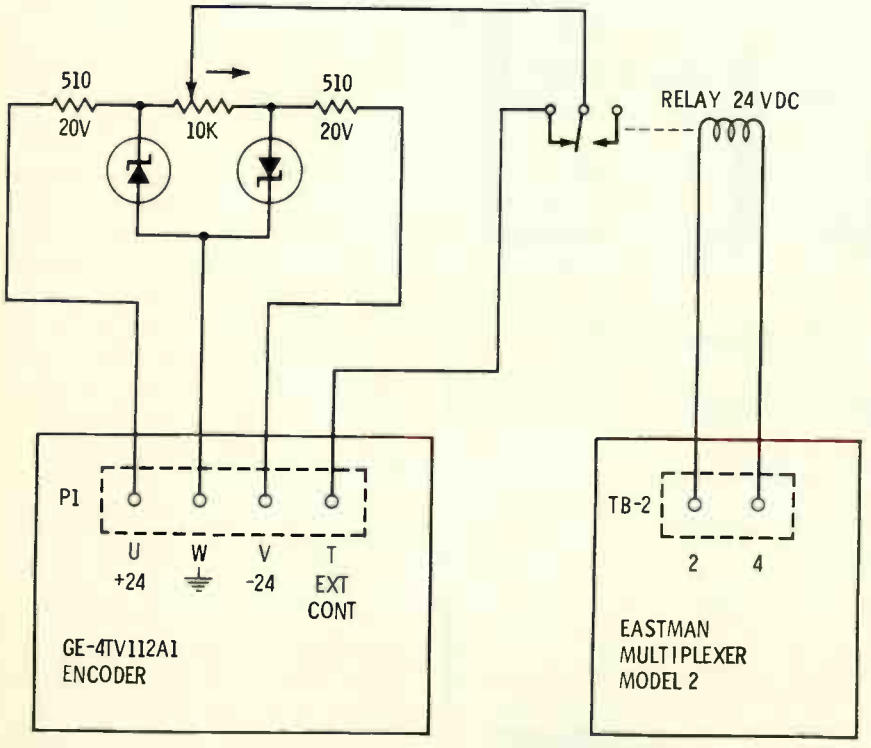

Fig. 2 Note that the relay coil receives 24 volts only when the mirrors of the multiplexer are in position for the slide projector. With the relay energized, slides only, nothing is connected to the encoder external control input. With the relay de-energized, films only, a preset control voltage is applied to the encoder external control raising the chroma gain of the encoder. Desired boost is about 10 IEEE units.

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NEW PRODUCTS

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

Heath Model IM25 Solid State VOM

Specifications and physical size of the Heath model IM25 Solid State Volt-Ohm-Milliammeter both are very impressive. Overall dimensions of the cabinet are 5⅛ in. high x 13½ in. wide x 6¼ in. deep, and the meter is 6 in. wide. (See Figure 1).

Nine ranges are available for the AC and DC voltages, beginning in decades of .15, .5, 1.5, and ending at 1500 volts full scale. The DC input resistance is 11 megohms on all ranges. Accuracy is said to be ±3% of full scale.

Separate 0-15 and 0-50 AC scales are printed on the meter face because the readings are not linear in the lower part of the scale, regardless of the range used. Do not use the DC scales to read AC voltages, even though the full scale readings may be the same. AC input

IM-25

resistance is 10 megohms shunted by 175 pf, including the probe with its shielded cable. Accuracy is listed as ±5% of full scale, and the frequency response as ±2 dB from 10 Hz to 100KHz.

The AC and DC milliammeter has 11 ranges covering from .015 to 1500 mills at full scale. The insertion resistance is different for each scale and varies from 10K on the .015 milliamp range to .1 ohm on the 1500 milliamp range. Accuracy is listed as ±4% of full scale for DC, ±5% for AC.

The ohmmeter function has 7 ranges from the low X1 scale with 10 ohms in the center of the scale, to the XIM scale with 10M in the center. Approximately +.07 volts is the maximum that can appear at the test prods during ohmmeter tests.

The IM25 VOM can be operated from 120 or 240 volts AC or either 50 or 60 Hz, or from self-contained batteries. Twelve "C" batteries power the AC and DC amplifiers, while the ohmmeter requires a 1.35 volt mercury cell and 2 size C cells. Since the power supply voltage for both battery and line voltage operation is regulated by two zeners, no difference in performance is noticed between line and battery readings.

Precision resistors (1% tolerance) are used for all voltage dividers. The solid state IM25 components include: 2 junction type field effect transistors; 13 silicon transistors; 2 zener diodes; 4 crystal diodes; 1 silicon diode rectifier.

Conventional circuitry is used in the DC voltmeter function up to the output of the function and mode switches. ("A" in the schematic of Figure 2) The 1M resistor, R42, (in conjunction with Q5 and Q6 transistors that are wired as diodes)

Spotmaster

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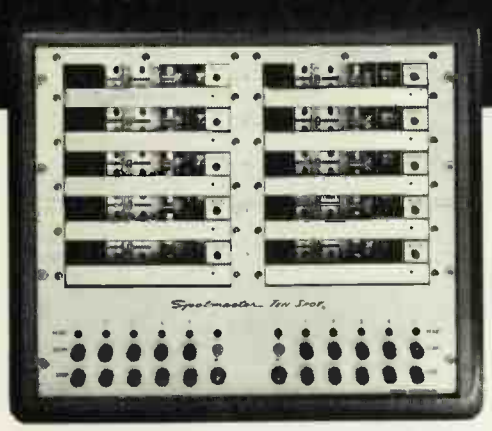
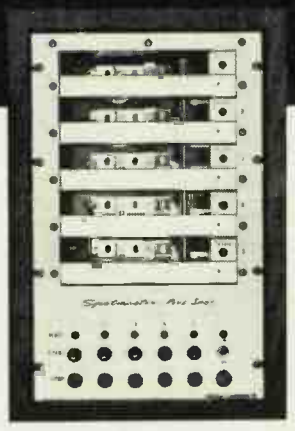


Ten • Spot Model 610B



Five • Spot Model 605B

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Spotmaster Ten • Spot (holding 10 cartridges) and Five • Spot (holding five) will reproduce any NAB Type A or B cartridge instantly at the push of a button . . . at random or in sequence. They may be operated manually or incorporated into programmed automation systems, using one, two or three NAB standard electronic cueing tones.

The Ten • Spot is designed for 19" rack mounting while the Five • Spot is available either in an attractive walnut-finished case or with a 19" front panel containing a cartridge storage cubicle. Both are backed by Spotmaster's iron-clad full-year guarantee.

For further information about these and other Spotmaster cartridge tape units, call or write today. *Remember, Broadcast Electronics is the No. 1 designer/producer of broadcast quality cartridge tape equipment . . . worldwide!*

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is a protective device to prevent damage to the FET. An excessive voltage will be shunted through Q5 or Q6 (depending on the polarity of the overloading voltage). The FET is wired as a source follower (equivalent to a cathode or emitter follower) which gives no gain and is coupled to the base of Q8. Q12 acts as a current regulator for Q7. Q13, in Q8's emitter circuit, is also another current regulator. Q14 and Q15 are wired as series diodes and are used as temperature stabilization of Q8.

Q8 is direct coupled to the base

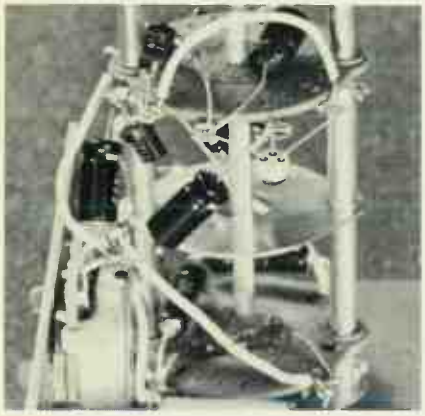
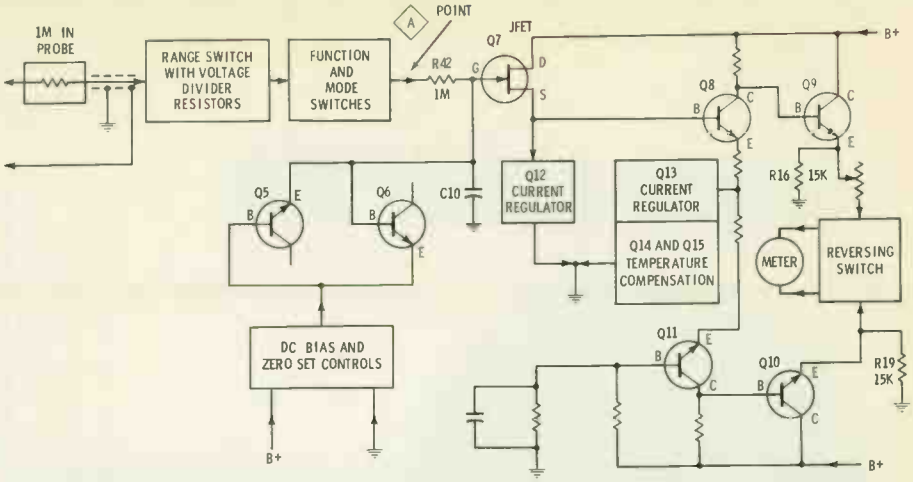


Fig. 1 Early wiring shows solid state complement.



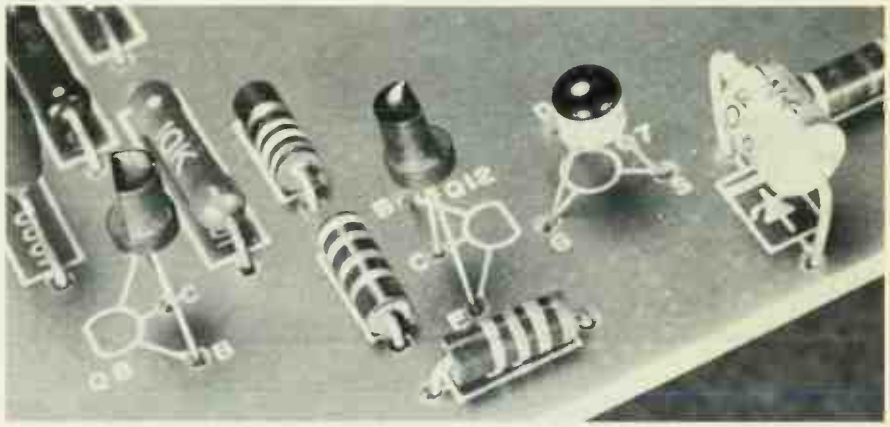


Fig. 2 DC path in the IM-25 shown at top. Above. **Fig. 3** shows layout of solid state components on PCB.

of Q9, whose emitter is part of the bridge circuit that deflects the meter. R16 and R19 are two arms of the bridge, while the emitter of Q10 is the fourth element of the bridge.

Q11 and Q10 supply a high degree of meter zero stabilization against thermal and voltage drifting. You will notice the emitter of Q11 is returned through the Q13 circuit along with the emitter of Q8.

Most ohmmeters in VTVM's make a voltage divider from a standard resistor and the external unknown, apply 1.5 or 3 volts from batteries and measure the voltage across the unknown resistor. With any ohmmeter voltage over about .8 volts, it is possible to obtain erroneous resistance readings in circuits containing diodes and transistors. Heath solves at least part of this problem by using an ohmmeter circuit that never supplies more than about .07 volts to the circuit under test. Some reading will be obtained with germanium diodes and transistors, but silicon transistors and diodes will not conduct on such a low voltage.

Unique also is the Heath IM25 ohmmeter circuit. Heath uses a

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NEW PRODUCTS

(Continued from page 49)

transistor, fixed battery voltage and an emitter resistor combination to generate a constant current of about 7 mills. This current, flowing through the 10 ohm 1% resistor, gives a voltage drop of .07 volts for all ranges. The internal DC amplifier is adjusted by means of the ohms calibrate control (not on the front panel) so this .07 volts reads full scale with no external resistance across the leads.

Other advantages of the constant current ohms circuit are constant accuracy as the ohmmeter battery ages, and no full-scale control is needed on the front panel. Because of the 7 mills drain in the ohmmeter function, the meter should not be left on "ohms" when the meter is not in use.

Positive or negative DC voltages can be read by throwing a polarity reversing switch.

Circle Number 51 on Reader Reply Card

Production Console

Visual Electronics Corporation introduced the "expandable" Model M1600 TV Production Console. Manufactured in Visual's Pasadena, California plant, the M1600 design is predicated on a basic console with two major additional features: TV audio requirements completely satisfied, and maximum growth and sophistication as required at minimal additional costs.

The basic console includes sixteen in-line mixers, four submasters, two output channels, power supplies, one monitor selector, a 10 watt monitor amplifier and a separate cue module. Balanced circuitry is used throughout the console for specification compliance with predictable consistency. Optional modules can be factory installed or customer incorporated within minutes. Space is also provided for additional power supplies and an additional monitor amplifier.

Circle Number 52 on Reader Reply Card

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SCA Generator

The McMartin M-103 SCA Signal Generator is a precision instrument designed for use in multiplex service in conjunction with FM broadcast transmitters.

Completely solid-state, using silicon devices throughout, the B-103 uses temperature-compensated integrated circuitry with guaranteed stability of the B-103 at 75 kiloHertz of better than ±200 Hertz. This compares with the FCC requirement of ±500 Hertz.

The B-103 covers the range of 20 to 75 kiloHertz. Models for 41 and 67 kHz operation are standard. Other frequencies within the above range can be furnished on special order.

Adjustment of proper audio input levels has been greatly simplified in the B-103. A peak flasher is provided for setting program input levels. The flasher operation is adjustable over a 50 to 120% modulation range with switch selection of either ±4 or ±6 KHz subcarrier deviation systems. The operating characteristics of the peak flasher are essentially identical to those used in FCC type approved SCA modulation monitors. The B-103 peak flasher, coordinated with a type-approved SCA monitor flasher, insures rapid, proper modulation adjustment of the subcarrier and eliminates the inherent ballistics problem presented by average-reading VU meters.

Electronic muting, with adjustable mute level, mute delay or disable function is employed.

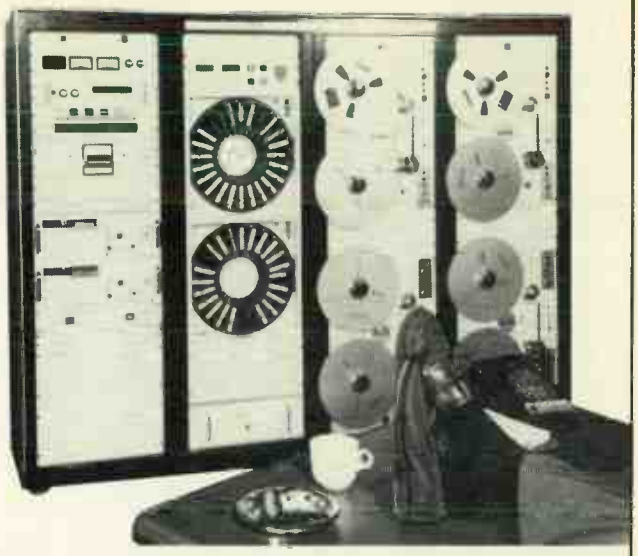
Circle Number 53 on Reader Reply Card

Solid State Triggered Sweep Scope

Leaders latest entry into the solid state oscilloscope field is the LBO-501. The 5" scope has a bandwidth of DC to 10 MHz making it ideal for every phase of color TV servicing. Its rugged construction makes it suitable for continuous laboratory and production line testing. Features such as triggered sweep, calibrated vertical input and calibrated time base, puts the instrument into the professional category. A size and weight reduction has been effected by the extensive use of semiconductors including a new solid state high voltage power supply.

DC coupling enables the user to

For the Program Director who wants everything...



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AR-1000 AUTOMATION SYSTEM

The new AR-1000 is an all solid-state, modular designed, total automation system that provides the ultimate in programming flexibility to meet any format requirements. It permits any station to readily individualize its programming up to 24 hours in advance, from up to 12 audio sources, and enables format changes to be made quickly and easily. The AR-1000 features all plug-in circuit elements, independent power supplies, photocell audio switching with full overlap, and built-in facilities for network joining. For real-time program logging, an all solid-state digital logger is also available.

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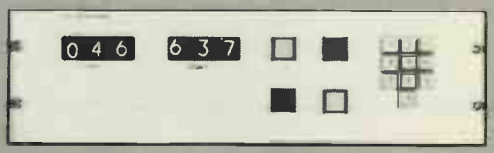

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World Radio History

make precise measurements in the DC millivolt region where a meter becomes useless. The triggered sweep makes it useful for viewing complex waveforms. Special sweep positions for viewing horizontal and vertical TV are provided. Among the conveniences offered are a lighted graticule, sharp rise time calibration square waves and a tilt stand for easier viewing. The vertical sensitivity is 20 MV pp/cm and bandwidth is DC to 10 MHz. Triggered sweep range is from 0.2 us/cm to over 0.2 sec/cm.

Circle Number 54 on Reader Reply Card

Unity Grain Delay Line

A unity gain delay line developed by **Andersen Laboratories** eliminates the need for cables and the associated equalizers and amplifiers necessary when cable is used to provide delay. The delay line is continuously variable, and produces delays equivalent to 200 feet of cable.

Delay is produced by electromagnetic means. Turning a selector screw provides a range of 0 to 280 nanoseconds. Frequency range is 30 Hz to 5 MHz, fully equalized over the entire frequency and delay ranges.

The circuit has a self-contained power supply which operates on 100 to 130 VAC, 50 to 60 Hz. Gain is adjustable ± 3 dB. Bandwidth across 5 MHz is flat to 0.1 dB. Package size is 2¾ x 5¼ x 10 inches.

Circle Number 55 on Reader Reply Card

Color Camera

A three-vidicon color television camera with built-in viewfinder, priced at $7,500, and immediately available, has been placed on the market by **International Video Corporation.**

The IVC-90 is the lowest priced color television camera available today and makes economical color television production a reality for CATV and closed-circuit users. The IVC-90 combined with the IVC-600-C color videotape recorder and a color receiver, provide a complete live color recording and playback system for less than $10,000.

The new self-contained camera utilizes solid-state circuitry and is compact and lightweight for portability. It features a permanently aligned optical system. Built-in integrated sync generator and encoder provide encoded outputs from a single coaxial connector. The camera may also be used with an external sync generator and encoder.

Control panel is located below the viewfinder and permits the operator to adjust camera master gain and pedestal and individual R, G and B target and pedestal. Provision is also made for remote operation of an IVC videotape recorder from the camera control panel.

An optional intercom module (plugs into right side of camera) terminates on a jack in the rear of the camera and connects the cameraman with the control room via a standard Western Electric headset. Two tally lights, one on top of the camera and one inside the viewfinder hood, are standard equipment.

The basic camera is supplied with three separate mesh vidicon tubes; 6:1 zoom lens; mechanical extension of focus, zoom and iris; 50 pin Cannon connector with 25 feet of video cable; and AC power cord.

Circle Number 56 on Reader Reply Card

CATV Converter

The AEL Suburbanite Converter makes it possible to add seven additional Super-Band channels to your 12 channel system. The Suburbanite has been designed for use in CATV systems where the ambient signal levels from off-the-air channels are not too strong. With a system using the new AEL Super-Band® amplifiers with expanded bandwidth out to 270 MHz, additional channels can be carried without distortion and beat problems.

The AEL Suburbanite converter is designed to deliver to a conventional TV receiver signals on the regular 12 channel broadcast assignments (channels 2 through 13) and, in its alternate mode, the Suburbanite will block convert all seven of the Super-Band channels into the tuning range of standard VHF tuner. The Super-Band channels are converted to Channels 7 to 13, thus adding seven additional channels. This broad band conversion requires no individual fine tun-


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FORCED AIR HEATER
(specials built to order)
- 201 Heater is built to Military specs.
- 201 Heater used aboard fixed & Mobile radio stations, mobile T.V. Vans, remote AM/FM stations, Pick-up Vehicles, Transmitter sites, etc. . .
- Broadcast stations will find heating equipment ideal for outdoor & indoor coverage. Built for rugged field performance; can be portable or attached to floor.
- Also available is our Lightweight & Mobile Food Warming equipment available for remote sites.
- Write for full catalog on our electric space heaters & food warming equipment.

VALAD ELECTRIC HEATING CO.
71 Courtlandt St. Tarrytown, N.Y.

Circle Number 29 on Reader Reply Card

World Radio History

ing after initial set up; only standard TV set tuning.

Circle Number 57 on Reader Reply Card

Trencher

Ditch Witch has introduced a new 37-horsepower trencher, the R-40. In size, the R-40 is the second largest Ditch Witch—between the 30 horsepower V-30 and the 60-horsepower R-60. The R-40 is powered by an air-cooled Wisconsin engine and has a maximum trenching depth of six feet, a maximum width of twelve inches. It is a rubber-mounted, four-wheel-drive unit.

Planned attachments include a

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about the products advertised or described in this issue.

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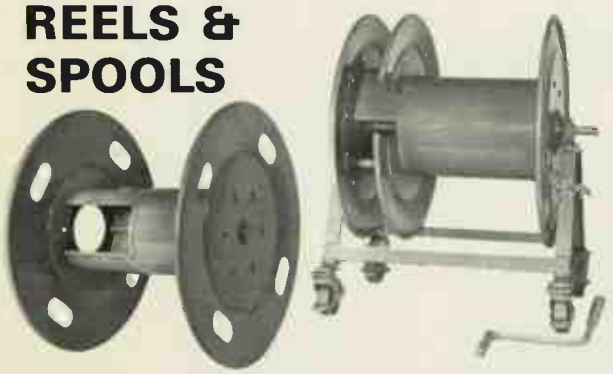
REELS & SPOOLS



FOR CABLE HANDLING

No matter what type of cable you use, Hannay offers the widest range of reels and spools for live cable handling or storage. All reels are available with manual or power rewind options to make your job easier.

Send for Catalog H-7001-EC for detailed specifications and prices.

HANNAY REELS

CLIFFORD B. HANNAY & SON, INC., WESTERLO, N. Y. 12193

Circle Number 21 on Reader Reply Card

"Want a Good Job in Broadcasting?

You'll Need a First Class FCC License."

Matt Stuczynski knows. He's the Senior Transmitter Operator of Radio Station WBOE. His story is typical of hundreds of men who have used Cleveland Institute Training as a springboard to success in Broadcasting. Here's what Matt says about Cleveland Institute:

"I give Cleveland Institute credit for my First Class FCC License. Even though I had only 6 weeks of high school algebra, CIE's AUTO-PROGRAMMED™ lessons really made electronics theory and fundamentals easy. After completing the CIE course, I took and passed the First Class Exam. I now have a good job in studio operation, transmitting, proof of performance, equipment servicing. Believe me, a Commercial FCC License is a 'must' for a career in Broadcasting."

If you want rapid advancement in broadcasting, the first step is a First Class FCC ticket with *your* name on it. And Cleveland Institute Home Study is a fast, economical way to get one. What's more, CIE backs their licensing programs with this money-back warranty:

"A CIE License Course will quickly prepare you for a First Class FCC License. If you complete the course but fail to pass the exam *on your first attempt,* CIE will refund all tuition."

With Cleveland Institute you get your First Class FCC License or your money back! Send coupon today for FREE book or write to Cleveland Institute of Electronics, 1776 E. 17th St., Dept. BE-62 Cleveland, Ohio 44114.

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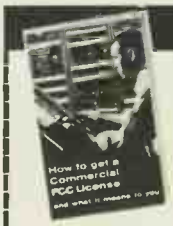

CIE Cleveland Institute of Electronics

1776 East 17th Street, Cleveland, Ohio 44114

Please send me your FREE book, "How To Get A Commercial FCC License."

Name_____ (please print)

Address_____

City_____ State_____ Zip_____

Occupation_____ Age_____

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Circle Number 30 on Reader Reply Card

World Radio History

front- or rear-mounted backhoe, front or rear mounted vibratory plow, boring unit and selective trenching attachments. The R-40 offers all the features made popular by other Ditch Witch units—the operator can vary the hydraulic speed independently of the four selective mechanical digging chain speeds, plus reverse; positive-power steering; unmatched operator convenience, comfort, safety and visibility. The R-40 complements the broad line of Ditch Witch trenchers ranging from 7- to 60-horsepower, both rubber and track mounted.

Circle Number 58 on Reader Reply Card

Portable Studio

The PORTA-STUDIO (Model TPC-100), designed to simplify set-up for remote television productions, has been introduced by **Tele-Mation, Inc.,** announced Lyle O. Keys, president of the Salt Lake City manufacturing firm. Two portable cases may be equipped with virtually all video and audio switching and control apparatus necessary for remote pick-ups.

Components may include such TeleMation equipment as a TMV-650 MULTICASTER Video Control Center, an audio mixer, and the TSE-100A Screen Splitter with fader bars. A second PORTA-STUDIO may be equipped with two 9″ video monitors for program and preview, and a TMV-529 Waveform Sampler for easy camera set-up and monitoring.

When equipped with a TMV-650 Video Control Center, the PORTA-STUDIO can accept up to six separate video inputs. The MULTICASTER incorporates a three-bus switcher (two mixer buses and programming and a separate preview bus) and offers master pedestal and gain control for remote operation of the Tele-Mation TMC-2100 Cameras. The TSE-100A Screen Splitter provides special effects such as corner inserts and vertical and horizontal wipes.

Program, preview and waveform monitoring is also possible by adding a second unit equipped with video monitors and TMV-529 Waveform Sampler. A TMV-529 permits display of the camera waveform on the viewfinder or video monitor.

Circle Number 57 on Reader Reply Card

Mixing Console

Gothan Audio Corporation announces the availability of what is undoubtedly the first mass produced major recording studio and broadcast console involving complete equalization, echo, filter and pan pot facilities.

The STUDER Model 089 is a compact twelve input, three channel studio and remote console of modular plug-in construction, totally in silicon solid state technology. It is complete even to such periferal systems as talk-back speaker amplifier, complete monitor system with 20 Watt speaker amplifiers, 20Hz—20 kHz test oscillator, pre-view cue system with built-in loudspeaker, complete remote control and signaling facilities and even a built-in ash tray.

The unit may be operated from either power lines of any voltage available anywhere in the world, or from external batteries. It is collapsible and comes in a fitted shipping case for damage-free transport.

Circle Number 60 on Reader Reply Card

Dual Channel Microphone

RCA HK-104 is a dual-channel dynamic microphone ideal for two-channel home-recording, conferences, panel discussions and general meeting recording applications. The HK-104 has a frequency response from 150 Hz to 10,000 Hz and may be used with either low or high impedance recorders. Features unique attractive design incorporating two unidirectional microphones in a single die-cast metal housing and having a satin-chrome finish. Supplied with gray metal desk stand and ten feet of two-conductor shielded ivory cable.

Circle Number 61 on Reader Reply Card

The Perfect Log

STANCIL-HOFFMAN R-70

24 HR. 4 TRACK RECORDER

Here's a full 24 hour, 4 track logger that's so compact and versatile you can take it anywhere to handle any assignment with 100% dependability or rack mount it in the studio. A remarkable new series of silicon transistor plug-in amplifiers makes the R-70 the most versatile ever—AGC, recall, full remote or automatic control, stereo, fail-safe, synchronous time injection, etc. 4 channels round the clock, complete on just one 7″ reel of ¼″ tape.

WRITE NOW FOR SPECIFICATIONS AND PRICES.

STANCIL-HOFFMAN CORP.

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Broadcast Engineering

World Radio History

TECHNICAL DATA

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

100. **AMPEX CORP.**—A specification sheet describing the new Ampex BC-210M monochrome broadcast television camera is now available. The BC-210M, designed for studio and remote use, is a monochrome version of the Ampex BC-21 color television camera. The BC-210M is designed to be easily converted to BC-210 performance level, a capability which allows users to avoid new camera expenses incurred when making the transition from monochrome to color television.

101. **DALE ELECTRONICS**—A new, 48-page catalog listing the full line of connectors is now available. Included in the catalog are 18 different connector types within these categories. Printed Circuit, Rack and Panel, Side Mount, Umbilical and Round Keyed Shell. Among the new styles listed in the catalog is Dale's SHP 40, a modular style printed circuit connector designed to meet requirements of the Navy's Standard Hardware Program. Also included are two new Edgeboard additions to the Dale Printed Circuit line—Series EBTL 050 for 1/32" and 1/16" boards with .050" centers. This series is said to be the thinnest of its type available. The catalog also includes complete dimensional information and ordering details on all models.

102. **DIALIGHT CORP.**—The new Product Selector Guide aids in the selection and procurement of more than a million and a half indicator lights, readouts and illuminated push button switches. Data is given in fully illustrated sections. Each section is devoted to indicators by size (Sub-Miniatures, Miniatures, Large) or by product groupings (Oil-Tight, Press-to-Test, Transistorized indicators). Separate sections of the Produce Selector Guide are also devoted to Iluminated Push Button Switches and Readouts. Four indexes, including one with military cross references, assist the user in obtaining the desired information.

103. **ELECTRONICS DEVELOPMENT CORP.**—The Video Clamper Data Sheet describes a clamper amplifier featuring 30 dB gain and capability of polarity reversal. Bandwidth is in excess of 20 MHz.

104. **ELCO CORP.**—A new 12-page publication provides a detailed analysis of Elco's state-of-the-art capabilities in the context of the high-technology electronics industry. Characterizing this technically oriented organization as a cohesive network of functional capabilities, the brochure defines the company's marketing philosophy and describes the facilities established in the United States and abroad to service its markets.

105. **BERNARD FRANKLIN CO.**—A new 104-page "Storage and Work Area Equipment Catalog" for executives responsible for storage planning in warehousing, manufacturing, stock room or production areas is now available. The

GOOD SOUND BUSINESS

Save money by reconditioning Your Ampex or Scully Heads

For only $45 you can have your present Ampex or Scully 3-head assembly reconditioned, to give you continuing service as good as new. Taber reconditioned heads give you these advantages:

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Circle Number 32 on Reader Reply Card

One of a series of brief discussions by Electro-Voice engineers

DROP BY DROP

JOHN R. GILLIOM
Chief Engineer, Loudspeakers

Reducing spurious resonances in a moving diaphragm is one of the most persistent and challenging problems facing speaker engineers. And in small cone tweeters, success in solving the problem dictates not only the ability of the speaker to provide smooth response over its effective range, but also strongly influences transient response capabilities.

In designing the current E-V 2½" cone tweeter, much of the development effort went into control of unwanted resonances, not only at the upper end of the spectrum, but also at the crossover point—a range often slighted but of more than casual significance to overall system response.

Investigation indicated that in addition to the fundamental resonance near the crossover frequency a 1st-order circular break-up mode of 6 kHz caused the edge of the cone to vibrate at excessive amplitudes. The solution was classical: addition of a controlled viscosity plasticized polyvinyl chloride compound to the compliance roll.

This material, commonly called damping compound, permeates the cone material, and when dry its high internal friction provides the desired control of rim resonances. But laboratory tests indicated that the quantity of damping compound to be added was most critical. Since the total cone mass was only 0.5 grams, even minor variations in damping compound characteristics and volume could lead to gross over-or under-damping.

The solution was fully automatic application of the compound. It was achieved by mounting the cone on a small turntable whose speed is precisely controlled. A carefully metered dispenser automatically flows exactly 200 milligrams of damping compound on the cone during a single rotation, with a tolerance of ±30 mg. (0.001 oz.). After the compound dries, each cone is then weighed before acceptance for final assembly.

In addition to the application of metered amounts of damping compound, other efforts to control cone motion have proved successful. Behind each cone is placed a glass fiber pad that fills the space between the cone and the frame behind it. Precisely controlled in both consistency and quantity, this pad adds mechanical and acoustic damping to the cone to reduce unwanted cone breakup, while contributing little to the mass of the moving system, so that exetended high frequency response may be maintained.

The result of these and other design characteristics that control resonances has been response that is relatively peak-free without excessive loss of efficiency.

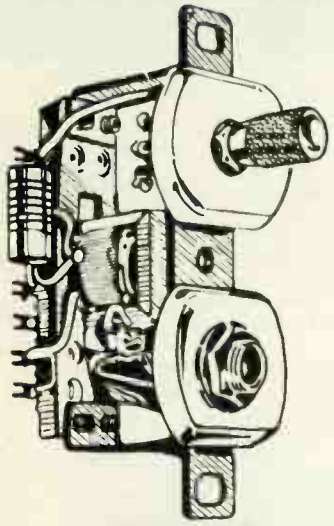
For reprints of other discussions in this series, or technical data on E-V products, write: ELECTRO-VOICE, INC., Dept. 203V 638 Cecil St., Buchanan, Michigan 49107

Electro-Voice®
A SUBSIDIARY OF GULTON INDUSTRIES, INC.

Circle Number 33 on Reader Reply Card

World Radio History

THE PROBLEM SOLVER!



WHERE CAN YOU USE IT?

WHAT: A complete intercommunications system, specifically designed for headsets or speakers. Modular constructed to fit into any standard electrical box. Basic system consists of: (1) Headset station with volume control (illustrated) (2) Line amplifier — 26dB voltage gain, and (3) Power supply to convert 110 AC to 24 DC. Available "in a box", too, for portable use wherever you have a 110 volt outlet.

WHO: Made by the company which designed and produced the "snoopy hat," the only headset that has been to the moon and back.

WHERE: Write for complete information on all 27 different modules and headsets designed to help you customize an intercom system for your own special needs, together with the name of your nearest dealer. Be assured of our prompt response to your inquiry.

David Clark COMPANY
INCORPORATED
360 Franklin St., Worcester, Mass., 01604
West Coast Office: 1696 Centinela, Suite 2, Inglewood, Cal. 90302
Circle Number 34 on Reader Reply Card

catalog gives ideas on how to layout new storage areas, and the equipment to use. It also gives illustrations of space saving ideas.

106. **GENERAL LABORATORY ASSOC.**—A brochure decribing the new line of custom, high temperature, mica paper capacitors is now available. The brochure describes major application areas, graphs, insulation resistance, dissipation factor and capacitance change against temperature. In addition, a section on performance characteristics describes the radiation resistance, corona resistance, high energy storage, cost advantage and reliability of GLA's wound mica paper capacitors.

107. **ITT**—A new catalog describing its line of MICRO-D™ Mark II connectors is now available. The Mark II unit is a high-performance microminiature connector that is rugged and moisture-sealed. Its aluminum shells provide EMI shielding with 40-dB attenuation at 1,000 MHz. A silicone elastomer seal provides complete moisture and humidity sealing between each contact and between contacts and shell. The rear of the connector is fully sealed wiht epoxy potting that surpasses the 10-day humidity cycle of MIL-STD-202, Method B. The connector employs size 24 MICRO-PIN®/MICROSOCKET® contacts on 0.050-inch centers.

108. **NARDA MICROWAVE CORP.**—The 1970, 152-page catalog, No. 17, is now available. It features more than 70 new products and improved specifications on virtually all items in the product line. The catalog is developed around the theme of the Broadband Generation, which encompasses the large number of products which span the microwave range of greatest interest, 1.0 to 12.4 GHz. The catalog also offers the latest in state-of-the-art coaxial couplers, attenuators and RF and microwave instrumentation. Devices and instruments are geared to the broadband concept. For ease of reference and to enable rapid selection of key components, each major section of the catalog is preceded by a summary section.

109. **NORTRONICS CO., INC.**—The publication of a new bibliography of reference works on magnetic recording is now available. Over 40 books and publications are listed, covering such topics as Re-

Give Us a Requirement to Build to

Broad Frequency Response?

AMF VIDEO PREAMPLIFIER
• f_1 .1 Hz thru f_2 25 MHz

Ultra Low Noise?

AMF SOLID STATE MODULAR PREAMPLIFIER
• —165 dbV per cycle

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Cybertrans fulfill your needs whether they be ultra-low noise, subsonic requirements or extreme broadband video specifications. The flexibility of our "off-the-shelf" preamplifiers enables AMF to satisfy a wide range of special or standard needs . . . we call it Cybertran Technology. This new expertise makes it possible for you to specify your preamplifier requirements and have AMF ship it to you. Write or call Jim Campman, Applied Cybernetics Products, AMF Alexandria Division, 1025 North Royal Street, Alexandria, Virginia 22314 Phone (703) 548-7221. TWX 703-931-4209. Representatives in major cities of U.S.A.

AMF ALEXANDRIA

Circle Number 35 on Reader Reply Card

World Radio History

cording, Video Recording, Servicing and Repair of Recorders, and Magnetic Recording Standards.

110. **PRINCETON APPLIED RESEARCH CORP.**—A new four-page brochure is available describing the value of noise figures as a tool in specifying the proper amplifier for a given low-level signal source. By considering operating frequency, input impedance, and source impedance, both experiment and amplifier can be selected to minimize system noise. The bulletin, "How to Use Noise Figure Contours", provides specific example of four typical amplifier matching problems, selection of the right preamp., determining optimal operating frequency and source resistance, approximating minimum detectable signals, and determining equivalent input noise resistance. Briefly described are the sources of amplifier noise, and a method for its experimental determination.

111. **RCA**—A brochure describing the RCA-CA3059 zero-voltage switch. It is a monolithic integrated circuit used primarily as a trigger circuit for thyristors. The brochure discusses circuit operation, characteristics, features, temperature controllers, etc. Illustrations are also included.

112. **TRYGON ELECTRONICS, INC.**—A new 16-page New Product Supplement to its Power Supply Handbook 269 is now available. The New Product Supplement details Trygon's new modular and rack adaptable power supplies for systems, test equipment and OEM applications. It includes detailed specifications on standard models as well as descriptions of standard and custom rack mounting versatility for power supplies capable of supplying DC voltages from 8 to 180 VDC and currents up to 70 amps.

113. **UNITRODE**—A new Short Form Catalog and Design Guide on the SSPI-Product Group Thyristors, High-Power Transistors, Gate Turn-Off SCR's Photo SCR's and Hybrid Power Integrated Circuits is now available. For reader convenience, SCR's are categorized by MIL, High Speed and Industrial Types and Transistors by Power, Power Switching, and High-Voltage Power and Power Switching Types. The Design Guide sections list those devices Unitrode recommends for use in new designs.

PEOPLE IN THE NEWS

WLEX Makes Several Major Changes In Engineering Staff

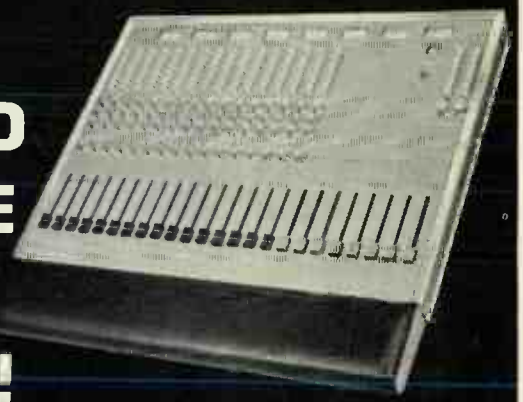
WLEX-TV-FM, Lexington, Ky., has recently made several changes in their staff. The changes are as follows:

Bob Goodrich has been appointed Chief Engineer. He is responsible for the engineering operations and maintenance. Goodrich joined WLEX-FM in September, 1969.

Albert W. Scheer has been appointed Chief Engineer of WLEX-TV. He has been in a supervisory capacity with WLEX-TV for the past year.

Bruce Waters has been appointed

NEW! FAIRCHILD PORTABLE MIXING CONSOLE!



MODEL FPC-50

The FAIRCHILD PORTABLE MIXING CONSOLE is the world's first truly portable mixing console . . . it goes wherever you go! It weighs only 45 pounds complete and is about the size of a suitcase, but only 2" thin. Put it on a desk, table, or stand, plug it into an external power supply or use the battery power source and it's ready to mix up to 16 inputs and 8 outputs including monitoring on each channel. One set of batteries (16 alkaline or ordinary flashlight "C" type batteries), self-contained in the arm rests, will provide 25 hours of continuous operation.

A complete 16-input, 8-output system with monitoring capability costs only $7990.00. (About $6000.00 less than a standard console with comparable facilities.)

Outstanding performance, reliability, and durability are assured because the FAIRCHILD PORTABLE MIXING CONSOLE consists of the identical component circuitry which has made FAIRCHILD standard consoles the pacemaker in motion picture, television, radio and recording studios throughout the world.

Take a FAIRCHILD PORTABLE MIXING CONSOLE to your next recording session. The quality is unquestionable, the portability is obvious and, of course, the price is right!

FIVE MODELS AVAILABLE:

16 inputs ____ 8 outputs
16 inputs ____ 4 outputs
16 inputs ____ 2 outputs
12 inputs ____ 4 outputs
12 inputs ____ 2 outputs

FAIRCHILD PORTABLE MIXING CONSOLES from $4990.00 to $7990.00.

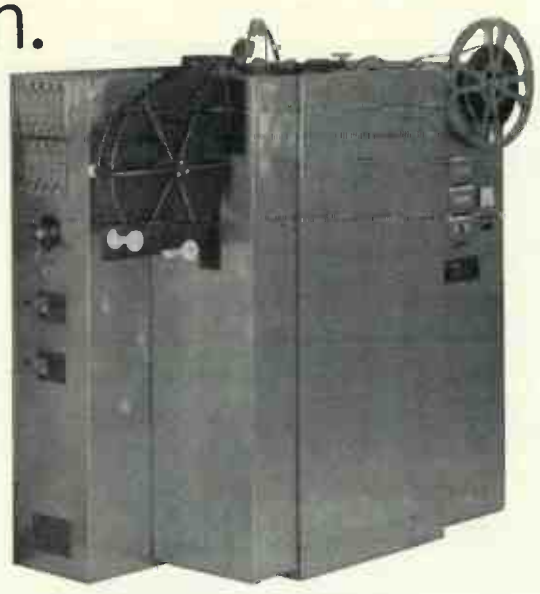
For complete details and performance specifications write to:

FAIRCHILD SOUND EQUIPMENT CORPORATION
Dept. BE-2 10-40 45th Avenue • Long Island City, N.Y. 11101

Circle Number 36 on Reader Reply Card

World Radio History

For a little guy, the Jamieson Mark IV color processor sure turns out the film.



The Jamieson Mark IV color processor may be small in size, but there's nothing small about its performance.

It is the easiest of all machines to operate.

It is fully instrumented and automatically controlled.

It has a warm-up time of just 10 minutes, a put-through time of just 23 minutes.

At that rate the Jamieson Mark IV color processor for 16mm and 8mm Ektachrome at 30 F.P.M. delivers processed film at a rate twice that of other machines its size.

But there's more to our Mark IV than just speed.

A lot more.

The Mark IV is no bigger than a standard office desk so you can easily install it in existing space.

It costs less to own than any other color processor in its class.

It is completely self-contained and its simplicity of design reduces maintenance requirements and makes servicing a breeze.

And we didn't stop there.

Our proven, patented small reservoir tube tanks are incorporated in the Mark IV color processor. These tanks contain only about one fifteenth the amount of chemistry required by ordinary open tank types. What does this mean?

The reduced volume gives you more stable chemical balance and finer temperature control. You get highest color quality, freedom from scratch hazards, lower day-to-day chemical costs and the gentlest, most reliable film transport system available.

The Mark IV is available in two versions. The fixed installation for TV stations and small commercial labs and in an air-transportable model with special electrical features that make it adaptable to any electrical conditions you may find.

For more information on the Mark IV color processor and the names of current users, write us.

Jamieson Film Company
EQUIPMENT DIVISION
2817 CANTON ST., DALLAS, TEXAS 75226
A/C (214) 747-5634

Circle Number 37 on Reader Reply Card

Supervisor, Daytime TV Engineering Operations. Waters has been with WLEX-TV since February, 1969. He was previously employed by General Telephone Company.

Bob Ball has been appointed supervisor, Nighttime TV Engineering Operations. Ball rejoined the Engineering Department of WLEX-TV in November, 1969. He has previously worked as an engineer for WBLG-AM and WVLK-AM and FM.

Broadcast Pioneer Dies In Memphis

Hoyt Wooten, owner and operator of WREC AM-FM and TV in Memphis, passed away in December.

Wooten began his career in radio by converting his ham station into the first commercial station in Mississippi under the call letters KFNG. The station was later moved to Memphis where the call was changed to WREC.

One of the first people in this country licensed to build and operate a television station, Wooten prided himself on the high standard of equipment used and the quality of the signals from his stations.

He was a member of the Tennessee Association of Broadcasters, the NAB and other professional organizations.

Kaiser Selects Hill As Engineering VP

Eugene R. Hill, director of engineering, has been elected a vice-president of Kaiser Broadcasting. Hill joined Kaiser in 1964 as chief engineer of WKBD-TV Detroit. WKBD-TV was Kaiser's first UHF station, the first of nine TV and radio stations on which Hill has supervised construction in the last five years.

In 1965 he was named director of engineering and transferred to Philadelphia to supervise construction of WKBS-TV. In 1966 KBSC-TV (Corona-Los Angeles) and WKBG-TV (Cambridge) began operations; 1967, WCAS (Cambridge) and WJIB (Boston), and in 1968, KBHK-TV (San Francisco) and WKBF-TV (Cleveland).

World Radio History

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

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

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

Spotmaster

Tape Cartridges

All lengths and sizes stocked — fast service — highest quality

Series Type	Time at 7½ ips	Unit Price
300	20 sec. (13′)	$1.90
300	40 sec. (25′)	1.95
300	70 sec. (44′)	2.00
300	100 sec. (63′)	2.15
300	140 sec. (88′)	2.25
300	3½ min. (132′)	2.40
300	5½ min. (207′)	2.75
300	8½ min. (320′)	3.55
300	10½ min. (394′)	3.70
600	12½ min. (470′)	5.30
600	16 min. (600′)	5.95
1200	26 min. (975′)	9.05
1200	31 min. (1163′)	9.95

Also: DL cartridges (for Spotmaster delay machines), empty cartridges, bulk tape, tape-tags and other accessories.

ANY ASSORTMENT—NO MINIMUM ORDER

BROADCAST ELECTRONICS, INC.
A Filmways Company
8810 Brookville Rd., Silver Spring, Md. 20910

Why does GBC sell more replacement vidicons than all other suppliers combined?

Because GBC offers top quality, fully guaranteed, factory sealed vidicons for less than half the price you'd have to pay anywhere else!

HITACHI 7038H **29.50**

HITACHI 7735A
High sensitivity **34.50**

HITACHI 7262
(Replacement for Sony & Panasonic) **34.50**

HITACHI 8507
(Separate mesh) **74.50**

All vidicons sold in lots of five. Add 10% for lesser quantities.

GBC Closed Circuit TV Corp.
74 Fifth Avenue, N.Y., N.Y. 10011 / (212) 989-4433

Circle Number 25 on Reader Reply Card

World Radio History

Situation Wanted

Man, First Class Radio Telephone License. Desires permanent job as broadcast transmitter technician in deep south working under chief engineer. William H. Wilson, 320 Brown St., Douglasville, Georgia 30134. Phone 942-6014. 2-70-1t

Help Wanted

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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1. WIDER FRONT WORKING ANGLE

The SM53 allows *greater freedom of performer movement—tonal quality is unaffected by movement throughout* the broad effective pickup area. *Eliminates "holes" and "hot spots"* when using multiple microphones. These valuable attributes stem from a broad, true cardioid frontal pattern *at all frequencies, in all planes*—freeing the user from the restrictions of overly tight angular sensitivity.

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The SM53 prevents sound coloration due to off-axis reflections or reverberation—and, in addition, unwanted sounds (even air conditioner rumble) are effectively controlled. These properties are achieved through the polar pattern which is singularly uniform with frequency (even at the extreme low end) and is symmetrical about its axis.

3. MECHANICAL NOISE ISOLATION

Built-in effective shock mount significantly reduces the objectionable stand, cable, and handling noises associated with many unidirectional microphones. The SM53 can be used in many applications where conventional units have proved marginal or unusable.

4. EXTRAORDINARY RUGGEDNESS

You can even drop the SM53 directly on its nose without damaging the microphone element—and it will maintain its excellent performance characteristics.

5. SUPERIOR HUM REJECTION

Built-in hum-rejection system reduces magnetic hum susceptibility by as much as 20 db compared to other units! Makes it far more usable in distant pickup applications and in areas with extremely high magnetic fields.

6. LESS SUSCEPTIBILITY TO "POP"

Integral "pop" filter minimizes explosive breath noise without external screening. Works well where other microphones are marginal or unusable.

7. MINIMIZED PROXIMITY EFFECT

Uniform tonal quality is maintained (without objectionable low-end build-up) regardless of whether the microphone is worked close up or from a distance.

8. FIELD SERVICEABILITY

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