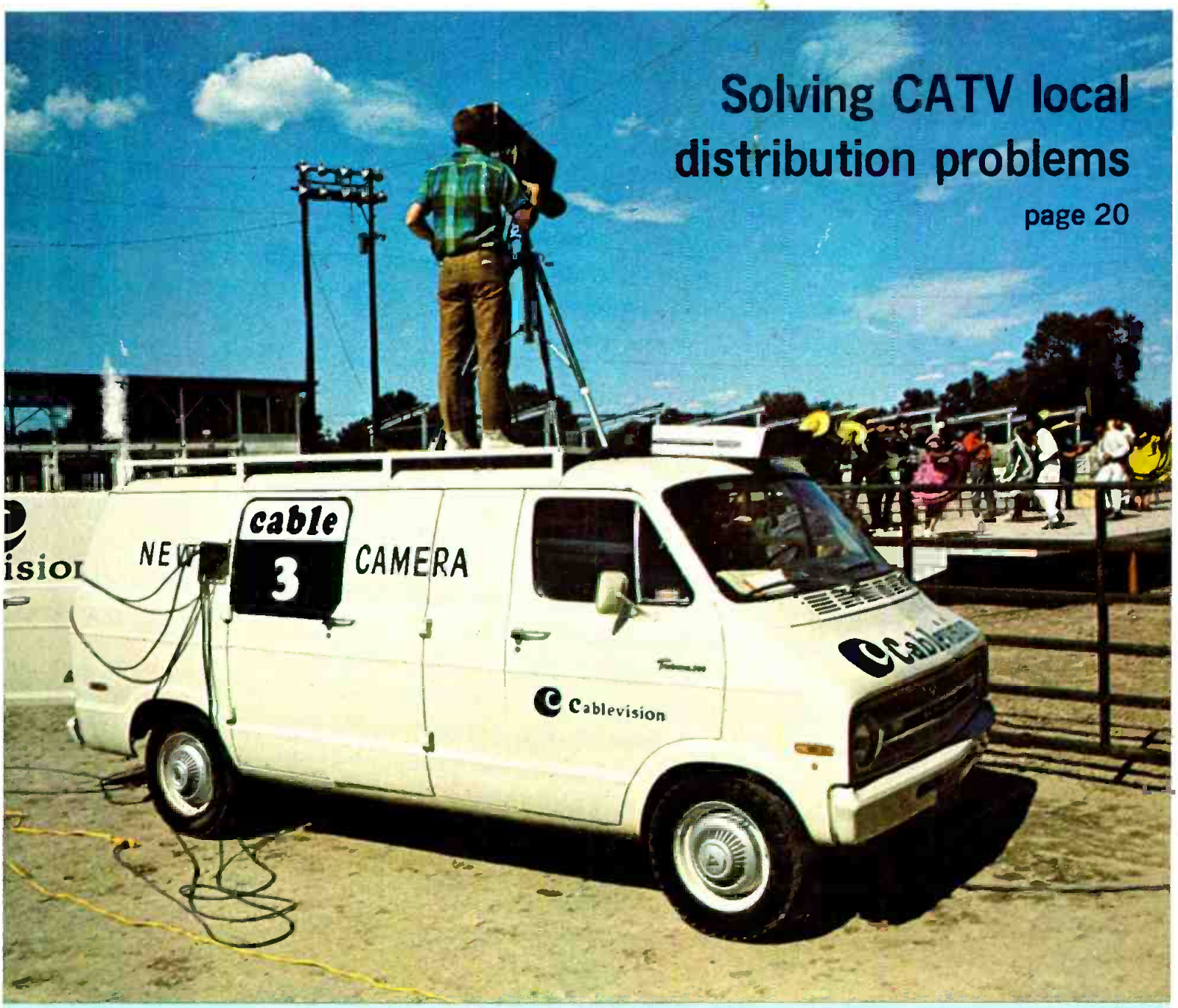
October, 1970/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry

A HOWARD W. SAMS PUBLICATION



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page 20

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October, 1970 • Volume 12, No. 10

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

This month's cover was taken of Pueblo TV Power's mobile van on location. Telemation Colorado, Inc. installed the solor studio system. Robert Miclette is the manager, Ron Katzin the program director. For this month's CATV article, see page 20. (Photo courtesy of TeleMation, Inc.)

DEPARTMENTS

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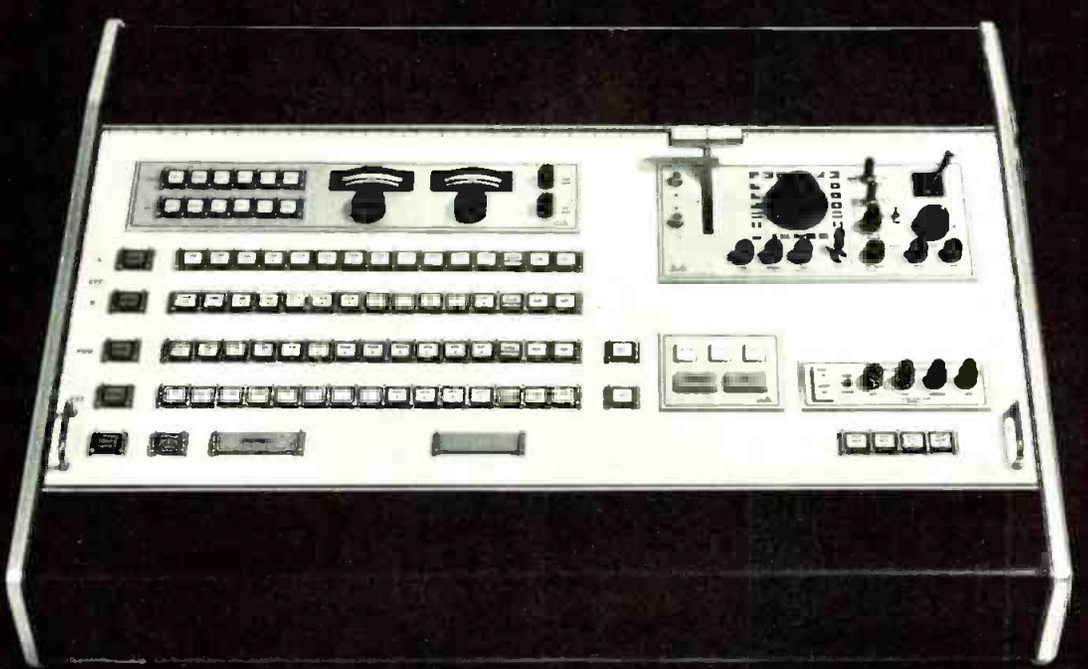

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DIRECT CURRENT FROM D. C.

October, 1970

By Howard T. Head

LM/VHF Channel Sharing Tests Fall Flat

The Commission has acknowledged receipt of the final report on "Sharing of VHF TV Channels By The Land Mobile Radio Service.". This document reports the results of a three-year effort by representatives of the land mobile radio services to determine the technical feasibility of land mobile/VHF sharing. Testing was confined to observations in the Washington, D.C. area, and nearby, where simulated land mobile operation was undertaken within the frequency limits of VHF television Channel 6 (82-88 MHz).

These tests were originally undertaken by land mobile representatives, with the cooperation of broadcast engineers, on a "crash" basis, the land mobile representatives insisting that immediate relief of land mobile "frequency congestion" was urgently needed (See Dec. 1966 Bulletin). Testing was originally planned for the Los Angeles, California area, but objections by the Mexican Government on the basis of potential interference to the Tiajuana, B.C. station on Channel 6 (XETV) resulted in shifting the locale to the Washington, D.C. area.

The Commission's Notice states that "no action" is being taken to implement VHF sharing, the principal reason being "this sharing should not take place until further information" is available. The principal need for this "further information" is the fact that the tests results contain serious discrepancies, in some instances reaching values as high as 50 dB, which were never satisfactorily explained. In other words, the land mobile testing fell flat on its face.

Mexican AM Treaty Again Under Active Consideration

The United States has received assurances from the Mexican Government that the new treaty governing AM radio broadcasting in the two countries (See Sept. 1969 D.C.) will be given prompt consideration by the Mexican Senate. The treaty, which has already been ratified by the U.S. Senate, is yet to be ratified by Mexico. The Mexican Senate will remain in session until the end of December.

U.S. broadcasters have at stake such matters as the presunrise operation of more than 200 daytime-only stations operating on the Mexican clear channels, and daytime power increases to 1 kW for Class IV stations on local channels near the Mexcan border. Present hopes are that the Mexican Senate will act on the treaty this fall, before the new administration of Mexican President-elect Luis Echeverria takes office on December 1, 1970. The Commission's staff has already prepared new rules implementing provisions of the new treaty, which can be put into effect shortly after ratification documents are exchanged by the two countries.

(Continued on page 6)

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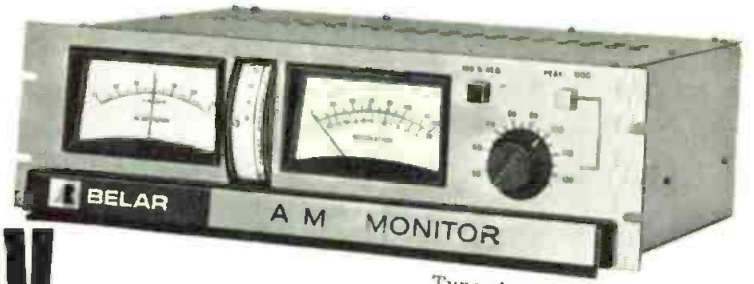

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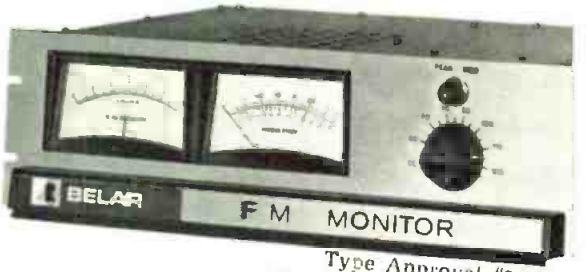

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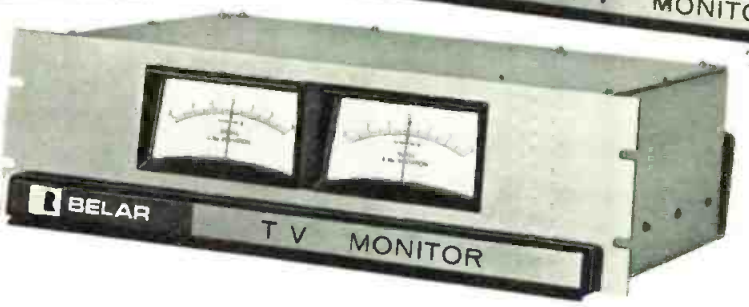

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Circle Number 6 on Reader Reply Card

(Continued from page 4)

Zenith Pay Television Approved by the Commission

The Commission has granted advance approval to the Zenith Radio Corporation system of pay-television which goes by the trade name of "Phonevision". Zenith has been endeavoring to obtain Commission approval of this system for almost twenty years.

The Commission adopted rules providing for pay-television in October, 1969 (See Nov. 1969 D.C.) with the requirement that all pay-television technical systems be granted advance approval by the Commission. At this writing, three television broadcast stations have applied to the Commission for regular pay-television operation, one each in Philadelphia, Detroit and Boston. An experimental pay-televsion station is continuing operation in Hartford, Connecticut.

Commission Studying Program Coding Systems

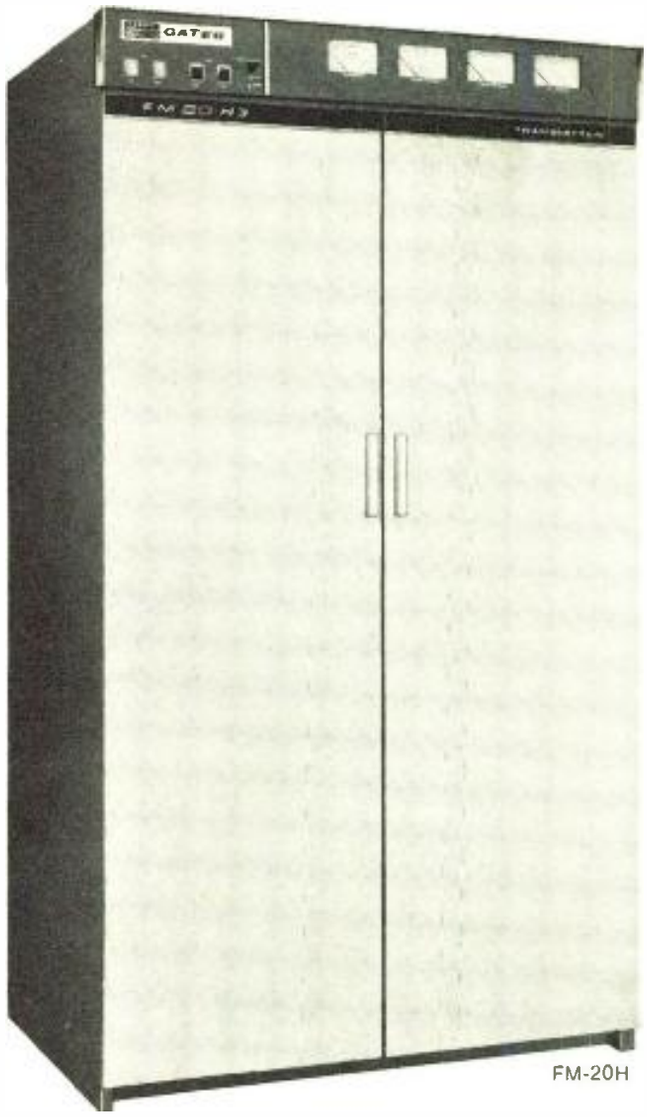
The Commission is actively studying various systems of coding to be included in radio and television programs and commercials, which will permit ready off-air identification of the carriage of particular program and commercial material. These systems are of particular appeal because they would permit automatic, foolproof identification of commercial carriage, as well as establishing payment for residuals and other rights.

The Commission has already approved one system proposed by International Digisonics Corporation (IDC), which places coded information on film commercials in the four corners of the picture to generate video "tones" which can be decoded by computer. Unfortunately, however, IDC and stations carrying the coded films have realized that the Commission's Rules require that the coded signals be confined to lines 21-23 and 260-262, inclusive, of the television raster, a virtually impossible requirement in scanning codes which are optically printed on motion picture film.

The Commission has also asked for comments on a system employing coded audio tones carried at a low level in a narrow frequency band in the aural portion of the program. In addition to the obvious application of this system to AM and FM radio as well as to television, the audio system has the further advantage of not risking any degration of television picture quality.

Short Circuits

The three television networks began testing of the EIA color vertical interval reference (VIR) signal on September 1, 1970 (See June, 1970 D.C.); symposia are also being held on color film consistency, another serious source of non-uniformity in color television pictures . . . The Commission has proposed to authorize "boosters" in the Instructional Television Fixed Service (ITFS) . . . NAB has opposed new tower painting rules which would increase the width of the painted bands and require prompt repainting.



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LETTERS TO THE EDITOR

The Wonderful World Of 'Wonders'

Dear Editor:

Judging by the letters published in **BE**, nearly everyone agrees that the "six week wonder" First Class licensee is a farce. Some suggest allowing a Third Class Endorsed to operate at least those AM directionals proved stable by virtue of their remote control authorizations.

But first, stiffen the Third Class exam. Not more technical, but more thorough, to assure the licensee really knows how to read meters. Most licensees cannot count meter divisions, do not understand "significant figures", and will not read during modulation pauses. Yet the R. I. expects to see 2 percent accurate logs.

When will a station, cited for inaccurate logs, challenge the FCC for effectively certifying that the announcer can read meters by awarding him a license? Perhaps the examination room should include an actual remote control terminal unit, with the examinee required to dial and read all parameters accurately.

Ronald Pesha
KRNY-AM-FM
Kearney, Neb.

It's A Matter Of What You Will Pay For

Dear Editor:

My mind can conceive of no practicable procedure to prevent "ninety day wonders" from entering the log signing business. No matter how intricate or complicated a test be made, it's passage would be a memory test.

The problems created by incompetent people allowing equipment malfunctions and FCC rules infractions are NOT the business of the FCC to correct and probably not entirely the fault of the "ninety day wonders". As long as there are economic considerations, there will be those who will prefer the least expensive product.

It appears that the thrust of the effort should be directed at educating broadcasters that they will in fact get what they pay for rather than stirring up that hornets nest in Washington, D.C.

Finally, I'm tempted to ask, even after teaching the subject, how many of us real, practicing, working, able to keep it on the air engineers could pass the test as it is without some intensive brushup?

Jim Burlingame
Chief Engineer
KEDO
Longview, Wash.

Licenses Should Reflect The Duty Performed

Dear Editor:

The letter from Mr. Walter Jung in your June 1970 issue was quite interesting.

Walter states that he recently passed the exams for a First Class license. This fact certainly does not detract from the value of his viewpoint and his suggestion. As a relatively old timer in the business (first license in 1933 and first empoyed in broadcast in 1934) I would like to express my views.

I certainly agree with him that something should be done about the "90 day wonder" schools. They are not producing technicians of engineers but are merely turning out license holders on a production line basis. The answer to this of course is a comprehensive modification of examination procedures by the FCC.

I do not entirely agree with Walter's viewpoint on periodic re-examination. This might conceivably be appropriate in cases where an engineer has been standing watches in an AM station for the entire period of his license. Basic AM procedures and techniques have not changed in the last 30 years at least. With the introduction of some solid state audio equipment the AM field underwent their most radical change

(Continued on page 10)

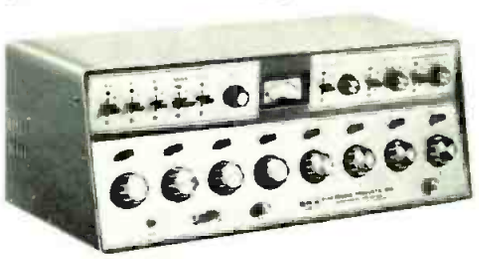
QRK Announces a Breakthrough

QUALITY CONSOLES AT REALISTIC PRICES!

QRK-5 MONO PRE-WIRED SYSTEM $1995

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

QRK-5S STEREO PRE-WIRED SYSTEM $2995



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

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

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

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(Continued from page 8)

in almost 50 years. However, this certainly could not be called a revolution.

However, in television, or even in FM to a small extent (with the advent of stereo and SCA), techniques and equipment design are in a constant state of flux. In television, if an engineer does not keep up with the state of the art he just won't hold his job. Most television engineers are constantly working with the most intricate and sophisticated types of equipment. I don't feel that periodic re-examination would accomplish a thing in this case.

Instead I would propose another idea for which I do not claim originality. It was first proposed some years ago by someone who escapes my memory but it never seemed to grab hold. However, I have always felt that it would be the best way to upgrade the profession. That idea involved the establishment of several grades of license. The eligibility of an engineer for employment in radio stations exceeding a certain power or his employment in a directional AM or a television station would be based on the grade of license which he holds. Advancement from one grade to the next higher grade would be based on a period of required service in the lower grade in addition to an FCC exam. This is not revolutionary in that the Commission already has a similar requirement for advancement from Radiotelegraph Second to Radiotelegraph First.

I think that it is fairly obvious that the engineering qualifications necessary for a television station differ radically from those which would qualify a man for service in a radio station. It is also just as obvious that a man qualified to operate a 250 watt non-directional AM station could not necessarily cope with the complexity of a directional array or a 50 kW clear channel station.

I maintain that there should be several grades of license or at least a system of endorsements for the various qualifications.

George F. Sprague
Chief Engineer
WLOS-TV, FM
Weaverville, N. C.

Ask, We Will Help You Receive It

Dear Editor:

Thanks to **Broadcast Engineering's** vast readership and the cooperation of those in the broadcast industry, my problems with an older model PRESTO tape deck have been solved.

A schematic was sent to me by Roger Bennett of WBTH in Williamson, W. Va., and I received numerous offers of assistance from stations throughout the country.

I would just like to say "thanks to the broadcasters and to **Broadcast Engineering.**"

Bob Ayers
Radio Station WCMA
Corinth, Miss.

Editor's Note: Since my introduction to the broadcast industry, I have been amazed at the "unwritten law of cooperation" that exists among engineers and engineer-managers. This column is always open to those who need help finding schematics, tubes . . . or you name it. Our thanks goes to our readers, too, because from cover to cover we are seeking to improve communications with the industry. That would be impossible without a responsible readership.

Oldtimer Request

Dear Editor:

As an old-timer in broadcasting who finds pleasure in old broadcast equipment and materials, I'd appreciate very much corresponding with anyone who has the vertical cut test record issued to its subscribers by World Broadcasting System, Inc. and, in addition, almost any other materials—as catalogs, indexes, scripts and pressing—that are related to transcription libraries.

H. I. Moseley
6311 Southwood Ave.
St. Louis, Mo. 63105

You Can't See Them, They Don't Work

Dear Editor:

Concerning page 6 of Direct Current from D.C. in your August issue and the subject of invisible car radio antennas: I experienced similar trouble with a 1970 Olds antenna.

After the usual ream of explanatory letters to the dealer, distributor, customer relations, and the manufacturer, I finally found a "modification kit" part number for windshield antennas. My local dealer ordered one and presented me with a $4.95 1969 Olds whip antenna, which, when installed, performed as expected!

The local dealer now stocks these "modification kits" to appease complaining customers. The number of listenable FM signals quadrupled with the installation of the whip. Still, the manufacturer flatly insists the windshield wire is "equivalent to a 28-inch whip on FM." Sigh! ! !

Dick Alder, CE
Station KCFM
Carmel, Calif.

Send Your Letters And Exchange Ideas To:

Broadcast Engineering
1014 Wyandotte, Kansas City
Missouri 64105

INDUSTRY NEWS

Comments Due Nov. 2

Rules Relaxation On Stage

In response to a petition by the National Association of Broadcasters (NAB), and requests by individual broadcasters, a Notice of Inquiry and Notice of Proposed Rule Making for possible amendment of Sections 73.93, 73.265, and 73.565 of the Rules (operator requirements for Standard AM and FM broadcast stations) has been adopted by the FCC to explore ways to relax routine operator requirements and improve the quality of the supervising first-class operator (Docket 18930).

The proposed rule would permit stations to be authorized to use third-class operators for routine operation on an individual basis, if an appropriate showing is made. The showing would have to include the stability of the transmitter, employment of a well-qualified first-class operator fulltime and at least one other first-class operator full-time or on a part-time basis. Higher power FM and nondirectional AM stations would have to make showings in some, but not all, of these respects.

Under the present rules, nondirectional AM stations operating with no more than 10 kW power, and FM stations with 25 kW or less transmitter output power, may employ third phone permit holders for routine operations. All AM stations when operating directionally, AM stations licensed for more than 10 kW and FM stations over 25 kW, must have first phone operators on duty at all times. Some 1,200 full-time or part-time directional AM stations would be affected if the new rules are adopted.

Under Section 318 of the Communications Act, only an operator licensed by the Commission may actually operate a radio station transmitter. Under Section 303(1) of the Act, the Commission has authority to fix the qualifications of operators, classify them according to their duties, and fix the form of their licenses. The requirement that transmitters must be operated by licensed operators only may not be waived except for TV repeater stations.

NAB requested that all AM stations and 50 kW or less FM stations be permited to use third phone operators. Directional AM stations would be required to have one full-time first phone operator, while others could have one either full-time, under contract, or on call.

Opponents of the proposal include the National Association of Broadcast Employees and Technicians, Elkins Institute, a technical school in Dallas, Texas, and a number of first-class operators. Pointing out that the proceeding is chiefly an Inquiry to determine what the operator requirements should be and to consider various matters pertinent to these requirements, the Commission said if the comments warrant, certain rule amendments of a relaxing nature may be adopted without further proceedings.

Noting the increasing number of technical violations at broadcast stations, the Commission said one of its most important considerations is whether the number of violations and discrepancies would be increased if the rules were relaxed.

It has not considered it feasible up to now, the Commission stated, to permit operation of directional stations by operators not holding the highest grade of radiotelephone license issued, but since many stations are having serious problems in obtaining properly licensed operators it might again consider the matter under conditions that would preclude a substantially increased hazard of interstation interference.

If third-class operators are to be permitted for routine operation of directional antenna stations, then a qualified first-class operator should be employed full-time rather than on a contract basis, the Commission said. It added that some provision should be made to have another qualified first-class operator available when the full-time employee is not available for duty. They also said that a showing in this respect will be required before the present first-class requirement for directional antenna stations will be relaxed.

Conceding that any examination can test only a limited sampling of an applicant's knowledge and not the practical application of it, the Commission asked for comments on the best methods of improving the competence of operators who supervise directional antennas so as to offset any lessening of operator quality if the rules were relaxed.

The Commision also invited comments on a large number of questions relating both to operators and their grades, the effect on technical operation, job security and minority-group opportunity, possible different standards for small markets, and to the general subject of possible automation of transmitters, including the extent to which this is in prospect for the near future.

Interested persons may file comments on or before November 2 1970. Reply comments will be due on or before December 1, 1970.

ITFS Translator Rules Proposed

Amendment of Part 74, Subpart I of the Commission's rules to provide for the operation of low power relay stations (translators or boosters) in the Instructional Television Fixed Service (ITFS) has been proposed in a rule making notice by the FCC. Among the changes proposed are deletion of Automatic Gain Control (AGC) circuits from the low power transmitters, and modification of present ITFS rules to permit the use of opposite polarization for relay stations. The Commission said it will continue to require that the translators or boosters have sufficient circuitry to turn the equipment off automatically when the last used signal leaves the air.

The proposal was in response to petitions by Jerrold Electronics Corporation (RM-1599), and the Solid State Division, Micro-Link Products of Varian Associates (RM-1613). Jerrold contended that power relay stations are needed to relay

ITFS signals to receiving stations shielded from direct reception because of natural and man made obstructions, and that local ordinances, physical limitations, safety hazards, and financial considerations often do not permit the use of tall towers or remote receiving sites. They proposed authorization of a low power repeater or booster station to relay ITFS signals over or around an obstruction by utilizing the type of "back-to-back" antenna used at microwave frequencies with a linear amplifier of approximately 40 dB amplification inserted between the dishes of the antenna to provide a suitable signal up to about one mile.

Economical Operation

In order to use economical low power repeaters in this way, Jerrold proposed that Section 74.934(a)(1) be amended so that the repeaters would not be required to be turned off when there was no signal on the individual channel being relayed. They also proposed that opposite antenna polarization at the input and output of a signal booster be permitted, and that Section 74.935 be amended to permit a booster to operate with a total output of up to 50 milliwatts or with up to four channels in its passband, each limited to 100 microwatts. In addition, Jerrold asked that Section 74.950 (f) be amended so that low power relay stations would not be required to be equipped with an automatic gain control (AGC) capability because, Jerrold claimed any signal variations caused by fading will not be affected by the linear repeater and will fall well within the AGC capacity of the ITFS receivers.

Micro-Link asked for a waiver of the Commision's rules in order to provide a low power translator to relay ITFS transmissions over or around obstructions to a school not in the line of sight to its ITFS stations. The company also requested that the AGC and automatic turn-off requirements be waived, asserting that these circuits are costly and not required for this specialized use.

Pointing out that under Section 74.950(f) an ITFS licensee must meet the requirements of 74.750(c), (e) and (f) of the Television Broadcast Translator Station rules, the Commision said when the ITFS rules were drafted it was assumed that single channel translators or signal boosters would be used and that the Television Translator rules would apply, but because of the development of multichannel ITSF equipment the proposed rules will eliminate references to the translator rules.

To Avoid Obstructions

The use of low power translator or signal booster transmitters as relay stations in the ITSF service, the Commission said, would allow use of a single ITSF licensee in situations where obstructions in the signal path keep the receiving a satisfactory signal from its ITFS station. Agreeing with Jerrold and Micro-Link that the AGC in television receivers can handle variations in the signal, the Commission proposed deletion of the AGC feature in these low power transmitters.

The Commision did not agree that the translator booster does not need an automatic turn-off and pointed out that any transmitter not in use, even a very low power transmitter, can amplify noise or extraneous signals that may be on the frequency when there is no overriding signal. They said they had always been concerned with this type of "pollution of the usable portion of the frequency spectrum" and that this "smog level" is becoming a very serious problem. Multichannel equipment will be considered in use when one or any combination of channels is capable of relaying a signal, the Commission said, and the proposed rules will require that sufficient circuitry be included to turn the translator or signal booster off when the last used signal leaves the air.

"YOU MEAN YOU'RE STILL REMOTELY CONTROLLING THAT STATION?"

NAEB Convention Coming

The 46th annual convention of the National Association of Educational Broadcasters has been set for November 8-11 at the Sheraton Park Hotel in D.C. The meeting, which will draw 7,000 public broadcasters and persons from allied fields, will be geared to the challenges which educational communicators face in their rapidly expanding profession.

More than 60 manufacturers of broadcast equipment have contracted for space to display their products. The equipment will be exhibited in the Sheraton's Exhibition Hall, the largest hotel facility of its kind in the country.

A comprehensive series of meetings is being planned. Among the subjects to be covered during the three-day meeting are the environment challenge; campus unrest; community involvement; public education; minority affairs; instructional technology; federal and private funding; the obscenity issue; and the status of legislation related to public broadcasting.

On Sunday, November 8, there will be a semi-annual meeting of the NAEB's Board of Directors. The opening reception will be held that evening.

Innovations in the 1970 convention schedule include a Newcomers' Briefing on November 8 when delegates attending their first NAEB convention will meet and talk with members of the Association staff, a President's Luncheon on November 11 when the Distinguished Service Award will be presented, and a buffet-reception on November 11.

NAEB Asks For Modification Of Cable Decision

The National Association of Educational Broadcasters has urged the Federal Communications Commission to modify a recent decision which would prohibit educational television stations from owning cable television systems.

CATV, according to the NAEB, can help educational broadcasters expand educational and public services in response to local needs.

In a filing with the FCC, the NAEB also said that local CATV ownership by educational stations would assure that a significant portion of available channel space on a CATV system would be reserved for educational and public service programming.

"Local educational stations," the NAEB said, "are owned by licensees which have deep roots in the local community . . . The bulk of these stations now offer significant amounts of local educational, cultural and public service programming and have a deep awareness of local tastes, needs and desires. This broad expertise would be extremely useful in developing distinctive and diverse programming and other services via a locally owned CATV system."

The filing said that local ETV stations have "not only the resources and knowledge which are requisite to accomplish those tasks . . . In many cases, a local radio station may be the best available, most experienced source of CATV local programming assistance."

The NAEB also said that even though the operation of a local CATV system may not prove to be a major source of funds for ETV "the avenue for supplemental funding through CATV should not be blocked peremptorily, except for the most compelling public interest reasons."

The filing is one result of recommendations made to the NAEB by the CATV Committee of the Association's Educational Television Stations Division. That committee will continue to study ETV's role in relationship to CATV.

Committee members are Rex Campbell, KUED, Salt Lake City, Utah; Michael Collins, WNED, Buffalo, N.Y.; William Hart, WYES, New Orleans, La.; LeRoy Lastinger, WEDU, Tampa, Fla.; Robert Page, WMSB, East Lansing, Mich.; and George Strimel, WVIA, Scranton, Pa.

FCC Moves CATV Microwave Vacate Date To Feb., 1976

Amendment of Section 91.522 (e) and Part 2, Section 2.106 of the rules to extend from February 1, 1971 to February 1, 1976, the date by which CATV microwave relay systems must vacate the 12200-12700 MHz band, has been proposed by the Commission in a rule making notice.

In a First Report and Order in Docket 15586, adopted October 13, 1965 (1 FCC 2d 897), the Commission established the Community Antenna Relay Service (CARS) to accommodate private (non-common carrier) microwave relay systems used by CATV operators to carry broadcast program material to CATV systems. Under that action, these systems would no longer be authorized in the Business Radio Service, but systems then authorized, and those authorized subsequently on applications pending when the order became effective, were permitted to continue to operate on frequencies in the 12200-12700 MHz band until February 1, 1971. CARS stations are authorized to operate in the 12200-12700 MHz band.

Thirty-seven CATV microwave relay systems are now operating in the 1200-12700 MHz band. Four licensees of such systems requested waiver of Section 91.552(e) to permit them to continue to operate in that band beyond the February 1, 1971 cut-off date. Cox Cablevision Corporation, Globe-Miami Cable TV, Inc., and Garden State Television Cable Corporation asked for an additional five-year period. Florida Antennavision, Inc., requested an extension pending action by the Commissinn on certain applications in the common carrier services proposing to provide it with a substitute microwave relay service.

The Commission said it appears that the considerations would apply to most, if not all, of the licensees of the CATV microwave relay systems now operating in the 12200-12700 MHz band, stating "we believe that this matter should be explored generally in a rule making proceeding rather than in connection with the pending or any future requests for waiver of the rules."

EDUCATIONAL BROADCASTING

Looking Inside Non-Commercial Broadcasting

By Walter Jung

Understanding The Choice

It can be quite interesting at times to take a look at circuitry and learn the "whys" and "hows" behind different circuit approaches. And it is also interesting in the sense that it allows a better understanding of various approaches, an essential ingredient to intelligent problem solving. With a sound circuit background the imaginative engineer can implement some real moneysaving additions to a limited budget station.

Regardless of whether or not he has a limited budget, there are always those times when a piece of specialized equipment is needed. In this case there is no alternative other than to create your own. On the other hand, in the case of a more standardized need, there may be a variety of different equipment which could conceivably meet your requirements. However, in this situation the correct choice is not always so clear either. You may well know your needs, but have some difficulty trying to relate them to different manufacturers specs. No matter how well written a spec sheet may be it is still your responsibility to get the facts, and this may require considerable perception. What it all boils down to is that it behooves the man in a technical position to be fully aware of technical capabilities.

This means he has to be tuned in on the latest devices, innovations and so on. It means he cannot afford to ignore anything new that could affect a future technical decision. He not only might be able to save money, but he also might improve accuracy, efficiency and productivity. Isn't that what we're after, improvement of our product?

Obviously the kind of awareness we are speaking of here does not come about overnight. It can only be attained (and thereafter maintained) by continuous and diligent efforts, inspired by a fundamentally positive attitude and sincere desire towards betterment. No one circuit can be a panacea. But to be able to select the best of anything, you have to first know the pro's and con's. In the interest of better understanding, that is the method we'll be using here. The area we'll be discussing this month is sync and pulse circuitry and methods used in separation and processing. Before we get into the actual circuitry discussion, lets briefly review what is required (or desirable) in a sync removal or stripper stage.

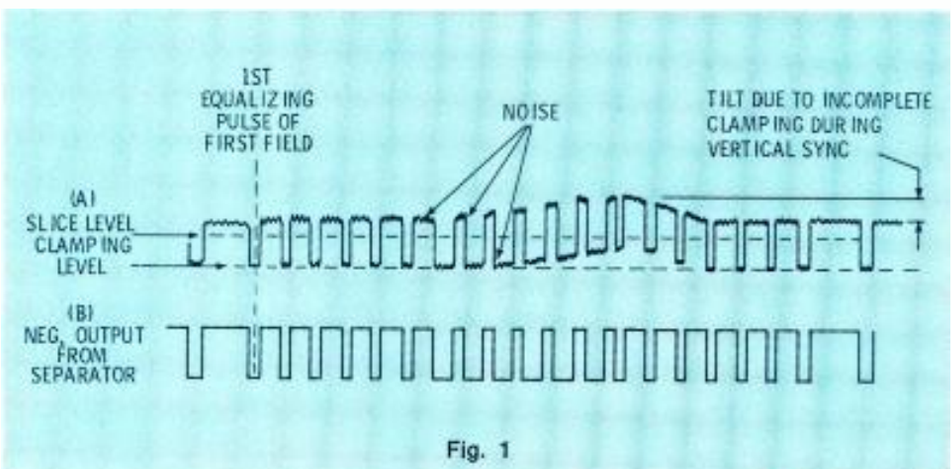

Fig. 1

An ideal sync stripper would deliver a sync pulse which is as nearly exact replica of the synchronizing portion of the video waveform as is possible. This is to say its leading and trailing edges should correspond as closely as possible to the original sync leading and trailing edges. Since the video waveform commonly suffers from hum and distortion and may be accompanied by noise, a good sync stripper should be a noise immune as possible, while still preserving the original sync timing. By the same token, it should be immune to APL variations, particularly at a rapid rate.

The most critical portion of the sync timing interval is the vertical blanking and sync region. Loss of any equalizing pulses or vertical sync serration here is intolerable. But as you might expect, this exact region is where noise and hum can wreak havoc . . . and where conventional sync strippers first fail. It is a challenge to clamp sync tips solidly while rejecting hum, but at the same time pass all of the vertical blanking information cleanly. The two just do not go together. A long time constant is necessary to pass the low frequency vertical pulses without tilt. But a long time constant impedes the fast clamping action necessary for hum removal at the horizontal rate.

One way around this is a short time constant circuit for good clamping at horizontal rate and a "slicing" circuit to pick off the pulses as shown in Figure 1. Even if the vertical sync has some tilt on the baseline it still can be detected cleanly by amplifying a narrow region in the middle above the tilt and thereby rejecting it. This also rejects noise on the blanking level or sync level as long as it does not punch through the slicing level. The slice level can be set to optimize noise discrimination by adjusting for a clean signal output, free of noise and video content.

Noise Discrimination

To visualize electronically how this is done, refer to Figure 1. Waveform A pictures a noisy video signal with the vertical interval expanded to illustrate noise on sync and blanking levels. This signal has been DC restored so all the hori-

zontal sync tips are at the same DC level. There may be some tilt during the vertical sync pulse interval, but this is allowable for reasons we will see shortly.

Now, if we are to draw a horizontal line through this waveform at approximately the midpoint between the sync tips and the blanking level, it would intersect only the leading and trailing edges of the sync pulses, as the main noise components are above and below this arbitrary line. The same thing is true for the tilt in the vertical sync pulse, since it is above and below this level it will not cross the line. Now we can accomplish just such an effect electronically by using a solid DC voltage as the reference line or "slice level" it is referred to in Figure 1.

If we apply the DC restored video signal to an IC differential amplifier, it will amplify the information about this DC point. Recalling our previous discussions on IC differential amplifiers, (BE, Dec. 1969) we know that this type of amplification has a high sensitivity within a very narrow region of the signal waveform. In this case we are confining the amplification to the sync region by applying the DC bias to a voltage comparator (a differential amplifier). This causes the differential amplifier to switch back and forth as the waveform passes through the slice level within the sync portion of the video signal, regenerating a clean sync signal with timing corresponding to the original leading and trailing edges.

What are the advantages of doing it this way? It might sound funny, but the high gain of the amplifier actually improves the noise immunity of the circuit and provides discrimination against noise and trash on either sync tips or blanking level. And there are other virtues. If a non-saturating amplifier is used as the comparator, it will add a minimum of delay to the separated sync signal.

Figure 1 illustrates the advantages of noise rejection during the vertical interval. To appreciate the virtues of this approach for minimum delay applications, let's look at a horizontal pulse interval (See Figure 3).

Stripping Sync

Conventional saturating sync strippers strip sync by driving a normally "off" transistor on during the peak of the sync tips. This approach is subject to timing variations due to pulse shape deterioration and even with perfectly clean input pulses has a minimum delay equal to a saturated stage (See Figure 3c).

Since this type of sync stripper conducts only on signal peaks, it will narrow the effective sync pulse width. This is shown in Figures 3a and 3b by the narrow positive output pulse which corresponds timewise to the peak of sync. So it is easy to see how this simple sync stripper has a few basic limitations. A more ideal approach is to sense the exact 50 percent amplitude point of sync on the input video and extract sync pulses corresponding to this instantaneous time. In Figures 3a and 3b this is shown by the negative output pulse corresponding exactly to the 50 percent amplitude of sync directly above. This is what the differential comparison is able to accomplish. An additional bonus is the very low delay of the non-saturated switching which contributes a minimum delay time between input sync and output sync.

The circuit of Figure 2a shows one application of this technique,

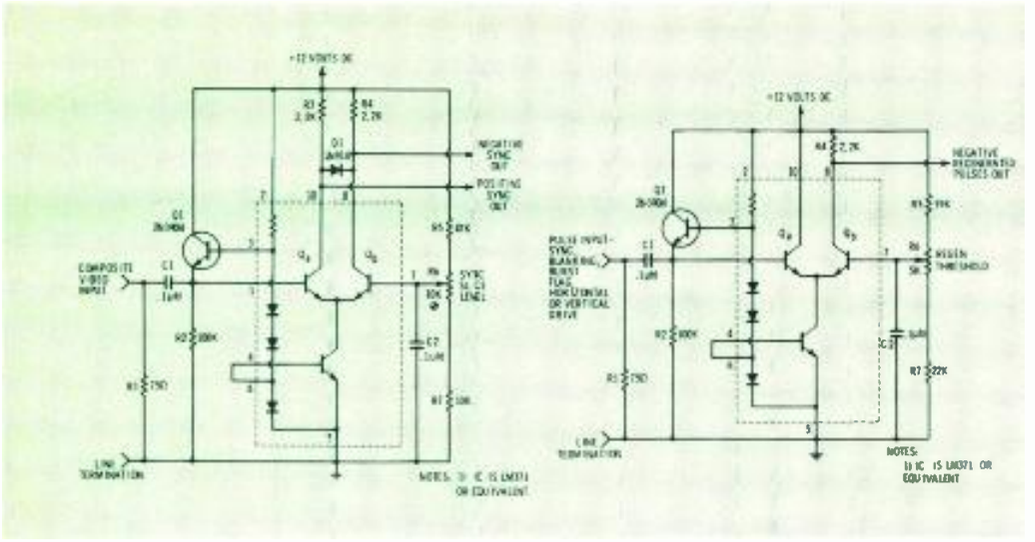

Figure 2

stripping sync from a 1 volt, 75 ohm composite video line. Within various circuits, different levels and polarities might exist. There is no reason the same basic technique can't be used in many places if its "marriage" considerations are observed. It can also be used to regenerate degraded pulse waveforms such as sync, blanking, burst flag and horizontal and/or vertical drives. After we go over a few necessary basics applying this technique, we'll see how it can be used in various applications.

To illustrate how the circuit of Figure 2 works, let's follow a signal through from input to output and see what happens. The signal is applied to Q1 through input capacitor C1. The base of Q1 is biased at a fixed DC level (2.4 volts) by the three diode stack within the LM371 IC. This means that Q1 will conduct on negative signal peaks one Vbe (that of Q1) below this 2.4 volt level, or about 2 volts. On negative signal peaks (sync tips) Q1 conducts heavily and clamps the waveform solidly at the two volt level.

Operation

This circuit is a most effective sync tip clamp for a couple of reasons. First, Q1 provides a lower "on" impedance than a simple diode clamp because of its current gain. The harder it is driven by negative peaks the lower its resistance. Second, it lends itself very well to biasing by using the bias diodes of the IC to provide a low impedance bias point for Q1's base. The heavy charging current peak goes through Q1's collector circuit rather than the base circuit, and thus the bias string does not shift on signal peaks. The nominally low impedance transfer of Q1 appears as a grounded base stage to the video signal.

Q1 clamps negative sync tips to a 2 volt DC level and this DC restored waveform is applied to pin 1 of the differential amplifier, the LM371. At the opposite side (pin 7) the slice level pot introduces a fixed DC voltage slightly higher (to equal the sync 50 percent amplitude point) and the IC compares these two voltages. If the input at pin 1 is lower than pin 7, Qb will be low also, corresponding to the negative sync tip. When pin 1 rises above the slice level at pin 7, the situation reverses, Qa turns on and Qb off. Qb will be high in this case, Qa low. The 1N914 diode between the collectors provides some additional limiting.

This circuit can be used with a 1.0 volt composite video signal and will deliver 4 volts of clean, noise-free composite sync with either positive or negative polarity. Noise immunity is quite good; it will reject 2 volts of hum superimposed on the video and a substantial amount of noise on sync tips and within the vertical interval.

It can also be used to regenerate noisy or distorted pulse waveforms. In this case the slice level should be set to pick off the 50 percent point of the input waveform (which is 4 volts in this case) and the slice level pot should be adjusted ac-

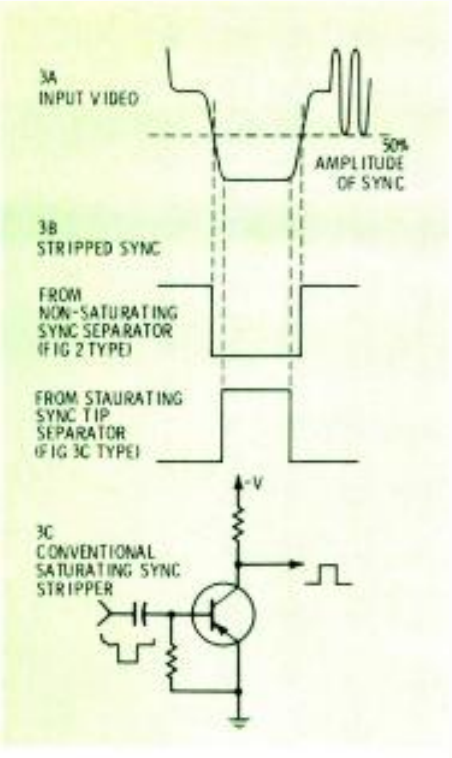

Figure 3

cordingly. The extra limiting of D1 is not needed here and it can be omitted. The collector of Qa (pin 10) should be connected directly to +12 volts. The above changes are shown in Figure 2b, a pulse regeneration stage based on the same concept. By using the differential comparison technique we have gained even greater noise immunity. This is because the amplifier will see only about a 100 mv portion of the total 4 volt input amplitude. So the peaks can be quite distorted and noisy but the output will remain clean as long as the noise does not cross the comparison threshold.

In both of the circuits we've seen so far, the input has been fed directly by a low impedance line. Due to the clamping action of Q1 in these circuits, a low impedance drive is mandatory. However, there may be cases where a circuit of this type is needed, but a low impedance drive is not available. Such a case might be to bridge a video or sync line. Here's what we can do in that case.

The circuit of Figure 4 is a PNP emitter follower which will drive either circuit 2A or 2B (less the termination resistor) for either sync stripper or pulse regeneration applications. For composite color video signals, a chroma trap will be necessary to remove the 3.58 MHz prior to sync stripping (these components shown dotted, Lt and Ct). A PNP emitter follower is necessary for a low source impedance in the negative going directions. This allows a fast charging action during the sync tip clamping interval, providing solid DC restoration.

These few examples have shown how a basic technique can be used for different tasks, working from standard waveforms. With a solid understanding of the concept, the imaginative engineer can extend the same ideas into different areas. The slicing technique, for instance, can be applied easily as a special effects keying stage. In this case the same circuit (2A) would be used, but the bias range of the slice circuit extended to operate into the video region above setup. The output pulses could then be used as a video insert keying signal. The slice pot would be brought out as a operating control and used to select the desired keying level.

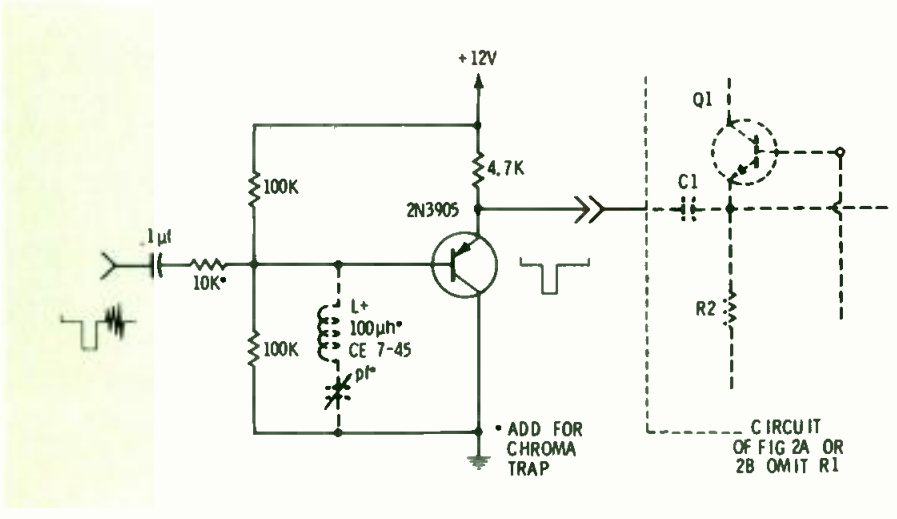

Figure 4

Solving CATV local distribution

By Leo G. Sands*

Recent FCC action and development of new transmission techniques are paving the way for more economical ways to transport blocks of TV channels from TV head ends to distribution centers from which signals are transmitted via cable to CATV subscribers.

This article, one of a series about CATV, examines some of the local transmission problems and their solutions.

"You can't get there from here" was the reply of a police officer to a tourist who was trying to find his way in Philadelphia. CATV system planners too find themselves faced with the problem of how to transport signals from here to there. This is a common problem in those large cities where there are no power and telephone poles on which to hang coaxial cable. So let's examine some problems and explore possible solutions.

In one large city, there was the problem of serving the city without exceeding the maximum practical cable length from the head end to the furthest subscriber. Another problem was how to transmit educational TV programs from the city's Board of Education building to the head end.

The first approach was to consider installing four head ends, each serving a sector of the city, and using microwave to feed locally originated programs to each of the four head ends. A review of the existing microwave licenses revealed that there were not enough vacant microwave channels in the area. (This was before the FCC allocated more CARS microwave channels, as will be discussed later).

The initial plan was scrapped and a single head end system was designed. Instead of locating the head end outside of the city, the local railroad station, in the center of the city, was selected as the head end site. Although not ideal from noise and signal-reflection standpoints, it was a good compromise.

Instead of a single trunk cable; the system plan called for eight trunks fed by a hub-type head end. (See Figure 1).

Running The Lines

"To get there from here" (from center city to the residential areas), it would be necessary to run the trunk cables underground through the downtown area. It would have been costly to dig up the streets and lay cable.

Telephone calls to the several railroads serving the city revealed that all of them were most willing to allow the CATV company to use their underground ducts in the downtown and industrial areas, and their telephone poles from there on to the city limits. The railroads have established modest tariffs for CATV cable installation rights. By installing the head end in the center of the city, maximum cable lengths could be maintained.

To transmit TV programs from the Board of Education building to the center-city head end, leased video circuits could have been used. Power line ducts were available, but their use would have caused inductive surge problems. The solution was simple. The city could install

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problems

an instructional fixed television station, operating in the 2400 MHz band, whose signals could be picked up by TV receivers, equipped with converters, at schools and homes. It's signals could also be picked up at the CATV system head end and fed through cable to the community.

The same system operator also wanted to import televised football programs from a distant city beyond the range of the station broadcasting the program. The first thought was to install a microwave system between the head end and a receiver at a location within range of the station. But, the cost would have been prohibitive considering the few hours it would be used per year. An alternative was to hire a video/audio circuit from the telephone company during the required hours, not on a continuing basis.

In very large cities, such as New York and Chicago, it can be very expensive to bury cable to pipe signals "from here to there". Again, the alternatives are to lease video/audio circuits or to use microwave to transmit signals from a head end to distribution centers. Leased circuits are costly, particularly when numerous channels are involved. Also costly are single-channel microwave links when several channels are to be transmitted. Costs can be lower when multiplexed microwave systems are used, as now permitted by the FCC. But, the number of TV channels that can be transmitted over a single microwave system is very limited when conventional frequency division multiplex (FPM) techniques are used. To transmit up to 40 TV program channels, as envisioned, would require the use

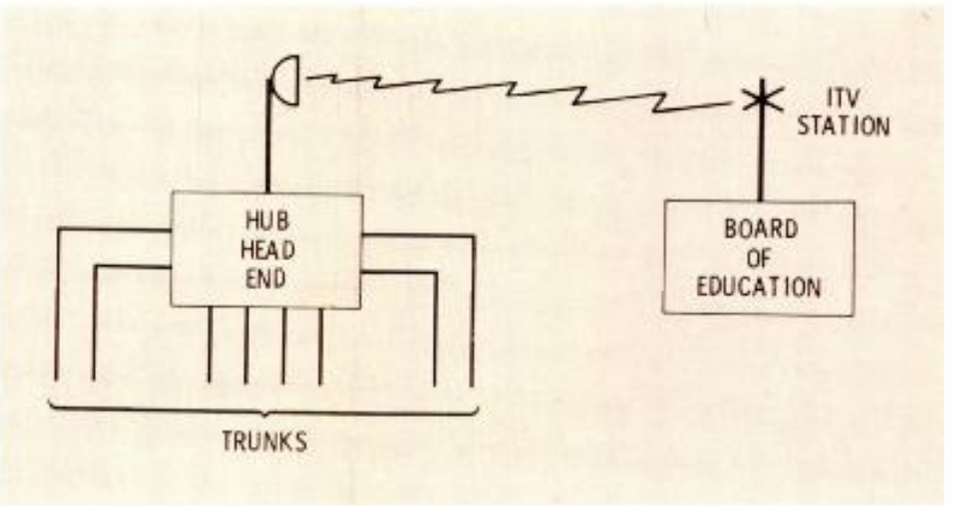

Fig. 1 Local pickup of multiplexed or stacked instructional television programs.

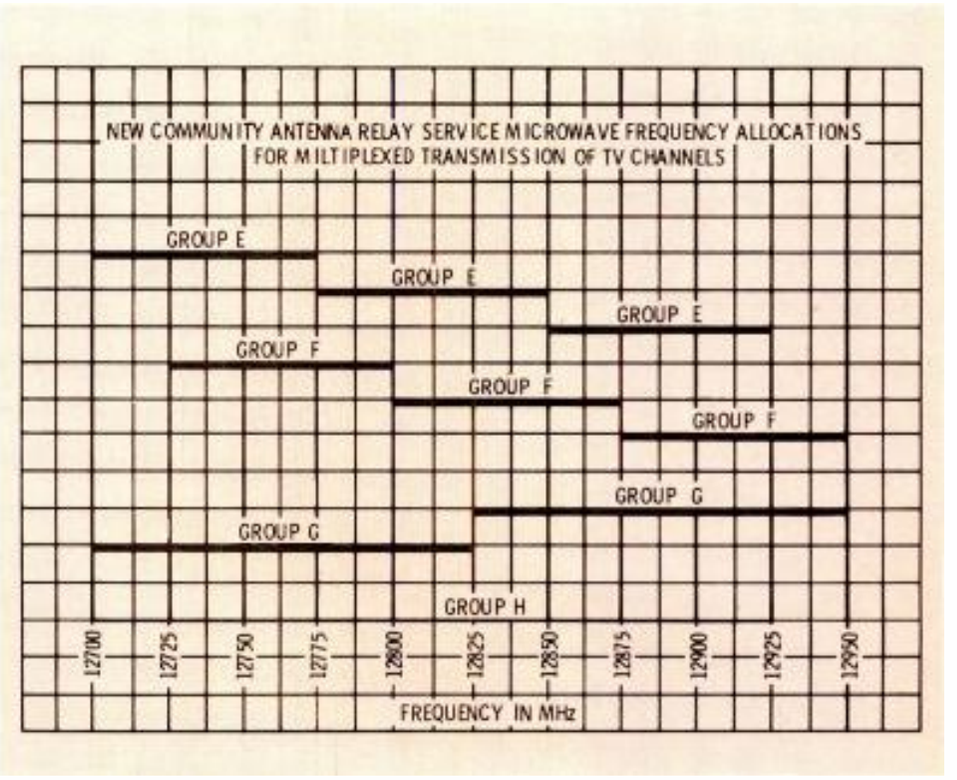

Fig. 2 CARS microwave frequency allocations for multiplexed transmission of TV channels.

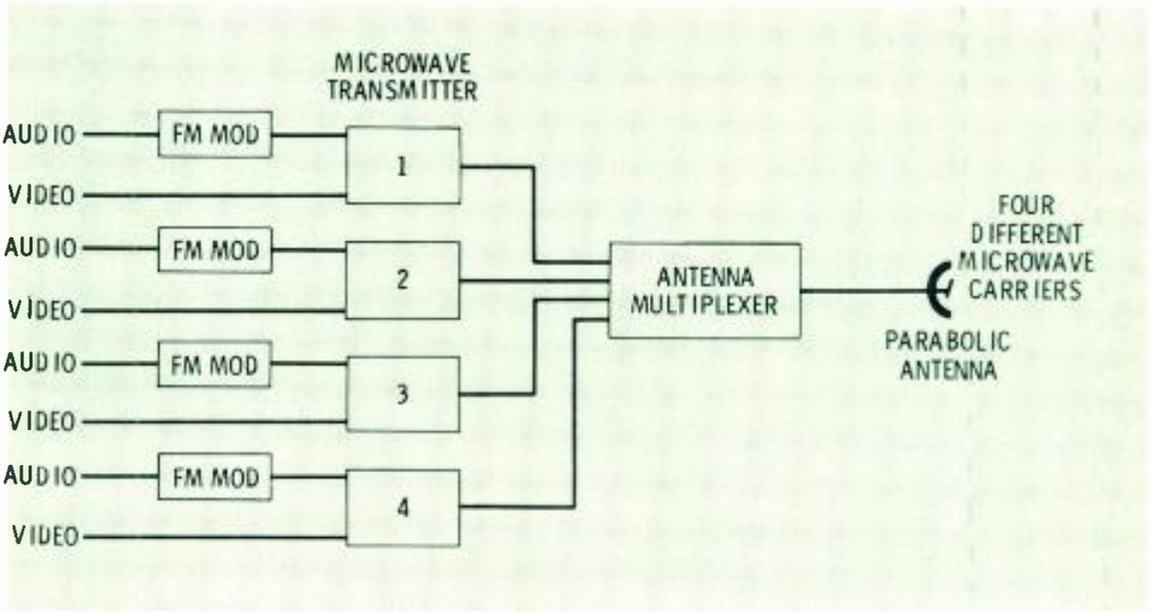

Fig. 3 Conventional microwave stacking technique.

of many "stacked" microwave links.

Effective August 14, frequencies became available in the 12700-12950 MHz band for transmission of multiplexed television signals by stations licensed in the Community Antenna Relay Service (CARS). These new frequency assignments are shown in Figure 1 which illustrates their relative positions in the band. In groups E and F, three or four TV channels may be transmitted, five to eight in Group G, and nine or more in Group H.

Under the new rules, a multiplexed TV microwave system may occupy up to 250 MHz of band space when transmitting nine or more TV channels. A microwave system transmitting three or four TV channels may occupy up to 75 MHz of band space, or 18.75 to 25 MHz per channel.

According to the new rules, CARS stations using FM to transmit a baseband of frequency division multiplexed standard television signals, will be assigned channels from Groups E, F, G, and H accoring to the number of standard television signals which comprise the baseband.

Transmitter peak output power may not be greater than necessary, and that stations using FM to transmit a baseband of frequency-division multiplexed standard television signals may be authorized to use peak power of 15 watts on frequency assignments in Groups E and F, 30 watts on frequency assignments in Group G and 60 watts on assignments in Group H.

In the past, it has been customary to "stack" microwave systems, each transporting a single TV channel, as illustrated in Figure 3, in order to transmit two or more programs simultaneously. Now it is permissible to multiplex three or more TV channels for transmission over a single microwave carrier, as illustrated in Figure 4.

In anticipation of the new rules, Chromalloy American Corporation and Laser Link Corporation held a press conference in New York City on July 16, which was attended by the author. At the press conference, Ira Kamen, president of Laser Link, and Dr. Joseph Vogelman, vice president of Chromalloy American, briefly described the quasi-lasar link system, a joint development of the two companies, which is said to be capable of transporting up to 40 TV channels. Given to the press were copies of a paper by Kamen and Vogelman which contains further details. The following are edited excerpts from the paper.

Quasi-Laser System

The Quasi-Laser system can be modulated by frequencies up to 250 MHz and has claimed capacity for 40 TV channels for intra-city distribution. The system uses Filtered Pulse Width Modulation (FPWM), which is said to be capable of providing multi-channel relay and transmission of TV programs, independent of frequency anywhere in the frequency spectrum between 8 GHz and 30,000 GHz. (See Figure 5.)

The initial system was demonstrated to the FCC in October, 1968, operating on a carrier frequency of 8 GHz with symmetrical side band, full carrier power. Full 32-channel capability was demonstrated with satisfactory performance being maintained down to signal-to-

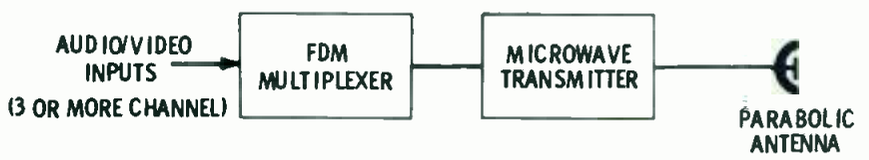

Fig. 4 Multiplexed microwave transmission system.

THE CARTRIDGE KILLER.

Scott Muni
WNEW-FM, New York

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Cable Capacitance	275 pF
DC Resistance	800 ohms approx.
Inductance	550 mH approx.
Channel Balance	within 2 dB
Stylus Tip	0.7 mil Spherical
Tracking Force	3-7 grams
Cartridge Weight	5 grams
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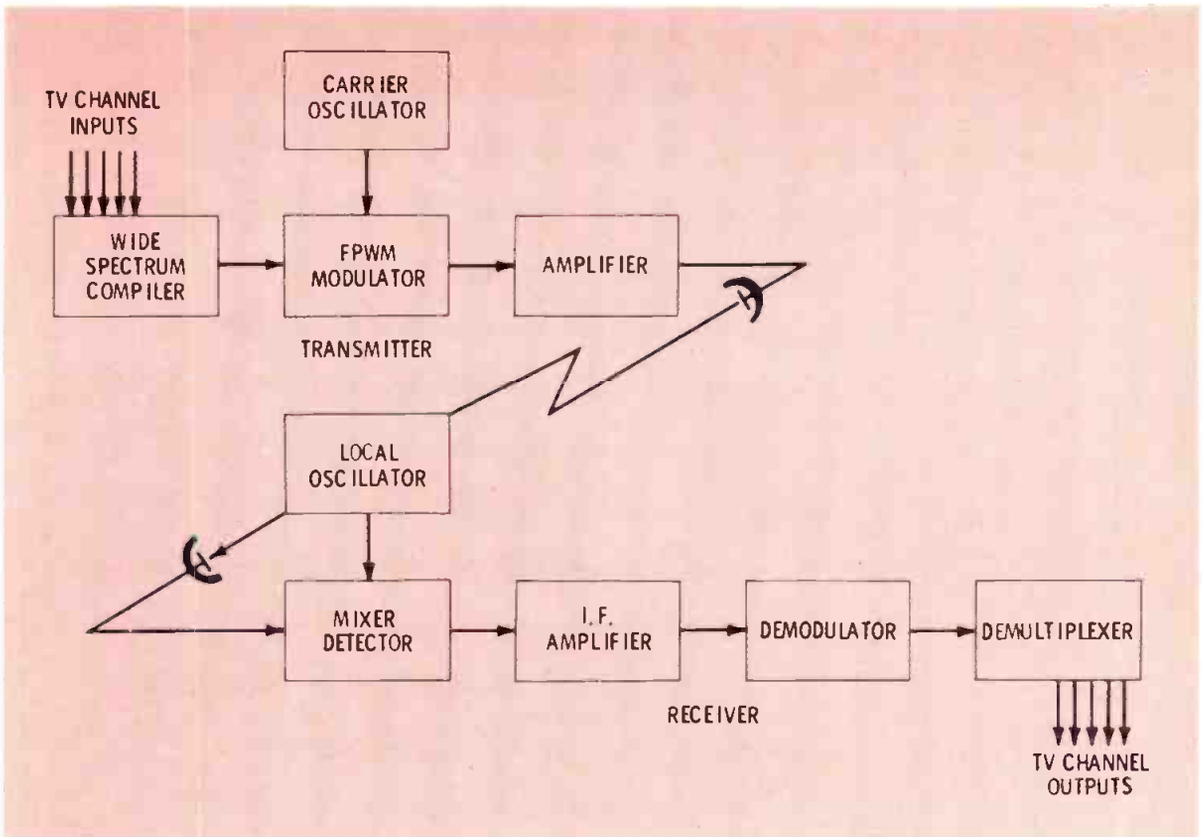

Fig. 5 The Filtered Pulse Width Modulation (FPWM) system is said to be capable of providing multi-channel relay and transmission of programs, independent of frequency within 8 to 30,000 GHz.

noise ratios as low as 3:1. Continued experimentation has been conducted on 18.5, 30.0, 39.3 and 42.0 GHz. Experiments conducted at all of these frequencies according to Kamen, verified that satisfactory performance is achievable using the FPWM technique even under adverse conditions such as major rainfalls.

Signal processing is done at low levels, and high level transmission signals are handled in stages not requiring amplitude linearity. It is claimed that the FPWM system is able to operate at lower signal-to-noise ratios than less noise immune systems, and can therefore be used for longer point-to-point transmission and in multi-hop systems.

The FPWM employs pulse width modulation to transmit the composite information content of a number of frequency multiplexed television channels, normally within NTSC standards. The individual channels from locally generated sources or off the air, are combined and down-converted to the spectral region starting at approximately 6 MHz and extending upwards in frequency in accordance with a number of channels being multiplexed.

Conversion Systems

Two systems of down conversion have been operated in demonstration links. In one case, the composite of Channels 7-13 is translated to the 6-48 MHz band, with Channels 2-6 remaining at approximately their present frequencies. In the second approach, each channel is translated on an individual basis to a frequency location appropriate to it. This combination of frequency multiplexed channels results in an output signal voltage whose instantaneous phase amplitude is the vector sum of the individual channel signals and contains frequency components equal to the highest frequency in the baseband. This instantaneous voltage is fed to modulator circuitry where a train of pulses is generated whose width is directly related to the instantaneous voltage.

In one configuration of this system, the pulse width varies from one nanosecond corresponding to the least positive voltage to 0.95 nanoseconds corresponding to the highest possible voltage for the case where three channels of television are in the baseband. For five channels, the pulse width varies from one nanosecond to .9 nanoseconds, and for twelve channels from one nanosecond to .84 nanoseconds.

The average pulse spacing is equal to the average pulse width. The average power in the pulse train closely approximates one half of the peak power. The width of the resultant train of pulses has a one-to-one relationship with the instantaneous voltages. These pulses are then amplitude limited and are used to switch the output of the carrier determining oscillator from "ON" to "OFF" in accordance with the rise and fall of the pulses. The resultant signal consists of a carrier, the first upper side band, the first lower side band, a second upper side band, and a second lower side band, and so on.

The signal is then filtered so as to pass only the first upper side band. For operation in the 12.7 to 12.95 GHz band, the carrier oscillator frequency is selected so that the upper first side band falls within the authorized band, and is centered at the assigned frequency. This signal is then amplified by a traveling wave tube. The radiated signal, after filtering and amplification consists of a frequency varying signal which results from pulse width

variations of the first modulation step. This signal has the general form and distribution associated with FM and is treated in a manner identical with an FM carrier.

Receivers

Two types of receivers have been used in this system. In the first type, the received signal is amplified by a tunnel diode followed hy a travelling wave tube, both of which operate in the transmitter frequency band. A filter limits bandwidth to that of the transmitter output signal. The amplified output is then heterodyned to an intermediate frequency where the pulse form is extracted by limiting. A network is then utilized to obtain an instantaneous voltage corresponding to the pulse width of the train of pulses present in the IF signal. The resulting signal is identical to that which was fed to the transmitter to produce the original train of pulses. The output signal is the instantaneous vector sum of the frequency multiplexed television channels which are reconverted to appropriate frequencies in the VHF television band.

The second type of receiver employs a balanced mixer and local oscillator at the input to immediately convert the incoming signal from the transmitter to an intermediate frequency. In this configuration, the receiver noise figure is approximaterly 8 dB higher than that which has been achieved with a tunnel diode input.

In multi-hop systems, no modulation is required at the intermediate repeaters and the cross-modulation remains unchanged.

Pre-emphasis of the frequency multiplexed baseband signal can be used to equalize the signal-to-noise ratios at the television receiver. In one 12-channel configuration, equalzation was adjusted so that a signal-to-noise ratio of 54 dB was achieved at both ends of the baseband.

Kamen said the tests confirmed that the FPWM technique is insensitive to carrier frequency, performing in essentially the same manner at all four frequencies used. The overall performance of the system, when transmitting multiple TV channels was evaluated. TV channels 7 through 13 were down-converted in the transmitter compiler from their regularly assigned frequencies to sub-band frequencies. They were up-converted in the receiver decompiler back to their regular frequencies for reinsertion into the distribution system. Experiments on the test link were also conducted without TV channel frequency conversion. When the seven New York VHF TV channels were used, the pulse width modulated signal occupied a bandwidth of 1 GHz.

According to wide publicity, the quasi-laser system was designed initially to solve a problem unique to New York and other large cities. The idea is to transmit signals from a head end to distribution centers which, in turn, feeds signals to apartments and homes via a coaxial cable network.

The FCC, in commenting on the adoption of the new rules (Docket No. 18838) said in part:

"The rule amendments are not confined to authorizing the use of Laser Link's FPWM exclusively, but are aimed at permitting the use of frequency modulation to transmit a baseband of several television signals. The FPWM system (which Laser Link considers proprietary) is simply one of several methods of accomplishing the frequency modulation, and its use is not required or endorsed above others by our proposed rules.

"Our primary aim in authorizing the LDS (local distribution service) was to permit CATV operators to use microwave relay links to span short distances where the use of cable was infeasible or uneconomical. Although almost no engineering measurements, performance data, or circuitry details were submitted in connection with the original proceedings, the benefits to be gained from LDS appeared so attractive that we were moved to provide for the service expeditiously. Similarly, we are impressed with the possible utility of FDM/FM relay equipment for certain limited-distance spans. We consider it beneficial to encourage development of LDS now by making frequency space available and by providing technical standards for both AM VSB (vestigal sideband) and FDM/FM systems of transmission, even though engineering designs and system testing are not yet completed.

"In the notice of proposed rule making which instituted this proceeding, we set forth a possihle baseband channeling arrangement suitable for FDM/FM multiplex operations and requested comments regarding the advisability of requiring such an arrangement. Only TelePrompTer and Laser Link responded on this point. TelePrompTer urged that a uniform baschand channeling scheme be adopted. Laser Link, on the other hand, indicated a belief that baseband arrangements should be left open at this time, or, alternatively, a slightly modified arrangement was proposed. The benefits of prescribing a baseband allocation at this time would he to secure interchangeability of equipment of different manufacturers and to insure optimum use of the radio channel. Only a few equipment manufacturers are involved in this area presently so that interchangeability considerations are not of primary concern. We believe that, under the bandwidth restrictions we have proposed, systems designers will find it mandatory to use the most efficient baseband channeling arrangement in order to secure good signal/noise ratios in the individual FDM channels. Accordingly, at this time there seems to be no compelling reason to adopt a baseband channel allocation for FDM/FM systems.

"We conclude. therefore, that the public interest would be served by adopting rules to permit LDS stations to use either vestigial sideband amplitude modulated emissions or frequency-division multiplex frequency modulated emissions. Depending upon individual circumstances, either system may provide economic advantages or spectrum-conserving features which may help CATV operators supply a service which otherwise might be infeasible."

Now that the FCC has allocated frequencies for LDS stations, it can be assumed that several manufacturers will soon be producing equipment for this service. And, when it does become available, it will be easier to get signals from "here to there" or "there to here". ▲

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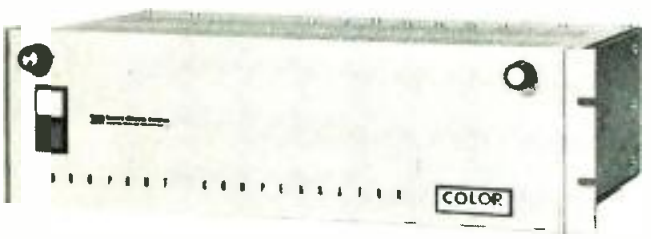

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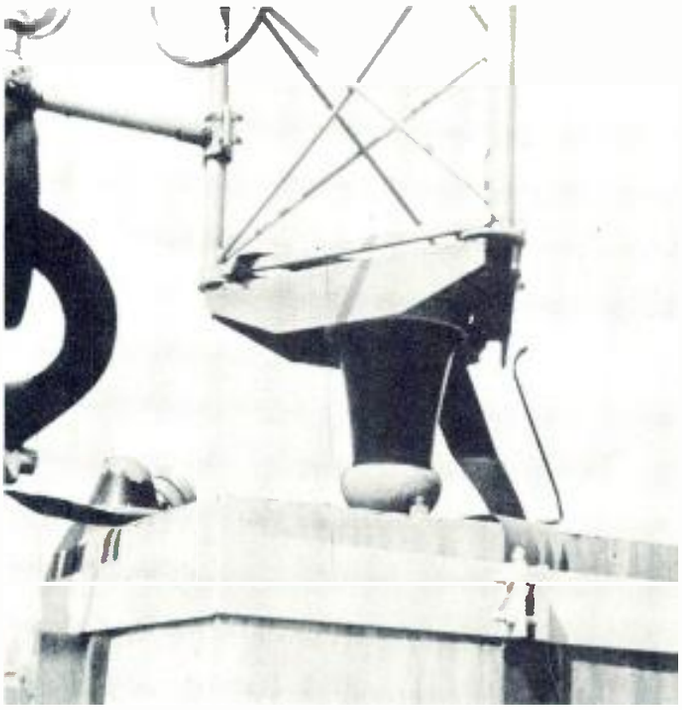
Circle Number 15 on Reader Reply Card

Reducing AM tower static

By Robert A. Jones*



In all cases, the attempt should be to install a low resistance path to ground. Of course, gaps and arrestors should be maintained. An intense lightning strike may still jump the gap. But static build-up arcing can be greatly reduced.

Static on AM towers has been a problem for all stations from the day the first one went up. However, there are ways to reduce, if not eliminate this problem. Possibly you think you already know all about this kind of difficulty, but I have found it helpful from time to time, to review those subjects we think we know all about.

Let's start by defining static. Static electricity on AM towers is that effect caused by the gradual build up of negatively charged particles on metal wires and towers. These little particles can be caused in one of three common ways. First, and most common is that caused by lightning. Second is by rain or snow, and third, is that type caused by charged particles carried on the wind, in front of storms.

The Greeks were the first to discover that static could be caused by rubbing amber. They attracted bits of cloth and caused their hair to stand on end! You may now know that the Greek word for amber was "Elektron". This name has stuck with us today and is the word we use to represent a negative charge of electricity.

Old Ben Franklin was the first one to prove the connection between static electricity and lightning. This was proved by his famous Kite and wet string experiment. (The Zap . . . ouch test.)

The map of the United States included here shows a number of thunderstorm days to be expected in each part of the country. The isobars represent these numbers. As the reader will note, the greatest number of thunderstorms occur in Florida. In fact, almost every fourth day, on the average, you can expect a storm in Florida.

Now let's consider what happens when these negative particles accumulate on the tower and guys. As you can see in Figure 1 those particles which hit the guys will build up, since they are prevented from leaking off by the guy wire insulators. Those that strike the tower will bleed off to ground (normally) through RF chokes or tower lightning neutral wires. In addition to RF chokes an lightning chokes, most stations will install "Ball Gaps" at the tower pier. These are usually of the ball type, or can be of the

*BE facilities Editor and Consulting Engineer, La Grange, Ill.

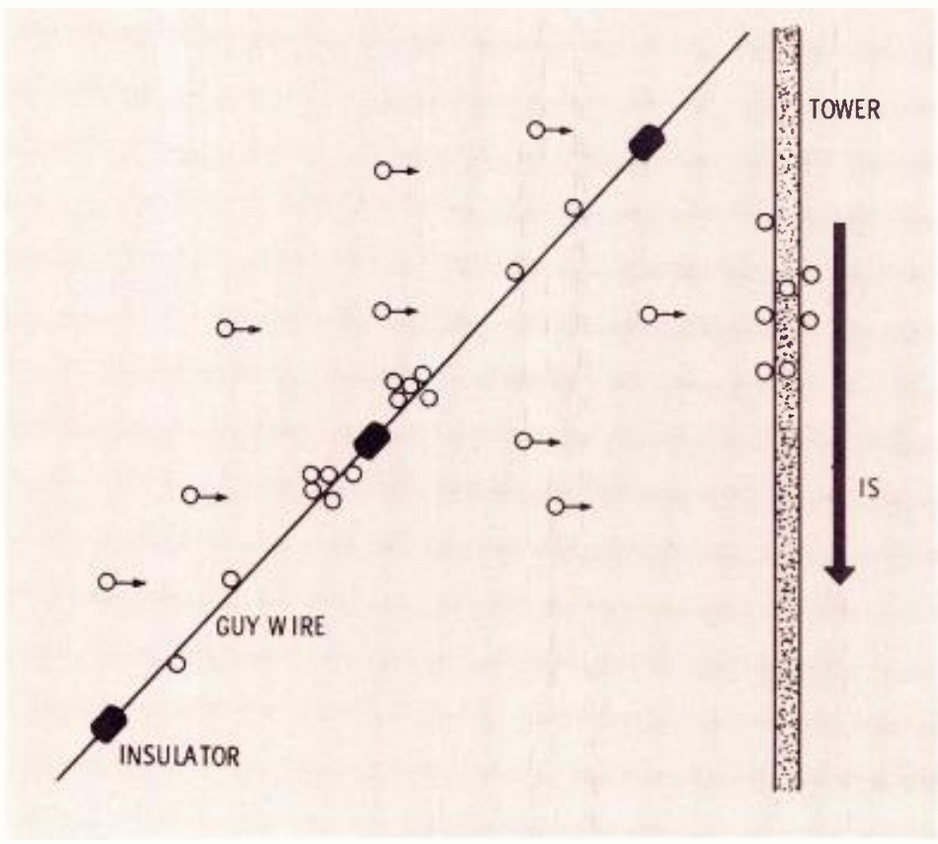


Fig. 1 Negative particles build up on the guys and tower. Since arcing across the insulators can occur, it is standard practice to securely ground the anchor points.

flat stock type. In addition, many stations have found it helpful to add lightning rods atop their towers. This is particularly recommended in areas of high storm density.

Crackle . . . Bang

The negative particles that gather on the guy wires can not bleed off to ground. As you may know, they continue to build up until . . . Bang! . . . there is an arc across the guy wire insulators.

Usually all insulators appear to arc, or flash, at the same time. Actually this is not what happens. Somewhere one insulator will arc first. The radiation from this one, traveling with the speed of light, trips all the other charged sections of guy wire. This is why they all appear to jump at the same time. (I should point out that it is standard practice to securely ground the guy anchor points, since this lowers the danger of fracturing an insulattor.) This arcing of the guy wires will cause a sudden burst of static into the tower. And this is what causes the biggest headache to broadcasters.

This static induced into the tower flows toward ground at an extremely high rate of speed. In most antennas it finds too much inductance in the RF choke. The result is that this sudden surge of current jumps the ball gap at the tower base. If the power of the transmitter is 5 kW or higher, the arc may be sustained. Once the air across the lightning gap has ionized, its resistance falls to a mere fraction. Because the resistance is then low, the power of the transmitter can maintain it. Most higher power stations have found it convenient to install some protective device that effectively breaks this arc, by momentarily shutting off the transmitter. Lower power stations usually find their transmitters will recycle by themselves, since their power is too low to maintain the arc.

Figure 3 shows how this can occur. For this example I have assumed a typical low impedance tower with a base value of 50 ohms plus j 75 ohms. Also, let's assume a typical "Tee network" and a one-quarter wave length transmission line. With the values shown, the transmitter will look into a matched load. When the ball gap arcs, it in effect, can be considered a short across the tower base. Calculating this through the network and transmission line, we find the transmitter seeing a load of 410-j 670 ohms. This instantaneous change in load causes the plate current to shift, which in turn causes the plate overload to trip. With normal transmit-

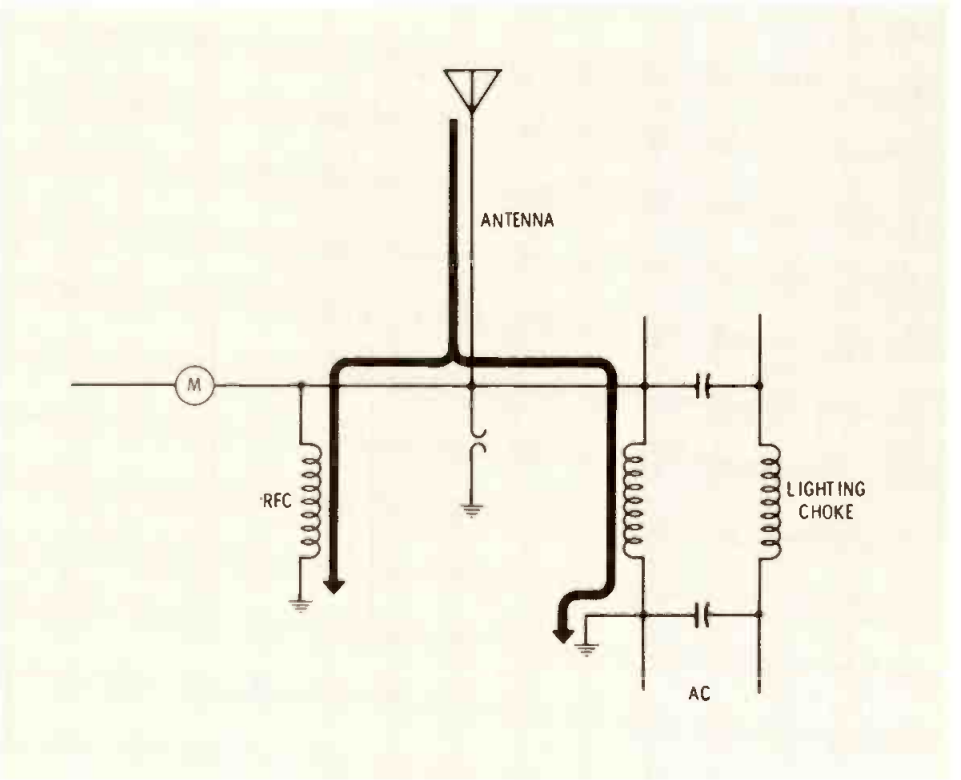


Fig. 2 Buildup on the tower can be bled off through a choke arrangement.

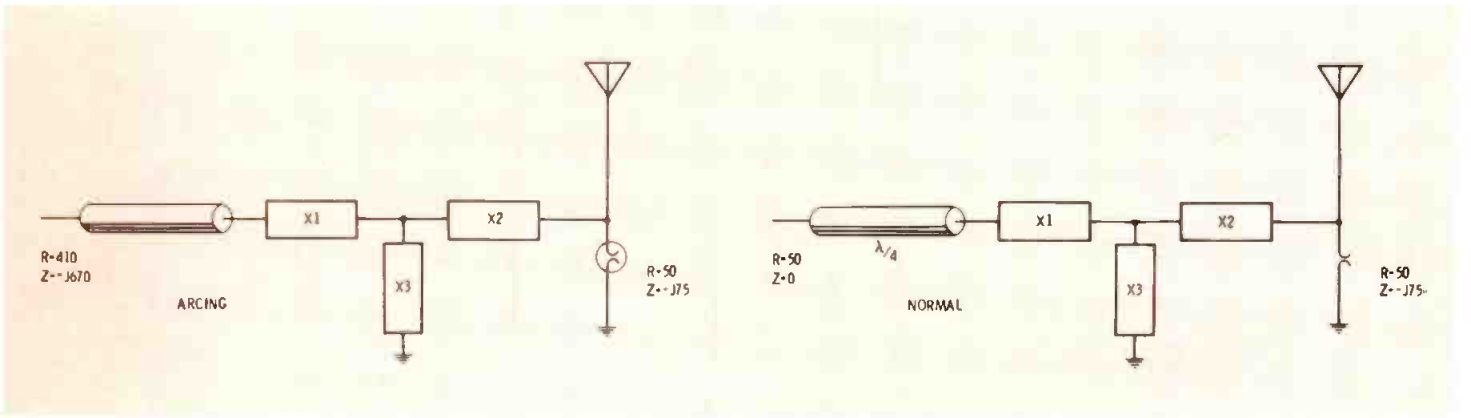


Fig. 3 With the arc at the ball gap, the air is ionized, lowering the resistance to a mere fraction. And this momentary low resistance will cause RF arcing.

ters, the recycling circuit turns the transmitter back on in a second or so.

Some people claim that shunt feed towers are immune from static. While it is true that there is no base insulator, the high static charges can be induced in the slant wire and cause trouble. I would agree that there may be less trouble, but it is not eliminated.

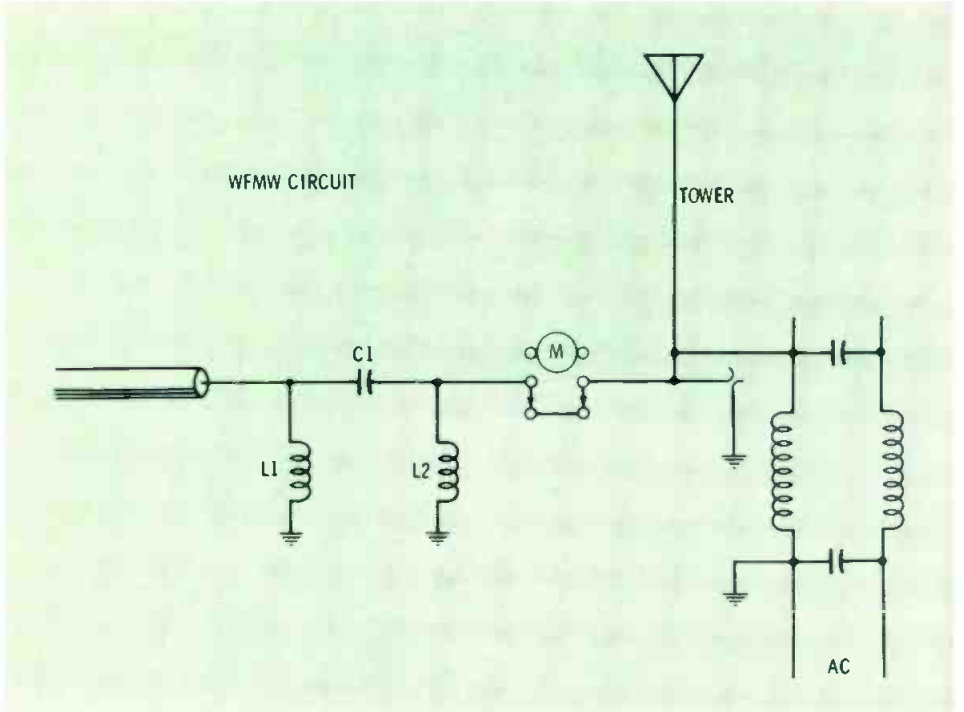


Fig. 4 The WFWM setup, using a low resistance low inductance across the tower base to eliminate arcing across the ball gap. Eliminating the arc eliminates transmitter load shifts and shutdown or recycling.

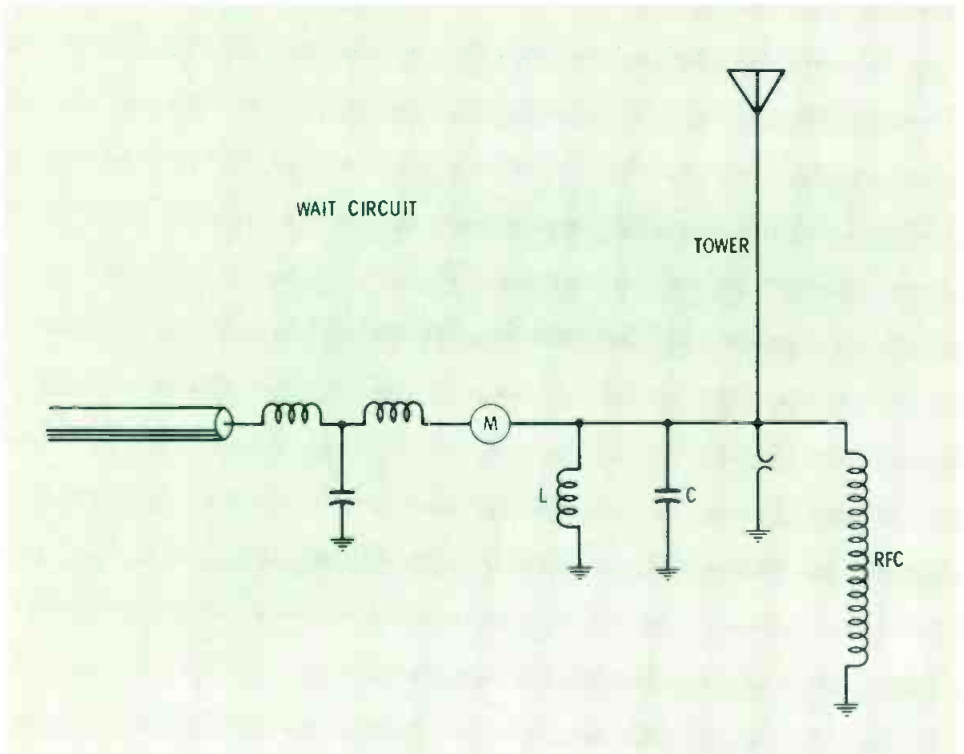


Fig. 5 The WAIT circuit. This arrangement offers a fast path to ground.

The big nusiance to flash-overs is not the danger of damage to equipment but one of interruption to station programming. These pops and arcs, on the air can be fatiguing to the listener. It is not unusual to sustain as many as five to ten arcs a minute under high static conditions. If your competitor's station is not popping off the air you may lose listeners.

Standard Solutions

There are two standard solutions to reducing arcs to a minimum. These are not new ideas I've concocted . . . but are common knowledge to most consultants. Let's refer to the first type of solution as that of a "Low Impedance" tower. For this I would refer the reader to the case of WFMW. The natural resistance of their tower is 62 + j2 ohms. The network designed to match this tower is shown in Figure 4. This is a not so typical "pi" network. As you will see it has two coils with one capacitor, whereas the normal "pi" has one with two capacitors. The idea is to use a coil with low inductance across the tower base. By using a low resistance low inductance in place of a normal high inductance RF choke, we can pass these sudden static strikes to ground without arcing the ball gaps. With this type of circuit the lightning gap seldom ever sparks. Hence, there is no more shift in load by the transmitter and few carrier interruptions.

The second case involves what I would call a "Hi Impedance" tower. For this example I refer to WAIT. Their tower has a self resistance of 440 + j560 ohms. The solution employed at WFMW would not work in this case because we would have had to use a coil with two or three times the inductance. Instead of a 'pi"' network we chose to install a special static circuit across the tower base. The reason we couldn't use a "pi" type approved is that the coils at this frequency with this high impedance would have contained too much inductance. For WAIT we decided to use a 10 μh coil. On 820 KHz this would give a reactance of 51.5

ohms. WAIT operates with 5 kW. This produces a base voltage of approximately 1600 volts which yields a branch current of 32.0 amps.

Now any station operator knows you just don't go hang a 10 μh coil across a 440 + j560 tower. If you did, the self resistance would be all wrong. This is solved by placing a capacitor in parallel with the 10 μh coil. Some would call this a tank circuit, but it really isn't. What it is, is a circuit used to eliminate or cancel, the effect of the coil, at 820 KHz, but not the advantage of a fast static path to ground. In our example, we found a 0.004 μfd capacitor was a good choice. We selected vacuum capacitors, because of the high branch current. Keep in mind that the current through the capacitor will be about the same as that through the coil. Figure 5 shows WAIT's circuit.

Installation

It is recommended that you use a Radio Frequency Bridge to correctly install this static circuit. The first step is to measure the self resistance of the tower. Then add the coil and capacitor to the circuit. This will probably cause the resistance to change slightly from the natural or self resistance of the tower. If so, adjust the coil slightly, until the resistance returns to the original value. At this point we have the static circuit properly tuned so that it does not upset the licensed operation of the station.

One area for the reader to keep in mind is the need for good, heavy guard straps between the static circuits and the ground system. For example, a single number 10 wire will not do. At WAIT we used a four-inch copper strap from the tower to the static circuit, and another four-inch strap from the circuit to the ground system at the base of the tower. We installed their circuit in a weatherproof box directly on the tower pier. By so installing the circuit we kept all leads to a very minimum. You must keep in mind that the object here is to construct the lowest possible resistance path to ground.

It might be of interest to call the readers attention to the fact that the earth's atmosphere resembles a large spherical condenser with the ionosphere and earth serving as the upper and lower plates. The atmosphere then serves as a leaky dielectric. The production of static is due directly or indirectly to atmospheric motions. Ben Franklin dealt chiefly with very intense and sporadic electrical effects accompanying storms. These cummulated in his invention of the lightning rod. The sharp point on the lightning rod has the effect of increasing the field strength in its vicinity and thus accelerates the motion of the ions in the air. Under normal conditions this sharp point produces an attractive field for the positive ions.

In summary, there is a need to solve your static problems. They can be solved, giving you an advantage over your competitor. ▲

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Circle Number 17 on Reader Reply Card

Automation Techniques

By Don Clausen*

Ours is a business of change. Television engineers had tubes and associated circuitry down pat, when along came transistors and transistor circuitry. Integrated circuitry was in the future, but now we talk about R.T.L., T^2, L and the like. Sales were selling 60-second spots where now the thirtys, twentys, and even tens are popular. Piggybacks are commonplace. Management is becoming more and more concerned by the rising operating costs. Labor is also affected by these changes. No longer is an engineer an engineer: His duties are not comprised of operational duties along with engineering. A switcher, in some cases today, is a programmer.

Then along came the computer, and the word "automation" crept into the television world. Most stations today have automation in its simplest form—that is, audio following video by relays, switchers or what have you. Some stations are using various automation devices that help in the "break-to-break" switching. Some of the larger markets, or more sophisticated stations are using computers in their automation efforts.

Most stations are looking to automation for financial, personnel, or operational efficiencies. However, there are many stations that, even though they are looking, are unsure of the steps to take. The chief engineer often is not much help because he too is starting from scratch. The operations manager is in the best spot to help with a station's automation because of his day to day program role; however, in most cases, he does not know engineering.

No attemp shall be made in this article to update or explain the details of any specific plant. Rather, this is an article on what to look for in the automation of your plant.

In present automation systems there are six basic words that must be applied. To be sure, we could add a great deal more, but let's start with these words: preset time; take time; cut time; elapsed time; real time and event.

Before a source can be placed on the air with a preset type switcher, that source must be preset. Thus "preset time".

When the course that has been readied on the preset bank is called for to fill an "on air" role, then that preset is taken. Thus "take time".

If your switcher has a cut bar, then the cut circuitry takes the preset. In this particular case "cut" and "take" are occurring simultaneously. Thus "cut time".

Using The Language

Before we look at elapsed vs. real time, let's look at "event". An event is a happening, or, as the American College Dictionary states "anything that happens or is regarded as happening; an occurrence, especially one of some importance". When the automation unit "takes" as source on the air, presets the switcher, or makes that proverbial cup of coffee, it has executed an event. Another way of looking at it is that every line on the program log constitutes one event. Because it is difficult and expensive to design an automation unit that directs many "happenings" at once, most automation systems of today operate event by event. Or as the Chronolog Corporation puts it, "step by step", thus the Chronolog "step system". This then is "event".

The time that it takes for an event to be completed is the elapsed time of that event. In other words, if a film runs 60 seconds, the 60 seconds is elapsed time.

The time that an event is to be placed on the air is the "real time" or standard clock time.

It would appear at first glance, that if an automation unit is purchased that it: presets the switcher, takes or cuts the preset, has a clock, and provides for the various roll and show pulses, provides for the loading and storage of a number of events, then really nothing else is needed and the breaks could be "automated". In some respects, this may be true. However, the issue is far more complicated than it appears at the outset. Let's examine slide change situations as a case in point.

Projectors

Most slide projectors work into a multiplexer. Also most slide projectors have two rotating drums. When a slide is showing on the right hand drum, the left drum has advanced so as to be ready for the next slide. When the change button is depressed, a mirror flips in the projector which now shows the left drum, and then the right slide now advances to the new slide. Regardless of the type of projector used, there is a change function. Normally, the slide projector is always lit: however; if the mirrors in the multiplexer are not in the proper position, the slide will not show. Thus again, regardless of the type of projector or multiplexer, there is a show function. In normal programming, there are three basic show, change, configurations for slides.

Event one-slide A, event two-slide B, event slide C. In this case, slide A shows on event one at take time: On event two, the advance or change is fired at take time and also is shown at take time. Thus the unit goes from slide to slide, event by event. Thus, change and show at take time.

Event one-slide A, event two-net, film or whatever, event three-slide B. In this case, the automated control unit must call for an advancement, or change to get to slide B prior to take time. If the advancement or change occurred at take time on event three, a brief showing of the slide from event one occurs on the air before the change has been completed to slide B. Thus the slide advancement must be called for prior to event number three. One method is to provide at the preset time, that change or advancement, so that at take time you end up on the correct slide or slide B. Thus change at preset and show at take. (In any non-automated mode, this configuration is known

*Director of Engineering, WIRL, Peoria, Ill.

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as the "change under".)

Event one-slide A, event two-network, film or whatever, event three, slide B, and event four-slide C. In this final case, event one-slide A, shows in the normal manner and event two presets. Event two shows and event three now presets, which advances our slide. Event three is taken, which shows our advanced slides or slide B. Event four presets; however, the up-coming slide now is not preset, but rather the slide change occurs at take time of event number four. If the slide had been allowed to advance at preset time on event three, the slide on the air or slide B would have been changed. Thus change at preset, show at take and preset inhibit.

This then comprises the various modes of slide operation that the automation unit should be capable of handling.

If a great number of slides are used in a given break on a fairly common basis, this in itself presents problems. Normally, automation equipment like the "step" type of Chrono-Log can handle 16 events. With ten slides in a commercial break plus a film and an ID slide, and then back into network does not leave many events. Of course, if a core memory, disc, tape, or whatever, is used for storage, this then alters the situation somewhat. The total number of events are usually not that important in cases of automation gear that draws from a storage file, such as the CRT type of Chrono-Log.

In the case of changing all slides, by virtue of the automation gear, has another far more serious drawback that that of total number of events to execute a given spot. If a spot has seven slides in a thirty second spot, where are the slides to be placed in reference to the copy? In addition to knowing the number of events to accomplish all the slide changes, each section of copy from one slide change to another would have to be timed to place those changes at the correct point in the copy.

To remedy this situation and the events used, perhaps a better way is with selective tones on cart tape. As audio cartridges are cut for a given spot, a tone is placed on the cart every time a slide change is needed in that given spot. Tones are detected in the playback units and a relay in the cart machine or auxiliary equipment, then changes the slides. Slide changes from one given group of slides to another group of slides are then the functions of the automation system. Not only does this reduce the number of events used to execute a slide spot, but in reality it makes the programming operation much simpler.

In most operations, the logs and books arrive from traffic a day or so before the air date. Placing tones on the carts as the books are cut reduces the chance for error at air time. Also, potential problems, like the wrong number of slides or changes for a given spot, can be caught before air time. In addition, it's far easier for the audio man to place the slides in sync with speech, than it would be to time the copy word lengths from slide change to slide change in a given spot. Even though a system could be worked out to solve the copy problem, one would still have to insure that the operator for the next day's operation received those timings for his "pinning" functions. Even if traffic programmed the system, the same logic holds. (Remembering that everything the automation equipment must do has to be programmed.)

With the cartridge tone method, the operators role from a slide change point of view is that of only programming the actual total spot length and pinning a slide advance function. The operator can now operate totally from the log only. As the system expands to the traffic department, traffic has one less machine function to program. Traffic's role is the same as the operator, namely, they are now concerned with the total spot and not what's in it.

If a last minute spot is changed to another slide spot, the total spot length may be the only change necessary to program. If the spot is scratched, again the programming problems are greatly reduced.

It is possible for the audio man to place a change tone on the end of the cart spot, for a slide advancement to another upcoming slide spot. A tone could also be placed at the end of a cart slide spot if the next up-coming event were a film, VRT, etc. followed by another slide spot or ID. However, in both of these cases, if a programming change came about after the normal run of carts were cut, the results would be disastrous.

Thus, slide spots are handled like any other film or VTR commercial matter and the operators role is that of only pinning the spot. Slide changes within the spot are recorded on the cartridge and the type of slide changes necessary for event to event transitions are handled by the automation equipment and its advance slide pin.

The final advantage in a system of this nature is that the cartridge slide role can also be expanded. Under the present explained system and with an average log, about 20 or 30 carts for a given program day are needed. This number of carts can be handled quite easily with two machines. However, if the wrong cart is placed in the programmed machine or the correct cart is placed in the wrong machine, not only is the given spot lost, but also chances are the entire break will be lost. (Remember, the automation operator must pin not only the slide event, but also which machine he wants the spot to run on.)

This cartridge tape weakness can be resolved by purchasing two Gates "Criterion 55" cart machines or the equivalent, which can handle more than one cart. Two of these machines will together hold and play one hundred and ten cartridges. All the tapes could be loaded in the morning prior to sign on for an entire operation day. The slide change tones are still contained on the prospective carts; however, the carts are handled only once. Also no machine deligation would be necessary. How? Because the majority of carts used in television are associated with slide spots or ID's. Therefore, when a slide spot is called for, the first cart machine is started by equipment in the automation unit, as soon as a slide is called for at take time. The slide spot then runs with its cartridge audio. To accomplish this automatic cartridge starting, whenever a slide is called for at take time, means that your automation equipment must have some sort of a flip flop, or bystable circuit. This circuit starts cart number one and the next time a slide is again called for at take time. Cart

machine number two receives its start. This one, two, one, two start relationship would then continue all program day in a sequential basis.

If a cartridge is needed for "audio under work", like a silent film with cartridge audio, then the original standard cartridge machines would be called in as cartridge machines numbers three and four. These machines would be fired only when so programmed. These machines would then be used for last minute changes, or special carts, that may otherwise destroy the one, two, one, two sequential log relationship of cartridge machines one and two.

If a "silent" slide is needed like in the case of a visual ID, the morning operator would load his cartridges as he normally would, with the exception that when he came to that specific slide event, he would leave that cart slot in his machine vacant. This system, then implemented with larger sequential cart machines removes many of the machines delegation problems that would otherwise face the operator or traffic division. As cartridge video tape becomes a reality, this type of system would then also benefit that end.

Films

Just as in slides, film handling by automation requires study. In most plants of today, film is handled by one of two ways. The first way is that of loading each film commercial or feature separately, spot by spot, and feature by feature. The feature under arrangement is usually kept on a given projector while film commercials within that feature are handled on another projector. The second method commonly used is that of splicing all the commercials for a given day on one large reel, which then is known as the commercial reel. In some cases, the commercials within a feature are also spliced into the feature reel. Just as each system has its advantages and disadvantages for a given plant, each system has its advantages and disadvantages from an automation point of view. The treating of each film separately makes "timing" an easier operation. Each and every film commercial, feature, free film etc. must be timed as it arrives in the plant.

It is true that the film industry has established a "code" of sorts, when it comes to film commercial lengths. Most of the national films will have audio out at fifty-nine seconds and the video going on black, with a total black achieved at sixty.

Indeed, there are enough exceptions that if each and every film is not timed, your on the air look will be choppy and full of end cuts, from an audio viewpoint. The film should be timed from the beginning of audio to "black" video. There are exceptions to this method of timing, but first things first. If the film in question is sixty seconds or under by one or two seconds, then that film can be logged by traffic as a standard sixty. However, if the film is grossly under or one second over sixty seconds, then traffic must be informed of the film's correct length for future log operations. If you choose an automation system that must be pinned or manually loaded, then the operators role is that of looking at his log and loading a sixty, thirty, twenty or ten second film as the case may be. However, if the film time is over by one or two seconds, that total time must be recorded on the log so that the operator can load his system accordingly. One workable method is to assign a film number in the following fashion: F478-30. The telecine operator loads film #478, while the automation operator pins the film duration for 30 seconds, so why is the film not logged as a twenty-nine second film? The main reason is that of standardization.

Your films in the plant would be sixtys, thirtys, twentys, tens, and the exceptions would be those that are over the standard. If films are not treated this way, then every film in the plant becomes an exception. Nine times out of ten, the film will have a second or two of black leader at the end, and if your equipment is programmed for the full time, all you will have between that film and the next event would be one second of black. In fact, it is a good idea to splice three or four seconds of optical black or exposed film on the tail of the commercial after it is timed. This insures a smooth on the air look in case of a pinned or operator timed error. This procedure will also allow for film loads that are not exact.

Another very vital reason for maintaining standard film lengths is that it makes traffic's job a little easier. If traffic has to deal in each and every film length variation, rather than dealing in tens, in about a month, one gal will be in a corner somewhere trying to "self distruct in thirty-two seconds".

Machine assignments for up-coming films can be forwarded to the operator from telecine as they are made available. In the case of traffic assigning, machine assignments, then a repeative system is perhaps the best. For example: First film on projector number 1, second film on projector number 2, third film on projector number 3, and fourth film on projector number 4. The fifth film down the log would appear on projector one, and the process repeates.

In the second method of projection, whereby commercials are on a commercial reel, and features are on a feature reel, all timings of films must be handled as before. However, machine assignments are simpler, as one projector can always be used as the commercial projector, and another as the feature projector. In the case of a two and three reel flick, some sort of second system of film preparation requires many copies of film.

The Piggyback

In recent years, a film commodity has come out that is known as a piggyback. In some cases the piggyback is one film with a total length of sixty seconds. In other cases, the film room will splice two thirtys together for a piggyback. If film preparation is required to splice piggybacks, then the total length must be made known to the operator programming the automation equipment, traffic must be notified of the true length, including the spliced black. The total length will always be over a standard sixty, because about one second of black is spliced between the films. Of course, if the piggy is treated as a normal sixty, the last film in that piggy will suffer an end cut.

As described in the "slide section" a momentary closure must be provided by the automation unit for the correct pre-setting of the multiplexer mirror for a given film projector's correct showing. If the first event was, a slide bread, the second event network, and then come out

of network to a film for the third event, before the actual time of that film is due, the multiplexer must be fired to flip the appropriate mirror to that film. If the multiplexer mirror were allowed to pull in at take time, a brief showing of that last slide could result before the film mirror had a chance to pull in. An ideal time for the multiplexer mirror to pull in would be when the preset occurs for that up-coming film.

There are two exceptions to this pull-in time, however. One is the case where a film is showing on projector number 1, and film projector two on the same multiplexer is about to preset for the next event. If the multiplexer mirror were allowed to preset for this film on the air film showing would be lost. Therefore, on a film to film situation, the "showing" or multiplexer mirror flips at preset time. The final exception to the preset rule is that case where the film chain is also used for production work between station breaks. In this case, the preset is meaningless, and someone must remember to get the mirrors in the correct position prior to air time. The operator, of course, never forgets to re-set his break. However, if he should forget, a way to solve this multiplexer problem is to have the closure at some time period prior to take time by a few seconds.

In the case of the Chrono-Log system, the roll film and roll VTR relays close prior to take time every time before an actual event occurs. Logic later decides whether these closures will be used for the starting of a film or VTR. Therefore, by using a set of contacts on these relays, one could accomplish this multiplexer set in the same fashion.

Pre-roll closures for film starts are adjustable and the time chosen is dependent primarily on the type of film equipment that the plant uses.

VTR's are perhaps the simplest source to use with present-day automation systems. The fact that all production is on the tape greatly simplifies the automation role, and limits its functions to a pre-roll and a take of that VTR. The only concern is that of the station's ID on preceeding a VTR event. If your VTR's are standardized with a five second pre-roll and your ID's generally run from three to four seconds in length, then there is going to be trouble in River City! The VTR will not pre-roll because the preceding event is shorter than the pre-roll time alloted.

Problem Solving

There are many ways that this problem can be solved. One way is to standardize ID's, in this case, at five seconds. However, this method will mean that your station breaks are non-standard as far as the networks are concerned, and the equipment will continually end-cut the network, or up-cut upon the return to network.

Another method is to have traffic watch for these specific cases and schedule five second ID's preceeding every VTR. However, it's one more item traffic has to worry about.

A third way is to have the programmer on duty pin a separate event that has a pre-roll only function. Like the traffic situation, it's one more item that the programmer has to be aware of. Also, if the total number of events are precious to a given operation, the "roll only" is very unhandy.

On larger automation systems, this VTR problem is of no consequence, because the larger systems have a comparator, core memory, or the like. If the upcoming event on the unit is a short slide, less than five seconds, the system will search the next event after the short slide for a VTR and roll that VTR and take it on the air at the proper time, after taking the short slide.

There is no best clear cut method to solving the pre-roll situation. Rather, be cognizant of the area and solve it according to your specific plant's make-up.

Local Live Periods

This area is extremely difficult to analyze because of the many different types of plants in operation.

If your plant is smaller and uses one switcher as both the production and program switcher, the problem is further complicated. The automation unit, as mentioned before, looks at every action event by event. Thus, after the break precedes the live show has been executed, the automation unit must go to manual on the ID. The live show is now handled as normal procedures dictate. After the live show, the automation system can be returned to use.

However, if your plant has separate production and program switchers, the entire live show can be treated as one event and the event and the system need never go manual. The program or automation switcher would have a source that picks up the output of the production switcher. The automation system would be programmed for the preceeding events as normal. When the break has been executed, the next event taken would be the production switcher source for the total "live time" duration. The live show would be handled on the production switcher, and when the correct end time came, the automation system would again execute the break.

This method is simple to handle and lends itself well to the larger systems programmed by the traffic department. The traffic department can then treat live shows as just another event.

The only drawback to this approach lies in telecine. If the same film chain is used for the breaks as well as the live periods, the telecine operator must see that the chain is restored to the correct modes for the outgoing station break.

Also, the intro and closes necessary to the live shows must be evaluated. The automation system will "take" the production source and preset the next source. Let's surmise that the introduction to the live show is composed of a number of slides. The automation presets its up-coming event, a film. What would happen in this case is that about the time the live show's intro slide is shown, the multiplexer mirror would be flipped to accommodate the film preset, and there goes the slide. Therefore, the best solution to this problem is a separate film chain.

Timing

The smaller systems are primarily designed for break to break switching. The events in a given break are run event to event on an elapsed time base. If a feature film, VTR, or network show is programmed on an elapsed time base, two events

are needed. One event is used for the total minutes in the show, and the next event is used for the total number of seconds. When events of this nature arise, it is better to pin or program the "seconds" portions of the show length on the first event rather then the second event. The reason for this is that when the system presets the next upcoming event, it is far easier to correct any problems that may be shown as a result of the preset. If the total show length runs 28:15, it would be far easier to correct a problem in the twenty-eight minute span than it would be with only fifteen seconds remaining.

Analysis

The best overall guide to any sort of automation is your operating log. Evaluate your log by drawing horizontal lines under each typed line of the log. This horizontal line should represent one single event. Next, proceed to evaluate the log—not event by event, but rather by noting the various kinds of conditions and groupings of events that appear as described earlier. With these conditions and events in mind, watch an actual station break. Then have your operator or switcher describe each and every step taken to execute the break. Specific problems not followed on a step by step basis, must be corrected before an automation unit can be placed in service. As it has been stressed many times earlier in this article, automation operates event by event.

Automation demands strict dead lines and timings. This will be a radical departure for many stations. Does your log have exact on and off times, segment times, and the like? If not, correct these areas before you automate, not after.

If automation is planned, it should be approached on the basis of automating the entire plant at some future date. In terms of electronics, the ultimate is complete computer control that not only switches all breaks, but also prints its own log, handles payroll invoicing, sales analysis, projections, receivable reports, bookkeeping and makes that "cup of coffee".

The general manager of the station must be one hundred ten percent sold on automation, and maintain that conviction. As automation is introduced to a plant, even on a small scale, it will at one time or another, affect all departments. Announcers will have to pace themselves. Engineers will have more operational duties. Sales will be selling an automated station. Yes, Virginia, there is a difference! A manually executed commercial is a man made product, and we all know that man-made products are better.

Continuity will now be writing spots that are more accurate, from a time standpoint. As a result of automation, and the departments that it will affect, decisions will have to be made that only the general manager can execute.

Automation, contrary to popular belief, does not reduce manpower. Rather, automation reduces work loads in certain areas, while concentrating and intergrating old job roles. The end result is a more efficient staff, with a greater product output.

In summary, automation is just a different approach to operations, with its own set of rules and handicaps. ▲

The vestigial sideband filter revisited

A review of basic theory combined with operational procedures and maintenance techniques.

By Pat Finnegan*

Before revisiting the sideband filter, a discussion of how the sidebands are formed will better illustrate the need for a filter.

The television picture transmitter is amplitude modulated. In a standard amplitude modulated signal two sidebands will appear. One will be above the carrier and one below the carrier in frequency. The distance away from carrier will be equal to the highest modulating frequency. Thus, if a carrier is modulated with a 5 KHz tone, sidebands will appear at Fc + 5 KHz and Fc - 5 KHz, as shown in Figure 1 a. The bandwidth is then 10 KHz. This is the channel width for Standard AM Broadcast stations. If instead of a single tone modulation the carrier was modulated with a sweep signal, the sidebands would appear as in Figure 1b.

Television channels are 6 MHZ wide. Now if the picture carrier was amplitude modulated in the conventional manner, it would appear as in Figure 2a. This would permit only 3 MHz of picture information to be transmited within its bandwidth. A 3 MHz picture however, would lack much detail as the fine picture detail translates into video frequencies up to 8 MHz.

In order for more picture detail to be transmitted within the 6 MHz channel, the picture carrier was moved to 1.25 MHz above the lower channel edge. The carrier could have been moved right up to the channel edge, but this would have created some problems. Such a position for the picture carrier could have provided more picture detail possibilities, but the average home viewer would have had trouble tuning in the station. Also, the carrier would present a greater possibility for causing interference to the adjacent channel. The final position of the picture and sound carriers are shown in Figure 2b. Notice that there is only 1.25 MHz of the lower sideband. The terms upper and lower as used here refer to spectrum space, that is frequency above or below the carrier. As there is only a vestige (trace or remainder) of the lower sideband transmitted, this is termed vestigial sideband transmission.

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The Sidebands

The amplitude modulation process in the TV transmitter generates two equal sidebands in the conventional manner. Now, however, the modulating signal is 4.5 MHz so as to include more picture detail. Since the picture carrier has been moved to 1.25 MHz above the lower channel edge, there is 3.5 MHz of the lower sideband overlapping the adjacent channel as shown in Figure 3. This part of the lower sideband must be suppressed or interference to the adjacent channel will be severe. The mileage separations of the allocation tables are based upon the fact each station would stay within its channel. If the channels were allowed to overlap as indicated here, the stations would need greater mileage separation, and the number of stations that could be accomodated would be much less.

Suppression of this lower sideband and the levels of amplitude tolerated are spelled out in the FCC Rules. Most studio video equipment is capable of passing at least 8 MHz of video information. This is almost twice as much as the channel width will allow. To make sure that no more than 4.5 MHz of video information modulates the transmitter, a low pass filter is installed in the video path just before it goes into the transmitter.

The field strength of the sideband at the lower channel edge, that is, at Fvc - 1.25 MHz must be down at least 20 dB. At the upper channel edge, the sideband must be down 20 dB. At Fvc - 3.58 MHz, the field strength must be down at least 42 dB. The reference point is the field strength of the upper sideband when the transmitter is modulated with a 200 KHz tone.

Low Power UHF

Low power UHF stations may make use of a waiver of this part of the Rules as well as the response curves. A low power UHF station is defined as a station on channels 15 - 83 with a transmitter delivering a maximum peak visual power of 1 kW or less. Notice that the first UHF channel cannot use the waiver as its lower sideband would be cutside the TV channels altogether and would cause interference to other services. Also, note that the term is transmitter of 1 kW or less, not ERP. These low power UHF's may transmit almost (but not quite) a full lower sideband. If color is transmitted, at Fvc - 3.58 MHz the sideband must be notched to at least 42 dB down. If interference is caused to other stations because of the lower sideband, then the low

Protect the unit from sudden temperature changes. The shield need not be elaborate, but it must cut off air drafts that will affect the tuning.

power UHF must comply with the normal sideband configuration as do all other TV stations.

To encourage development of UHF stations in small markets, the FCC granted these waivers a few years ago. In reducing the more stringent technical requirements, equipment costs could be less for these stations.

Response

Diode response of the recovered sidebands is interesting and can be confusing to an operator if he is monitoring the waveform fed from a diode. Figure 4a shows the familiar "boot" pattern when the transmitter is swept and detected with a diode. A diode detects both the sidebands and adds them together in its output. If the sidebands were full, as in standard AM modulation, there would be no "toe" on the boot. Instead, the amplitude would proceed from the carrier and smooth out to about 4.2 MHz and then drop down to the base line. But now we are dealing with vestigial sidebands and only 1.25 MHz of the lower sideband is transmitted. This lower sideband is added to the upper sideband and produces the "toe". The amplitude of the lower sideband near carrier is the same amplitude as the upper sideband. Out beyond 1.25 MHz, there is only the upper sideband. Thus, the next part to carrier is double the rest of the upper sideband. The detector output is a voltage measurement and when values are given in decibels, the voltage formula for decibels is used. Thus, when the voltage is cut in half (or doubled) this is a 6 dB change.

The receiver IF response curve is complementary to the transmitter sideband curve and thus provides a smooth response across the pass band. (See Figure 4b). Those who have had the opportunity of aligning receiver IF stages know that the picture carrier marker is placed down the slope of its curve 50 percent. This is half way or 6 dB down.

The transmitter operator may become confused if he is observing a waveform monitor at the transmitter which is fed from a diode after sideband shaping has taken place. If color is being transmitted, the most obvious discrepency would be the color burst on the back porch of horizontal blanking. If the correct amplitude of burst were viewed going into the transmitter, after the transmitter it would appear to be ½ the correct amount. Should the operator not understand the action that is taking place, he may attempt to increase the video peakers so that the "correct" level of burst was coming out of the transmitter. If he were able to accomplish this, the video would be severely overpeaked and would be transmitting twice the correct amount. (See Figure 5a and 5b.)

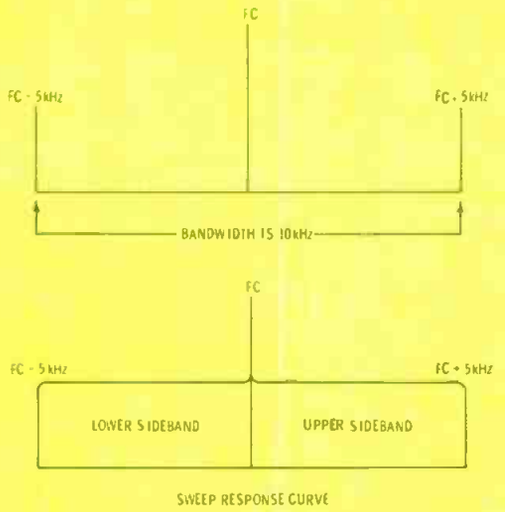


Fig. 1a A 5 KHz modulated tone causes two sidebands to appear.

Fig. 1b Sweep modulation to 5 KHz instead of tone modulation.

Sideband Shaping

The technique employed to suppress the lower sideband will depend to a large extent upon the manufacturer of the transmitter. Shaping can take place in a low power modulated stage or stages by the tube tuned circuits; with small passive filters somewhere in a low power area; tuned circuit shaping in power stages; and/or finally, a "brute force" filter at the transmitter output. One or more of these methods may be employed within the same transmitter.

High power transmitters and particularly high power UHF transmitters generally use more than one method in the same transmitter. They suppress the lower sideband at a low power level either with tube circuitry or a small passive filter, and then again by a "brute force" filter at the transmitter output. This is a preferable method for two reasons. First of all, there is power in the sidebands. If both sidebands were present and amplified all the way to the output, the output filter must take on a greater task when it suppresses the lower sideband. If only lower stage or low power shaping is used, mistuning of the power stages can cause the lower sideband to reappear. When one thinks in terms of high power UHF transmitters of 55 kW or 110 kW, it is well to keep a large part of that lower sideband away from the final filter. When both techniques are used, should any of the lower sideband reappear, the final filter will correct it in a positive manner and with ease.

The Filter

Once the lower sideband power has been amplified, it must go somewhere. It won't just go away. Generally, it is suppressed with a filter and diverted to a load resistor where it is dissipated.

Filters designed to be placed at the transmitter output include heavy components which can handle the powers involved. These are usually transmission line sections or waveguide sections, and the traps are made tunable.

The tuned sections are resonant sections and since they are coaxial line sections, very high Q is possible. With the high Q, very sharp notches in the signal are possible. Along with the plus features, they are also very sensitive to temperature changes. Because of the high Q, high RF voltages can be developed across the circuits and this becomes a design consideration.

While some transmitters only use a filter following the transmitter, some units are combined with diplexers so that the aural transmitter may be diplexed with the visual carrier and sent up a single transmission line to the antenna.

A Commercial Unit

One sideband filter designed for UHF uses diplexers. The diplexer

action is used both to filter and to diplex the aural carrier into the same transmission line. Here is an elementary description of how it works. Figure 6 is a one line diagram which will help illustrate the action of this unit.

The visual carrier is fed into the main input of the first diplexer. This unit has been adjusted so that it presents a constant impedance to the visual across the passband. The diplexer divides the visual into two equal parts and feeds them 180 degrees out of phase to the two arms. The signal goes along each arm until it meets the first tuned circuit in each arm. All the tuned sections are series resonant to the particular frequency to which it is tuned. Thus, the first filter in each leg is tuned to 1.5 MHz below visual carrier. This frequency on the lower sideband sees a very low impedance or short circuit. The Fvc-1.5 MHz signal does not pass but is reflected toward the source. Notice that the lower leg is ¼ wave longer than the top leg. The signal is delayed the equivalent of ½ wave as it goes toward the filter and on its return trip. This is a 180 degree phase shift, so that the two reflected signals reach the arms of the diplexer but are now in phase. Since they are in phase, they cannot go back through the main entrance, but instead will be routed to the side port to which is attached an absorbing load resistor. The Fvc-1.5 MHz signal will be dissipated here.

The next filter along the route on each side of the filter unit is tuned to Fvc-3.58 MHz. This signal will not pass the filters and is reflected back to the load resistor and is absorbed. The next filter is tuned to Fvc+4.5 MHz, which is at the sound carrier frequency. The same action occurs as before, but this time the upper sideband is notched. At all other frequencies other than the one they are tuned to, these filters are parallel resonant or a high impedance.

The visual signal with its notched sidebands are now fed to the output diplexer, but this time to the output legs. Here the diplexer is fed in reverse. Notice that the top arm of the unit is ¼ wave longer than the lower arm. This causes the two sections to reach the diplexer 180 degrees out of phase (which made up for the delay in the other leg). Since both are out of phase, the signal will feed on through the diplexer and out to the antenna.

The Aural Carrier

The aural carrier is fed into the side port of the output diplexer. At this entrance, it must go toward the filter and divide into two equal sections, but they are in phase and can't feed out to the antenna. Instead, they proceed toward the visual end until they meet the Fvc + 4.5 MHz filter. The aural signal sees a short circuit and does not pass but is reflected back to the diplexer. As the upper arm is ¼ wave longer than the bottom arm, again the equivalent of a ½ wave section of travel is involved so the phase is reversed 180 degrees. Thus, as the two signals reach the diplexer arms they are 180 degrees out of phase and can feed right through the diplexer and out to the antenna. The aural transmitter does not feed the antenna direct but instead "bounces it off" the sound filters.

Since diplexer action is used both in filtering and mixing, it is very important that each filter be tuned exactly the same as its counterpart on the opposite leg and that each side be correctly balanced. If any imbalance occurs, the load resistor can become overloaded and other problems develop internally.

Maintenance Problems

Temperature around the unit is important. Such a high Q unit is very sensitive to temperature outside changes. Direct blasts of air or drafts, whether they be hot or cold, should be avoided. Temperature changes will cause the metal of the filters to expand or contract and thus detune.

Gas pressure should be regulated and maintained at a constant pressure. Changing the pressure inside the units has the same effect as temperature outside the unit—detuning. Some filter units use no gas at all, some use nitrogen, while high power units often use sulfur hexafluoride gas. Again, this depends upon the manufacturer. Gassing the filter unit increases the dielectric constant between the conductors and gives better protection against voltage flashovers.

If the unit is gassed, it must be kept gas tight. Gas is not free and a leak can become expensive. A regular cylinder of nitrogen costs about $7.26. Sulfur hexafluoride is sold by its physical weight, and this is $3.00 a pound. A cylinder the same size as the nitrogen cylinder just mentioned will cost about $330.00 as they have about 110 pounds of gas in them. Leaks at this

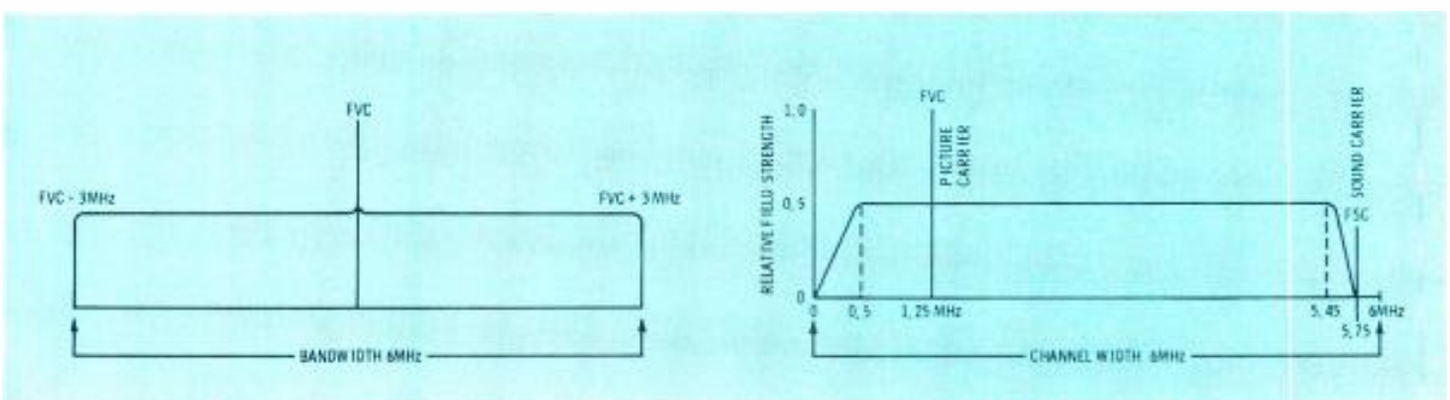


Fig. 2a The 6 MHz TV channel would only permit 3 MHz of video modulation if both sidebands were transmitted.

Fig. 2b Vestigial sideband transmission. Picture carrier has been moved to the left of center—the lower channel edge. Lower sideband has been suppressed. This permits 4.5 MHz of video modulation.

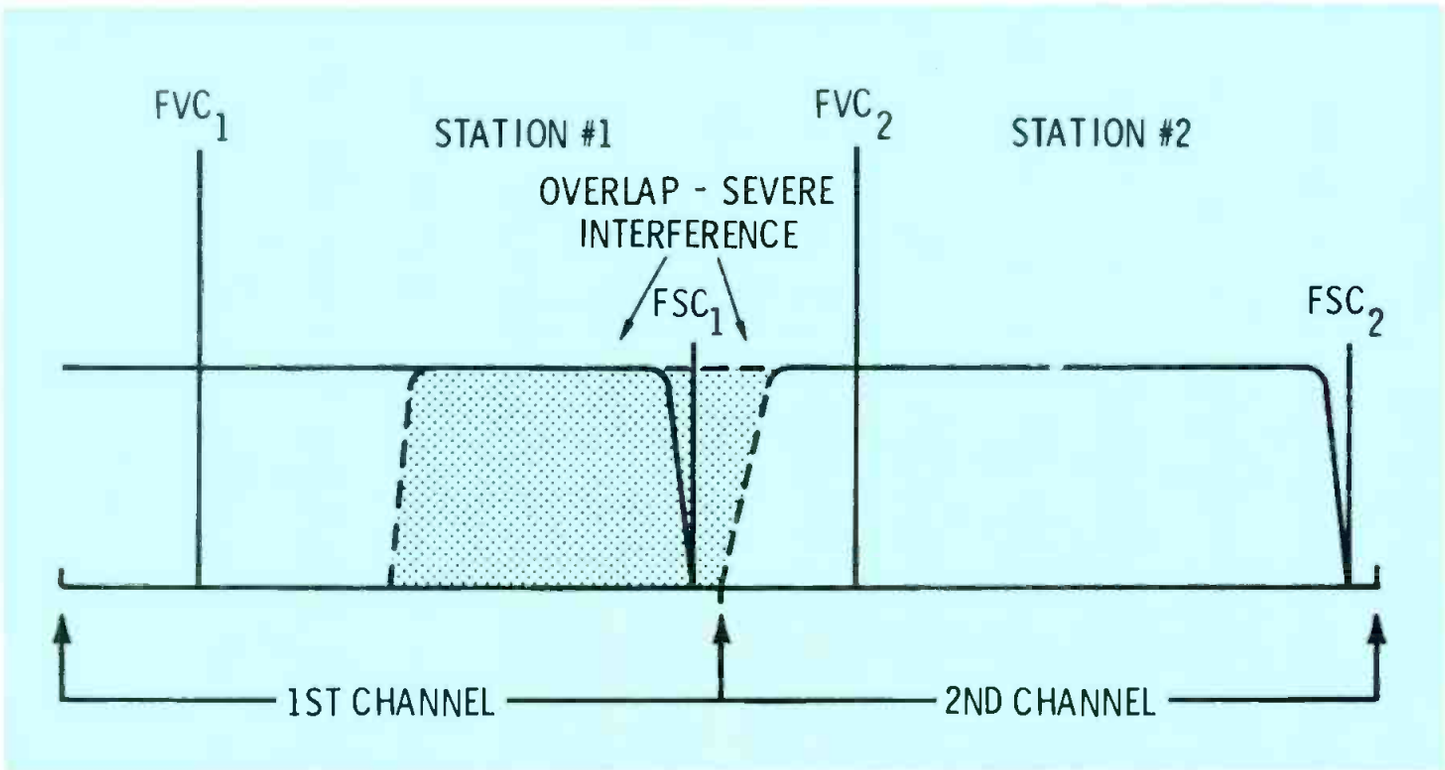


Fig. 3 Severe interference would be caused if the lower sideband were allowed to overlap the adjacent channel. The amount of overlap is shown in the shaded area.

price can be very expensive!

Burning contacts can be another problem. This may be due to flashovers or loose connections. Gas and its pressure will help prevent flashovers, but a loose contact will continue to heat and burn, all the time getting worse. High RF voltages and currents are present inside these units, so it is necessary that all contacts be tight and clean. High power units also have blowers to direct air down into the tuned units to help keep those parts cool.

Physical damage is possible even though these are somewhat rugged units. They are as strong as the waveguide or transmission line units of which they are made. Even so, physical damage can occur in a number of ways. One should be especially careful if working with heavy tools above these units. Care should be taken not to drop anything on the unit. Also, nothing should be piled on top of it, nor should anyone stand on the unit for any reason. Any of these things can cause dents or broken gas joints. Small dents can cause some detuning, but large dents can cause serious trouble.

These filters are something of a necessary evil. To squeeze in enough picture detail into the channel, the lower sideband is lopped off. These sharp notching filters do the job of shaping the sidebands, but there is a price to pay in the form of phase shifts and ringing. Ringing and phase shifts especially affect color passage. Envelope delay equalizers are required ahead of the video input to the transmitter to compensate for these faults, but they never completely cure them.

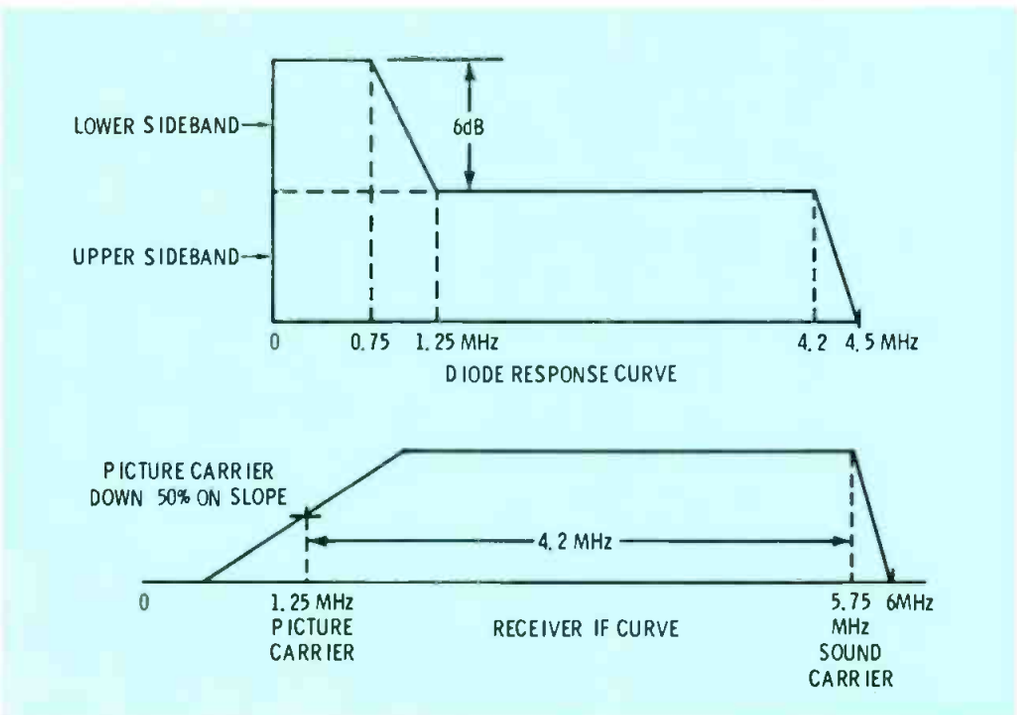


Fig. 4a Diode response curve.

Fig. 4b Receiver IF curve.

As was mentioned earlier, these are sensitive units. If changes or damage is allowed to occur, the normal faults are greatly exaggerated and more enter. With ringing for example, a small amount may produce an outline on small subjects in the video picture while on large

objects it may not be noticed at all. Some color edgings may be present. Now if the ringing becomes severe, say from some detuning or damage, a single ballplayer in the center of the ballfield by himself, viewed on a wide angle lens, may appear to be a whole row of players—like a chorus line. (The team may win, but you lose!

If the sound is also diplexed into the antenna, detuning of the sound notches will allow aural carrier feedover into the visual transmitter.

Inspection

Filter units do not need a great amount of maintenance. Mostly, they need protection, and inspection. Daily checks of the gas level and pressure and inspection for leaks if the gas usage goes up suddenly. Make sure the air baffles are kept in place to keep drafts from the unit.

During the daily transmitter inspection, the engineer should feel the tuned units and elbows for any signs of heating. If there are hot spots, trouble is brewing and it probably won't be long in coming. The power indicated on the reject load should be checked also.

Opening the units should never be attempted unless it is absolutely necessary. If such action is necessary, and if it is a gassed unit, first bleed off the gas pressure. If the gas is allowed to rush out quickly, it can move the inner components and detune them.

Once the unit is open, care must be taken not to move the inner conductors because this will cause detuning. Remember that a unit as described earlier depends upon the lengths of the paths to cause phasing. Even a fraction of an inch can change this.

Tuning is not recommended for the station engineer unless he has both the knowledge and the equipment to do the job correctly. It is best to have the field engineers of the manufacturer or a consulting firm do the job.

Equipment required for tuning includes a good RF signal generator that will cover the channel in question, plus an accurate calibrator for the signal generator. A slotted line and a detector completes the package. VHF channels can use another method. This has a RF sweeper device and detector to view the results on an oscilloscope much as the video sweeper and analyzer do for video. This is an excellent method as it permits one to view the whole bandpass at the same time. The first method requires checks on at least every quarter megacycle.

The first indication of mistuning of a filter unit will show up on the VSWR meter on either the aural, visual or both transmitters. Any mistuning will not present a good load to the particular transmitter and VSWR will increase.

Treat the sideband filter kindly and it will do its job. Leave the tuning alone. Mistreat it or fool around with the tuning and you have troubles in a big hurry—and these troubles are not a simple matter to cure in a hurry. ▲

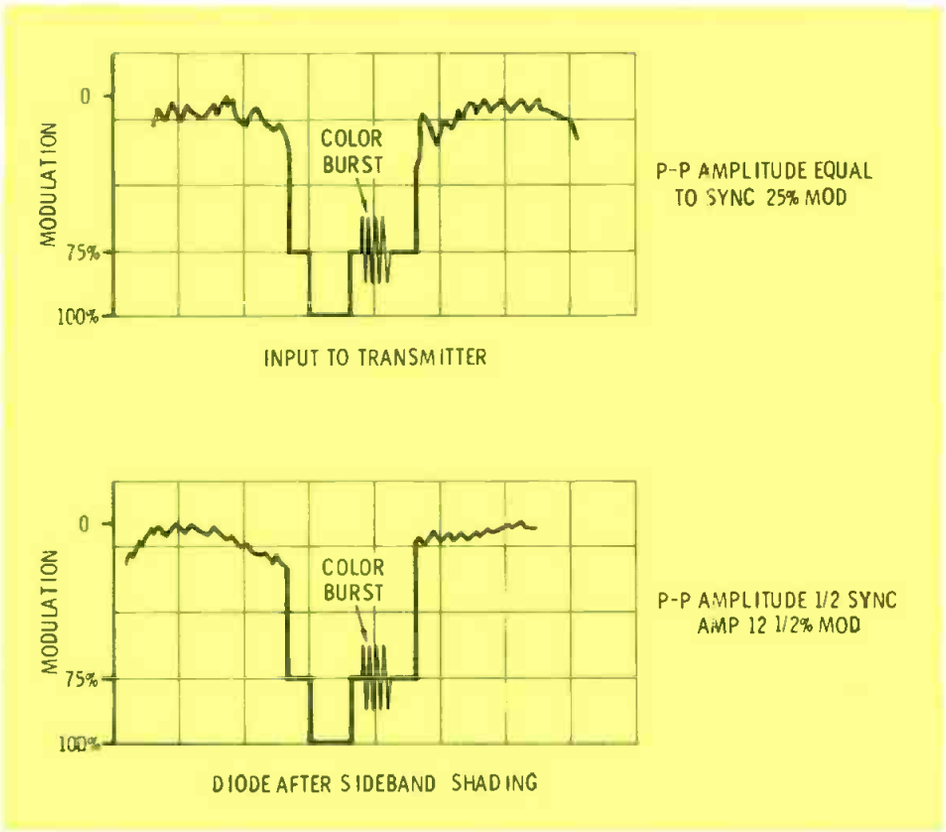


Fig. 5 The amplitude of the color burst on the back porch of horizontal blanking, as viewed by diode after sideband shading is exactly one half the amplitude viewed going into the transmitter, or after a good demodulator with a good IF curve. The sync is transmitted in the lower portion of the sideband, while the burst at 3.58 MHz is only from the upper sideband—6 dB down. 5a shows input to transmitter. 5b is diode after sideband shading.

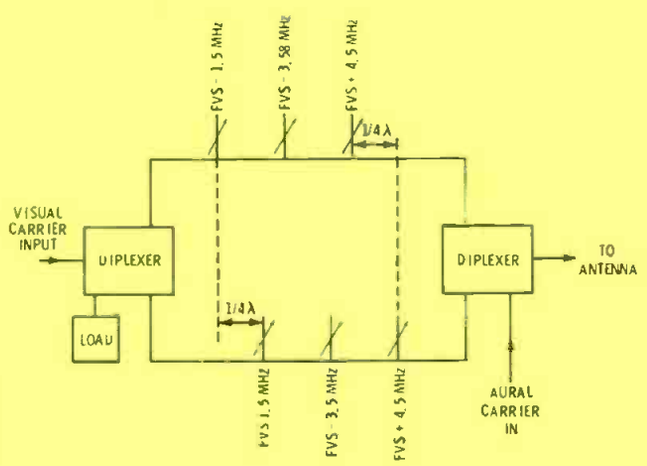


Fig. 6 Operational diagram of a commercial unit used on UHF.

The only UHF tetrodes that will deliver up to 2 KW CW at 1000 MHz with a guaranteed -52 db intermodulation*

The outstanding linearity of our tetrodes allows the engineer to design TV translators with visual and sound carriers amplified through the same tube—exceeding FCC and CCIR specifications.

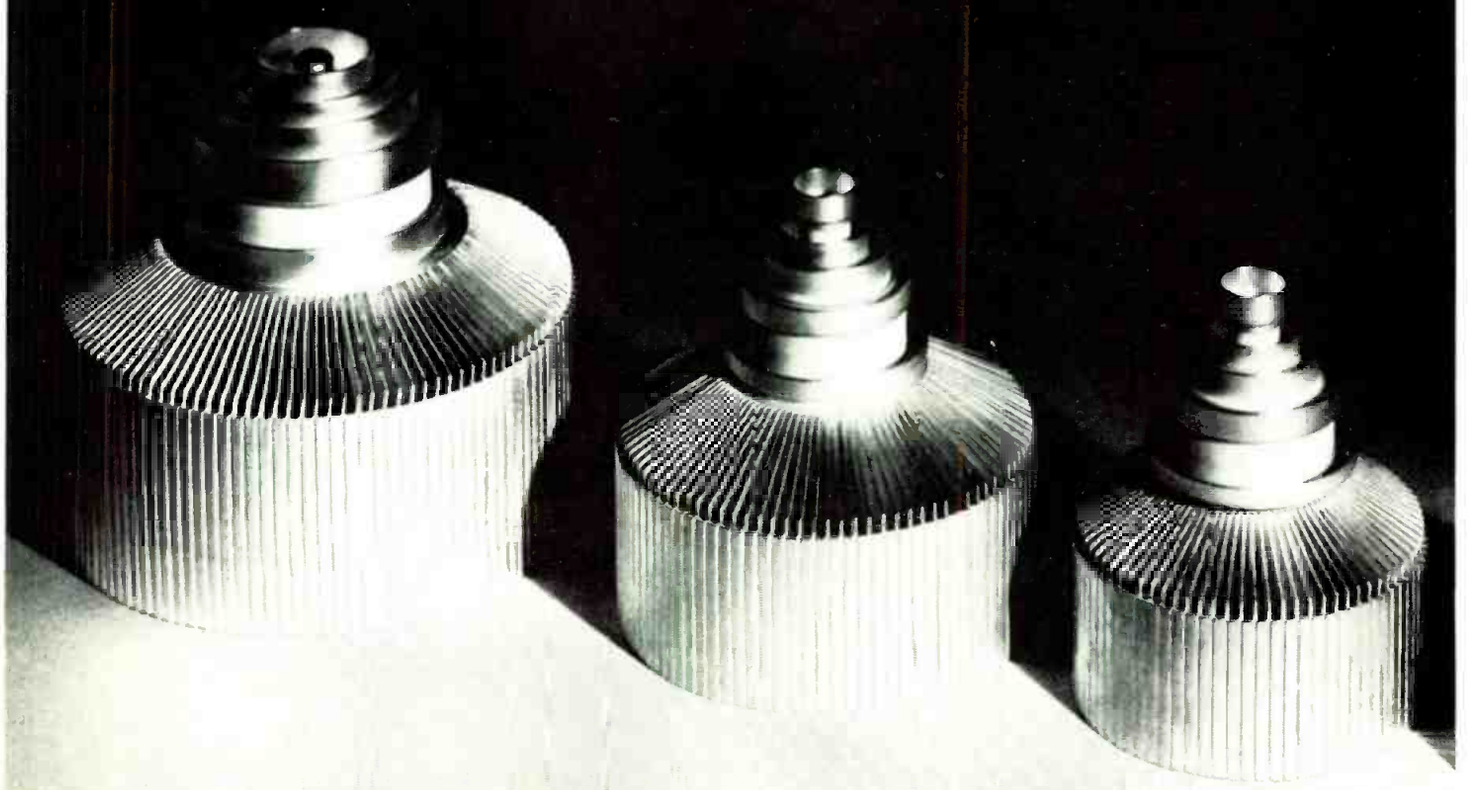
All ceramic-and-metal construction assures long-life and reliability under severe environmental conditions. Hundreds are in field use today at low operational cost.

These tetrodes are part of the most comprehensive line of UHF tubes available. They can be driven by our 20 dB gain triodes thereby permitting use of a solid state exciter.

A family of coaxial cavities has also been specially designed to assure optimum performance of our tubes in UHF operation. For more information about these tubes and our entire line of UHF triodes and tetrodes, please circle the appropriate number of the Reader Service Card or contact us directly.

Tube Type	Typical Plate Voltage (volts)	Typical Plate Current (amps)	Drive Power (watts)	Output** Power (watts)
TH 327	2300	0.6	6.5	250
TH 331	3500	1.8	50	1000
TH 290	3500	3.0	100	2000

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



THOMSON-CSF

Thomson-CSF Electron Tubes, Inc./50 Rockefeller Plaza/New York, N.Y. 10020/(212) 245-3900

Circle Number 20 on Reader Reply Card

Use your scope to check transistors

By Carl Babcoke*

Transistor tests range from a series of many accurate measurements displayed on charts and graphs down to the simple go/no-go tests suitable for servicing techniques. The test method described here is of the latter type, and is of value because the majority of transistor failures are of the catastrophic type such as open or short circuits. With some exceptions, the method also works quite well in-circuit.

An old, but still useful, method of testing transistor junctions with an oscilloscope as the display device is given in the schematic of Figure 1. Any base-emitter or base-collector junction of a transistor exhibits diode characteristics. That is, when the element made of "P" material is positive relative to the other element made of "N" material, resistance of the junction is at a minimum. Conversely, negative voltage applied to the "P" element and positive to the "N" element will cause nearly an open circuit between the two. AC voltage applied to such a transistor junction will cause it to be conductive to current flow during one-half of the sine wave. The emitter-collector path involves two dissimilar diodes of opposite polarities, therefore rectification is somewhat indefinite.

Interpretation of the scope waveform is the only difficult part of this test, so we will show photographs of typical waveforms to guide you. The circuit causes both the waveforms supplied to the vertical and horizontal amplifiers of the scope to be changed by the condition of the transistor junction "diode".

A horizontal line, as shown in Figure 2a, indicates an open circuit, or a vertical line (Figure 2b) indicates a short across the test leads. In fact, the scope is pre-set by shorting and opening the test leads before

*BE Solid State Editor.

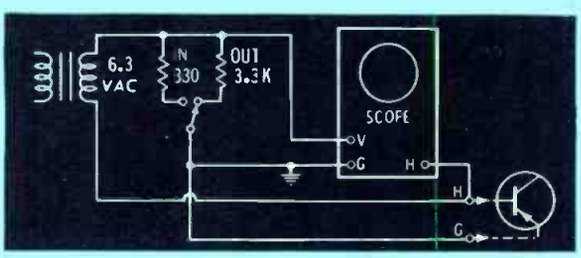
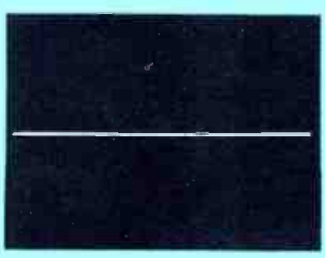


Fig. 1 Schematic of a transistor testing adapter for use with almost any oscilloscope. Both vertical and horizontal deflection voltages are supplied by the adapter, and no locking of the scope is ever needed. Two values of resistors are shown: 330 ohms for in-circuit and 3.3K-ohms for out-of-circuit transistor or diode tests.

Fig. 2 Single straight lines produced by open or shorted transistors (following the simple pre-adjusting explained in the text).



(A) A horizontal line indicates an open across the test leads.

(B) A vertical line indicates a short across the test leads.

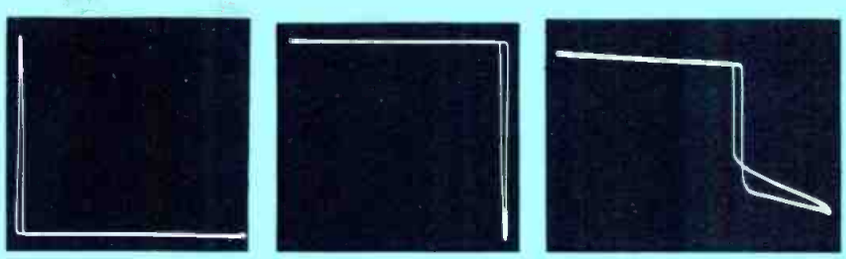


Fig. 3 Waveforms typical of most normal germanium transistors.
(A) PNP polarity transistor with base connected to H and emitter (or collector) to G. A diode with the cathode connected to H and the anode to G will produce the same waveform.
(B) The same PNP transistor with the base connected to G and the emitter (or collector) to H. A diode with cathode to G and anode to H produces the same waveform.
(C) A PNP transistor with the emitter connected to H and the collector to G. Rectification is inefficient, and scope gain must be increased to obtain a large waveform.

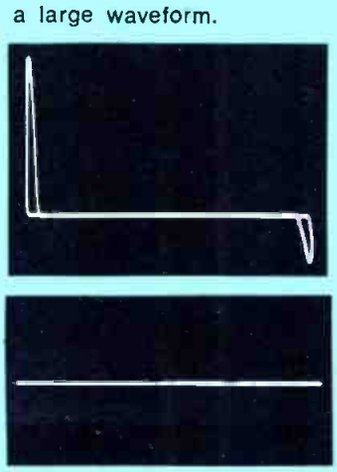


Fig. 4 Silicon transistors present further problems.
(A) One type of NPN polarity silicon transistor with the base connected to G and the emitter to H. The extra negative-going tip on the right is evidently zener action. It is not scope overload, nor does it appear in the base-collector waveform.
(B) Collector-emitter tests show an open circuit, when the transistor is a silicon type.

a transistor is tested. The "H" input on the scope is the external horizontal sweep input, and the sweep selector switch must be set to correspond. With nothing connected to the test leads, adjust the horizontal gain control for a horizontal line on the scope for about one-half screen size in length. Short the test leads together and adjust the vertical gain switch and control for a vertical line of about the same height as the length of horizontal line in the previous step. Focus and beam intensity of the scope should be adjusted normally.

Typical waveforms for a non-defective germanium PNP transistor tested out-of-circuit are shown in Figure 3. Connections of a specific test lead to the specific transistor element are listed so you can use this method of identifing the polarity of diodes or transistors. Otherwise, it is not necessary to observe polarity in connecting the test leads; the right angle waveform will face the opposite direction if the leads are reversed or the polarity of transistors changed.

Silicon transistors produce the same waveform as germanium types in the base-emitter and base-collector tests (the zener effect shown in Figure 4a has been in all the base-emitter tests of silicons I have made so far), but emitter-collector tests (Figure 4b) show an open circuit.

Sharp corners on the scope waveform are the hallmark of a good diode or a good transistor junction. This is true also during the valuable in-circuit tests. If other components obscure the sharp corner, remove the transistor for a more definite test.

Waveforms produced by resistance, capacitance or inductance (without a transistor or diode) are shown in Figure 5. Comparable waveforms with transistor junctions, as might happen in-circuit, are shown in Figure 6. Actual in-circuit waveforms are pictured in Figure 7. The 3.3K-ohm resistor was used to intensify the waveforms. Be sure the power is turned off to the circuit under such tests.

Some of the advantages of this method of testing transistors as rectifying diodes are as follows:

- Extreme speed. Just attach the test leads to base-emitter, base-collector and emitter-collector in sequence. Any short or open indication stops the test with the diagnosis of "defective transistor".
- No charts or scales. There is one value of resistor to select for in-circuit and a higher value for out-of-circuit; that's all.

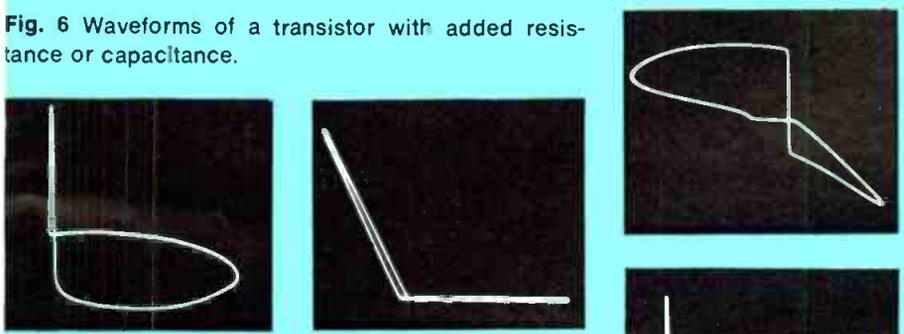
Disadvantages of this test method are as follows:

- There is no indication of moderate leakage.
- The emitter-collector path of silicon transistors always test open, thus only a short can be detected.
- No numerical ratings can be found by the test.

Next month, we shall explore other methods of transistor testing such as DC beta tests, resistance tests and turn-off/turn-on tests. ▲

Fig. 5 Waveforms produced by resistance, capacitance or inductance without a transistor.
(A) A 3.3K-ohm resistor across the test leads gives this tilted waveform.
(B) Either a .47 mfd capacitor or a filter choke across the test leads produces a near-circle.
(C) The same transistor connections with a 3.3K-ohm resistor in parallel between base and emitter.
(D) A PNP germanium transistor with the emitter connected to G, the base to H through a 6.8K-ohm resistor, and a 6.8K resistor in parallel with the base and emitter. The waveform approaches that of a pure resistance, but the diode corner is still visible.
(E) Same transistor with emiter connected to G, the base to H through a 6.8K-ohm resistor, and a .068 capacitor in parallel with base and emitter.

Fig. 6 Waveforms of a transistor with added resistance or capacitance.



(A) A PNP germanium transistor with the emitter connected to G, the base to H, and a .25 capacitor in parallel.
(B) The same transistor connections with a 3.3K-ohm resistor in series between base and H.

Fig. 7 In-circuit waveforms.
(A) Emitter-to-collector of a PNP germanium transistor connected to an unloaded audio output transformer.
(B) Emitter-to-base of the same transistor (including bias resistors and electrolytic coupling capacitor).

ENGINEER'S EXCHANGE

Remote Metering Cure

At WHIO, we have been operating our AM transmitter by remote control for a number of years. The need for more operating and metering positions made it necessary to purchase a new system.

We were able to use the existing metering pick-up units with the new remote control system . . . or so we thought!

The transmitter voltage, current, and AC potential worked beautifully, only re-calibration was required. However, when the common point and antenna sample lines were connected into the new system, we had more than a few moments of panic. The remote meters fluctuated wildly up and down scale! After a few cups of strong coffee, and a quick look at the help wanted ads, we decided that we had better make it work (new pick up units were not requested and the company purse strings had already been tied on the project).

A look at the sample lines with a scope showed that the required DC meter voltage had so much "grass" superimposed on it, that the meter voltage was all but invisible.

The old system worked because the interfering signal was AC caused by modulated RF being induced into the sample lines, and the remote meters were DC movements. I suppose the capacity of the TELCO line helped, too.

The new system didn't work because the sample voltages are processed, and converted to audio tones for telemetering. The interfering signal completely overloaded the processing circuits in the new remote control.

After trying capacitive and/or inductive filters, plus a large amount of extra grounding (with little success), we thought of an old trick used a few years ago to filter noise out of a 10-meter mobile receiver.

It's a coaxial capacitor brought out by Sprague under the name of "hypass". A search of my personal junk box came up with two of these of doubtful vintage and condition. They were installed in one of the lines, and (whew!) the remote meter held steady.

New capacitors (0.5-50 volt) were purchased and mounted in a metal box to isolate the noisy input from the clean output, the system calibrated, and put into operation.

Work was then started to convince the boss that I am, indeed, a genius, and worth more money, etc., etc. However, he considers this sort of thing as "part of the job". Anyhow, it's nice to know that us old foggies can come up with an OLD trick to tame the new breed of digital equipment.

Jim Shupe
WHIO-AM
Dayton, Ohio

ATC Modification Cuts Air Failures

At KGO Radio in San Francisco we have 14 ATC Criterion series tape machines in operation. This being a news type station and a network owned and operated station, these machines see quite extensive duty. For a number of months we were having difficulties with motorboating, hum and other similar problems that seemed to originate in the plug-in type amplifier and power supply.

We tried cleaning and bending the contacts on the modules with no success. Then we opened the cans to discover that the component boards inside relied upon the metal spacers for conductors between the circuit boards. Tightening the screws that hold these spacers in place was effective for a brief time, but then the old problems would return.

The solution to the problems came when we decided to provide standard wiring between the component boards. Since there is insufficient clearance between the edges of the boards and the cover to run wires, it is necessary to cut indentations in the boards. This can be accomplished very simply by using a small, abrasive type mandrel mounted in a ¼ inch electric drill. Have now wired all of the plug-in units; amplifiers, cue amps, and power supplies in our ATC machines, resulting in reduction of air failures by at least 90 percent.

R. V. Stuart
Daly City, Calif.

Alert Canadian Station Spoofs Vandals

The incidence of vandalism was increasing at the transmitter. Nothing broken or broken into, but writing on the building walls, broken glass in the lane and missing bulbs from the ATU hut outside fixtures. Small things that would probably grow if something wasn't done and as is usually the case, done cheaply. Then I read where Canadian author Farley Mowat had solved a similar problem at his farm. Figure 1 shows the solution. The black edged yellow triangular sign reading "Danger-Radiation hazard to unprotected personnel" coupled with the technical appearance of the site has removed all signs of any "visitors".

All the sign means is: Don't walk around with your shirt off or you may get a sunburn. The only indication of anyone near the property was a snowmobile track up to one of the signs, and straight back to the road.

At the same time the signs were erected I installed two small horn speakers under the eves of the transmitter building. Program sound is constantly fed to the speakers giving the impression that someone

(Continued on page 50)

Installation at KOAT-TV, Albuquerque, N.M.

ENVIRAZONE II®

- *Increases headwheel life*
- *Increases tape life*
- *Reduces video drop-out*
- *Reduces electronic equipment failures*

WHAT IS ENVIRAZONE II? Envirazone II is a specially designed (with the help of TV engineers) laminar flow module which provides the cleanest possible conditions (Federal Standard 209a, Class 100) at the video head and tape transport area where it really counts.

WHAT IS THE PRINCIPLE OF ENVIRAZONE II? Envirazone II completely isolates the VTR unit from the surrounding ambient air. Room air is circulated through high efficiency particulate air filters. These filters remove particles 0.3 microns and larger with an efficiency of 99.97% and discharges the air in a laminar pattern at a velocity of 90 feet (±20 feet) per minute. This ultra-clean air gently sweeps the tape head and transport area removing all airborne contamination within the area and provides a positive barrier against particles from the surrounding dirty environment.

WHAT ARE THE RESULTS? With the removal of dust and other particulate matter from the air, abrasive action upon the headwheel and video tape is greatly reduced.

Over 150 stations, in all parts of the U.S. and in all climates, are proving that Envirazone II improves VTR performance and cuts replacement costs.

In every instance the chief engineers have noticed an absence of dust which ordinarily accumulates on and throughout the VTR equipment. As a result many have mentioned that relay failures within the actual VTR equipment have been almost completely eliminated. Others have commented that there has been a reduction in the amount of video "drop-out" since the Envirazone II units have been installed. And finally, perhaps by far the most important result noticed, is that the headwheel life has been dramatically increased. Many TV stations have reported in excess of 100% increase in headwheel life — resulting in a potential savings of thousands of dollars annually.

Video equipment and tape manufacturers have been saying for years that environments within VTR rooms should approach that of clean room conditions in order to improve video headwheel and tape life. Now, thanks to Envirazone II, these conditions can easily be obtained with a minimum of investment.

OTHER APPLICATIONS? Envirazone II, because of its portability and slimline design, has almost unlimited use. Several stations have installed units directly over film islands, tape storage racks and slow-motion projection equipment. Envirazone II units are also used in numerous mobile TV vans and in remote installations where airborne dust has been a serious problem.

SHOULD YOU INVEST IN ENVIRAZONE II? With headwheel refurbishment costs continuing to increase, something has to be done to extend present headwheel life. Although there are other variables such as humidity, abrasive tapes, operational procedures, etc., which are responsible for head wear, dust has been labeled as one of the worst.

JOIN THE MANY STATIONS NOW SAVING MONEY WITH ENVIRAZONE II UNITS. STOP WASTING OPERATIONAL BUDGET MONEY ON EXCESSIVE HEADWHEEL REFURBISHMENTS.

Envirco
DIVISION OF BECTON DICKINSON AND COMPANY B-D

for additional information and a list of TV stations now using Envirazone II call or write Lou Sanders, Product Manager,

ENVIRCO P.O. Box 6468 Albuquerque, N.M. 87107 (505) 345-3561

World Leader in Environments for Industry and Medicine

Circle Number 21 on Reader Reply Card

(Continued from page 48)

may be in the building, acting as further deterent to prowlers. I connected the speaker amplifier across a diode detector rather than the program line. This serves as a reminder to staff that the transmitter is on when work is being done at the site. Already the saving in bulbs has paid for the signs and there has been no indication of vandalism.

W. R. Graham
Kitchener, Ontario
Canada

NEW PRODUCTS

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

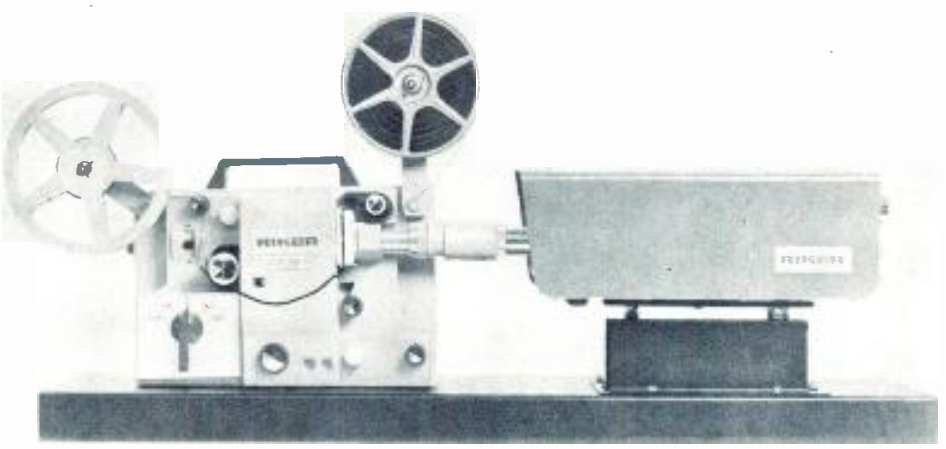
Riker Develops Film Chain

The Cable TV industry's first professional quality 8 mm film chain with TV shutter and synchronous motor, has been developed by **The Riker Corporation.** It handles both Super-8 and standard 8 mm films, translating them into video and audio signals.

Until now, most Cable TV operators have originated local program material using monochrome viewfinder vidicon or Plumbicon R cameras and video tape recorders. Mr. Foster pointed out that the 8 mm camera is considerably less expensive and easier to use for remotes than a mobile TV studio. Further, it is easy to do remote color pickups at night with 8 mm cameras, a feat next to impossible with TV cameras.

The Model 709 8 mm film chain sound projector, with synchronous motor, TV shutter and ASA magnetic sound is available for immediate delivery. Sound can be added in as many steps as desired, using a special AUTO BLEND key for superimposition. Three signal lights simplify audio mixing: green for playback, red for recording and white for sound on sound superimposition.

Circle Number 50 on Reader Reply Card



Riker Super-8 Film Chain

Service Tools

A number of new "fix-it" tools, with special applications in the servicing have just been introduced by **Xcelite Incorporated,** manufacturer of precision hand tools.

A pair of super long (20⅞" overall), fixed handle, hollow shaft nutdrivers with hex openings of ¼" and 5/16" is designed to simplify work involving color TV tuners, bezels, and other up-front components where the only access is through the back of the set. However, Xcelite states that, on many other jobs, the extra length of these nutdrivers will be found to be a great convenience, particularly since more power can be applied with less effort than with shorter tools. Features include rigid shafts; precision, cold-drawn, case hardened sockets; color-coded, plastic (UL) handles.

Two interchangeable 7/16" and ½" external hex Palnut driver shanks, which fit all Xcelite 99 handles including Tee and ratchet type, are also offered. These are said to save time and prevent damage to fasteners or equipment when removing inverted Palnuts of the most common sizes found on balance controls, on-off switches and

(Continued on page 52)

CALMS TAPE TENSION.

Headache? Take aspirin.

Tape tension trouble? Take TEAC.

For instance, take the A-6010U stereo tape deck here – with its unique tape tension control system: an inertial flywheel and compliance arm for precision record/playback running speeds and smooth, fast winding. This system helps reduce external factors contributing to wow and flutter, such as warped reels and splices.

TEAC offers fast relief for other common complaints, too: unique ***phase sensing auto reverse*** operates electronically at any chosen point on the tape, or takes a sensing foil if you'd rather. Separate heads permit ***source- or off-the-tape monitoring while recording*** for easy A/B comparisons. And our exclusive ***symmetrical control system*** makes tape handling logical and easy – fast or slow, forward or back, at a flick of the finger.

This tape deck can't cure everything that ails you, but you're bound to feel better once you own one.

TEAC

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

Circle Number 22 on Reader Reply Card

volume controls of most TV sets, record players and portable radios. Shanks are hollow so that they easily slip over projecting shafts.

For fast, clean, tip cutting of fine wires, especially in close quarter work, Xcelite is now making available a new pair of miniature, close cutting diagonal pliers. Lightweight and only 4" long, these economical pliers feature forged alloy steel construction with polished head and precision hand-honed and hardened cutting edges. Comfortable, plastic coated Cushion Grip handles and a coil spring opener reduce hand fatigue and recommend this tool for electronic and electrical assembly operations as well as service work.

Circle Number 51 on Reader Reply Card

Video Tape Editing & Control

A new line of flexible, automatic video tape editing and control systems, designed to meet the requirements of both the broadcaster and the production facility, has been introduced by **Datatron Inc.**

Known as the "VIDICUE 5000" the system enhances the use of the quadraplex VTR for the broadcast facility by providing precise, economical control of program and commercial construction. For the teleproduction facility, the VIDICUE can function as a highly sophisticated, computerized editing system, enabling the user to perform on tape what he had only been able to do on film in the past due to cost and technical restrictions.

The minimum basic editing system includes the VIDICUE Model 5100 Time Code Generator and the 5200 Control Unit. A single generator supplies an amplitude modulated code (identifying hours, minutes, seconds, and video frames) to any number of video or audio recorders within the facility.

This code is recorded on the cue track or one audio channel while recording or previewing the tape. Time in hours, minutes and seconds is displayed as a digital readout on the 5100 unit or on optional remote parallel displays.

The system uses a 30 pps code with a nominal carrier frequency of 600 Hz, thus assuring ease of distribution on audio pairs or phone lines within or between facilities. In addition, interface requirements are kept to a minimum and basic reliability is enhanced. Wide code bits distributed over the entire time frame provide for greater differentiation between bits, promote discrete video frame resolution, and assure readibility under the most extreme circumstances and severe dropouts. Typically, existing cue track heads on most recorders may be used, and no modification of most cue amplifiers is required.

The 5200 Control Unit portion of the VIDICUE 5000 provides automatic search and cue, frame synchronization, and editor control of one, two, or three recorders. More

machines may be controlled with the addition of an optional Programmed Editor Control.

As a universal editing system, the 5200 is designed to interface with any highband broadcast recorder, quality helical VTR capable of insert electronic editing, and any servo controlled multi-channel professional audio recorder.

Four basic modes of operation are performed: Cue/Preview—control of single machine; Sequential Edit—assembly of scenes on the record tape from the playback; Insert Edit of new material in a prerecorded tape; and A • B roll—involving precise control and synchronization of three machines for effects edits.

Circle Number 52 on Reader Reply Card

Instant Studio Dolly

A unit on wheels which provides a mount for a television camera and monitor, a platform for a VTR unit, and five integral quartz lamps and a microphone input on an extension boom converts any room into an "instant television studio" is now being offered by **TV Dolly-Lite Systems.**

Called "TV Dolly-Lite" the 220-lb. unit also has its own simplified control panel for the operation of the equipment mounted on the unit —and rolls easily from room to room. With only a few minutes' familiarization, any amateur operator can achieve near-professional results.

The TV Dolly-Lite does not come with a camera, microphone or video tape recorder. Thus, presently-owned equipment can be packaged on it, or new equipment can be purchased to suit the requirements of the user.

In operation, the integral quartz lamps can be pre-set to provide any desired degree of illumination—on any subject the camera points to—even for color telecasting or recording. And once the lamps are set, the camera remains on the light axis, even during panning and tilting. A single operator can move the entire unit easily for dolly-in or dolly-out effects. The unit draws 30 amps of power, and its single power cord permits easy maneuverability in operation. There are no bulky cable bundles to contend with.

Circle Number 53 on Reader Reply Card

Decorator Switches

A new "Decorator Line" of Push Button Switches, which enhance the panel appearance, is now available from **GRAYHILL, INC.,** La-Grange, Illinois. This new line of switches combines panel style with the contact systems of the GRAYHILL Series 30 or Series 46 Push Button Switches that have been proven reliable in many thousands of applications. The design provides maximum versatility in combining the correct front-panel appearance with the correct contact system. The "Decorator Line" includes 32 different switch combinations (without consideration of button color).

Circle Number 54 on Reader Reply Card

Digital Frequency Counter

The new **Telectric** frequency counter CMC Model 616 offers direct readout of frequency measurements up to 225 MHz. This capability is due to built in pre-scaling circuitry. It allows the 616 to offer the higher frequency measuring advantages at a cost comparable to less capable instruments. The pre-scaling technique is a divide-by-10 circuit

(Continued from page 53)

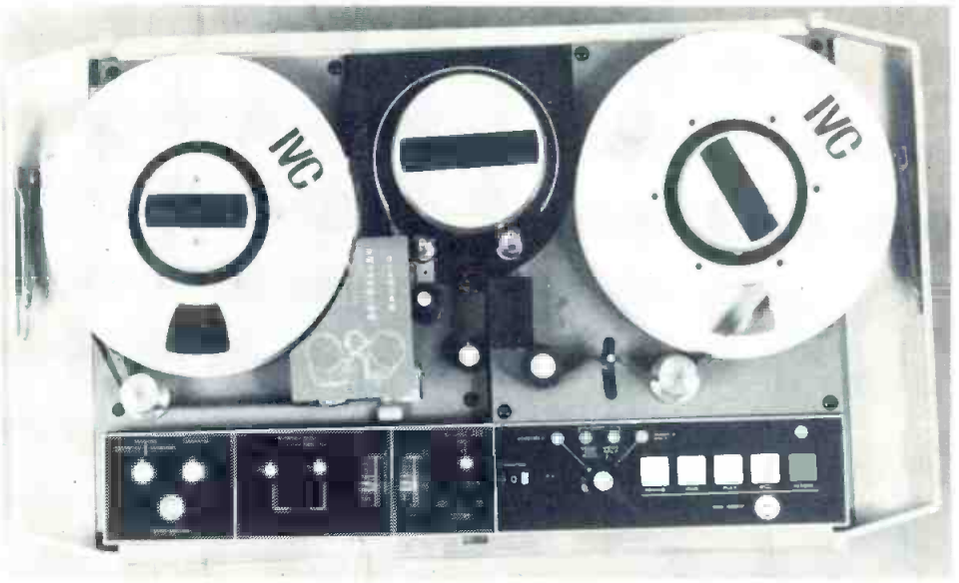
in the input amplifier. The decade counting units count and display every tenth pulse.

The 616 uses all silicon semiconductors for extended life and reliability. The counter has an extended operating temperature range of −20°C to +55°C. The silicon semiconductor display storage circuitry gives the added advantage of a fast response time to readout changes.

By adding one of the 616s Frequency Converter Modules, The 616 may be extended to 1.3 GHz or to 3.3 GHz. By adding the Model 633 Time Interval Function Module, the 616 counter can be converted to a Period or Time Interval meter with resolution to one microsecond.

Typical applications include: alignment of UHF communication links; calibration of HF signal generators; direct monitoring of AM, FM, and TV carrier frequencies; checkout of radio transmitters; testing video systems and pulse generators. The 616 is capable of running from either 110 VAC or 230 VAC (for overseas use).

Circle Number 55 on Reader Reply Card



Color VT Recorder

A new color videotape recorder offering both insert and assemble editing has been placed on the market by **International Video Corporation,** it was announced by Donald F. Eldridge, IVC president.

"The IVC-870 vertical interval editor inserts new material into previously recorded programming and electronically splices or assembles material from two separate program sources, such as live cameras or other recorders. Tearing, rolling, distortion and other loss of information are completely eliminated," Eldridge said.

The IVC-870 features capstan servo for precise timing of programming, a second audio track, built-in speaker/amplifier, and offers excellent time-base stability. Four-motor, servo-controlled design assures fast lockup. Video bandwidth is 5 MHz, video signal-to-noise is 44 dB and horizontal resolution is 400 lines.

Designed for closed-circuit use, the recorder is ideal for either local or remote applications. Available in a portable carrying case or as a deck for rack mounting, the IVC-870 will play in any position. In the portable case it weighs 78 pounds.

Circle Number 56 on Reader Reply Card

Chromium-Dioxide Tape Cassette

The first commercially-available cassette to utilize chromium-dioxide-coated recording tape has been announced by **BASF Systems Inc.,** Bedford, Massachusetts.

According to Jack Jackson, Manager of Marketing Technical Services for BASF, the new Chrome Cassette approaches professional reel-to-reel recording quality when recorded on a suitably-based machine. The special chromium-dioxide coating offers a number of advantages over iron-oxide formulations. It provides high sensitivity with low print-through, better high frequency response and dynamic range, excellent fidelity at the slower cassette recording speed, and freedom from dropouts and head clogging which sometimes result from iron-oxide surface defects and rub-off.

Because chromium-dioxide can be applied in a thinner coating without sacrificing performance, a thicker, stronger tape base can be used for extra durability without loss of program time. The new Chrome Cassette is presently available with playing times of 30 minutes (C30) and 60 minutes (C60).

Circle Number 57 on Reader Reply Card

Tape Recorder

A new tape recorder/reproducer developed for the professional recording industry has been announced by **Tape-Athon Corp.**

The new recorder, designated Model 1000, is equipped with a number of significant features including a drive system consisting of

three motors and two solenoid controlled capstans. Such a configuration provides separate movement of each capstan, reducing wow and flutter to minimum regardless of reel loading or torque. The tone quality produced by such a tape drive is said to be superior to standard single drive systems.

Also featured on the new machine is a tape lift mechanism that lifts the tape toward the pickup heads or away from the heads, completely out of the field. This tape lift movement may be activated either manually or automatically. An illuminated "CUE" button, on the front panel of the recorder is used to control the tape lift motion.

Circle Number 58 on Reader Reply Card

Tape Deck

Sony Corp. of Japan has introduced a successor to the Model 355 —the Sony Model 366.

New features on the Sony Model 366 tape deck include automatic total mechanism shut-off, mike/line mixing, record equalization selector switch, built-in sound-on-sound, and hyperbolic heads, which do not require pressure pads.

The unique shut-off mechanism automatically turns the motor off and returns the transport to the "stop" position when the tape runs out or breaks. This disengages the pinch roller and record buttons. The feature eliminates the posibility of forming an undesirable flat spot on the pinch roller.

Separate controls regulate the record levels of microphone and line inputs. Also, both microphone and line inputs may be mixed and recorded simultaneously. The record equalization curve for either standard or low noise, high-output tapes.

Circle Number 59 on Reader Reply Card

CATV Signal Generator

Tektronix, Inc., announces the 144 NTSC Test Signal Generator, designed to provide high-quality television test signals for cable and broadcast TV systems. Combined in one compact, solid-state unit are: NTSC encoded color bars, full-field or split-field; modulated staircase with variable APL, 10% to 90% and fixed APL, 50%; convergence crosshatch; and vertical interval test signals, staircase or color bars.

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

144 is an ideal sync generator for local program origination.

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

Circle Number 60 on Reader Reply Card

RF Load Resistors

With costs increasing in nearly every sector of the economy, price reductions are unexpected, rare good news. Larger production runs and procurement economics have made possible substantial 15-25% price reductions in the TERMALINE® Hi-Power RF Load Resistors manufactured by **BIRD Electronic Corporation.**

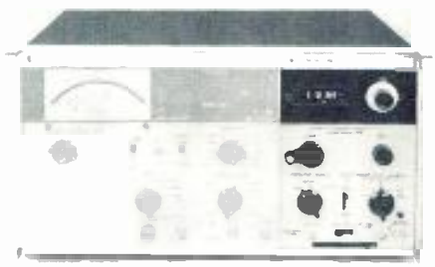
This line of 3⅛" water-cooled Loads now includes nine models: 15, 25 or 50 kW continuous power dissipation, 3⅛" unflanged (51.5 ohms) or 3⅛" EIA (50 ohms) VHF and UHF units. All exhibit low VSWR of 1.1 in their operating band and can be used at DC and power line frequencies for substitution calorimetry up to 1500 MHz.

The loads weigh about 13 lbs., i.e. they can be bolted to the end of a line, and are cool to the touch under full power with only 6-10 gum water flow.

Circle Number 61 on Reader Reply Card

Long Sweep Time Wave Analyzer

A new plug-in for the **Hewlett Packard** Models 3590A/3591A Wave Analyzers have a sweep time of 10,000 seconds. Sweep time provided by other plug-ins is 620 seconds. Low frequency and audio



measurements require slow sweep speeds—on the order of 1 Hz per second. This new HP Model 3595A Sweeping Local Oscillator will cover 10 kHz in one sweep at 1 Hz per second, or 20 kHz at a sweep rate of 2 Hz per second. Frequency response of low-frequency networks, transducers, filters, etc. can be measured over several decades of frequency with a single sweep.

Sweep rates of 1, 2, 10, 100 and 1,000 Hz per second are provided. The sweep rate can be switched without transients, so that the less interesting portions of the frequency spectrum may be traversed at a faster rate. Log sweeps can be made at all rates.

Circle Number 62 on Reader Reply Card

MATV Coax Cables

Two distinctly new 82-channel coxial cables, now available from **Jerrold Electronics Corporation,** claim lower loss, greater mechanical strength and shielding superior to common "RG", "RG-Foam" or "foil-drain wire" types.

The Jerrold "Coloraxial" cables —CAC-6 and CAC-11—have been engineered to exacting requirements of 82-channel color MATV systems, according to Jerrold engineers. Both cables have 80 dB shielding and they retain this characteristic with bending and pulling, of the aluminum braided shield covering a thick mylar-aluminum foil tape. The additional braided shield (instead drain wires as in some cables) provides mechanical protection to the foil and also allows easier connector installation in the field.

Featuring lowest loss and flat match through and beyond VHF, these new cables assure truly professional results. The 80 dB reliable-shielding is rated at 40 to 50 dB better than average RG cables.

Circle Number 63 on Reader Reply Card

CATV-MATV Systems Analyst

A completely different method in systems measurement technology is now available with the use of a new type of test equipment now available from the **JFD Electronics Corp.** /Systems Division.

Called the Systems Analyst, the new unit is considerably faster and easier to use than existing methods of checking Cable TV (CATV) and Master Antenna TV (MATV) systems.

The Model 7500 Systems Analyst can be used for a wide variety of applications, including: sweep-

ing cables for return loss and frequency response; troubleshooting trunklines; checking amplifiers for gain; splitters, directionals and taps for loss and VSWR; measuring bandpass of filters and single channel amplifiers; and calibrating field strength meters.

Because the Systems Analyst provides data directly in dB, it is far easier to operate than conventional test equipment. Further, the chance of human error is reduced considerably.

The new JFD unit emits a continuous, flat signal from 50 to 220

MHz, with an accuracy of ± 1 dB. It also provides a narrow band crystal controlled reference signal at 73.5 MHz. The amplitude of the reference signal is accurately monitored on a panel meter and calibrated to within ±0.5 dB.

Also, the Systems Analyst includes a built-in 75 ohm comparison bridge, enabling the technician to measure directly the return loss of any passive or active 75 ohm device.

Circle Number 64 on Reader Reply Card

Color Tape Splicer

The Hartman Color Tape Splicer, designed by George Hartman, combines greater accuracy, dependability, speed and convenience to revise current thinking about mechanical video tape splicers, is available through **Television Equipment Associates.**

Features include built-in optics, automatic battery-operated editing lamp, and a new high-precision internal tape cutter. Independent tape lifters, internally dispensed splicing tape, and super-sensitive tape positioning facilitate editing.

Its small size, light weight and rugged construction make the Hartman Color Splicer the ultimate for for portability and remotes. Supplied in a fitted attache case, the editing kit includes developer, applicator, tape cleaner and all essential accessories, plus a specially-edited dissertation on tape editing by George Hartman.

Circle Number 65 on Reader Reply Card

CCTV Video Monitor

A new compact, low-cost all-solid-state closed circuit television monitor with a nine-inch diagonal picture tube and all-channel off-air TV reception capability has been announced by **General Electric's** Visual Communication Products Department.

The new TH-32-A monitor's small size, compactness, and quality performance make it especially adaptable for CCTV security and surveilance applications where

monitor space and viewing area are limited.

The monitor's total picture area is 38 square inches. Its resolution specification is better than 350 lines as a CCTV video monitor with a 1.0 volt composite video feed. The monitor can be switched from CCTV video input to off-air VHF and UHF reception.

Circle Number 66 on Reader Reply Card

Frequency Selective Voltmeter

The Model 2006 by **B&K Instruments** features a complete solid-state chassis and four major output indicators. It is a portable, self-calibrating device for use in the 0.1 to 230 MHz frequency range. Measurement versatility is maintained by using the high impedance FET or the 50 ohm probe input. The high sensitivity and wide dynamic range (2.5 uv to 50 volts) coupled with two fixed bandwidths make it ideal for application to nearly every AM-FM carrier or percent-of-modulation measurement need. The precise performance of the Model 2006 makes it ideal for field or laboratory measurements. Built-in recharging circuits and Ni-Cad batteries are included.

Circle Number 67 on Reader Reply Card

Video Amplifier Phase Correctors

Availability of two Rank Cintel Adjustable Phase Correctors to the North American market has been announced by **Rank Precision Industries, Inc.**

The Correctors, Types A and B, equalize phase errors in video amplifiers. Major uses are in the design of video circuits by engineers and in the manufacture, installation and operation of TV transmitters.

A major feature of the Adjustable Phase Correctors, according to Rank, is the simplicity of their operation. Once the adjustors are included in an amplifier circuit, the amount of phase distortion present and the compensation required can

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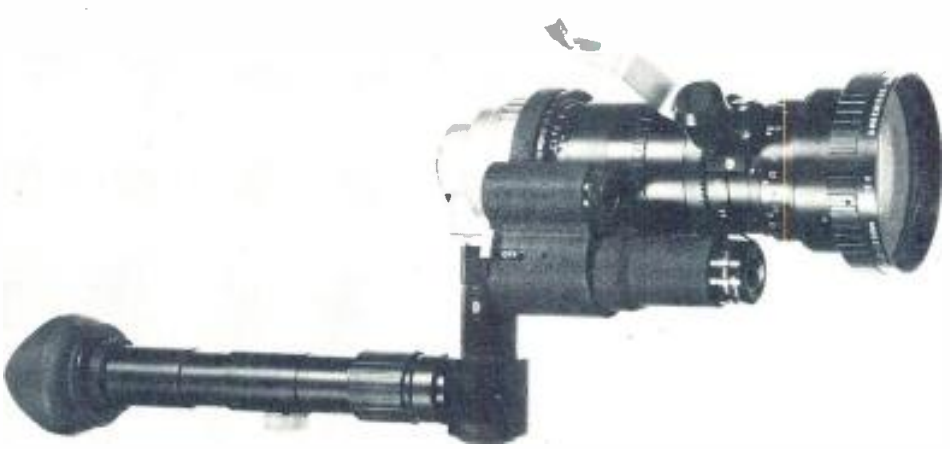
Automatic Iris

At the recent Society for Motion Picture and Television Engineers Conference in Chicago, **Angenieux Corporation of America** introduced the latest electro-optical mechanical lens design for the motion picture industry. Known as the Angenieux 10x12 AVB DA, the automatic iris system than was previously only available for reflex cameras has now been incorporated into the standard 12-120 mm, f/2.2 zoom lens with 7½ inch viewfinder.

Now, users of the Auricon, Bell & Howell, Bolex, and other non-reflex cameras can have the capability of a 3 mode automatic iris zoom. The Angenieux 10x12 AVB DA can be used as a "full time" automatic iris or semi-automatic iris zoom. By switching the electronic system off this lens can be utilized as a normal manual zoom.

Measuring the light that actually passes through the entire lens, the completely self-contained system is capable of accommodating all film emulsions within a range of ASA 10 through 400. Exposure focus system is employed for critical focusing. Upon pressing a button, the iris opens to full aperture. When released, the iris returns to the required opening.

Circle Number 68 on Reader Reply Card



easily be seen by oscilloscope.

The necessary circuit values are then obtained by reading the Correctors' dials, and a fixed corrector pad can be substituted for the Phase Correctors in the circuit.

Circle Number 69 on Reader Reply Card

TV Colorcomp

A new instrument which provides precise color alignment of television monitors has been developed by the **Electronic Products Division** of **EG&G, Inc.**, Boston, Mass. EG&G's Model 570 TV Colorcomp not only permits a highly accurate reproduction of a monitor color

standard, but is sufficiently sensitive to detect and correct color differences more accurately than human eye perception at high, medium and low light levels.

Colorcomp permits fast, precise lineup of any monitor and can be used with all monitors in a given area without need for separate memory modules. The Colorcomp generates three control readings which define an established color standard for a given monitor. Lineup of the monitor is achieved by simply dialing these control readings on the Colorcomp and adjusting the monitor controls until a null "zero" reading is obtained on the instrument meters.

The tri-sensor detector optics and unique null balance circuit achieve measurement precision of better than 1 MPDC (minimum perceptable color difference) when the monitor is adjusted to white. The necessity for a profusion of control knobs or data memory modules is eliminated.

Circle Number 70 on Reader Reply Card

Send Your Industry News To Broadcast Engineering For Better Coverage

TECHNICAL DATA

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

100. ADC PRODUCTS—The new 16-page color catalog of communication components from ADC illustrates and describes over 400 stocked parts plus many of the almost 3,000 components available. Included in the catalog are the ADC Products-pioneered "Bantam" line of miniature plugs, jacks and panels, plus other telephone-type plugs, jacks, patch cords, lights, terminal blocks, jack panels, lamp strips, lamp sockets, lamp caps, designation strips, jack strips, and coaxial jacks, plugs and panels.

101. ALTEC LANSING—The 1970/71 stereo component catalog features the theme "our products are a little better" and is the largest and most comprehensive catalog ever issued by the manufacturer. Offered in the 25-page booklet are 12 new stereo components, including new speaker systems, complete music centers, stereo receivers, an electronic crossover biamp, tuner preamp, and biamp speaker systems. For those confused by the various power ratings employed today, Altec offers a simplified explanation for the difference between RMS continuous power, total IHF music power and total music power ± 1 dB. A wide variety of Altec "exclusives" are featured throughout the catalog such as the Acousta-Voicette which allows a trained Altec dealer to "tune" any room to a flat acoustical response.

102. AMPEX CORPORATION—A new 24-page brochure on Ampex's broadcast television equipment is now available. The brochure gives features and specifications for studio recorders; portable recorders; disc recorders; cameras; video production control systems; RF products and broadcast video accessories. Photographs are also included.

103. ANGENIEUX CORP. OF AMERICA—Now available is a four-page pamphlet on their TV camera zoom lenses for support systems. These lenses allow a fast exchange of range extenders, easy interchange of lenses, and a precise adjustment of the back focal distance.

104. B & K INSTRUMENTS, INC.—Recently there have been some changes in the Walsh-Healey Act governing noise limits. B & K Inst. have summarized the latest requirements of the Walsh-Healey Act in a data sheet entitled "Occupational Noise Exposure".

105. CBS LABORATORIES—A new two-color product brochure for the broadcasting industry describes a complete line of audio and video products for radio and television broadcasting, and includes a description of the products, their specifications and price lists. The featured

(Continued on page 52)

Our new krypton-halogen replacement for the PS52 fits the same fixture, lasts twice as long and maintains constant color temperature for life.

That's some replacement.

New DSF 1500-watt krypton-halogen studio lamp.

PS52 1500-watt incandescent studio lamp.

When you replace a PS52 studio lamp you can replace it with something better.

The something better is Sylvania's DSF krypton-halogen lamp which fits the same fixture as the PS52.

Its average rated life is 250 hours. More than twice the life of the PS52.

And that's useful life, because the DSF is as bright at the end of its life as it was at the beginning. There's no darkening with age as in the PS52.

And its 3200° K color temperature is there right from the beginning. And it's still there 250 hours later. Constant.

The DSF has low-noise construction. There are no loose parts to resonate when used with SCR dimmers.

With all these advantages, the DSF is more than a replacement.

It's a major improvement.

Sylvania Electric Products Inc., 100 Endicott St., Danvers, Massachusetts 01923

SYLVANIA
GENERAL TELEPHONE & ELECTRONICS

(Continued from page 60)

item in the brochure is a special color insert on the new electronic color television broadcasting device, known as the "Color Corrector". This device permits adjustments in color variations after a television program has been encoded, and at any point during its transmission. The first of its kind for commercial television, the color corrector has been termed one of the more significant breakthroughs in color television broadcasting. The brochure also features such new generation products as the Mark II Image Enhancer with "crispened-comb filter" to sharpen television images as they are transmitted to the home, and the Dynamic Presence Equalizer, which enhances audio broadcast signals. The Color Masking Processor Model 538 and the widely-used Television Display Systems for digital display of elections returns, stock reports, weather and sports are featured. New models of the popular Audimax and Volumax are also detailed.

106. CHRISTIE ELECTRIC CORP.—A newly revised version of their catalog AC-70 which covers their complete line of high-current. DC power supplies is now available. The catalog includes complete electrical and mechanical specifications on over 300 basic and modified power supplies. Regulation options include magamp, SCR, series transistor, load-regulated only, and unregulated. An integral index eases the task of finding the correct supply for a specified job.

107. COHU ELECTRONICS, INC.—An expanded, six-page data sheet on the 6000 Series closed-circuit television system is now available. Sheet 6-499 is printed in two colors, includes 11 photographs and a block diagram plus specifications.

108. ELCO CORPORATION—This expanded 1970 edition describes 18 connector series including MIL-C-21097, modular, and metal-plate designs with contact spacings of .100", .125", .150", .156" and .200". Among the 27 sizes ranging from 4 to 84 contacts are connectors compatible with most terminating techniques including automatic and manual wire wrap, solder, and taper tab. The single- and dual-readout contacts are of the tapered, single-beam design, of the low-cost ribbon type, and of the high-reliability double-cantilever design. Insulator materials include glass-filled diallyl phthalate, nylon, and polycarbonate, while phosphor bronze and beryllium copper function as contact materials. A three-page illustrated index to all Elco p.c. connectors permits identifying the required connector series instantly. The guide contains complete drawings, detailed specifications and connector descriptions.

109. ELECTRONICS DIVISION—of American Relays. The new, fully illustrated 7-70 Guidebook of Electromechanical Components and Equipment introducing a Transducer Selection Guide is now available. This new feature, which describes popular types, functions, and applications of transducers, is designed to assist the engineer, scientist and teacher in selecting among listed pressure and position transducers, accelerometers and load cells. The 100-page Guidebook contains sections on counters, flow meters, precision potentiometers, servo mechanisms, test equipment and timers. Other categories include gyros, military synchros, fractional horsepower motors, blowers and stepping switches. All material in stock for immediate delivery.

110. ENTRON, INC.—An illustrated brochure—"The Key to Easy Maintenance . . . Passives with a Test Point"—describing their new CATV line with input and output test points that enable signal levels to be monitored throughout a cable system is now available. Available directly from stock, the line includes splice blocks, multitaps, directional couplers and a power insertion unit. Each will accept the Entron TP-4 test probe, which can be used to measure RF levels and 60 Hz AC voltage. The new passives, designed for CATV systems operating in the frequency range of 10 MHz to 300 MHz, feature corrosion-resistant housings, stainless hardware, and sealed pressure-proof fittings.

111. ESC ELECTRONICS—A new 12-page brochure describing their Dual In-line LC Filter Series is now available. The brochure gives part numbers, specifications, feasibility ranges, attenuation, phase shift and group delay characteristics, and time response for its lowpass, linear phase and highpass filters. The frequency ranges of these filters are 1 KHz to 10 MHz and impedance

ranges are 50 ohms to 5000 ohms.

112. FAIRCHILD SEMICONDUCTOR—A cross reference guide listing the company's complete stock of plastic transistors which are the nearest equivalents to more than 400 standard industry 2N types is now available. The listings are contained in a two-color pamphlet that folds out, accordion fashion, into 18 panels. Each panel measures 7 by 3½ inches. The publication is called "Fairchild Plastic Transistor Industry Cross Reference Guide".

113. INTERNATIONAL RECTIFIER,—Semiconductor Div. All major IR semiconductor devices are presented in an easy reference format in the new 20-page, full color, illustrated "Short Form" Semiconductor Device Digest. The book reflects the company's in-depth product capability. IR's line of electronic devices covered in the company's Device Digest and indexed on the cover for quick reference includes: Silicon Controlled Rectifiers, Power Logic Triacs, High Power Silicon Rectifiers, Selenium Rectifiers, Zener Regulators, Low Power Silicon Rectifiers, Silicon Assemblies, Light Sensitive Devices, and Heat Exchangers (to use with semiconductors). Each category of semiconductor devices is presented in compact tables and charts giving ratings, parameters, and other important specifications.

114. JERROLD ELECTRONICS CORP.—"Systems and Products for TV Distribution" is a recent catalog published by Jerrold with a subtitle that reads "for apartments, hotels, motels, schools, hospitals". This informative booklet includes numerous product photos and specs on virtually every one of its 32 pages that cover the industry's most complete and technically advanced product lines in TV distribution equipment. Recognizing the needs in modern TV distribution as high-resolution color, greater flexibility, more and more channels, and low maintenance costs, Jerrold has collected under one cover all of the components and equipment any contractor-engineer needs to install a first class distribution system. Including numerous specification tables and application notes, the catalog covers systems antennas and accessories, head-end equipment, distribution equipment and components, and installation aids.

115. METEX CORPORATION—A twelve page, three-color, fully illustrated brochure reviewing the relationship between EMI filtering and shielding is now available. The brochure describes why low frequency magnetic fields and high frequency plane wave fields are usually the predominant shielding problems of absorption of reflection and leakage through discontinuities. The study also includes a guide for the design of EMI gaskets that derives from the theory that is presented. This study of basic EM shielding theory is presented in concise, but simple, easy-to-read language, and is supported by drawings and graphs for full comprehension.

116. RAYTHEON COMPANY—A new six-page brochure describing their analog products is now available. An extensive line of A-to-D and D-to-A conversion equipment is covered including instruments, Mini-blocs™, M-Series analog cards, hardware and accessories. A-to-D equipment includes Multiverter III™ and Miniverter™, both of which consist of A-to-D converters, multiplexers and sample-and-hold amplifiers. Detailed in the brochure are 10, 12, 15-bit binary and 3-bit BCD A-to-D converters including various combinations of multiplexing and sample-and-hold amplifiers. Complete system performance, logic level, and analog input specifications are listed together with model designations for identification and ordering convenience. Typical performance characteristics and model designations for the 10 and 12-bit binary D-to-A converters as well as the newly introduced Analog Data Distributor are included.

119. WELLER DIVISION—Cooper Industries, Inc. A completely revised and expanded catalog of Weller industrial soldering tools is now available. A wealth of technical and performance information on their controlled output soldering tools is presented, as well as a broad array of tip styles and accessories. Standard, miniaturized, isolated and low voltage tools required for today's sophisticated electronic work are included. In addition, a comprehensive "basic soldering tool selector guide" relating specific Weller tools to typical soldering situations, is contained in the catalog.

U.S.-Canada Borders On Cable Carriage Protection

Requests by American television stations that CATV systems located near the Canadian border be required to afford protection against carriage of U.S. programing released by Canadian television stations before its release in the United States have been denied by the Commission. The CATV systems involved carry both U.S. and Canadian TV signals. The TV stations asked for either special program exclusivity or same-day exclusivity.

Various petitions by TV stations for special relief, requests by CATV systems for waiver of program exclusivity rules, and requests by TV stations for show cause orders against CATV systems, were also denied.

The Commission, pointing out that it has ordered CATV systems to provide Canadian prerelease protection on only three occasions, concluded that the recent Canadian Radio-Television Commission ruling limiting the amount of U.S. programing on all Canadian television stations will have a "marked effect" on the amount of U.S. network programing delivered to Canada for use by Canadian television stations, and that it is likely that the percentage of U.S. audiences tuned to Canadian stations will decrease as programing specifically designed for Canadian viewers becomes prevalent on Canadian stations.

Eight requests by TV stations for Canadian prerelease protection on CATV systems in 17 communities in Washington, New York, Vermont, North Dakota and Minnesota, were denied by the Commission. Requests for special relief were filed by Fisher's Blend Station, Inc., licensee of KOMO-TV, Seattle, Washington; Rollins Telecasting, Inc., licensee of WPTZ, North Pole, New York; Vermont New York Television, Inc., permittee of WVNY-TV, Burlington, Vermont; and WDAY, Inc., licensee of WDAY-TV, Fargo, North Dakota, and WDAZ-TV, Devils Lake, North Dakota.

The Commission told these licensees that they had not adequately demonstrated the need for special relief. Information indicates that the prerelease problem is not especially significant, the Commission stated, and whatever problem exists seem to be on the verge of elimination.

Four CATV operators asked for waiver of the program exclusivity requirements of Section 74.1103(c) of the rules as a result of requests by station KOMO-TV, Seattle, for protecton against Canadian signals. The Commission denied the waiver requests of Telecable of Bremerton, Inc., operator of a CATV system at Lake Stevens, Washington; Northwest Cablevision, Inc., operator of CATV system at Seattle and Issaquah, Washington; Telecable of Thurston County, Inc., operator of a CATV system at Olympia, Washington; and Port Angeles Telecable, Inc., operator of a CATV system at Port Angeles, Washington.

The Commission determined that Canadian signals carried by the systems are all "distant" for priority purposes; that KOMO-TV places at least a Grade B signal over each of the systems; that KOMO-TV has a higher exclusivity priority than the Canadian signals;

and that it is entitled to program exclusivity.

The Washington CATV operators, as well as Dimension Cable TV, Inc., operator of a CATV system at Plattsburgh, New York, were directed to comply with the exclusivity requirements of Section 74.1103(e) of the rules within 30 days. Colorcable, Inc., operator of a 100-subscriber CATV system at Lake Stevens, Washington was directed to comply with the exclusivity requirement of Section 74.1103(e) within seven days after it obtains 500 subscribers.

Two of the licensees who had asked for prerelease protection, Rollins Telecasting Inc., licensee of station WPTZ, North Pole, New York, and WDAY, Inc., licensee of WDAY-TV, Fargo, North Dakota, and WDAZ-TV, Devils Lake, North Dakota, were also denied requests for show cause orders against cable companies. Rollins had asked for action against Dimension Cable TV, Inc., and WDAY against G-F Cable TV, Inc., proposed operator of CATV systems at Grand Forks, North Dakota, and East Grand Forks, Minnesota.

The Commission stated that since it had denied WPTZ's request for Canadian prerelease protection against Dimension and since it is directing Dimension to provide WPTZ with same-day program exclusivity, it is not appropriate to grant Rollins' request. The Commission noted that it had already denied WDAY's request for Canadian prerelease protection aginst G-F Cable, thereby answering WDAY's key objection to G-F Cable's proposed operation, and that G-F Cable has agreed to provide same-day program exclusivity to WDAY-TV and WDAZ-TV.

Alarming Siren Effects

The Commission has received complaints and comments from the general public, law enforcement officers, and other public safety officials, concerning the use of sirens and other alarming sound effects primarily in commercial and other announcements. As one complainant stated, "[t]he unexpected sound of a siren coming over a car radio can quite easily be confused for the real thing and can be and has been responsible for motorists making sudden gestures to yield to a nonexistent emergency vehicle." Another complainant stated that, " . . . citizens who are not closely associated with emergency work would perhaps react in a manner that could cause accidents, or become careless and fail to yield in an actual emergency." Still another complainant stated that, "[a]s an operator of an emergency vehicle using a siren, I have been told by motorists that they did not pay attention to the sounds of a siren or yield because they thought the sound was coming from the car radio."

The selection and presentation of advertising and other promotional material are, of course, the responsibility of licensees. However, in this selection process, licensees should take into account, under the public interest standard, possible hazards to the public. Accordingly, in making decisions as to acceptability of commercial and other announcements, licensees should be aware of possible adverse consequences of the use of sirens and other alarming sound effects. We do not refer to sound effects which are integral parts of dramatic programs.

IF Something Can Blow, It Usually Does

By John Sweigart, Jr., WRSC

Happens every time—at least that's the way it seems when it happens.

You've been knocking yourself out assembling equipment and building up the department. You're communicating well with your suppliers. The film assignments have been getting out on time and the quality of the work is looking better with each job. The brass has approved a bigger A/V budget for the coming year. Public Relations and Sales Promotion are beginning to look on you as something more than the guy down the hall who pulls the slicks for the press releases.

Then one day your boss—the VP in charge of Whatever—calls and mentions that the Old Man himself is going to be dropping by his office and why don't you hustle up and show him that new employee relations film? So, up you go and set up the screen and projector in the next office. The VP and the Old Man walk through the door and nod and say "Hi" real friendly like.

You turn out the lights and turn on the projector and it all starts off like gangbusters. You begin thinking that next week would be a real good time to hit your boss for that raise. Then you notice a little unevenness in the sound—kind of like a record with a hole punched off center—and you think it will go away, but it doesn't. It gets worse and begins to WOW like crazy and the music sounds awful and the narrator sounds like a whiskey baritone trying to straighten out after a three-day drunk. The VP gets fidgety. The Old Man gets fidgety. The tension is building up on you. You just sit there and your shoes start to fill up with sweat.

Four minutes into the 20-minute film the Old Man gets up and strides out mumbling something like, "Nice work, there Jones . . . " and your name isn't Jones. The VP stops in the doorway and just looks at you while he chews on his cigar—and you forget about the raise and begin to wonder where you left the Want Ad section of the morning paper.

You know it's a good print. You know the track is clean and in sync. What was the one unknown? In this case the projector . . . but it could be any piece of gear. Has someone used it since you last used it? Is it overdue for a maintenance? Has there been any rough handling? Regardless of the gear involved, you don't know if it is going to work the way it's supposed to work unless you have personally checked it out.

In this age of automation—with people so dependent on machines—the machines are still at the mercy of the people, if they are to function as designed! And we are at the mercy of our attitude toward going above and beyond the call of maintenance duty.

Commission Drafts WARC Proposals

The latest Commission proposals for the United States presentation to the 1971 World Administrative Radio Conference (WARC) of the International Telecommunication Union (ITU) on space telecommunications to be held in Geneva, Switzerland, in 1971, and an evaluation of the comments filed in response to the Sixth Notice or made by interested parties in a recent oral presentation on the subject, have been issued by the Commission in a Seventh Notice of Inquiry (Docket 18294).

The Commission also released an accompanying document, "Draft Proposals of the United States of America for the World Administrative Radio Conference for Space Telecommunications - Geneva, 1971," superseding the "Preliminary Views of the United States" which accompanied the Commission's Fifth Notice of Inquiry, and incorporating proposed changes in these views accompanying the Commission's Sixth Notice of Inquiry. The Fifth Notice was released August 27, 1969, the Sixth Notice was adopted March 23, 1970, and the oral presentation by interested parties was held before the Commission on May 19, 1970.

A proposal by educational groups to allocate the frequency band 108 MHz for FM direct satellite broadcast was rejected because the Commission said that the signal from the satellite would represent a potential interference source over roughly one-third of the world. The current U. S. proposal covers a multiplicity of channels in the 88-100 MHz band.

A proposal suggested by some educational groups to reserve the 470-890 MHz band for direct satellite-to-home broadcast, the Commission stated, is consistent with the Commission's footnote accommodation of television broadcasting from space in the frequency band 614-890 MHz.

The suggestion by these groups to reserve the 2500-2690 MHz band exclusively for educational TV, public TV services and other educationional and noncommercial communications was not adopted by the Commission. Comments were invited, however, with respect to definitive proposals to use this band in part or entirely in a manner compatible with other existing or proposed uses.

The current U.S. proposal for the use of the 2550-2690 MHz band contemplates space-to-earth transmissions in the earth sciences satellite service, with one or two sophisticated earth stations, remotely located, using extremely sensitive receiving systems capable of using power flux densities well below the sensitivity of Instructional Television Fixed Service receivers; and, in the 2500-2550 MHz band, communication satellite operations in Alaska, space-to-earth. In each case, the band would be shared with terrestrial services.

Properly qualified, the Commission commented, there is merit in a proposal by educational groups to allocate a band of frequencies at 12 GHz for a distribution service. An educational proposal "for allocations in the 18 GHz and 35 GHz bands which may have important future uses" was termed too general to evaluate by the Commission.

Broadcasting network interests, commenting on Commission proposals, expressed general agreement with tentative U. S. proposals, but stated that they are exploring alternative domestic satellite and terrestrial program distribution systems and may comment later on frequency needs.

The Commission had proposed earlier that there be co-equal sharing between the broadcasting - satellite and communication-satellite services in the 11.7-12.2 GHz band, with the communication-satellite service limited solely to the distribution of television program material. It decided that limiting the communications-satellite service solely to the distribution of TV program material would waste spectrum space, in view of the uncertain status of the broadcast-satellite service, and removed the limitation from its proposals.

On the question of choosing an up-link to send program material to the satellite for broadcasting in another band allocated to the broadcasting-satellite service, the Commission said that since broadcasting is normally a Commission-licensed function, it had designated non-Government communication-satellite service bands for use as up-links.

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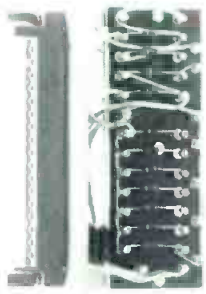

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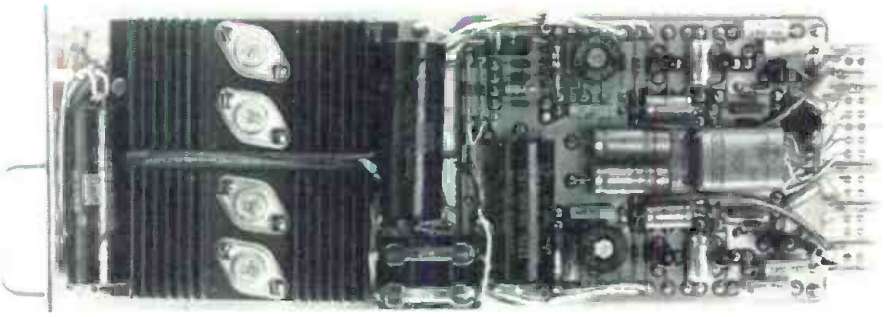

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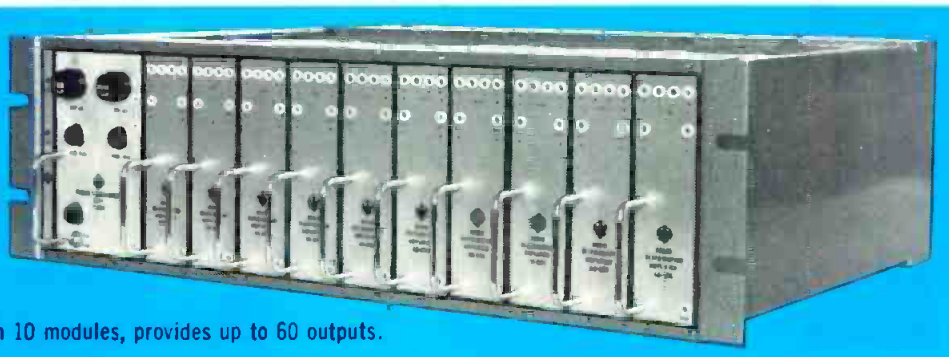

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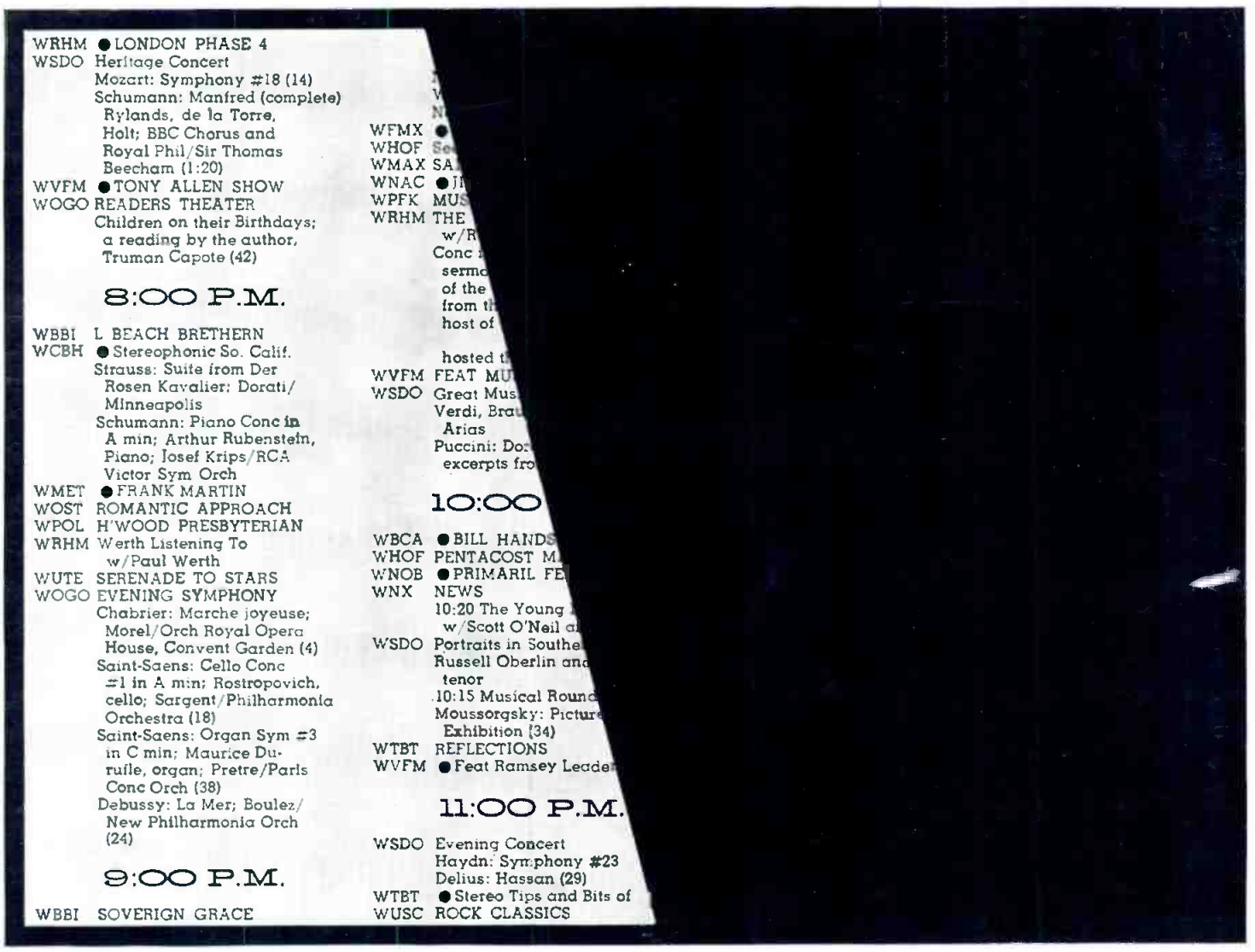

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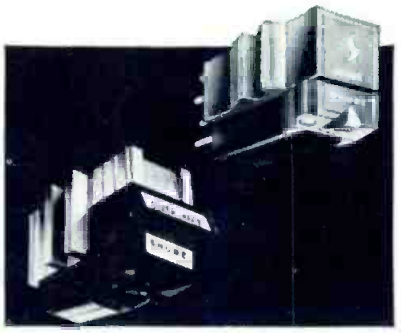

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