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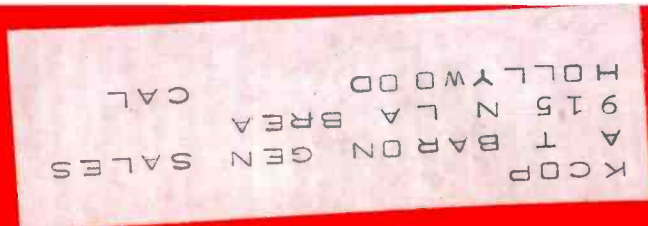
# Video Communication Journal



Serving the Audio-Video Communications Industry

**IN THIS ISSUE**

- \*CCTV—Refining Inexpensive Cameras
- \*COAXIAL CABLE—Basic Theory
- \*MEASUREMENTS—Binary Counters
- \*TV SIGNALS—Reflection Effects





# JERROLD VIDEO MICROWAVE 6 TO 13 KMC

## ... BEST FOR CATV, CCTV, ETV, AND STL USE

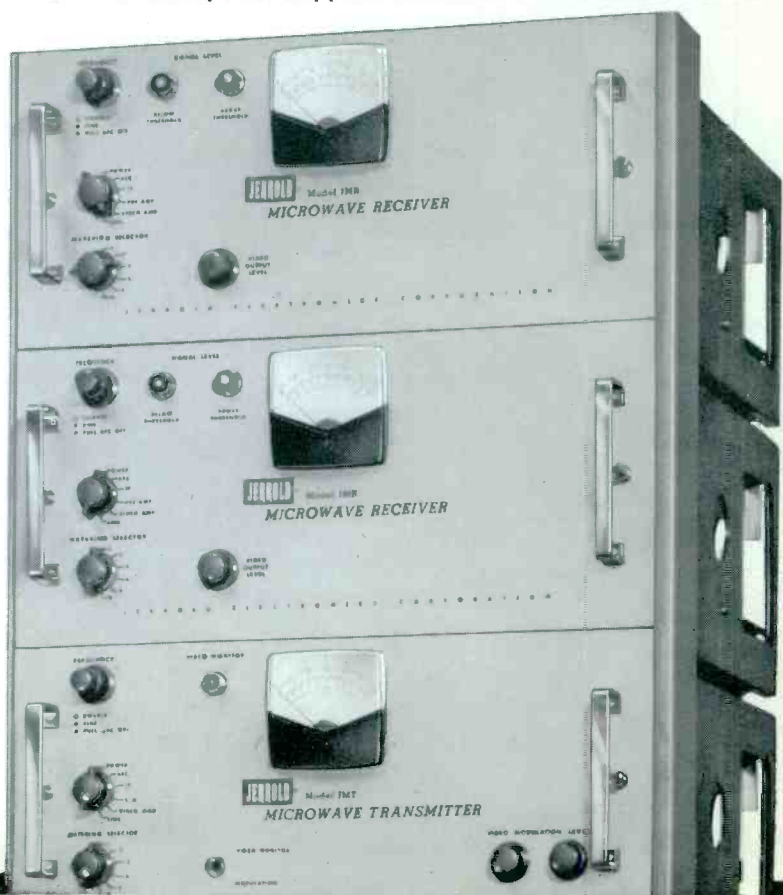
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# Channel

# 1

## INDUSTRIAL RADIO SERVICE PLIGHT STRESSED AT SIRSA MEETING

The "desperate situation" which the special industrial radio service is currently facing, as a result of frequency shortages, was stressed by Special Industrial Radio Service Association General Counsel Jerome H. Heckman during a recent meeting of the SIRSA's Board of Directors in Washington. His address set the stage for the appointment of a special "task force" to search for additional frequency living space for the special industrial service.

Mr. Heckman expressed the hope during his remarks that the FCC will "recognize the plight of special industrial users and give some immediate and overdue relief" to the service by finalizing outstanding 25-42 megacycle split channel proposals which would allocate a number of additional channels for special industrial use.

The SIRSA General Counsel pointed out that "The Commission's budget of about \$13,000,000 a year is allocated so that the Safety and Special Services portion can be roughly estimated at about 15%." Using the FCC estimate of a \$5,000,000 return from license fees, he said, "and taking into account the top fee prescription of \$100, presumably for broadcast applications, apparently the non-broadcast services will be contributing roughly \$3,000,000 a year to aid the Commission in processing broadcasting and public safety applications."

He noted that "the Commission is now asking users outside of the broadcast and public safety categories, including industrial users, to subsidize other radio interests with license fees, just as they have been supporting them by limiting their legitimate demands for more spectrum." Little has been done over the years by the broadcasters to reduce their need for the spectrum now allocated to them, he said, "while the nonbroadcast interests have for years been attempting to 'make do' with inade-

CATV  
MATV  
2-WAY  
UHF-TV  
Microwave

quate allocations by spending great sums of money and time on such efforts as 'channel splitting'."

Mr. Heckman suggested that "some industrial users might well consider the filing of an appeal with the courts" in connection with the "filing fee" plan, "since there are many who would have to pay at least \$2,000 to \$3,000 every five years simply to have their current licenses renewed, assuming that the originally proposed fee schedule is carried through."

## CLOSED-CIRCUIT TELEVISION EQUIPMENT MANUFACTURER ANNOUNCES MERGER

A Joint announcement from E. G. Gramman, President of DYN-AIR Electronics, Inc., San Diego, and Omar E. LaHue, President of Communications Control Corporation, Van Nuys, told of the final filing of a merger between the two companies.

DYNAIR Electronics, Inc., designs and manufactures closed-circuit television switching and distribution equipment plus a line of television broadcast transmitting equipment.

Named to the post of President and General Manager of the com-

bined companies is E. G. Gramman. Vice President and Sales Manager will be Omar E. LaHue. The surviving company, Communications Control Corporation, will change its name to DYNAIR Electronics, Inc., within thirty-days, it was reported.

## RISING MATV COSTS?

A New York City prime contractor for motel, hotel, and apartment MATV systems has announced to its customers that prices would increase by 25% on April 8, 1963. The firm involved stated that the increase was made, based on increased costs. The report also stated that the increase received due consideration and it was felt that this measure should be taken rather than to compromise the quality of equipment.

## CANADIAN CATV FORCES BBG INQUIRY

The Canadian Board of Broadcast Governors has reacted with unusual swiftness upon learning that a CATV system is planned for Brandon, Manitoba, Canada. Brandon is now served with primary signals from a single CBC interconnected local outlet, and is in the Grade C coverage area for Winnipeg television.

Reportedly, a Canadian group has laid plans to bring CATV from the United States into Brandon via the UHF translator-tropospheric scatter method devised by a Saskatchewan CATV operator last year.

This would mean that Brandon's single Canadian outlet will be outnumbered by American cable programs if the CATV system is installed.

In light of this, the BBG has announced plans to review its denial of an application to CJAY-TV, Winnipeg independent telecaster (February 11, 1963). CJAY-TV had filed for permission to extend its service into Brandon with a satellite telecasting system.

The new hearing on the matter of CJAY's application was scheduled to be held on March 27.

# VIDEO-COMMUNICATION JOURNAL

Combining Television Horizons and Communication Horizons

PUBLISHED MONTHLY BY HORIZONS PUBLICATIONS

Post Office Box 1557 • Oklahoma City 1, Oklahoma

## Editorial

It doesn't appear that any guesswork is necessary to tell that Spring is here. I believe that most everybody has noticed a certain change of pace that usually accompanies this period. For a little affirmation, take a quick look around and observe the flourish that is applied to almost every activity.

What with all the robust energy that is showing up in all phases of the communications business, video and audio, we will probably see a great deal of interest developing in the field of politics. Most all of this interest will fall in the legislative area, I feel sure, and especially where the Federal Communications Commission is concerned.

There is no need to outline all the specific points of contention. Where the Federal Communications Commission is involved, we are vitally concerned with the activities of this group, more so than normal due to the technological developments that make for a rather questionable future. For instance, fifteen years ago we couldn't and didn't anticipate the growth we have had and will continue to have.

Most all of our lives we have been asked by one group or another to contribute to a worthy cause. This is a part of our long standing tradition to aid others. In this same plane, let's direct some of our efforts toward giving our various associations and organizations a boost so they may carry this backing to the legislative halls. It is a well known fact that many succeed instead of few.

Incidentally, the broadcasters have been hitting a rough and rocky road the past few months. Their problems, whether they be self-created or not, point out that most anything can happen with a degree of severity dependent upon the amount of group representation.

RLM

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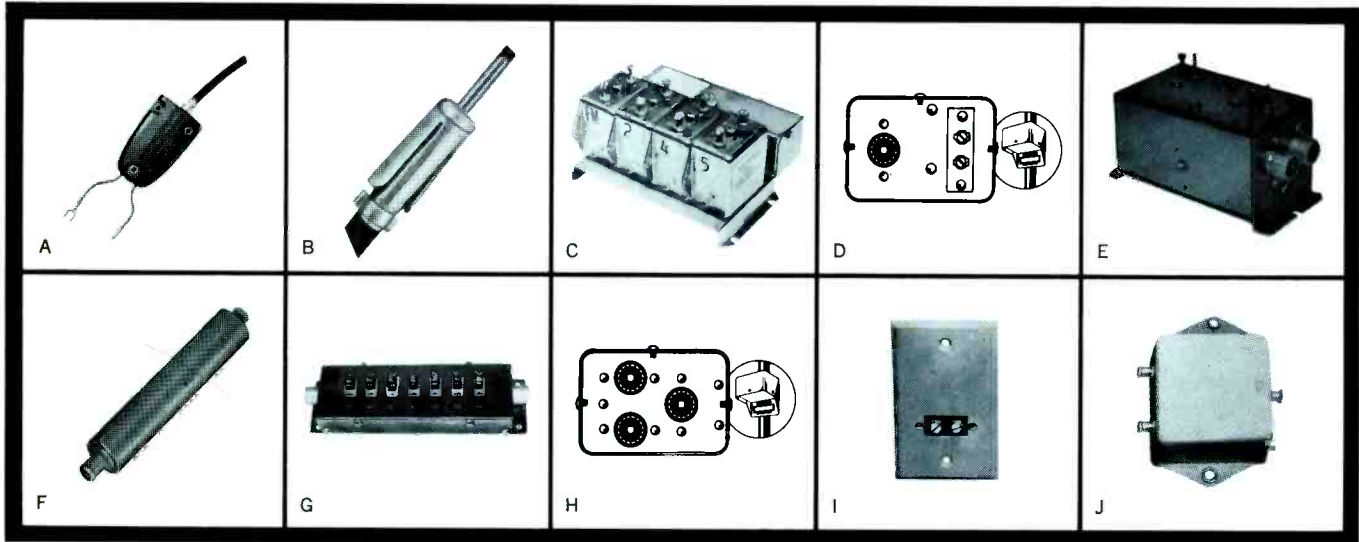
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"For want of a horse a kingdom was lost"—for want of an effective reliable accessory—the investment in the major equipment in a Master TV antenna system can go down the drain. These Blonder-Tongue engineered MATV accessories will bring out the full potential of any system and deliver the cleanest, strongest signal to the individual TV receivers. What's more, these accessories will slice hours from installation and maintenance time.



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P-75S—Solderless AUTOPLUG (illustrated). Major improvement of well known Motorola type auto plug. No need to strip braid or solder inner or outer conductor. Very rugged and reliable.

P-59T—Solderless UHF type male plug for RG-59/u cable

P-11S—Solderless UHF type male plug for RG-11/u cable

QDP—Solderless QD plug for RG-59/u

POU—Push-on UHF plug for RG-59/u

POB—Push-on Benconnector plug for RG-59/u

M-73—Solderless Benconnector plug for RG-59/u

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**C. FILTERED MIXERS/SPLITTERS, MODEL MX**

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**D. OUTDOOR BALUN, MODEL MB-b** Outdoor, weather-protected balun matches 300 ohm and 75 ohm lines. Uses UHF type of SO-239 connectors for 75 ohm cable.

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With only these two traps, MATV installers can attenuate any undesired frequency in the entire VHF/FM band. No need to stock a great number of traps. MWT-2 covers 54-108 mc; MWT-3 covers 174-216 mc range. Further, the traps provide at least 60 db attenuation of any VHF/FM frequency with virtually no loss to desired frequencies. They can be tuned simply with an off-the-air signal and TV set for most applications. Type SO-239 connectors.

**F. FIXED ATTENUATOR, MODEL FA** Least expensive attenuator on market. Available with 3, 6, 10 or 20db of attenuation. Should more attenuation be needed, it's easy enough to cascade FA's. Quick disconnect connectors make installation easy.

**G. VARIABLE ATTENUATORS, MODELS SA-7 and SA-3** Model SA-7 is accurate enough for lab measurements. Installer can select any attenuation from 0 to 62 db in steps of 1 db. Can be used for all frequencies from 0 to 216 mc. The SA-7 can be tem-

porarily connected into any portion of a MATV system to determine optimum attenuation at that point. The SA-3 is a 3 switch attenuator for any frequency from 0 to 216 mc. Selection of attenuation from 0 to 38db is in these steps: 0, 6, 12, 18, 20, 26, 32 or 38 db.

**H. OUTDOOR 2-WAY HYBRID SPLITTER/MIXER, MODEL MDC-2b** High quality hybrid splitter/mixer. It can be used to split or combine any signals from 10 to 216 mc, making it suitable for sub-channel systems. Internal insertion loss is less than 0.3 db. Excellent back-match. UHF type SO-239 connectors. Weatherproof.

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**J. INDOOR MOUNTED SPLITTERS, TS-772 & TS-774**

TS-772 (illustrated) low cost hybrid 2-way splitter can be used to split or combine RG-59/u cable. TS-774, inexpensive 4-way quasi-hybrid splitter.

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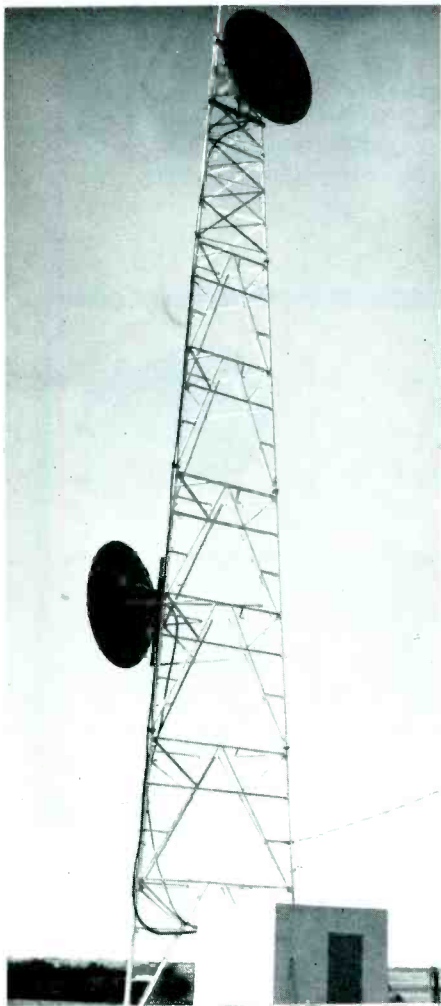
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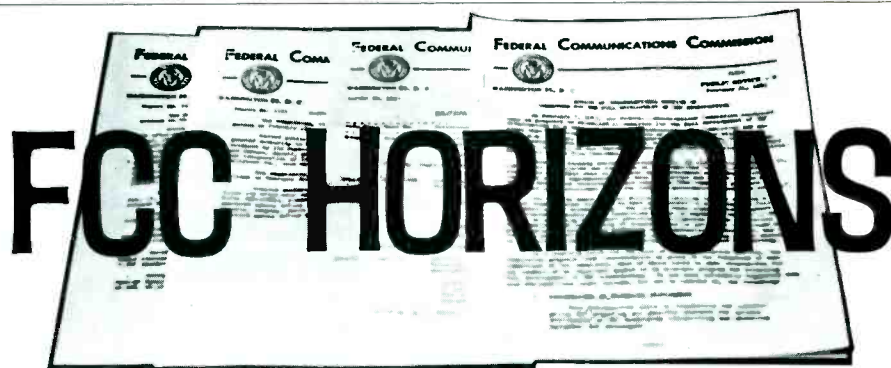


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FCC actions, applications and public notices reported here are a representative sampling of actions which the Publishers of Video-Communication Journal feel will be of interest to our readers. The listing is by no means a complete report of all FCC actions in or out of these allied fields of communications.

#### GENERAL ACTIVITIES

By memorandum, the Federal Communications Commission has granted an exception to their CATV micro-wave application freeze, as outlined in Docket 14895.

On March 22 the Commission announced it would still consider applications from CATV operators who desire and need the assistance of microwave to bring educational television station signals into their head-end equipment.

The Commission's freeze, it said, is perhaps unduly broad when it requires a condition against duplication even in the case of applications from CATV systems proposing a Business Radio Service (12-13 Kmc) microwave system solely to transmit off-the-air signals of educational television stations.

Effective March 22, the Commission began processing CATV microwave applications operating in the Business Radio Service when the applications called for microwaving ETV stations. The usual provision that the CATV station carry without material degradation, if requested, the signal(s) of present and future local (to the CATV system) television stations continues.

Chairman Newton Minow dissented, in part, on the memorandum.

The Commission has revised its list of equipment acceptable for licensing under rule parts 7, 8, 9, 10, 11, 16, 19 and 21. The new list, current to the 11th of February is not available from the Commission. Copies for public distribution are available by Seabrooke Printing Co., Inc., 514 10th Street, NW., Washington 4, D. C. Copies are available for inspection at any regional FCC office.

The Commission invites comments to Notice of Proposed Rule Making based upon a petition which seeks to amend Part 11 of the rules to make available certain mobile service frequencies above 152 megacycles for use by the Special Industrial Radio licensees in Alaska, Puerto Rico, Hawaii and the Virgin Islands. These frequencies are presently assigned to the Petroleum, Forest Products and Manufacturers Radio Services, on a primary basis, but for the most part lie unused in these areas.

The Commission has invited comments to Notice of Proposed Rule Making seeking to amend Part 21 of the rules governing the Domestic Land Mobile Radio Service, to limit the location of rural subscriber and dispatch stations to the service area of their related base stations (described by field strength contour of 37 db above 1 microvolt per meter) except in areas not

served by the same type of base stations. Pending decision on this proposal, all such applications which do not conform with the proposal will not be processed.

#### CATV MICROWAVE ACTIVITY

The Commission has granted a modification of a C. P. for **Eastern Microwave of Oneonta, New York**. The Eastern modification calls for delivering any 3 of 5 New York television stations (as selected by the customers) by means of a power split. The systems to be served are the Jerrold Electronics Corporation system, Binghamton, New York, and commercial customers (television station) WBJA-TV, which will be provided with the signals of WABC-TV.

The **Telephone Utilities Services Corporation** has filed for construction permits to install fixed video relay stations in the 6 Kmc band to locate near Jonesboro, Texas and Copperas Cove, Texas. The pick up point of the system is proposed for 1 mile south of Walnut Springs, Texas. Three channels of television are proposed for a CATV system in Copperas Cove, one channel will be dropped off to a CATV system in Gatesville, Texas, and the total three channels will go on from Copperas Cove to CATV systems in Killen, Lampasas and Burnet, Texas.

**Mesa Microwave, Oklahoma City, Oklahoma** has filed for construction permits to install two channels of microwave in the 6 Kmc band to a CATV customer at Durant, Oklahoma. The stations to be provided to Clear Vue TV, Inc. in Durant are those of KRLD and KTVT, Dallas.

**Tower Communication Systems Corporation, Sugar Creek, Ohio** has been granted construction permits to install a multiple channel television video link in the 6 Kmc band to serve CATV systems in Coshocton, Cambridge, Sugar Creek, Dover, New Philadelphia, Uhrichsville and Denison, all in Ohio.

The complex system will provide television signals from Cleveland and Columbus to its customers.

**Mesa Microwave, Oklahoma City, Oklahoma** has filed an application to construct a 6 Kmc video relay link to provide off-the-air television signals WKY and KOCO, Oklahoma City, to a CATV system to serve Beaver, Oklahoma.

**First Television Corporation, Salisbury Maryland** seeks construction permits to provide up to four television signals to subscribers in and around Salisbury, Maryland. Two relays are proposed, in the 6 Kmc common carrier service. One is to be located at Cambridge, Maryland, the other at Salisbury, Maryland.

**Autry (Gene)-Sigon Communications, Los Angeles, California** has filed a detailed request to modify one existing construction permit and to pick up two additional C.P.'s for fixed video relay stations to operate in the 6 Kmc Common Carrier Service between San Luis Obispo, California and Soledad Peak, California. If granted the system would complete a 6 Kmc video link running from a pick up point within the service area of Los Angeles television stations north to a pick up point within the service area of San Francisco television stations.

The applicant seeks to add the signal of educational television station KQED, San Francisco, to the video system now installed or being installed along the California coast, and feed CATV systems located along the coast. The present operation of video-relays carries all seven Los Angeles television stations. Channel 13, Los Angeles, will be dropped in favor of the addition of the San Francisco educational station. Los Angeles has no educational telecaster at present.

**Northco Microwave, Inc., Laconia, New Hampshire** has filed for a construction permit seeking to add a point of communication, Bennington, Vermont.

#### TWO-WAY ACTIVITIES

**Rogers Radio Communication, Chicago, Illinois** has filed a construction permit to replace a base station transmitter operating on 452.30 megacycles with a new unit which will increase the power input level from 40 to 100 watts.

**General Communications Service, Inc., Tucson, Arizona**, has filed for a construction permit to install an additional transmitter to operate on 459.20 megacycles atop Green's Peak, near McNary, Arizona.

**Muenster Telephone Corporation of Texas, Muenster, Texas** requests waiving of Sections 21.118 (d), 21.205 (h) (3), and 21.208 (g) to facilitate their application for a construction permit seeking to install 1 base station and 30 mobile units in the 150 megacycle band. Authority is requested to communicate with a new rural subscriber fixed radio station.

**Tydings Electronics, Inc., Pittsburgh, Pennsylvania** has requested a developmental construction permit to install 1 base station and 25 mobile units on 152.12 and 158.58 megacycles in Lowellville, Ohio. The applicants requests waiving of section 21.404 (d).

**Florida Radio Communications Company, Ocala, Florida** requests a modification of a construction permit to replace base station transmitters operating on 152.15 and 152.21 megacycles which will increase the input power from 120 watts to 147 watts, and make antenna changes.

**Delta Valley Radiotelephone Company, Inc., Stockton, California** has been granted a construction permit to change existing repeater frequency to 72.98 megacycles and control frequency to 75.50 megacycles, as well as make numerous other control and repeater frequency changes at several locations in and around Stockton, California.

**The Hawaiian Telephone Company, Honolulu**, requests a developmental construction permit and license to operate inter-office fixed radio stations at any location within the territory of the grantee on frequencies between 454.40 and 459.65 megacycles (12 frequencies in all). The applicant requests special temporary authority to conduct field strength measurements in connection with the selection of suitable sites for stations proposed to be established in the rural radio service.

The Commission, by the Chief, Safety and Special Radio Services Bureau, has revoked a pair of licenses.

The license of station KAM-853, Esslinger Flying Service, Inc., Eureka, Kansas, was deemed no longer in effect when the applicant failed to answer Commission communiques concerning alleged infractions of Section 11.158, concerning lighting of antenna towers.

According to Commission records, four communiques were directed to the licensee concerning the alleged infraction. They received no answers.

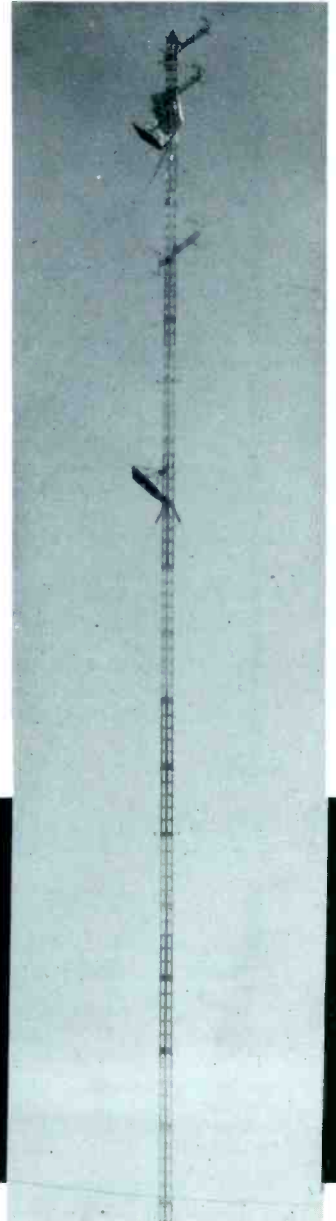
Albert C. Reich, d/b as West Sac Taxi Company, West Sacramento, California also had his license revoked when he failed to notify the Commission of a move in his station location. The licensee of station KMA-642, in the Taxicab Radio Service, also failed to respond or answer Commission communications on the alleged infraction.

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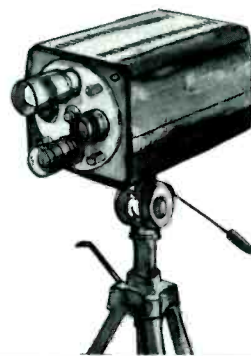
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# SYSTEM HORIZONS



## PEOPLE . . .

Milton J. Shapp, Chairman of the Board, The Jerrold Corporation has received the 1963 Philadelphia Fellowship Commission Award.

Mr. Shapp was honored for Jerrold's interracial employment policies, for his work helping to establish and for promoting the country's Peace Corps, and for his sponsorship of a Philadelphia neighborhood renewal program.

Richard P. Gifford has been appointed to gear up General Electric's world-wide multi-million dollar communications business.

Named to the position of general manager of the G-E Communication Products Department, with headquarters in Lynchburg, Mr. Gifford will have full responsibility for all product lines of the department. These include mobile two-way radio, microwave and telecommunications, power line carrier.

Walter A. Clements, vice-president for distributor sales and advertising manager of Littlefuse, Inc., has been elected president of the Association of Electronics Parts and Equipment Manufacturers, Inc., at the groups annual meeting.

Robert F. Tresnak has been appointed Assistant Sales Manager for the Analab Instrument Corporation. Mr. Tresnak will handle a wide variety of sales and marketing duties for Analab, a producer of precision oscilloscopes and oscilloscope recording cameras.

## ATTENTION-SYSTEMS!

Video-Communication Journal provides a handy tear out post card on heavy card stock between pages 32 and 33 of this issue. CATV-MATV contractors, two-way system contractors and installers are urged to report news of their business operations on these cards. One card is provided for TV reporters, a separate card is supplied for two-way reporters.

Warner Associates, Washington, D.C. has been named sales agent for precision measuring instru-

ments in the District of Columbia, Maryland, Virginia and eastern West Virginia by Motorola.

## PLACES . . .

Bruce Merrill, President of Ameco, Inc., Phoenix, Arizona based CATV equipment manufacturing company, has announced the opening of a Southern Regional Sales Office in Dallas, Texas.

"Increase in sales and in turn-key contract jobs coupled with area customer acceptance of Ameco fully transistorized CATV equipment has created the need for this move," according to Merrill.

The Dallas office at 2516 Pine Bluff (telephone DAVIS 7-9091) is staffed by Ameco's Southwestern Regional Manager, W. E. Dart, Jr.

Spivey-Cole Company, with offices in Denton, Houston and Richardson, Texas, has been appointed sales representative for the Distributor Sales Division of Jerrold Electronics Corporation. Spivey-Cole will represent Jerrold in Texas and Oklahoma.

## THINGS . . .

The acquisition of the INTEC-Westbury Community Antenna Television (CATV) equipment line of Intercontinental Electronics Corporation, Westbury, New York by Electronics, Missiles, and Communications (EMCEE) has been jointly announced by EMCEE and INTEC. This new area of interest by EMCEE is in keeping with the firm's desire to provide a complete service to shadow television areas, according to the firm's president Dr. B. W. St. Clair.

The purchase involved all of the outstanding stock under the INTEC and Westbury name, engineering information, and manufacturing know-how. The terms of the transaction were not disclosed.

The new INTEC-Westbury line will be handled by the newly formed Westbury CATV Division of EMCEE at 4 Tecumseh Avenue, Mount Vernon, New York.



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*seamless* ALUMINUM SHEATHED CABLE

*at the lowest prices ever...  
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.412 JACKETED	CWT-1042	.482	1.05	1.65	1450	120
½" PLAIN	CWT-1078	.500				130
½" JACKETED	CWT-1079	.580	0.80	1.30	1200	170
¾" PLAIN	CWT-1047	.750				300
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# REFINING INEXPENSIVE CCTV EQUIPMENT

## INTRODUCTION

The tremendous upsurge of interest in closed-circuit television, on the part of the business world, appears to have stimulated many manufacturers into this particular area of electronics. With the availability of more and more equipment, the use of CCTV is being accepted as an everyday tool for modern industry. Reputable banking institutions are using CCTV, along with hospitals and a host of other users, too numerous to mention.

The newly increased interest in closed-circuit television seems to be mainly attributable to the introduction of relatively low-priced equipment. Like anything that is inexpensively priced, though, there are a number of drawbacks. In what might be termed "non-professional" applications, the newer camera equipment more than fills the bill. However, in critical applications the inexpensive forms of equipment lack some features that could be considered necessary to maintain a professional operation. For instance, there are usually no provisions for automatic light control. Another item is the lack of control of the horizontal oscillator's frequency.

For the most part, the newer, low-priced cameras are of excellent design and should provide trouble-free service. The available features on all of the new equipment run the full range with units that have everything from a four turret lens assembly to remote control. One of the outstanding features is the relative size of the newer cameras. Without fail, most of the cameras are small enough to be easily handled and non-obtrusive.

## HOW THEY WORK

The sole item responsible for the excellent quality of the new, low-priced cameras is the Vidicon tube. This is the same type of tube that is used in some of the more expensive equipment. From a purely layman view, the Vidicon is truly a wonderful invention that provides unbelievable detail. Technically the Vidicon is a highly precision tube involving some very clever design techniques. Looking at the physical dimensions, the tube is only about  $1\frac{1}{8}$ " in diameter and  $6\frac{1}{4}$ " long. The overall shape of the tube is very symmetrical throughout its length. Connection to the internal electrodes is through an 8-pin base and a circular ring up near the optical-glass face of the tube. This latter connection goes to the signal electrode or "target."

If it were possible to visually observe the process that takes place within the Vidicon, you would see

the following. A small positive voltage is applied to the optical side of a photo-conductive layer (signal plate). The back side of this same layer is scanned by the electron beam from the gun assembly and consequently takes on a negative potential. In total darkness all of the above conditions are true and no changes will occur since the photo-conductive layer is behaving like an insulator. But, as soon as the photo-conductive layer is exposed to light, it becomes semi-conductive in proportion to the amount of light. Those areas that are struck by light will develop a more positive charge on their reverse (electron beam) side as a result of the layer becoming partially conductive. When the electron beam scans these areas it will supply a sufficient number of electrons to bring the charge back to a more negative potential. It is during this operation that the video signal is developed. Each time that the electron beam is called upon to charge any area of the photo-conductive layer, a small amount of current will flow. If a resistor was to be inserted in series with the positive supply lead connected to the signal plate, the minute charging current flow would cause a proportional voltage, thus we have the video source.

## SWEEP CIRCUITS

The sweep circuits used with the electro-magnetic Vidicons in the inexpensive cameras are generally of standard design. The vertical oscillator is of the driven type rather than free-running. The driving pulses for this type of oscillator are derived from a differentiating network that is tied to a diode clipper and a 60 cycle a.c. voltage source. A typical oscillator of the driven type is shown in Figure 1. The

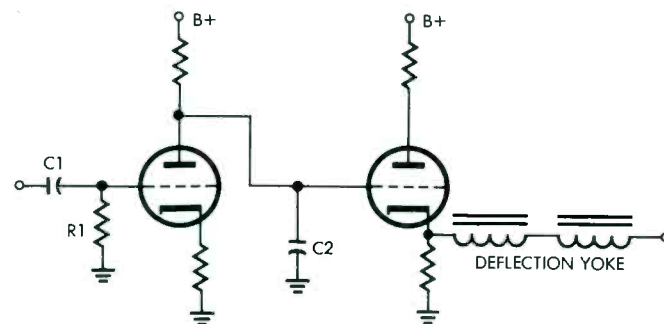


FIGURE 1

resistor R1 and capacitor C1 are selected to provide the proper bias for the left-hand triode (discharge tube) so that this stage will remain cut-off in between the required positive driving pulses. How-

ever, the right-hand triode will be conducting heavily when the left-hand triode is cut-off. This is due to the positive potential across C2. Whenever a positive potential or pulse is applied to the grid of the left-hand triode, this stage will conduct heavily and discharge C2 rapidly. The right-hand triode will now have a much less positive bias and consequently its plate current will fall to a low value and the plate voltage will rise toward the value of the source voltage. After the positive driving pulse has passed, the left-hand triode will cease conducting and since the voltage across capacitor C2 cannot change instantaneously, the right-hand triode will remain with a low value of plate current. This is the key to the development of the sawtooth sweep voltage. A capacitor cannot change its charge instantaneously. Instead it will assume a change in potential on an exponential basis.

Therefore, as C2 charges through the left-hand triode's plate load resistor, the plate current of the right-hand triode will rise in proportion to the charge across C2 and develop a sawtooth waveform. This is assuming that C2 is a selected value that will not fully charge during the time between positive driving pulses so advantage may be taken of the most linear portion of the exponential curve. This process will continue to repeat itself as soon as another driving pulse is applied.

In contrast to the vertical oscillator, the horizontal oscillator is generally a free-running, non-synchronized, multivibrator. Here, the frequency determining elements consist of an L-C combination, usually compensated for temperature effects. Although this may not sound like a very stable way to generate the horizontal scanning frequency, in practice it proves to be very satisfactory in every way except for critical applications.

## MODIFYING THE CAMERA

Part of the reason for all the attention given to the sweep circuitry is to acquaint the reader with enough of their operation so it would be easier to discuss specific modifications. One of the first modifications that really needs to be considered is conversion of the typical horizontal oscillator to allow for external triggering. One accepted circuit is depicted in Figure 2. Note that the original L-C combination in the grid of the first triode (discharge tube) has been removed and an R-C network substituted. The next step would be to connect a crystal-controlled, 15,750 cps oscillator to the R-C network, through a cathode follower, and the horizontal oscillator will now be locked to a true reference.

However, this modification only insures that the horizontal oscillator will operate at the proper frequency and has little bearing on the actual shape of the camera-generated sync pulses. Why be concerned with the camera-generated sync? Well, if the camera is to be used on, for instance, a community antenna television system, some difficulty may be experienced with sync drop-out when the camera is put on-the-line in place of a TV signal. Some subscribers sets may only drop out of sync for just an instant but there may be other sets that will not

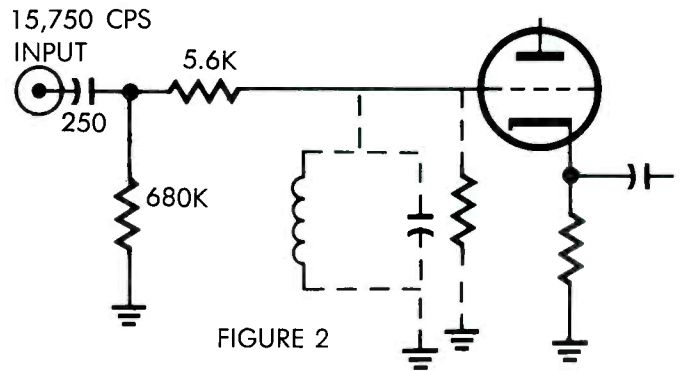


FIGURE 2

adequately lock on the camera-supplied sync signal. This is, of course, only to be expected from those types of cameras that have a poorly formed set of synchronizing pulses. Anyways, it would appear advantageous to be able to supply commercial standard sync for two purposes. One is to overcome what has previously been discussed, sync drop-out, and the other is to allow for interlace which is non-existent with the normal sweep circuits used in inexpensive cameras.

Developing commercial sync requires little imagination and only a bit of tinkering instinct. Using the chassis from a television receiver, the horizontal and vertical sweep circuits can be completely removed along with any other non-essential items except for the tuner, I.F. strip, video detector and amplifier, sync splitters and sync amplifiers. This will form the basis for the development of sync pulses than can be used to drive the camera and line equipment. Any reliable television station can be used as the sync source providing a little checking is done to make sure that the sync levels don't bounce around.

Taking off the sync amplifiers (or adding same if not present in the TV receiver) through cathode followers is about all that is necessary. These signals, which should be positive going triggers, can then be applied to the camera to trigger the horizontal and vertical oscillators. Going back to the vertical sweep system, it is relatively important that the trigger levels be a little stout (large amplitude). The reasoning here is based on the need for holding the first triode cut-off during the sweep cycle. Besides just maintaining adequate sync levels, there are some very necessary changes that must be made to the R-C network at the grid of the first triode (discharge tube). Here, the necessity arises because of the shaping factor required. Figure 3, shows the common R-C network used when the shaped waveform is developed from a 60 cycle a.c. source. The bottom half of Figure 3 shows the R-C network makeup as required when using commercial trigger pulses. All the values that are given are those actually used in specific CCTV cameras and won't always be applicable to other equipment for a number of reasons such as the required bias to keep the discharge tube cut-off may vary considerable depending upon the tube used for this purpose. Suffice to say, a little experimenting with values that vary about those shown will generally give you the anticipated results.

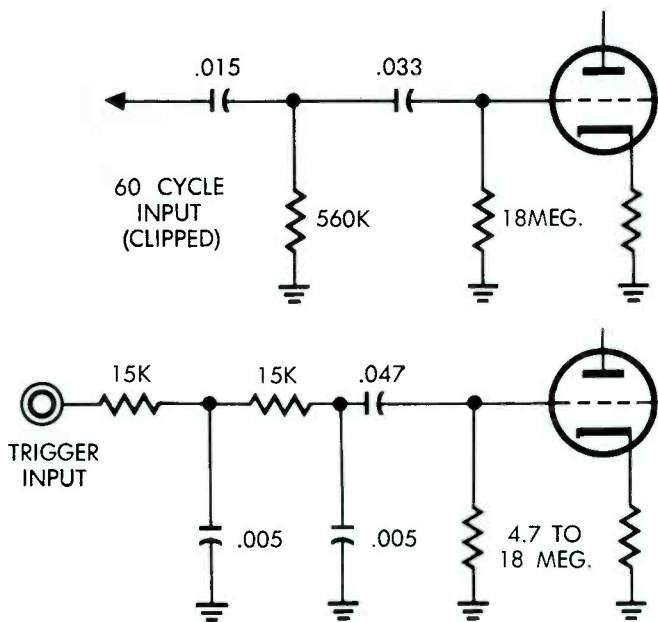


FIGURE 3

The horizontal oscillator can be triggered much in the manner as was shown for the crystal-controlled version. As an alternative the horizontal oscillator can be converted to a driven stage rather than free-running as shown in Figure 4. Circuit-wise, this type of driven oscillator is similar to the one used for developing the vertical sweep except that some modifying has been done to improve the linearity. This particular circuit has been tried and the resultant waveform checked via the oscilloscope. It appears that this circuit will do the job with a degree of precision that doesn't conform with its simplicity.

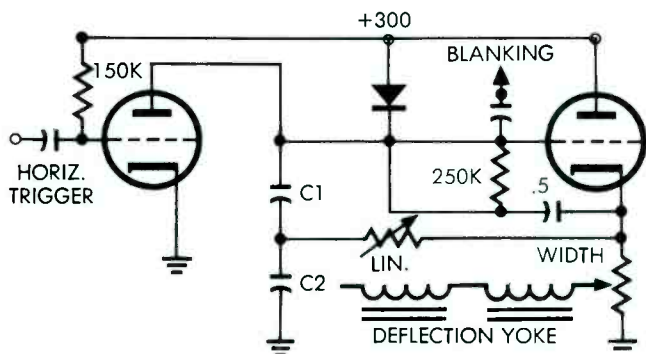


FIGURE 4

Carrying this process a little further, most of the cameras that use the type of sweep circuits described also take their sync off the oscillator stage. As was mentioned previously, this is the main reason for sync drop-out, and doesn't lend itself to convincing the television receiver at the subscribers location that it ought to interlace. Therefore, these sync sources should be foregone and the sync derived from the modified television receiver. Once again, there is one important point, the stability of the

commercial sync signal (amplitude-wise) must be insured. With the modern AGC equipment we now have this should pose no significant problem. But, don't rely solely on the AGC qualities of a modified television receiver.

Leaving the sync modifications, there are some cameras available that do not have any provision for centering the sweeps. This type generally has the Vidicon deflection yoke tied back to the driving source through an electrolytic capacitor. Further examination should show that these circuits are identical with those that include centering controls except that the electrolytic is added and there are no centering controls. Having had the occasion to work with one that had no centering provisions, a simple modification has been found that will alleviate this situation. First, the deflection yoke should be disconnected from the electrolytic and the yoke tied directly to the cathode of the output stage. Install a voltage divider between one of the DC supply lines and ground, such as shown in Figure 5. Re-install the electrolytic from the arm of the potentiometer to

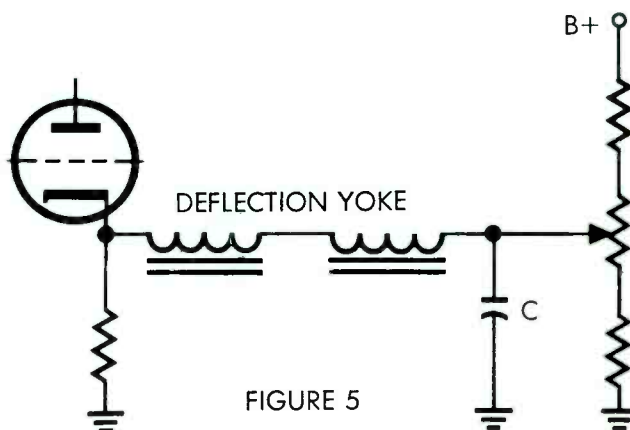


FIGURE 5

ground. This completes the changes and the camera will now have a means by which the sweeps may be properly centered. One word of caution, though, make sure that a low DC potential is applied to the deflection coils when initially making the centering modification. If too high a DC current flow is induced, the deflection yoke may become magnetized requiring demagnetization.

In conclusion, this article is intended to give the users of inexpensive CCTV cameras some ideas that can be applied to up-grade their equipment. It is not the intent to imply that these modifications are easy or adaptable to every piece of equipment. This is why the exact details, wire by wire, were avoided because it will take a little adventuresome spirit to tackle these specific items that were covered and one exacting modification is likely not to be compatible with some equipment. It was probably also noted that no mention was made of the rest of the camera circuits, such as the video amplifiers, RF generator and modulator. In the future, these topics will be included more on an informative level since not too much can actually be done that would significantly improve the electrical operation of these particular circuits.

# Understanding Coaxial Cable

by Albert E. Hankinson

## DETERMINING CHARACTERISTIC IMPEDANCES

When the opportunity to write this series of articles first presented itself, my immediate reaction was to back away and leave the glory to some hardier soul. However the opportunity to write on a subject near and dear to my heart was too much and the die was cast.

The main intent of this series is to present transmission lines with the accent on the coaxial variety, particularly in relation to their development and general usage.

One can usually find general agreement that a wide background in math is extremely helpful in fully understanding coaxial lines and certainly any attempt to discuss transmission lines without the introduction of some minor forms of math would be almost disastrous. During this treatment, the attempt will be made to keep the discussion on a "conversational" level with math included for explanation only as absolutely necessary.

First, coaxial lines fall into a definite category. They are most commonly used in relatively low impedance applications. The reason they are primarily low impedance lines becomes apparent when the formula for determining or designing the Characteristic Impedance ( $Z_0$ ) is considered.

$$\text{Given: } Z_0 = \frac{138}{\sqrt{K}} \log \frac{R_1}{R_2}$$

In this formula,  $K$  is the dielectric constant, in practice, we can substitute the term (138 X Velocity Constant) for  $138 \div \sqrt{K}$ .  $R_1$  is stated as the radius of the inside conductor while  $R_2$  is the radius of the outside conductor. To prove the point, consider the design of a 600 ohm coaxial line. To make it easy, use an air dielectric, thus the formula would evolve into 138 times the log (base 10) of the ratio of  $R_1$  to  $R_2$ . If you carried out the operation, you would obtain the following approximate results: A 600 ohm coaxial line would have an outer conductor roughly the size of an oil drum and a center conductor of No. 28 wire. Not exactly the type of cable one would order in hundred foot rolls! This fairly well explains why coaxial lines are found in impedances varying between 40 and 150 ohms.

Now to consider the applications. Whether we think in terms of moving energy from the transmitter to the antenna or the received signal from the antenna to the receiver, we are continually concerned with the efficiency of transfer. This efficien-

cy of transfer is greatly dependent upon the particular termination provided for the cable in question.

Since terminations are so important a factor, and since we will find that every way we turn, we run into a termination problem, then it behooves us to put these terminations in their proper perspective. In this matter, my own opinion, and it certainly is not original, is that the best approach is to develop the "lossless line" concept.

The "lossless line" is a theoretical line. It does not and cannot exist. However if we can imagine that one could exist, we can use it to our own advantage to explain transmission line phenomena, and later, by minor conversions in our thought processes, we can apply these developed concepts to practical lines. The "lossless" line is a line which does not have any factors which would attenuate the energy moving back and forth on the line. There are no frequency effects due to the capacitance between conductors or losses due to different dielectrics. As previously stated, it does not and cannot exist. Its greatest advantage is that if we assume it could exist and proceed to analyze transmission line behavior as applied to a "lossless line," then we can introduce the various factors that come into consideration on a practical line and greatly simplify the task of explaining the phenomena.

## VECTOR ANALYSIS

Here we meet our first obstacle. In order to avoid long formulas requiring the use of  $j$  factors and necessitating the usage of polar to rectangular conversion processes, we turn to a vector presentation which lends itself very well to a pictorial presentation. In order that we may start off on common ground, it might be well at this time to give a general definition of a vector. A vector is a mathematical means of showing a magnitude and a direction. The magnitude is indicated by the length of the vector in given units while the direction is laid out on a circular scale. If we chance upon two vectors of the same or different magnitudes, whose direction or phase angle is the same, then we may add the two magnitudes and adopt the original angle which is common to both. If instead we find two vectors of the same or different magnitudes but whose phase angles or direction differ by exactly 180 degrees, then we may subtract the smaller from the larger in which case the remainder is the new magnitude and the new phase angle will be the angle of the larger. In our travels along the transmission line, we

will find instances where the vectors will be of equal magnitudes but opposite in phase and therefore will cancel. Using these vectors in terms of voltages or currents, we are able to move them along the transmission line in question and by plotting their points of addition and subtraction, we can accurately plot the voltage wave on a coaxial line.

This above method is the exact thing that people have been doing for years however for some reason, many explanations simply point out that certain conditions exist at certain intervals on the line and steer clear of showing how and why these conditions result and how we can use them to our own advantage.

It may seem that an incongruity exists when we start to analyze using pictorial methods as while we are stressing coaxial lines, our illustrations will indicate that we are dealing with parallel conductors.

It is necessary merely for the sake of clarity in our illustrations to use the parallel conductors and this in no way compromises the analysis as regards coaxial lines.

One of our first steps is to set up reference points to which we can refer as we go through our analysis. Figure 1 represents the first attempt to establish these vital reference points.

In Figure 1, we have a source of radio frequency energy coupled to a load or termination by a section of transmission line. Line length is always an important factor for consideration, however, we will find that in various circumstances, the effect of the line length in some instances will be almost colossal with respect to other factors. The main point here is that one cannot expect a length of transmission line to behave exactly the same way in all installations unless certain basic rules are followed. In Figure 1, simply for ease of illustration, we have chosen a line length which is exactly 1 wavelength or 360 degrees which we will find will be a much handier way of dealing with transmission line problems.

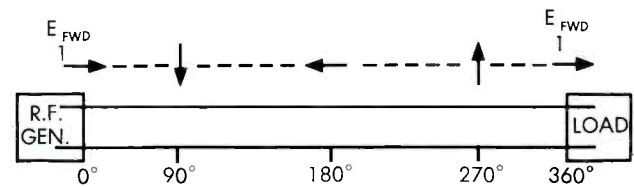
As previously stated, we will analyze transmission line behavior by examining the movement of vectors along the line. In order to avoid unnecessary complications, we will primarily use voltage vectors and logic to show corollary actions.

We pointed out at the beginning that the "terminations" or loads are our main concern and if one examines existing technical information concerning transmission lines, he will find that sooner or later, all references are made with respect to the "termination."

It is possible to prove mathematically or to point out in demonstration that various terminations will cause different voltage patterns to exist on a transmission line. Before we can determine "mismatch" conditions and their effects, it is necessary to fully understand just how these voltage waves are created on the line. It is one thing to make the statement that these waves are the result of improper terminations but entirely something else to prove them.

By use of our vectors, we can show how a plot of vectors adding and subtracting on a line set up our voltage conditions and from these, show the variations of impedance along the line.

FIGURE 1



NOTE:  $E_{FWD}$  IS A REFERENCE. IT IS ALWAYS SHOWN AT THE LOAD AS A MAGNITUDE OF ONE AND A PHASE ANGLE OF ZERO. ROTATIONAL DIRECTION OF A RETARDING VECTOR IS CLOCKWISE.

In Figure 1, we show a vector at the source and a vector at the load. These two vectors are identically labelled. If we could have observed the vector when it left the source, we would have noted that it revolved in a **Clockwise** direction. Since the line length was 1 wavelength or 360 degrees, the vector rotated one complete turn and consequently wound up in the same position as when it started. If in the course of its rotation, we had stopped it every 90 degrees and retained this position, then we would have the intermediate vector conditions as shown in Figure 1.

### REFLECTED ENERGY

If at the terminating end, we had a mismatch, rather than the correct resistive load, all or part of the energy delivered to the termination would be rejected and returned to the source. It is possible, if the termination is known, to determine the magnitude of the reflected energy and the phase angle associated with this reflected energy as it leaves the terminating end. The energy which leaves the termination and moves toward the source is commonly referred to as the "Reflected energy" or  $E_{ref}$ . Keep in mind that when the Reflected energy moves down the line from the termination toward the source, it will be passing successive or following portions of Forward energy. Since all following Forward energy will appear exactly as the initial wave, it is possible for us to plot the vector magnitude and phase of the Forward and compare it with a vector plot of the Reflected and determine the resultant at any point on the line.

The usual procedure is to compare the vectors at key points along the line where they will be either in phase (same phase angle) or 180 degrees out of phase (oppositely phased). In Figure 2 we see the vectors that represent a complete sequence of energy leaving the source and arriving at the termination and then the energy (reflected) which comes into being at the termination and is moving toward the source. At this point, we are required to resort to some simple math to show how we arrived at the magnitude and phase angle of the vector representing the reflected energy. The magnitude and direction of this reflected energy is found by use of the

following formula:  $\gamma = \frac{Z_r - Z_0}{Z_r + Z_0}$ . In Figure 2,

we show a termination ( $Z_r$ ) of 100 ohms pure resistance. We will assume a  $Z_0$  or line characteristic impedance of 50 ohms. Substituting in the formula, we find that  $\gamma$  is equal to a fraction which when

(Continued on Page 40)



# BINARY FREQUENCY COUNTERS

—Staff Extra—

— Staff Extra —

Given two specific items to count, the natural tendency is to say one and one equals two. Given four items we would think one times four is four. This is our known decimal system and the method man has used for years to solve his mathematical problems. Up until now man has been content to rely upon the decimal system and really had no need to do otherwise until he began his search for an electronic adding machine.

Unfortunately our decimal system is not entirely compatible with electronic circuitry, at least not with simplified circuitry.

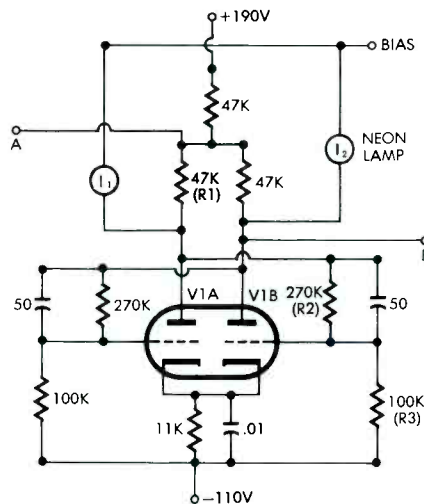
The binary system as most are familiar with it is most usually found in much of the frequency counting equipment now in use. In this application, binary counting equipment has many merits that really come into their own when dealing with small, portable units. In a binary system, only vacuum tubes and some form of direct read-out device is needed instead of mechanical devices or tapes.

But, what makes a binary counter operate? Like all systems, there must be a single item which the entire operation is centered on. In the binary counter, this is the bi-stable multivibrator. Not just one bi-stable multivibrator, but many are needed to accomplish the counting process. It is entirely through the diligent use of these stages that all the counting functions are initiated and terminated.

Analyzing a bi-stable multivibrator is a complex process requiring a thorough knowledge of vacuum tube theory. In a capsule form of explanation the bi-stable multivibrator is a two-tube regenerative circuit which can remain in either of two stable states. In order to change the multivibrator from one state to the other it is necessary to introduce a trigger pulse from an external source. This means that actually the bi-stable multivibrator is a two-way switch.

Taking a single bi-stable multi-

vibrator as an example, let's put a neon lamp in the plate circuit of each triode as shown in Figure 1.



Assuming that V1B is conducting and V1A is cut-off, neon lamp I1 will be lit. This will occur since V1A's plate voltage will be high as compared to the plate voltage of V1B allowing sufficient potential across I1 to cause it to ionize (assuming proper bias potential is applied to one side of I1). Now, as this type of multivibrator cannot change states unless an external pulse is applied, let's inject a high amplitude negative pulse at point A. Immediately V1's plate voltages will drop causing a drop in V1B's grid voltage as obtained through R1, R2, and R3. At the same instant, V1B's plate voltage will start to rise as its plate current decreases and the resulting rise will drive V1A's grid more positive consequently causing V1A to begin conducting. As V1A starts to conduct and its plate voltage decreases due to current flow through the plate load resistor, the voltage applied to V1B's grid will become even more negative. The process will then continue until V1B is entirely cut-off and V1A conducting.

With our example bi-stable multivibrator switched from V1B con-

ducting to V1A conducting, the neon indicator lamps will also have switched and I2 will be ignited. Now, if this stage was to be put to use we could operate it as a 2:1 frequency divider since every other pulse will ignite I2. But, by adding several other stages to this single one, a basic counter can be formed that will ignite certain neon indicators only when a certain number of input pulses have been applied. This is exactly how a binary frequency counter operates. Take for example our binary stage that has just been switched to V1A conducting. If another negative pulse was now applied to this stage, its condition would reverse and V1B would begin conducting. As V1B's plate voltage decreased a negative pulse would be generated at point B. This negative pulse could be used to trigger an additional binary stage.

Referring to Figure 2, which is an actual decimal counting unit from the Beckman Instruments, Inc., Berkeley Division, Model 7360 binary frequency counter, it is noted that the indicator system is tied together in such a way that it takes a combination of stages to operate the indicators. To understand the complete process, follow the operation of the decimal counting unit from the start with all the right-hand triode stages conducting. This represents the normal idling condition that the decimal counting unit will maintain, as it will be seen further on in the text. In binary language this is state "0." In this state only one indicator lamp will be lit, namely the zero.

As indicated in Figure 2, I101, the zero neon lamp, has a potential of -30 volts and +25 volts applied across it and consequently this lamp is in an ionized state whereas the rest of the lamps have insufficient potentials to cause ionization. If a negative pulse (number one pulse) was applied to the first binary stage the action as described in the previous example would

cause V101B to cease conduction and V101A to conduct thereby decreasing the +25 volt potential applied to I101 to zero volts and increasing the potential applied to I102 from zero to +25 volts. In this condition, I102, the numeral one indicator, would ionize and I101 would cease ionization. Binary stage V101 is now in state "1."

The next pulse that comes along (number two pulse) will switch V101 back to V101B conducting (state "0"). In the process of V101B starting to conduct, a negative pulse will be generated and coupled over to V102, the second binary stage. Here, the same process is repeated as with V101, V102B will cease conducting and V102A will conduct. This stage is now in state "1". Now the potential, -30 volts, that was applied to I101 and I102 will go more positive causing the ionized lamp, I102, to cease ionization. Since V102A is now conducting, the potential applied to I103 and I104 will go more negative, to a -30 volts. This brings I103, the numeral 2, to its ionizing level due to the -30 volt potential and the +25 volt potential derived from the plate of V101A.

Negative input pulse number three will cause V101 to switch a-

gain to state "1," left-hand triode conducting. During V101's switching process, V101B ceases conduction causing its plate voltage to rise thereby generating only a positive pulse which cannot trigger V102. The only change that has taken place at this point is the swapping of potentials applied to I103 and I104 by V101. Whereas I103 was ionized, I104, the numeral three, will now be ionized and I103 extinguished. Remember, everytime V101 is switched, the zero and +25 volt potentials are reversed.

When negative input pulse number four is applied, several changes occur to cause the numeral four indicator to ionize. Following this fourth pulse from the input, V101 will switch to its right-hand triode conducting, state "0." As the right-hand triode, V101B, starts to conduct and its plate voltage decreases, a negative pulse will be generated triggering V102 to state "0," right-hand triode conducting. The same process will again occur, a negative pulse is generated by V102B and V103 will switch from state "0" to "1." Now, a careful examination of V103 will reveal a feedback loop from the plate of V103B to the grid of V102A. When V103 switches states it will pro-

duce a positive trigger which is carried back by the feedback loop to trigger V102A into conduction changing this binary stage to state "1." I104 will now be extinguished since the potential derived from the plate of V103B will have gone more positive dropping the ionizing voltage. However, I105, the numeral four, will ionize due to the +25 volt potential from the plate of V101A and the -30 volt potential due to the conduction of V103A and V104B.

When negative input pulse number five is applied to the decimal counting unit, only one change will occur. V101 will switch to state "1," reversing the potentials applied to I105 and I106 by V101. I105 will extinguish and I106, the numeral five, will ignite since I106 now has +25 volts applied instead of a zero potential. None of the other binary stages will switch at this time as V101 generates only a positive pulse at the plate of V101B when it switches from state "0" to "1."

The next sequence requires all the binary stages to operate plus an additional feedback loop. As soon as input pulse number six is applied, V101 will switch to state "0."

(Continued on Page 36)

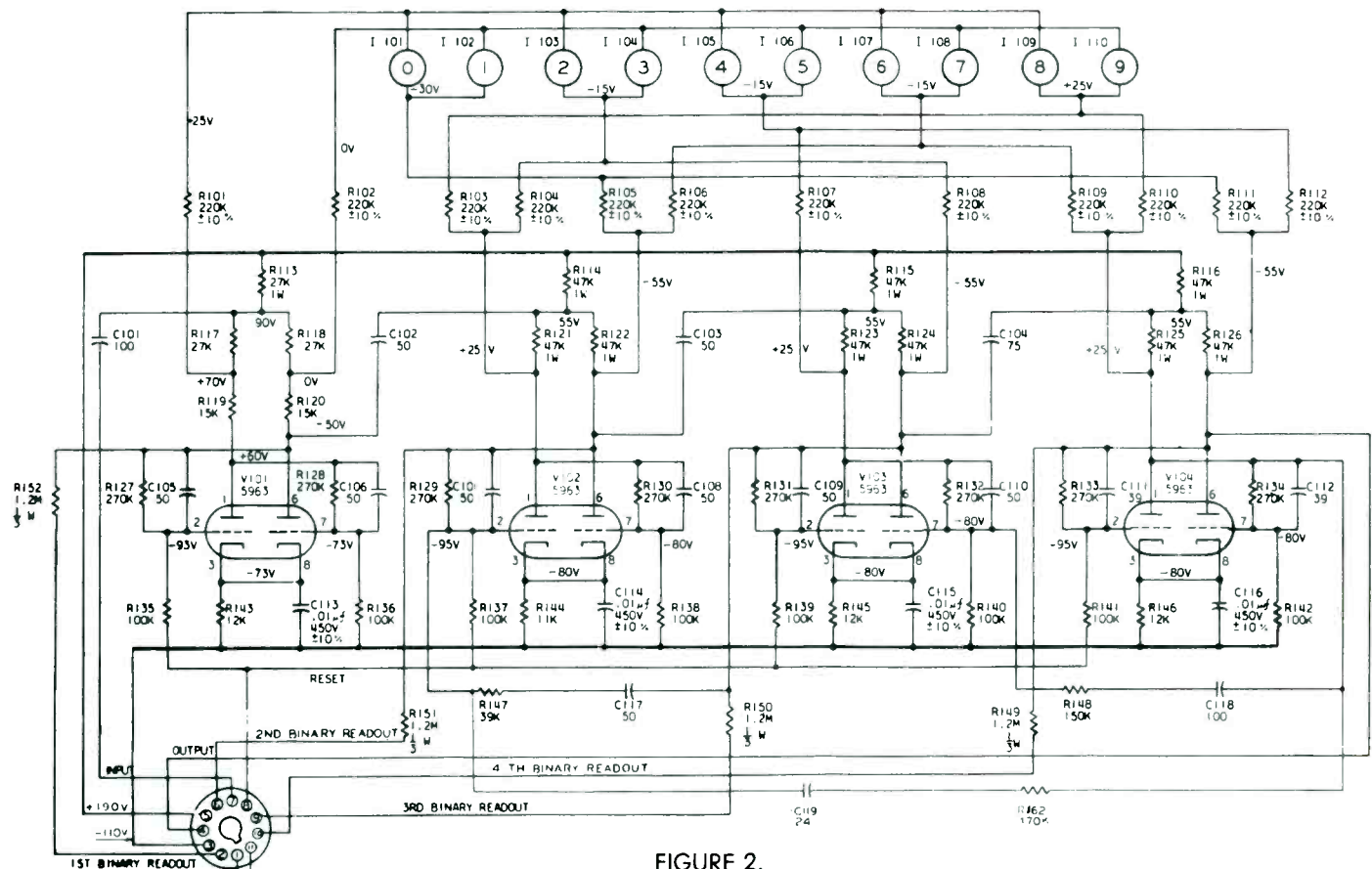


FIGURE 2.

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# Our Man in Public Safety Communications

By Robert E. Brooking



---

## OCTOBER 31, 1963 APPROACHES

A letter from Mr. Ben Waple, Acting Secretary of the Federal Communications Commission has been received by your editor. Because of the importance of its contents, it is reproduced here in its entirety.

FEDERAL COMMUNICATIONS  
COMMISSION  
Washington 25, D.C.

Mr. Robert Brooking  
Communications Engineer  
City of Burbank  
275 East Olive  
Burbank, California

Dear Sirs:

This is in regard to the Commission's requirement set forth in Section 10.252 of the Rules that after October 31, 1963 stations licensed in the Police Radio Service will no longer be able to transmit communications pertaining to the fire activities of the licensee.

The Commission has received numerous inquiries from affected users indicating that many licensees have only recently become cognizant of this requirement. A considerable number of these letters show a lack of awareness that this regulation was adopted in 1958 as part of Docket Number 11990. Commission correspondence and releases since that date have continually warned affected users of the need to make plans to meet the October 31, 1963 deadline. In addition, Commission representatives at each National meeting of the Associated Public-Safety Communications Officers, Inc., and of the International Municipal Signal Association have stressed this point and have encouraged those in attendance to remind other licensees of the effects of this rule.

Despite these constant efforts to give adequate publicity to this rule, it is recognized that many users may still not realize that they are faced with an imminent choice: either they must establish a separate fire radio system, or they must modify their existing systems from the Police to the Local Government Radio Service. This latter alternative would, of

course, enable users to establish a single communications system to transmit messages pertaining to any or all of their official activities, including police and/or fire.

It is probable that in the next few months there will be various local or regional meetings of public safety radio users in your area. Since it is anticipated that you or your representative will attend these meetings, the Commission is seeking your aid by requesting that you disseminate the information that Section 10.252 does impose a requirement that fire communications must be divorced from police systems as of November 1, 1963. If possible, the Commission would appreciate the printing of this letter in any magazine or bulletin to which you have access.

It is hoped that word of this requirement will reach every Part 10 radio system, and the Commission will be grateful for any help you may be able to render. In addition, we would welcome any report or other comment you may care to submit.

Very truly yours,  
/s/ Ben F. Waple

---

Your editor was invited to speak at the City Managers' Department Meeting of the League of California Cities. The topic was "The Radio Communications Muddle" and it dealt with the problems mentioned by Mr. Waple. Portions of that talk are reproduced here because of the need for informing the persons responsible for Public Safety licenses of the pending changes.

"On April 16, 1957, the Commission released Docket 11990. On May 12, 1958, a Report and Order was released which became effective on June 30, 1958. This Docket was very important to you City Managers because: first, it created the Local Government Radio Service; second, it amended Section 10.252 restricting the communications which stations licensed in the Police Radio Service may transmit to those 'essential to official

police activities of the licensee.' One exception was permitted because of the extensive use of police frequencies for fire activities and the emergency nature of the fire service. Quoting from the report, 'The Commission concludes that stations licensed in the Police Radio Service may be utilized for the conduct of official fire activities to the conduct of official police activities until October 31, 1963. During this time, appropriate arrangements may be made for the conduct of fire radio activities in accordance with applicable requirements.'

Thus, the Commission, in effect, granted a period of five years and four months to Public Safety licensees to make the necessary changes. However, no such 'period of grace' was allowed for the other functions previously mentioned.

What were the reasons behind the FCC actions? Simply this: police agencies were complaining that the police channels were overloaded and a large part of the overloading was due to non-police use. The obvious answer was to restrict the use of police frequencies to official police activities of the licensee. However, the licensees, cities, counties and states did have a justifiable need for radio communication for a variety of non-police functions. It was for these needs that the FCC created the Local Government Radio Service. A governmental entity may, if it wishes, operate its police and fire services on one frequency after October 31, 1963 by moving them to a Local Government channel. It can also use this channel for all of its other land mobile radio needs. For the small city, this presents an ideal answer. On the other hand, a city of 100,000 population will probably need two police frequencies, a fire frequency, a highway maintenance frequency and a local government frequency.

In the case of Civil Defense, the Commission went so far as to establish a new section, 10.9, which states, 'A station licensed under this part may transmit communications necessary for the implementation of civil defense activities assigned such station by the local civil defense authorities during an actual or simulated emergency, including drills and tests: **Provided**, that such communications relate to the activity or activities which form the basis of the licensee's eligibility in the radio service in which authorized.' In other words, police frequencies may be used for Civil Defense activities which pertain to law enforcement, only. Fire frequencies may be used for Civil Defense activities which pertain to fire suppression only.

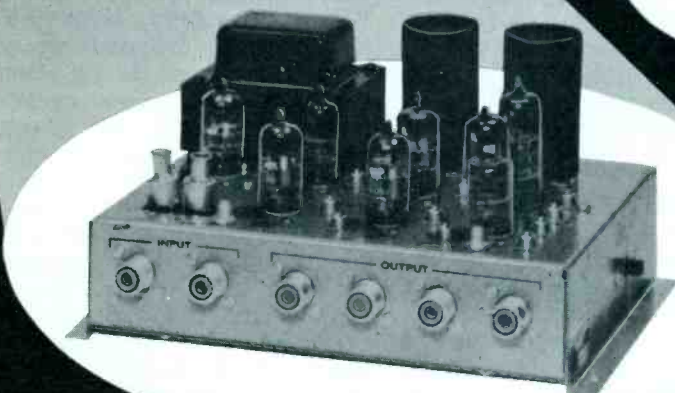
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# Our Man in Europe

**GORDON J. KING**  
Assoc. Brit. I.R.E.  
Brixham, Devon, England

As briefly mentioned last month, the British Government has now given the go-ahead for experimental pay-TV over wire. This was given in a second White Paper report published in December, and the proposal is for controlled tests in a small number of wired areas lasting several years in three test areas — London, the Midlands and the North.

A definite stipulation is that only pay-TV programme must be distributed and that the wired networks employed for the tests must also carry the existing free programmes of the BBC and ITA and put over the new BBC programme when that begins. The paper emphasises that there is no Government guarantee that after the tests — to start in 1964 — there will necessarily be authorisation for a general or permanent pay-TV service.

It is intimated that the tests are merely to test public reaction to such a service, and to reveal whether sufficient programme material could be obtained to justify this mode of entertainment.

Although expected, the report on pay-TV was greeted with mixed feelings by the various interests. We have over here several firms—some of them of American origin—engaged upon the development of pay-TV systems both off-air and wire, and some of these systems are almost ready to put into action. We also have organisations specialising in the production and acquisition of pay-TV programme material on an exclusive basis; and, of course, relay operators of many thousands of subscribers just rearing to go over to pay-TV. The stage is thus set and it now only awaits opening time.

Pay-TV as an experiment has been criticised in various quarters.

It has been pointed out that since the experiments are not to start until 1964 the problem as to which of the systems available is the best may by then be solved, so that technically the experiment will have little to offer. Further, because the essence of pay-TV is that people will pay for good programmes, from the commercial aspect it has been suggested that a limited experiment could not prove very much since good programme material is expensive and a large market is needed to justify it.

Whatever the critics say, experimental or otherwise pay-TV is to come to pass after many years of hard pushing by the CATV boys.

## MULTIWIRE OR COAXIAL?

So far there is no definite information whether the tests will be launched on the Rediffusion and British Relay Wireless multiwire systems or on the larger coaxial systems. It is likely that both systems will be used for the tests, but the Government stipulation that existing and future free services have also to be put over is likely to give a bit of trouble to the multiwire operators.

Excluding radio programmes, it seems as though large systems will have to provide capacity for four channels by 1964 and for five channels a little afterwards. At the present there are two fundamental television programmes in any given area (though a greater number can sometimes be received from more distant transmitters but are invariably duplications), one on each of the high and low bands. The Government has now given the green light for an extra BBC programme (duplicated in all areas) on the 625-line CCIR UHF system. This is also to happen in 1964, along with the pay-TV experiment.

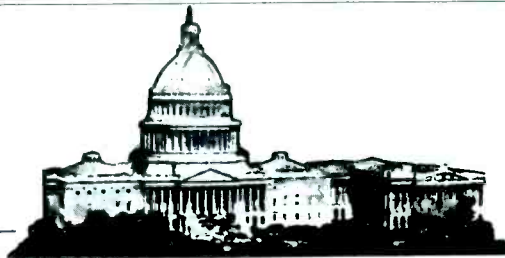
These give a total of four channels, and the fifth may arise from a second ITA programme. So far, there has not been Government

sanction for a second ITA channel, the White Paper saying that ITA had not taken a sufficiently positive role in the past. This has resulted in severe criticisms of the proposals from ITA sources, with Sir Robert Renwick, chairman of ATV, accusing the Government of being hostile to commercial television. Nevertheless, it is fairly certain that the ITA will eventually be given a UHF channel for a second programme.

It is essential, therefore, that new systems are planned with at least five channels in mind, and that steps be taken to see how existing systems can easily have their channel capacity increased. Some CATV equipment manufacturers are already producing equipment with a wider spectrum and a greater signal level handling capability than hitherto. The British Belling and Lee, for example, has increased the bandwidth of repeaters from 30-80 Mc/s to 30-220 Mc/s, and the ancillary equipment is being developed to give a total of seven channels for television plus four or more for FM sound.

Over here we have got to be rather careful when we talk about channel capacity at this stage in time because our 405-line channels have a 5 Mc/s bandwidth while the 625-line channels occupy 8 Mc/s. Thus, while an existing or planned system may be said to be suitable for seven channels, these may be 5 Mc/s channels, 8 Mc/s channels or a mixture of both. Ultimately, we shall be going over exclusively to 8 Mc/s channels on both VHF and UHF (and possibly a controversy apropos VHF versus UHF, and vice versa will be triggered off this side of the Atlantic. Already there is talk in the back rooms!), which means that we shall have to gear all our systems to suit, and we might as well do that soon than later.

**To Be Continued**



By Robert E. Tall

# Our Man in Washington

**Cox Confirmed As FCC Member:** Kenneth A. Cox, Chief of the FCC Broadcast Bureau for the past two years, has formally taken the oath of office as a Commissioner of the agency, following his Senate confirmation for the post. With Mr. Cox' qualification as an FCC Commissioner, the long service of T. A. M. Craven, who has served as an FCC Commissioner on two separate occasions, came to a close as FCC member. Mr. Craven is still with the Commission as a consultant on satellite communications.

**Old Microwave Docket Closed Out:** The FCC has closed out an old set of microwave rule proposals, issued in 1953, which have been taken care of in a series of subsequent dockets. When first issued more than nine years ago, the proposals in docket 10797 were the first looking toward revising allocations above 1000 megacycles since early 1948, and were designed to provide exclusive allocations for common carrier and safety and special service fixed and mobile microwave communications, in a departure from the previous shared-usage arrangement. The plan, which covered frequencies ranging from 890 to 12,200 megacycles, was also to provide an increase in spectrum space available for television broadcast pickup service. In view of its subsequent actions in other cases, the Commission said, the 1953 proposals are now "moot."

**Plans for Terminating 25-890 Mc Case:** Rumors were flying around Washington that the FCC staff has begun serious work to terminate the agency's proceeding in docket 11997—launched several years ago to determine present and future allocation policies with respect to the 25-890 megacycle frequency spectrum. The same rumors, however, were to the effect that the efforts are directed toward closing out the docket and getting it off the agency's formal backlog of cases without satisfying the urgent need for additional land mobile radio frequencies which was proven in the proceeding.

**Public Safety Operator License Proposal Date Extended:** At the request of the Associated Public-Safety Communication Officers, the FCC has extended, until May 20, the deadline for comments on its pending proposals which would drop the present requirement that an operator of a base or fixed station in the public safety radio services hold an FCC restricted radio-telephone operator's permit (docket 14950). The proposals had been supported unanimously by those organizations which had already submitted their comments before the old March 18 deadline. APCO noted, however, that the proposals are of direct importance to the police and other public safety services, with results throughout the country, and that it wants to "determine the views of its widespread membership on a more intensive basis."

**Phone Companies to Furnish More Data:** Telephone companies which provide common carrier two-way radio service, presently exempted from some of the requirements that face miscellaneous common carriers applying for new base station facilities or expanded channel capacity, would in the future come under the same requirements as the MCCs, under new FCC rule proposals. Comments in the docket (14989) are to be filed with the Commission by April 15. The agency noted that the detailed information has not been required of the telephone companies in the past, except in unusual cases, because of conditions that prevailed in the early stages of development of the service. It was once feasible to permit telephone companies to eliminate electrical interference through cooperation, the Commission said, but "extensive and increasing public acceptance of the mobile radio service, plus a surge of interest on the part of independent telephone companies, indicate the need for the submission of data suitable for reference and analysis by the Commission's staff." The agency said the increasing tendency

for communications common carriers to become involved in hearings, raising questions of coverage and local demand for service, makes the availability of technical data "essential."

**Special Industrial Rule Proposals:** In a set of special industrial radio service rule proposals, the FCC has suggested that licensees in that service be permitted to use frequencies above 152 megacycles assigned to other industrial services, in Alaska, Hawaii, Puerto Rico and the Virgin Islands, on a non-interference basis to those services to which the frequencies are assigned. The proposals stem from a request from Alexander & Baldwin, Inc., of Honolulu. Such a rule had been in effect years ago, but was deleted several years ago, and the present rules would require any special industrial licensees using the out-of-service frequencies to get off them by April 1. This requirement, however, has been suspended while the Commission works on formally reinstating the provision. Comments in the docket (14990) were asked by April 19. The Special Industrial Radio Service Association has already endorsed the reinstatement of the rule.

**FCCA To Meet July 16-19 In Dallas:** The 14th annual conference of the Forestry, Conservation Communications Association will be held July 16-19 at the Executive Inn in Dallas, Tex.

**Emergency Preparedness Functions Assigned FCC:** The FCC was one of 20 federal departments and agencies assigned emergency preparedness functions as part of the nation's defense program, in a series of new executive orders from President Kennedy. The order assigning functions to the FCC declares that the agency "shall, subject to the policy guidance of the Director of the Office of Emergency Planning, prepare national emergency plans and develop preparedness programs covering provisions of service by common carriers, broadcasting facilities, and the safety and special radio services; assignment

of radio frequencies to Commission licensees; and the protection, reduction of vulnerability, maintenance, and restoration of facilities operated by its licensees in an emergency." Among other things, the order provides for "Authorization, operation and use of safety and special radio services, facilities and personnel in the national interest in an emergency."

#### **Amateur Mobile Logging Requirements Relaxed:**

At the request of the American Radio Relay League, the FCC has completed amateur radio rule changes to provide that "during a period of continuous amateur mobile operation, the time of each transmission may be omitted from the station log provided that the date and times of commencing and terminating such mobile operation are entered" in the log.

#### **Another Request For Hobby Class License:**

The Volunteer Emergency Radio Communications Organization, of Houston, Tex., has backed up, with a formal petition, the similar earlier request of the International Crystal Manufacturing Co. that the FCC formally add a "Hobby Class" of license to the amateur radio service and allocate a group of frequencies in the 29 megacycle band for the new class. The action is required, the group said, in view of the Commission's approach to the Citizens Band radio service, which is curbing the organization's emergency work. The "Hobby Class" request is being opposed by some amateur radio groups, including the ARRL.

#### **Marine Group To Discuss Petroleum Radio:**

Petroleum industry radio developments, along with a variety of other subjects, will be discussed at length during the Spring Assembly Meeting and Symposium of the Radio Technical Commission for Marine Services May 14-16 at the Hotel New Monteleone in New Orleans, La. Also up for discussion will be FCC plans for single sideband communications in the marine services, and the plan of the American Waterways Operators, Inc., for establishment of a maritime mobile VHF-FM radio-telephone communication system on the inland waterways.

#### **Quick Action Asked On 450 Mc Request:**

The Central Station Electrical Protection Association and the controlled companies of the American District Telegraph Co. have petitioned the FCC to "sever" its 1960 proposal to create an Industrial Protection Radio Service from the other parts of its overall docket involving the 450-470 megacycle band, and to establish the new service "immediately." The

petition asked further that frequencies from 460 to 460.5 Mc to be allocated to the new service for mobile communications. While the overall 450-470 Mc proposals are bogged down because of channel splitting considerations in that spectrum area, CSEPA-ADT said, the requested frequencies for the projected Industrial Protection Radio Service "are now available for allocation" and the needs of the industry are "urgent."

#### **FCC Cautions Again On Police-Fire Divorce:**

The FCC has launched another wide campaign to inform all police-fire radio service licensees of its requirement that "after Oct. 31, 1963, stations licensed in the police radio service will no longer be able to transmit communications pertaining to the fire activities of the licensee." The Commission points out that the requirement has been on its books since 1958, and should be stressed by police and fire officials at every opportunity.

#### **Unanimous Support For Local Government Coordination:**

The Associated Public-Safety Communication Officers, last of the groups to file, make it unanimous that public safety licensee organizations like the FCC's proposals to permit the coordination of local government radio service frequencies by the frequency advisory committee method in use in other radio services. APCO, one of the five organizations of public safety radio users whose members would assist in the frequency coordination chores involved, pointed out that the procedure proposed "may in some particular respects be slightly cumbersome because it requires cooperation on the part of a number of groups interested in the use of frequencies in the public safety services," but that "experience obtained through actual utilization of the procedure will indicate whether there are any rough spots and, if so, how they can be smoothed over." The FCC staff, meanwhile, is expediting the rulemaking in an effort to get the procedures into actual operation by the first of May.

#### **IMSA-IAFC Support APCO Request For Inquiry:**

Support for the petition of the Associated Public-Safety Communication Officers for a "formal inquiry" into present and future requirements of public safety agencies throughout the country for radio spectrum space has been registered with the FCC by the International Municipal Signal Association and the International Association of Fire Chiefs. Under the APCO plan, the FCC would assume "affirmative" participation in the inquiry as it has done in proceedings in other areas of its jurisdiction. The "extraordinary increase in fire dis-

tricts reflected by the development of suburban belts of population around the major metropolitan areas in the United States," IMSA-IAFC declared, "has made the allocation of more spectrum space an urgent requirement."

#### **Five-Year Extension of Radio Altimeter Use:**

The FCC last week granted a petition of Aeronautical Radio, Inc., and the Air Transport of America, and extended for five years, until February 15, 1968, the time within which the 420-460 megacycle band may be used by aircraft radio altimeters.

#### **New Frequencies Available For Local Government:**

Four new frequencies for the local government radio service — 46.52, 46.54, 46.56, and 46.58 megacycles — will become available for assignment as of May 1, under a report and order issued by the FCC winding up a rule-making proceeding launched by the Commission in November, 1961.

The two primary 46 Mc frequencies involved—46.54 and 46.58 Mc—had been returned to the public safety radio services in 1961, after the FCC determined that their use by aeronautical fixed and international fixed public "forward scatter" systems was not necessary. Formerly assigned to the forestry conservation radio service, the frequencies, along with their 20 kilocycles "splits", were proposed for the local government service in the November, 1961, notice.

The proposals were supported by the three principal national public safety radio organizations involved—Associated Public-Safety Communication Officers; International Municipal Signal Association; and Forestry, Conservation Communication Association.

In its report and order (docket 14356), the Commission pointed out that "The most serious impediment to potential applicants in the local government radio service has been the shortage of available frequencies."

In proposing to assign the 46 Mc frequencies to the local government service, rather than restore them to the forestry conservation service, the Commission had pointed out that users in the latter service were making use of frequencies in the 150 Mc band, "and hence their usage of the lower band frequencies would decrease."

The FCCA comments, the agency said, not only agreed with the proposal to make the 46 Mc frequencies available to the local government service, but were "also in accord with the Commission's proposal to permit forestry-conservation systems presently authorized on the frequencies 46.54 and 46.58 Mc to continue such opera-



tions but that no new systems in this service will be authorized." The agency added, "Of course, these (forestry-conservation) operation must be on a non-interference basis to any authorized local government radio systems."

The Commission also pointed to its recent rule proposal in docket 14932, "which would permit applicants in the local government radio service to satisfy the Commission's frequency coordination requirements by obtaining a letter from an appropriate Frequency Advisory Committee recommending that the applicant be assigned the requested frequency."

The "word" is that the Commission will not accept any local government applications contemplating use of the four new frequencies until May 1, and that any such requests it receives prior to that date will be returned without action.

**Conference To Be Held Regarding Telco Owned CATV System:** The FCC designated Hearing Examiner David I. Kraushaar to preside at the Commission's scheduled hearing on the application of the Houston County Telephone Co. for microwave facilities near Dodge, Texas, to transmit signals to Colovision Engineering Co., a community antenna TV system in Crockett, Texas, which is 76%-owned by the telephone company. A prehearing conference in the case was scheduled for April 19.

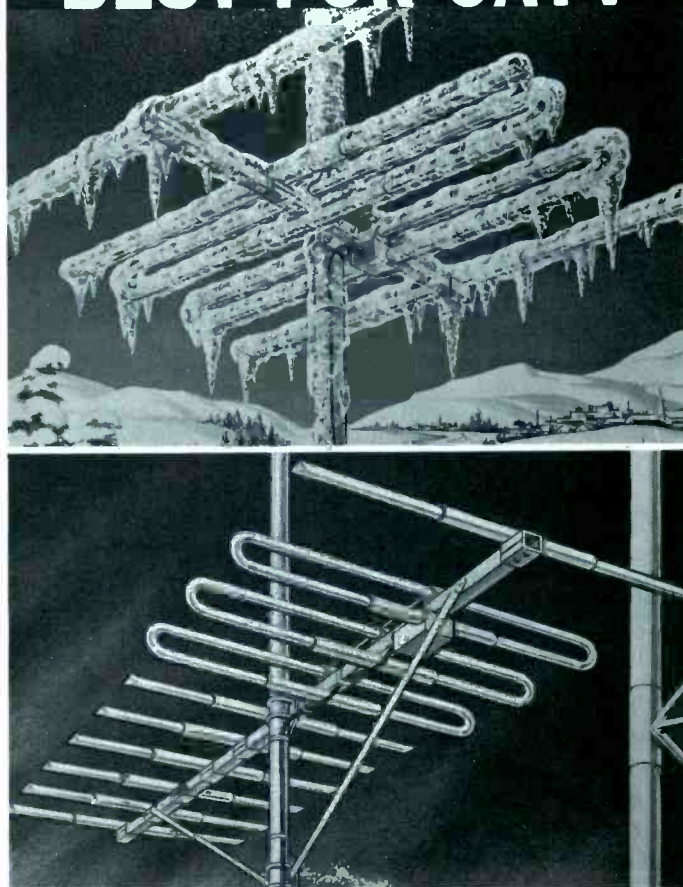
Commissioners Robert T. Bartley and Robert E. Lee dissented to the FCC action setting the case for hearing. Mr. Bartley, issuing a dissenting statement, declared that the telephone company "is an existing common carrier licensee."

"In my opinion, its common carrier status is not to be questioned merely because its principals also own stock in the proposed subscriber, Colovision Engineering Co.," he said.

**Minow Urges Separation Of Commission Functions:** Endorsement of the periodic suggestions that the FCC should be divided into an administrative agency and a communications court came this week by FCC Chairman Newton N. Minow, but Mr. Minow made it clear that he is "probably alone at the Commission in this view." His statement came April 2 in an address to the National Association of Broadcasters' annual convention.

The FCC Chairman described the recent report of the Federal Communications Bar Association on proposed structural changes of the Commission as "useful," and referred to some of its recommendations as "most constructive."

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JT-400D	0.114	0.525	0.536	0.547	0.632	0.77	1.3	167
JT-404S	0.064	0.285	0.296		0.407	1.31	2.2	64
JT-404D	0.064	0.285	0.296	0.307	0.407	1.31	2.2	73
JT-408S	0.081	0.373	0.389		0.460	1.01	1.6	89
JT-408D	0.081	0.373	0.389	0.400	0.460	1.01	1.6	101

**JT-1000 SOLID-SHEATH SEMIFLEXIBLE COAXIAL CABLE**

Type	Nom. Outside Diameter (in.)				Attenuation (max.) (db/100 ft)		Ship. Wt. (incl. reel) (lb/1,000 ft)
	Conductor	Dielectric	Un-Jacketed	Jacketed	Channel 6	Channel 13	
JT-1750	0.1400	0.680	0.750		0.60	1.03	280
JT-1750J*	0.1400	0.680	0.750	0.850	0.60	1.03	330
JT-1500	0.0980	0.450	0.500		0.84	1.40	130
JT-1500J*	0.0980	0.450	0.500	0.580	0.84	1.40	160
JT-1412	0.0752	0.362	0.412		1.05	1.65	100
JT-1412J*	0.0752	0.362	0.412	0.480	1.05	1.65	120

\*Cable overall jacketed with Xelon.



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Division of The International Silver Company

Wallingford, Connecticut

Dept. TH 35

\*A DuPont Trademark

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## PART TWO

# SEQUENTIAL AUTOMATION --FOR NON-DUPLICATION

In order to program any of the tapes, it is necessary to set up a program log, on paper, to tell at a glance what time various pieces of equipment or channels must be switched on or off. Using this log as a guide, the appropriate switches would be actuated for each fifteen-minute period up until the end of the broadcasting day and corresponding entries made in the log. This process goes very rapidly since each time the non-program switch is actuated, there is only a 3-second delay before the switch may again be operated. All of this time, by the way, is involved in starting the tape deck in motion, recording the non-program tone on the tape, and shutting the tape deck off. Likewise, whenever the program switch is actuated there is but a 20-second delay before this switch may be again operated.

Looking back at the original timing sequence, it would appear important to actuate the program switch at a precisely specified time that would be some few seconds separated from non-program tones or other programming sequences. This is not true, however, the equipment will do it for you. When the programming switch is actuated the following sequence takes place in the programming equipment:

1. A 20-second recycling timer is energized.
2. At the same instant, a 400 cycle tone generator is energized (cue tone). This tone generator will continue to operate for a total elapsed time of 2-seconds.
3. The tape deck is set into motion at the same time as the timer and tone generator.

The exact length of the above operation is governed solely by the 20-second recycling timer and naturally the maximum period of time the tape deck will run each time the program switch is actuated. Keeping this in mind, there has to be a fairly rapid method by which a tone may be put on tape to handle the "conditioning" phase of the operation. This assumption is the reason behind the selection of the impulse dial system (telephone dial). By use of an impulse dial the tone bursts will be accurately generated and put on the tape in a short period of time. The dial system will also insure the proper triggering of an associated step switch located at the head end site.

To go on with the actual programming, right after the program switch is actuated there is an allotted period of time in which the conditioning tones must be put on the tape. It is within this time that all the "dialing" would be accomplished to set up the head end equipment prior to the actual switching by the initiate tone.

The period of time allotted for the dialing process is a total time of 13-seconds less the 2-seconds of time it takes for the tone generator to operate. This leaves about 11-seconds in which 8 digits may be easily dialed. For most normal cases this number of digits should be sufficient.

Going on still further, after 13-seconds has elapsed the 13-second switched output from the 20-second recycling timer is used to trigger a 1400 cycle tone generator. This tone generator puts a very quick burst of tone on the tape lasting for a period of only one-half second. This is the designated initiate tone. When the 20-second recycling timer reaches the end of its time period it will cut off the tape deck and everything is back to normal, ready for actuation of the program switch once again.

The operation of the non-program function is somewhat different. Each time the non-program switch is actuated it operates a 1000 cycle tone generator and simultaneously starts the tape deck. The tone generator output is then fed into the tape deck and the tone recorded on the tape. After an approximate 3-second delay the tape deck is stopped. In operation the 1000 cycle tone serves a double purpose. One is to provide a means by which the tape sequence may be counted if the need should arise but more important, this tone is used as an automatic cut-off signal that shuts the tape deck off so it will not run for the full 20-seconds.

### **CIRCUITRY**

Going through the entire system is difficult if the individual sections are not broken down somewhat. Beginning with the timing unit, as shown in Figure 1, the most important component is the 15-minute timer. This unit should be very accurate and above all — reliable. Setting up the timer is only a matter of adjusting the cams, two are necessary, so that the switches are actuated at 14-minutes and 42-seconds past the end of the prior fifteen minute period. This is the only adjustment that is needed as the rest of the timing will follow in sequence.

In order to describe the operation of the timing unit, assume that the two cams on the fifteen minute timer have just closed their respective switches. When this occurs, relay A will be energized. Its sole contacts will start the 0 to 10-second timer. At the same instant, power will be applied to the 15-second thermal relay by the second cam on the 15-minute timer. Depending upon where the manual timer adjustment was set, the 0 to 10-second timer will con-

tinue to run until it reaches the end of its pre-set period.

When the 0 to 10-second timer runs out, it will close its respective contacts and hold these contacts in the closed position until relay A is released. As soon as the timer contacts have closed, relay B will energize. This relay will start the 20-second timer, close contacts A, start the tape deck, and open contacts B. The latter contacts will break after the others make which is a requirement this relay must meet. When contacts B open, the 24 volt power source will be removed from the fifteen minute timer contacts controlling relay A and this relay will de-energize. As soon as this occurs, the 0 to 10-second adjustable timer will re-set and open its contacts. When the timer contacts open, relay B will be unaffected since it has locked itself up through contacts A.

The next function that occurs in the actuation of the contacts in the thermal relay after a total time of fifteen seconds has gone by. When this happens, the 24 volt source is removed from the line going to the upper cam contacts on the fifteen minute timer. After a total time of 20-seconds, the contacts on the 20-second timer will open and remove the 24 volt source from relay B and de-energize this relay. When relay B de-energizes, the tape deck will stop and the 20-second timer will be re-set thus closing its contacts. Since relay B is now de-energized, it cannot be actuated through the A contacts. Note also that when relay B de-energized, it closed its B contacts, applying 24 volts to the open contacts of the thermal

relay. At this point, nothing more can happen until the cam contacts on the 15-minute timer ride over the cam lobes which will take approximately one-and-a-half minutes. When the cam contacts open, the thermal relay will close its contacts and the whole timing system will be ready for another sequence. Note that a time clock is inserted in series with relay A. This clock is used to deactivate the operation during the hours that the television stations are off-the-air.

All the foregoing operation is based upon a normal switching sequence when a non-program tone is not present on the tape. If a non-program tone is present on the tape, the entire operation as described will take place except that relay D will also be energized right after the tape deck is started and a 1000 cycle tone burst is applied to the 1000 cycle tone receiver, energizing relay D. As a result, relay C will be energized and lock up through contacts F. The other set of contacts on relay C will open up the circuit to the tape deck drive control relay and stop the tape unit. Relay C will then remain energized until the 20-second timer opens up relay B, removing the ground for relay C. When relay C de-energizes, it will close the contacts to the tape deck control relay circuit. However, the tape deck will not run again since relay B has opened up the circuit to the tape unit. Note that a capacitor, C2, is located across the coil of relay C. This capacitor is added to prevent relay C from opening up immediately to allow relay B to completely break the circuit to the tape deck.

The programming unit, which is shown in Figure

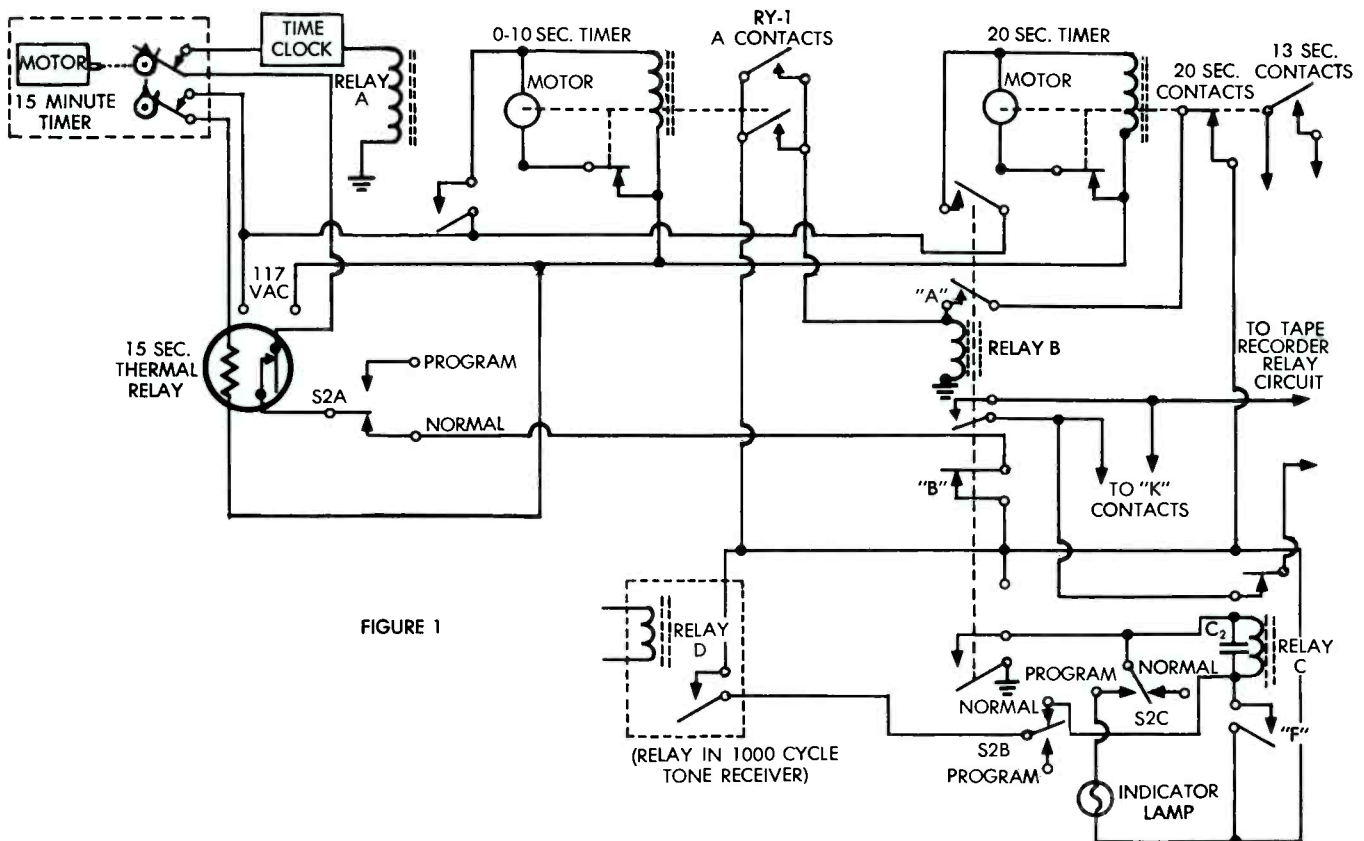


FIGURE 1

2, is separate from the timing unit although it is tied in with the timing circuits. For most systems, the tie-in should present no problems even though the timing unit is used for everyday operation. There are bound to be times when there is no program change for an hour-or-so and this would be, of course, the most logical time to do the tape programming.

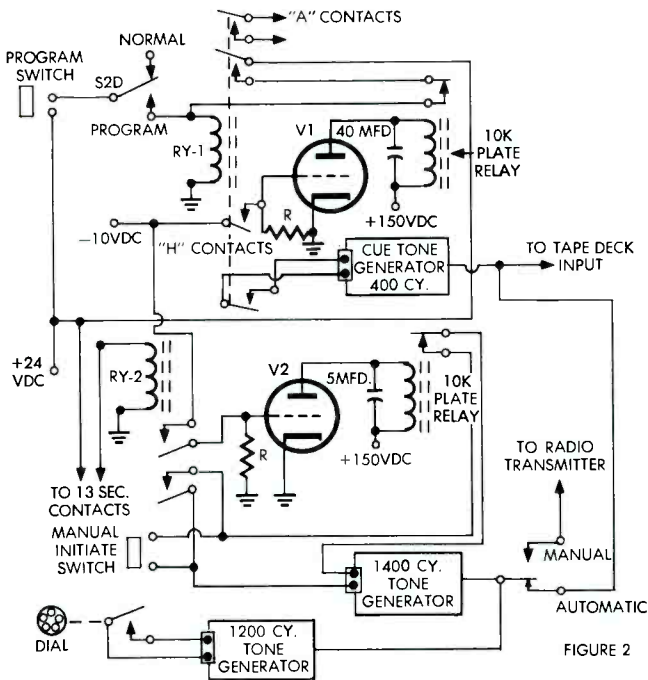


FIGURE 2

The program unit uses a single push-button, SPST switch, to start the program sequence. When this switch is actuated, providing S2 has been thrown in the program position, relay RY-1 will be energized and lock up through contacts G. At the same time the A contacts will close and the H contacts will close. When the A contacts close, closing relay B, the 20-second timer is started along with the tape deck. Refer to Figure 1 for location of the A contacts of RY-1. When the H contacts close, a negative bias voltage is applied to V1, cutting this tube off. However, its 10,000 ohm plate relay will not de-energize for one-and-one-half seconds due to the capacitor across the relay coil. As the plate relay de-energizes after its delay period, its contacts will open up RY-1, cutting off the 400 cycle tone generator and re-energizing the 10,000 ohm plate relay. Since the operation of the 20-second timer and the tape deck is controlled by relay B, which is locked up through its A contacts, the A contacts on RY-1 will now have no effect on the timer or tape unit when they are opened. Up to now, a total time approaching 2-seconds will have elapsed. Note also that when the program switch was actuated and relay B was energized, that an indicator lamp was turned on. The purpose of this lamp is to alert the operator when the programming sequence is taking place so the program switch will not be inadvertently actuated.

Immediately after the program switch is actuated and after about a 2-second pause, there will be a time period of about 11-seconds in which the "dialing" would be accomplished. As soon as a total of

13-seconds has elapsed, the 20-second timer will close its 13-second contacts. These contacts will energize relay RY-2 and in turn RY-2's contacts will turn on the 1400 cycle "initiate" tone generator and apply a negative bias to V2. With V2 cut-off, its 10,000 ohm plate relay will de-energize when the relay shunt capacitor discharges, after one-half second, causing the 1400 cycle tone generator to cut-off. RY-2 will continue to be energized until the 20-second timer reaches the end of its time period. When the timer runs out, and relay B drops out shutting off the tape deck, the indicator lamp will go out indicating that the sequence is ready to be repeated.

Depressing the non-program button, shown in Figure 3, causes RY-3 to energize and lock up through its own contacts. V3 will now be biased to cut-off via RY-3's J contacts. The K contacts on RY-3

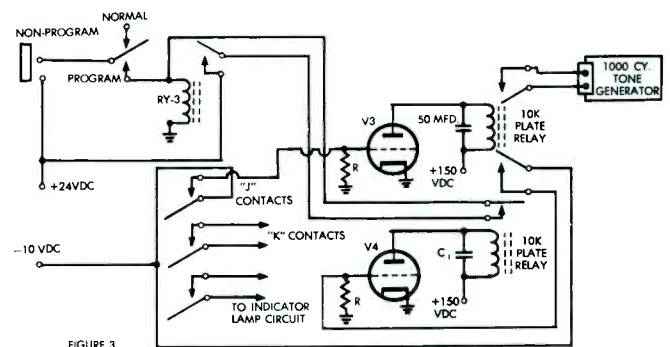


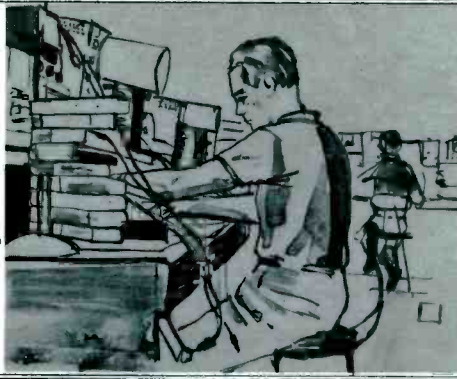
FIGURE 3

will start the tape deck. The exact location of these contacts can be found on Figure 1. The last set of contacts on RY-3 are used to turn on an indicator lamp warning the operator that the equipment is in operation. During all this process, the capacitor across V3's plate relay will be discharging through the plate relay coil. When the relay finally de-energizes, after approximately one-and-one-half seconds, the 1000 cycle tone generator will be actuated and a negative bias will be applied to the grid of V4, cutting this stage off. As soon as C1 discharges across V4's plate relay, the plate relay contacts will open RY-3, shutting the tape deck and indicator lamp off and resetting the equipment back to normal. C1 is the only critical item in this particular circuit and should be selected so that V4's plate relay remains energized for no longer than one-half second.

The remaining circuitry is left up to the operators choice since there are so many different approaches to the same end. It is suggested, though, that consideration be given to obtaining a Stewart-Warner X-Y switch for the head-end. This particular step-switch is ideal from a stand-point of cost and physical size.

In closing, it is hoped that those operators who contemplate using equipment to avoid non-duplication will try this type of system. From the cost and time end, an automatic operation is highly desirable but better still you are injecting a level of professionalism that your subscribers and the broadcaster must respect you for.

# New Product Horizons



Called the Log Series, these antennas are built around a basic unit which employs a backward wave log periodic structure to provide the antenna with gain and impedance essentially constant over bandwidths up to 200 mc/s. Five different high-gain patterns are obtained when the basic units are used in combinations. As a result, the antenna required for almost any situation is always in stock for immediate delivery.

Bulletin 632, describing these new Log Series antennas, is available from the manufacturer.

**Tristao Towers, Inc.**, 415 E. 5th Street, Hanford, California has a new data sheet available on their series 100 and 300 medium and heavy duty crank-up towers. Heights to 105 feet are available with these towers which can quickly be assembled and hoisted into the air for temporary or permanent installation. The series 300 tower will support 300 pounds of dead weight antennas or 100 pounds under heavy wind conditions.

Additional data is available from the manufacturer.

## TEST AND LAB EQUIPMENT

**The Hammarlund Manufacturing Company, Inc.**, 53 West 23rd Street, New York 10, New York has announced a new Secondary Frequency Standard for measuring transmitter frequencies, calibrating frequency and deviation meters, as well as setting FM transmitter deviation with precision.

Known as the Hammarlund TM500-A, the new instrument is intended for use in laboratories and by those engaged in servicing mobile and aircraft radio equipment. It measures frequencies to an accuracy of 0.00003%, far in excess of FCC requirements, from 5 kc to 500 mc/s.

Price of the new unit is \$675.00, delivery time is 30 days. Full details from the manufacturer.

## BROADCAST COMPONENTS

**Visual Electronics Corporation**, 356 West 40th Street, New York 18, New York has shown a fully transistorized image orthicon camera that features no lens turret, but a 10 to 1 zoom lens with high optical quality.

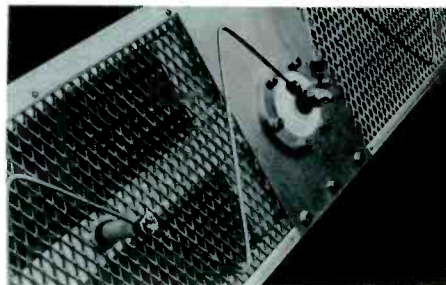
This is, Visual states, the first camera built to take full advantage of the zoom lens, thereby doing away with the cost and complexity of both the conventional 4 or 5 lens turret and the conventional optical focus mechanism which moves the image orthicon assembly.

Simplicity is the keynote of the control functions throughout. A simplified remote control panel contains adjustments for iris control, pedestal, gain, lens cap switch, and intercom level.

The camera is manufactured in New York and utilizes all U.S. components.

Pricing is expected to be competitive with existing 3 inch image orthicon tube type cameras.

The **General Electric Broadcast Division** has announced a new series of UHF stable-transmitters and "zig-zag" panel directional antennas.



The new equipment was first shown at the NAB conference in Chicago during the early part of April.

Frequency drift in the new stable-transmitter series is no more than 5 parts in 10 million, according to GE.

The new antenna makes available an almost limitless variety of directional radiating patterns.

## CATV-CCTV

**Denson Electronics Corporation**, Box 85, Rockville, Connecticut has announced a series of low-cost closed circuit television origination packages including monitors and cameras. A typical \$500 package includes a vidicon camera, 21 inch monitor. All equipment is to EIA standards (525 lines, 60 fields, 30 frames, 2:1 interlace).

Catalogue No. 1273TV listing industrial and broadcast cameras and equipment with miscellaneous component parts is available for the asking.

**Merrell Electronics, Inc.**, 519 Hendrix Street, Brooklyn 7, New York has announced an all new FM Multiplex Tuner Kit. The tuner features pre-wired and pre-aligned "front-end", AFC, pre-wired and pre-aligned FM Multiplex section and pre-aligned i.f. transformers. The manufacturer states the frequency response of the unit is 20 cps to 20 kc plus/minus .5 db; sensitivity 1.4 uV for 20 db quieting; distortion less than 1%; hum 6 db below 1 volt; output level 2.25 volts at 100 % modulation. The tuner is available wired or as a kit, with or without multiplex. Prices start at \$34.95.

## CATV-MATV-CCTV LITERATURE, DATA

The **Distributor Sales Division, Jerrold Electronics Corporation**, 15th and Lehigh, Philadelphia 39, Pennsylvania has a new set of literature covering a new line of television distribution equipment for homes, motels, offices, apartment buildings, hospitals, etc.

The information, including photographs, charts, block diagrams and specifications covers a wide range of newly developed systems and components. The data includes detailed specifications on master antenna system yagis, high-output, broad-band amplifiers, the new Ultra-Tap, and installation procedures.

**Blonder-Tongue Laboratories, Inc.**, 9 Alling Street, Newark 2, N. J. has launched a nationwide campaign to inform leaders in business, industry and schools of the advantages and applications of closed circuit television to the methods and efficiency of their operations.

Six separate applications' types are to be featured in the 12 month campaign. The first application is CCTV in banking, which kicked off in April. In the campaign heavy advertising, direct mail and personal solicitation is being coordinated throughout the nation by B-T personnel.

**Entron, Inc.**, 2141 Industrial Parkway, Silver Spring, Maryland has a new Equipment Catalogue available, for the asking. Entron's new catalogue, which contains the latest price list and data sheets, covers the key products in any system, including preamplifiers, ALC strips, mixers, trunkline equipment, distribution and bridging amplifiers, tapoffs and transformers.

Anyone not on the regular Entron mailing list, who has not yet received a copy of this new catalogue, may have one for the asking.

## COMMUNICATIONS EQUIPMENT

The Communications Products Department, The **General Electric Company**, Lynchburg, Virginia, has engineered a new fully-transistorized hand-held VHF-FM voice communications transceiver

that is less than 6 inches high and 3 inches wide.

Dubbed the 'Voice Mate', the unit operates on any frequency from 130-174 mc/s and is available for one or two channel operation. Less than one inch thick, it is cased in plastic and fits easily into a shirt pocket.



The unit weighs 12 ounces, including more than 5 ounces of battery power. Power output to the collapsible antenna is 500 milliwatts.

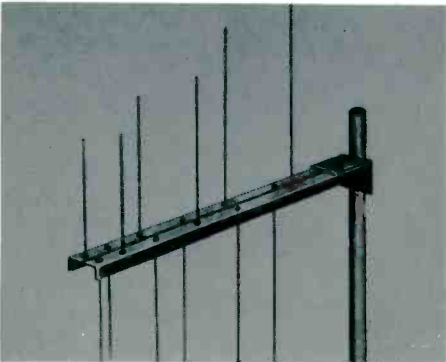
For further information, write Section P, General Electronic Communications Products Department, P.O. Box 4197, Lynchburg, Virginia.

A low-cost FM communications monitor receiver has been announced by the **Lafayette Radio Electronics Corporation**, 111 Jericho Turnpike, Syosset, L.I., New York. The 8-tube unit is available in two models to cover either 30-50 or 154-174 mc/s. Both units are priced at \$59.95 net.

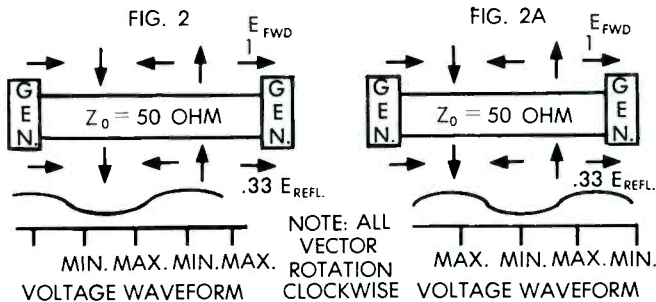
The set has a sensitivity of 4 uV or less for 20 db quieting; built-in, all electronic, adjustable squelch control; 5 inch speaker; illuminated slide rule tuning dial and transformer type power supply. An external speaker may be added to tie-in to an existing system.

## VHF-UHF ANTENNAS, HARDWARE

**Prodelin, Inc.**, P. O. Box 131DM, Hightstown, N. J. has announced a new type of base station antenna for the 150 and 450 mc/s communications bands, with gains up to 10 db.



converted to a decimal quantity, is .333. This is the magnitude. Since no angle has appeared, the angle is taken as zero. In Figure 2A, we have a termination of 25 ohms. Using the same formula, we find that gamma in the second case is equal to  $-.333$ . In this case we are interested in the angle and want to deal with a positive magnitude of gamma. The minus sign preceding gamma merely indicates that a phase reversal has taken place. Therefore we can revamp the result and  $-.333$  becomes  $.333$ 180. We have calculated two values of gamma for two different terminations. These values of gamma can more simply be stated as the directions for drawing the Reflected energy vectors. This is done in Figures 2 and 2A for each case.



Beneath Figures 2 and 2A, the vectors have been compared at key points on the line. These key points are 90 degrees (electrical) from the termination toward the load, at 180 degrees, 270, and back the full wavelength or 360 degrees from the load or termination which puts us at the source. Keeping in mind that the addition or subtraction of these two vectors (Forward and Reflected) will produce a combined or "resultant" vector, and this resultant vector represents the voltage appearing at that particular point on the line, we are able to plot the voltage waveform and show the development of the voltage maximums and minimums on a transmission line.

Once we have mastered the concept of vector addition and subtraction on a coaxial line, we can move on to the application of this knowledge.

I must admit that although I tried to keep this on a "conversational" basis, the math in the form of vectors was an absolute necessity. All the foregoing is merely general information necessary for future development and application. Once we have mastered the character of various line sections, we are ready to move on to more familiar ground such as Voltage Standing Wave Ratio, line attenuation, frequency effects and methods of correcting for improper terminations. In future discussion, we will attempt to prove that this theory can be tied to practical work.

Mr. Hankinson, author of this article, has long been a specialist in the field of transmission lines and radiation patterns. In his current capacity, Mr. Hankinson is employed by the Federal Government and is instructing the subject of transmission lines to civil students, on an engineering level.

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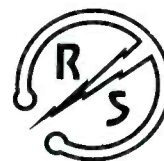


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# Mobile Radiotelephone —Hawaiian Style

Hawaiian Telephone Company, a supplier of radio-telephone installations to motorists since 1948, is on the air with a completely new \$500,000 mobile telephone system.

Company President Douglas S. Guild said the system is the largest of its type in use by any independent telephone firm in the United States.

Placed in operation Sept. 15, it uses a mobile dial car telephone designed by General Electric Company. Calls can be dialed to or from cars directly, without operator assistance, and the use of the instrument is similar to the use of a regular office telephone.

A key feature in Hawaiian Telephone Company's new installation is extended area mobile service covering the entire island of Oahu on a flat-rate basis for \$39.50 a month, without any additional charge for each call made.

Any car containing the duplex mobile-dial unit may dial either to land-line telephones or to cars similarly equipped. The calls originate from the radio unit in the vehicle and are transmitted to one of six telephone company base stations where interconnection is made automatically with land lines or with other cars.

Initially, the system is licensed by the Federal Communications Commission for three channels in the 150 Mc common carrier band and serves 105 cars. Push-buttons on the control head used by the driver of the car allow the subscriber to select any one of the three channels. Busy lamps glow if the channels are in use.

A fourth channel is planned for early 1963, and according to John Jaquette, executive vice-president of Hawaiian Telephone, a request has been filed with the FCC for a fifth channel to handle additional message traffic. This would permit continued expansion of mobile telephone service on the island to meet the heavy demand which has already developed for the new service.

The new radio equipment has five-channel capability. Each mobile subscriber ultimately will be able to select any one of the five. Hawaiian Telephone Company's vice-president of operations, Raymond Alden, estimates that several hundred cars will be able to obtain service when all five channels are in operation. An extensive waiting list already exists.

Expanding its marketing department to handle the new mobile dial telephone program, Hawaiian Telephone has set up a separate section to insure proper sales support of the program. Robert S. Lowrey, general marketing manager, predicts that at least 500 subscribers will be served by the mobile system by 1965.

Simultaneously with the announcement of the new system, Hawaiian Telephone disclosed its plans for quick servicing of the equipment. It has provided 5,000 square feet of new building space with a screened room fully-equipped with test benches using laboratory-type test instruments.



Looking over and checking the new equipment is part of the routine procedure at the Hawaiian Telephone Company's large service facility.

Receivers terminate in Honolulu in a Secode diversity panel which selects the best signal and all other receivers are locked out. Three Secode COT-3 terminals are located in Honolulu's downtown central office. Over 100 route miles of microwave and wire line facilities are used to connect the base stations.

The use of six sites has been a key feature permitting extended area mobile dialing. Additionally it will help the company to upgrade its coverage for private system users who need island-wide communications.

In such instances, it will be possible for the user of an authorized private system to obtain a telephone company link to the six base station sites and to control all six sites from one central location.

John E. Field, president of ComTel Engineering, Inc., of Redwood City, Calif., was consultant and application engineer for the project.

The entire modernization program is part of Hawaiian Telephone's long-range communications plan aimed at staying well ahead of FCC deadlines on technical standards. By November 1963, all telephone companies and private mobile users throughout the nation must meet new FCC requirements, converting older radio-telephone systems using wide band techniques to new narrow band standards.



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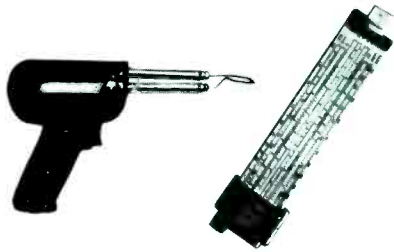
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## Tape-Athon, Corp.

523 South Hindry • Inglewood, California  
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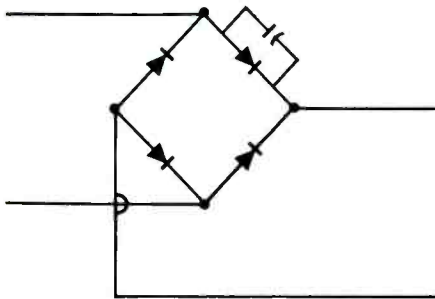
# Horizons Lab Report

## THE SILICON DIODE

A great many of us have learned, mostly the hard way, that silicon diodes have a regrettable habit of failing quickly due to overvoltage transients or capacitive charging currents that exceed the ratings of the diode.

However, despite the fact that some little care is necessary when dealing with silicon diodes, the end result is more than worth the effort. We all recognize the failings of the hard tube rectifier, especially when it sits in equipment up on top of a nearly impassible mountain peak. But, let's see what can be done to overcome a few of the obvious problems.

Reducing the damaging effects of transient voltages developed by current interruption requires only that a capacitor be installed in parallel with the diode such as shown in Figure 1. It is just that



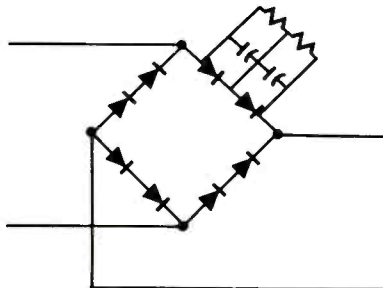
simple. In the case of multiple diodes such as shown in Figure 2, the capacitor serves two purposes. Diodes have what is called "recovery time." This means that when a diode is conducting in the direction of easy current flow and the diode stops conducting due to the E source passing through zero volts, all diodes in series do not reach cut-off at exactly the same instant. This fact is of small concern since we are usually talking about a 60-cycle source and recovery time is in the matter of a

few microseconds.

On the other hand, with a switching transient that has a total width of a few microseconds, Diode A may be ready to block the transient but Diode B may be slower than A and can't accept its share of this transient just yet. The transient voltage won't wait so Diode A takes the brunt of the energy and consequently winds up being damaged. So, since diodes do not recover in the same time period we have to help them. It is at this point that the capacitor is used to cause sufficient delay in the application of the transient to allow ample time for both diodes to recover.

The shunt resistors shown in Figure 2 are used to make sure that an even distribution of voltage takes place across the diodes. This is very important when dissimilar diodes are used. Without the resistors, the recurrent PIV will ultimately damage one or the other of the diodes.

Now let's get rid of damaging capacitor charging currents. If a choke input filter is chosen, there is no problem. The choke will automatically limit the charging current with further precautions unnecessary. If a capacitive input



filter is chosen we will gain one thing in lieu of another. What we gain is the elimination of transients because of the capacitor's

ability to absorb or buffer transient energy. What we lost is control over the initial capacitor charging current and this cannot be considered as an insignificant item. Depending upon the individual power supply, the initial charging current may run upward of 3 to 8 amperes. Conceivably this value can be much higher, however, the impedance of the transformer secondary plays a large part in keeping the peak value moderate. Even at the lower values (3 to 8 amps) considerable damage can be done to silicon diodes. To get rid of the probability of damage, add a resistor in series with the Eac

If you ever have occasion to check a silicon diode with your ohm-meter, think twice. In actuality you can measure a relative front-to-back ratio but be assured that this value will be only relative. The reason for this statement is based on the low-voltage, low-current capabilities of most ohm-meters. They are usually incapable of measuring the true qualities of a silicon diode since they can't supply enough voltage to bring the diode quite away past the threshold point.

## WE TEST THE PATCH-A-CALL

Telephone phone patching (i.e. transferring calls on the telephone line to the radio system, and vice versa) is not new to the communications industry. Radio Common Carrier operators have had their experience with these devices, and many Business Radio Service and other licensee groups utilize this convenient means of expanding the usefulness of a two-way radio system.

The Patch-a-Call is completely solid-state, fully automatic and voice actuated. It is designed to be compatible with the Western Electric Series 500 telephone unit or any handset with equivalent electrical characteristics.

Once installed into the base station transceiver (or transmitter and receiver units), operation is simple and trouble-free enough than an office girl can easily serve the functions necessary to set the unit up and control it and the transmitter-transceiver.

The Patch-a-Call complies with FCC regulations and may be utilized in any radio service except where telephone patching is prohibited by specific telephone company regulations.

(Continued on Page 37)

# Thoughts on Ghosts

by P. Freen

Benco Television Associates Ltd.

The increasing use of very low loss cables such as PD-375, BAL-14F, or equivalent, together with the improved definition of modern TV sets has tended to increase the problems of system design.

The definition of modern TV sets requires that the CATV system introduce the minimum amount of "ghosts." Unfortunately the use of low loss cable has the effect of increasing the possibility of ghosts unless a thorough understanding of the mechanism of reflections along a line results in a system layout which will keep reflections to a minimum.

As a preliminary to a discussion of reflections it must be pointed out that in general, CATV components such as splitters, amplifiers, etc., cannot be relied upon to have reflection coefficients of better than 20 db (1.2 SWR). Even this implies considerable precision.

The figure of 20 db actually means that if a signal of 1 MV is sent along a lossless coaxial line terminated by a unit whose reflection coefficient is 20 db, 100 microvolts will be reflected back to the source. This reflected signal will show up as a ghost whose distance from the main signal on the TV screen is dependent upon the distance from the discontinuity or termination that the picture is observed.

Experiments have been conducted at BENCO in order to determine the minimum ratio of ghost to main signal that can actually be seen on a TV set. It has been found that if a ghost is 25 db lower

in amplitude than the main signal it is barely detectable. At 30 db down it is invisible.

It is obvious then, that in the example given above of a lossless line terminated with a device having a reflection coefficient of 20 db, the ghost will certainly be visible.

Fortunately coaxial cables are not lossless and this fact modifies the results of the example discussed above to the extent of the loss per foot of the cable actually being used.

Consider the example of the older type CATV system using solid dielectric RG-11/U type cable for the main trunk line (Figure 1).

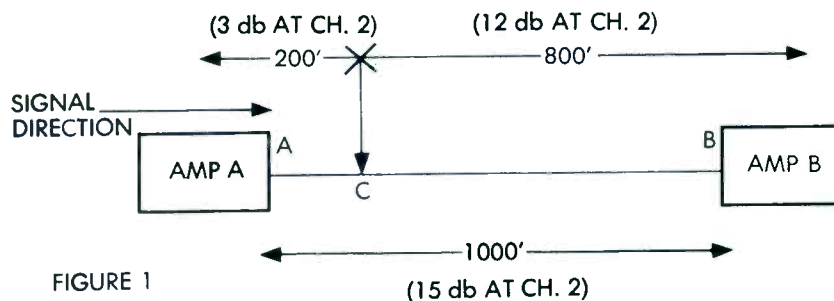


FIGURE 1

A signal leaving amplifier A and traveling down the coaxial cable towards B will encounter a reflection coefficient of 20 db at discontinuity C and another reflection coefficient of 20 db at the input of amplifier B.

The main signal leaving A travels down the line to discontinuity C and is reflected with a 20 db loss due to the reflection coefficient of C plus a cable loss of 3 db back to A and from A back to C with an-

other 3 db loss, assuming the worst possible case that the output of amplifier A is unmatched.

Thus a television set tapped onto the main line at C sees the main signal plus a ghost which is  $20 + 3 + 3$  db which equals 26 db down. At this distance (200 ft.) the ghost would be located approximately  $\frac{1}{8}$ " from the main signal. If visible it would be quite annoying. Fortunately 26 db down is acceptable as being invisible although there is not much safety margin.

The situation at the input to amplifier B is as follows: The reflection just discussed from point C will still bear the same relationship to the main signal (26 db down) because both the main signal and the reflection from point C (returned from C to A and back) will suffer the same cable attenuation before returning to B. There will however be a new reflection coefficient set up by the 20 db reflection coefficient of the input termination due to amplifier B.

This reflection from B will be 20 db down from the main signal and will suffer a cable loss of twice 15 db before returning to point B. A total of  $20 + 15 + 15$  db or 50 db down. This is negligible.

There is also another effect due to the reflected signal from B travelling back past C which originates yet another reflection which is of course 20 db down and will suffer a cable attenuation of  $12 + 12$  db before coming back to point B. This signal will therefore be weaker than the main signal by  $20 + 20 + 12 + 12$  db or 64 db

down. This can also be considered negligible.

It can be seen from the above that by far the most effective discontinuity in producing a ghost is that produced by the device at point C, although with RG-11/U type cable it would still not be visible.

Now consider the example of the newer type of CATV system using PD-375, BAL-14F or equivalent foam dielectric cables for the main

trunk line (Figure 2).

The main signal leaving A travels down the line to discontinuity C and is reflected with a 20 db loss due to the reflection coefficient of C plus a cable loss of 0.9 db back to A and from A back to C with another 0.9 db loss. Thus a television set tapped onto the main line at C sees the main signal plus a ghost which is  $20 + 0.9 + 0.9$  db or 21.8 db down. The ghost will still be approximately  $\frac{1}{8}$ " from the main signal and at only 21.8 db down will be quite visible.

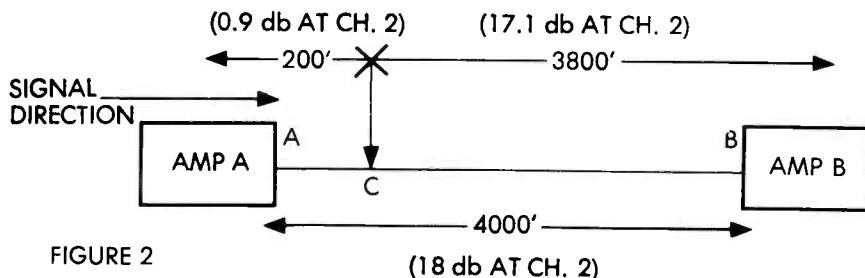


FIGURE 2

The signal at Point B will still have the ghost in the same relationship to the main signal as at point C (21.8 db down) since both the main signal and the reflection from C (returning from C to A and back to C) will suffer the same cable attenuation traveling from C to B.

The reflection from point B towards A and back will still be negligible as in the previous case of the RG-11/U trunkline.

The above examples illustrate that in the case of the RG-11/U trunkline the ghost produced by the discontinuity at point C will not produce a visible image. However, in the case of PD-375, BAL-14F or equivalent trunkline cable the ghost produced by the discontinuity at point C will produce a visible image and it should be noted that this ghost is present at the input to the following amplifier and will be passed through the whole system trunkline.

A further point of interest is the fact that the position of the discontinuity along the line has a considerable bearing on its ability to produce a ghost.

Obviously if the discontinuity is almost at point A the strength of the ghost will only be 20 db down although no ghost will be visible since the position of the ghost will coincide with the main signal. On the other hand if the discontinuity is almost at point B the reflected signal will have to traverse the length of the trunkline between amplifiers twice before coming back to the input of amplifier B.

This implies that it will be at least 56 db down from the main signal ( $18 + 18 + 20$  db or 56 db).

If the amplitude of the ghost is plotted on a graph against the length of trunkline commencing at the output of amplifier A and finishing at the input to amplifier B, it will be found that the strength diminishes linearly to a minimum of 56 db.

It should be emphasized at this point that if the amplifiers are used at less than 4000 feet spacing, the discontinuity produced by the

reflection coefficient at the input to the amplifier will act in exactly the same way. For example if the spacing between amplifiers was only 1000 feet then the ghost would be only 29 db below the main signal rather than 56 db as it is at 4000 feet spacing.

To summarize the above discussion; if it is assumed that the ghost should be better than 30 db below the main signal then there should be no discontinuity in the main cable for at least 1000 feet from the output of the preceding amplifier when using BAL-14F, PD-375 or equivalent type cables, and 250 feet when using RG-11/U type cable.

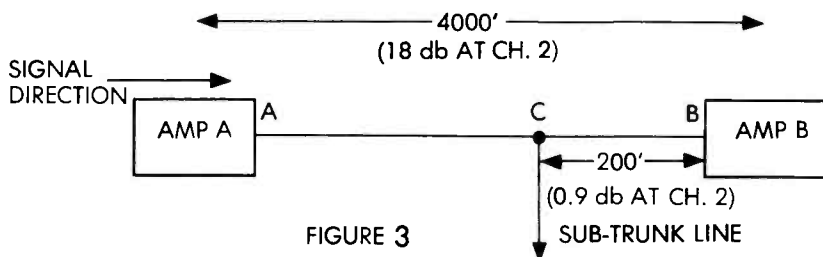


FIGURE 3

The only exception to this rule should be if the discontinuity occurs immediately after an amplifier where the ghost would coincide with the main signal.

All the preceding examples have been calculated at the frequency of Channel 2 since at this frequency cable losses are at a minimum. At all other television channels the situation with regard to ghosts will be improved to the extent that the cable losses increase.

On cables carrying sub-channels

the situation with regard to ghosts will be worse than the above examples to the extent that cable losses decrease from the channel 2 frequency.

A further consideration which is often encountered in a trunk line layout is the tapping of the line between A and B for a sub-trunk line.

It has been shown in the previous examples that no ghost will be caused in the main trunk line (A to B) if no taps are made in the first 1000 feet of BAL-14F, PD-375 or equivalent type cables. However the situation in the sub-trunk line must also be considered (Figure 3).

The main signal leaving A travels down the line to the input of amplifier B passing tap-off C. The reflection from C on the main line will be approximately 54 db down as shown on the graph for 3800 feet of cable.

Tap-off C however receives the main signal plus a signal passed from C to B (0.9 db down), the reflection from amplifier B (20 db down) and a further 0.9 db back from B to C. A total of only 21.8 db down.

The cure for this situation is to use an asymmetrical splitter such as the BENCO 2ASP-75MP at point C which only passes the signal traveling from A to B to its sub-trunk line. Any signals (including the reflection from B) traveling from B to A will suffer a further attenuation in the asymmetrical splitter of at least 10 db. Therefore the reflection from B in the above example instead of being

21.8 db down in the sub-trunk line will be at least 31.8 db down, which is well below that which is required to produce a ghost.

The four criteria for trunkline layout should therefore be:

1. The main trunkline should not be tapped at all if possible except right at the amplifiers.
2. The full recommended output and gain of the amplifiers should be used.

(Continued on Page 40)

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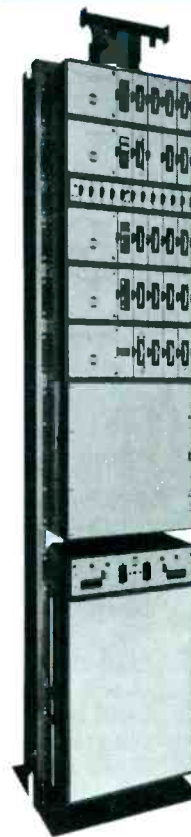
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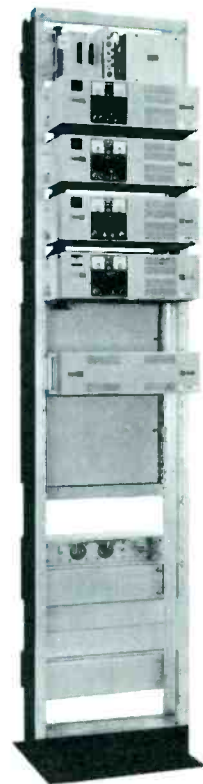
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SPECIFICATIONS:

FREQUENCY	POWER	IF BANDWIDTH
5925 to 8400 mc	100 mw	15-25 mc
	1 w	15-25 mc
	5 w	15-25 mc
10,700-13,200 mc	50 mw	15-25 mc
	500 mw	15-25 mc



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V101B's negative output pulse will cause V102 to switch to state "0" and in turn V103 will switch to state "0." When the plate of V103 goes negative, generating a negative output pulse, V104 will be triggered to state "1." When the plate of V104A goes negative due to conduction, the resultant negative output pulse will be applied back through a feedback network, made up of C118 and R148, to the grid of V103B causing V103B to cease conduction thereby switching

this stage to state "1." Also, the negative output pulse from V104B will be applied back through R162 and C119 to the grid of V102A. However, V102A will be unaffected as this section of the tube is already cut-off due to the conduction of V102B. At this point, I106 will extinguish due to the rise in V104B's plate voltage. I107, the numeral six, will now ionize as a result of the conduction of V102B and V104A which place a -30 volt potential on one side of I107. The +25 volt potential that is applied to the other side of I107 is derived from V101A which is the cut-off section of V101.

Going on with input pulse number seven, since V101 is in the "0" state it will switch to state "1" and will not affect any of the other binaries. This will swap the potentials applied to I107 and I108 by V101 and consequently extinguish I107 and ignite I108, the numeral seven.

Negative input pulse number eight will cause V101 to switch to state "0," V102 will switch to state "1," I108 will now be extinguished due to the rise in V102's plate voltage. I109, the numeral eight, will now ionize due to the conduction of V102A and V104A resulting in a -30 volt potential for one side of I109. The other necessary potential, +25 volts, is derived from the plate of V101A.

When the ninth negative input pulse is applied to the decimal counting unit, only V101 will switch, going from state "0" to "1." Here again as in previous instances the potentials applied to I109 and I110 will be swapped causing I110, the numeral nine, to ionize and I109 to extinguish. The rest of the binary stages will be unaffected since no negative trigger was generated by V101's switching action.

The tenth input pulse affects all the binary stages. Since V101 was in state "1" as were all the rest of the binary stages, this last pulse will cause everything to revert to state "0." Also a negative output pulse is generated by V104B as it resets to state "0." When all the stages switch as a result of the tenth input pulse, the potential applied to I110 by V104A will go more positive causing the indicator to extinguish. As noted, the entire decimal counter is now back to the beginning and as a result the zero indicator, in I101, will be ionized.

If the counting process was to be carried on, the negative output pulse generated by V104B during

the resetting phase would be used to trigger another decimal counting unit or a series of units to achieve the necessary read-out. As it can be seen, this first unit has provided a single output trigger from ten input triggers. Another similar unit would provide the same division so that one output trigger would result from 100 input triggers with only two units in operation and so on.

In essence, the foregoing is a basic idea behind the operation of the binary counter. There are many forms of counters with all types of read-outs, so many that it is difficult to describe each and every system. However, all modern units function on a set basis such as has been described. Where seemingly complex counters are uncovered, a little objective analysis will provide the key to their operation and improve your own techniques in the proper use of such equipment.

#### AMECO APPOINTS CHIEF R & D ENGINEER

William A. Rheinfelder has been appointed Chief Engineer of Ameco's Product Development Department, according to an announcement by Bruce Merrill.

Rheinfelder, born in Munich, Germany, came to Ameco from Motorola Semiconductor Products Division in Phoenix, where he was Applications Consultant and Solid State Circuit Design Specialist for the past six years. He will be responsible to Ameco's Director of Product Development and Purchasing, James E. Connor, for research and development programs looking toward continuing improvement of Ameco fully transistorized all-band amplification equipment.

After receiving his BS degree in mathematics and physics from the University of Munich in 1948, and his MS in Electronics from the Institute of Technology in Munich, Rheinfelder was a Research Scientist with Brush Development Corp., Cleveland, Ohio, from 1951 to 1953, and was Senior Project Engineer for Westrex Corp., in Los Angeles, specializing in development of sound recording and motion picture instrumentation before he joined Motorola in 1957. Rheinfelder, who originated, among other solid state circuits, the emitter tuning concept, is a senior member of IRE.

Rheinfelder joined Ameco on January 16, 1963, and resides with his wife, Linda, and two children at 4317 East Calle Feliz in Phoenix.

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**Lab Report**

(Continued from Page 32)

Connection of the Patch-a-Call to the transceiver or transmitter is done through the speech amplifier stage.

Audio from the Patch-a-Call is coupled into the speech amplifier grid at the same point as the audio input from the microphone normally employed with the unit. A second lead connects at the keying relay where the push-to-talk switch from the microphone connects. This provides keying of the transmitter by the voice actuated relay in the Patch-a-Call. A third wire from the Patch-a-Call substitutes for the ground return on the transceiver speaker, handling the ground return through the voice operated relay in the Patch-a-Call so that the transceiver speaker is deactivated on transmit, eliminating audio feedback paths.

The fourth inter-connecting lead ties the Patch-a-Call and the transceiver - transmitter package together through a common ground return.

The Patch-a-Call is housed in an attractive grey plastic case. The

inner circuitry is circuit board mounted and sealed in epoxy or some substance suitable to protect it from both the elements and prying eyes.

**OPERATION**

In our installation, we utilized the unit with a low-band Business Band system maintained between the Horizons Lab and our main office and mobiles. The radio at the base location is a new proto-type



unit which will be released by an eastern manufacturer at the Parts Show. We aren't at liberty to discuss it, except to note that it is of standard 30 watt AM design and a transceiver, in packaging. It is, we feel, representative of the many low or high band transceiver packages on the market today.

The Patch - a - Call modulation level is set with a pot control on the base of the unit. A trial run using a signal from the telephone requires approximately 15 seconds to set the pick-up level in the Patch - a - Call so that normal telephone levels will both key the transmitter (through the VOX circuit in the Patch-a-Call) and provide maximum modulation level on the transmitted signal.

Since the unit is VOX operated, the transmitter keys only when the party on the telephone is talking. A milli-second delay (which can be adjusted) after the telephone party ceases talking deactivates the VOX transmit portion and the party using the radio transmitter at the other end can then transmit back directly through the base station package onto the phone lines through the Patch-a-Call. A unique lock-out circuit prevents the party on the telephone from interrupting the radio-line party.

Price of the Patch-a-Call is \$74.95. The Manufacturer is Business Radio Company, P.O. Box 5652, Minneapolis 17, Minnesota.

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April 16-17—Meeting of Public Safety Communications Council. Essex Inn, Chicago.

April 17-19—Joint Conference of Petroleum Industry Electrical Association and Petroleum Industry Supply Association. Rice Hotel, Houston.

April 19—Comment date on special industrial rule proposals which would permit licensees in that service to use other industrial frequencies above 152 Mc in Alaska, Hawaii, Puerto Rico and the Virgin Islands (Docket 14990).

May 1—Four new frequencies become available for the local government radio service—46.52, 46.54, 46.56 and 46.58 Mc.

May 14-17—Annual meeting of Industrial Communications Association. Eden Roc Hotel, Miami Beach, Fla.

May 14-16—Assembly and Symposium of Radio Technical Commission for Marine Services. Hotel New Montelone, New Orleans.

May 20—Comment deadline on FCC proposals to drop operator licensing requirement for public safety radio base and fixed station (Docket 14950).

June 4—Annual meeting of National Petroleum Radio Frequency Coordinating Association. Statler Hotel, Washington, D.C.

June 5-6—Semi-annual meeting of American Petroleum Institute Central Committee on Communications Facilities. Statler Hotel, Washington, D.C.

June 7-14—National Community Television Association annual convention. Seattle, Wash.

June 15—Persons previously eligible in the special industrial radio service, who received licenses prior to June 15, 1958, but no longer eligible, must transfer to other radio services in which they are eligible.

June 18-21—Annual meeting of National Committee for Utilities Radio. Jung Hotel, New Orleans, La.

July 16-19—Annual Conference of Forestry, Conservation Communications Association. Executive Inn, Dallas.

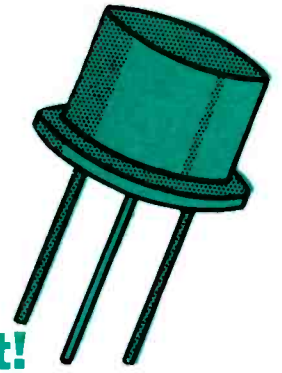
Aug. 13-16—National APCO Conference. Leamington Hotel, Minneapolis, Minn.

Oct. 31—Mobile radio users must meet full narrow band technical standards of FCC.

Nov. 1—Fire radio system must move off frequencies allocated to the police radio service.



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**CATV WEATHERBOARD** Complete direct view system. Local temperature, humidity, barometric pressure, rainfall, wind speed and direction and time — all readable at once in large bold print. Revolving band of advertising or other messages gives motion to screen. Complete system is electronic with remote readings on Edgewise meters, making possible large print in condensed area. .... about \$750.00



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Pioneer Manufacturers of  
Transistorized CATV Systems

Thoughts on Ghosts  
(Continued from Page 34)

3. If the trunkline must be tapped it must not be done in the first 1000 feet for BAL-14F, PD-375 or equivalent type cables. (250 ft. for RG-4.)
4. Where a sub-trunk line is required to be fed from the main trunkline, its tap-off should be a symmetrical or asymmetrical splitter.

The above criteria, if fully observed in system layout, will result in a system which is free from line ghosts.

The likelihood that several line ghosts caused by discontinuities in the system, which in themselves are invisible, will add up and cause a visible ghost is quite remote. Such a case would require that all the discontinuities producing ghosts occur at exactly the same distance from the input or output or the lengths of trunkline connecting each amplifier in the system.

However, if a picture is transmitted which is essentially say, a black rectangle, then if there are a number of invisible ghosts in the system these could add up and produce a visible ghost even if the preceding four criteria are followed.

This type of ghost would tend to produce a smear and can only be eliminated if the system is laid out in such a manner that the addition of all the voltages produced by the TOTAL number of reflections in the system is 25 db below the main signal.

In other words, if a system has two discontinuities producing "smear" ghosts which are 30 db down, the "smear" ghost at the end of the system would be only 27 db down from the main signal, or 3 db worse than just one reflection. Two more reflections or 30 db would increase the ghost content of the picture by a further 3 db, four more by yet another 3 db and so on, implying that each doubling of the number of reflections increases the ghost content by a further 3 db.

Therefore as in any other engineering project, a compromise must be reached, and it is suggested that if the four criteria mentioned previously are observed, a very good compromise is obtained, giving a picture at the end of the system which is completely free from spurious outlines but which may under certain conditions have somewhat less contrast than the original picture.

**COMMUNITY ANTENNA  
TELEVISION SYSTEM AIDS LOCAL  
AGENCIES DURING FLOOD**

The Cumberland Television Corporation, recently under fire from city officials who are attempting to impose a franchise (not necessarily to Cumberland TV Corporation), had a golden opportunity to show just how important a community antenna television system can be. During the flooding of the Appalachian Regions, the Cumberland River which originates near Cumberland, Kentucky, began to show signs of creating a possible flood at approximately 8:00 P.M. on Monday, March 11, 1963.

Officials of the system felt that a vigil should be conducted to see if the water level rise was likely to be sufficient to create a flood condition. In conjunction with their own vigil the system officials telecast the following warning via CCTV: Before Retiring — Check River Increase in Your Area. It wasn't long after this, about 10:00 P.M., when the situation did become serious. Bill Ridsen, General Manager of the system, after making things secure at his home which is situated on the Cumberland River and checking into the well being of others in the area, re-opened the CCTV studios and began telecasting over the CCTV channel. Ridsen, who heads the Warning Division of the Local Civil Defense organization, made his office available as headquarters

**MANAGER WANTED**  
For Large CATV going in soon.  
Must be experienced. Good deal.  
Write background, etc. to Box 39  
Video-Communication Journal  
P.O. Box 1557  
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for the Fire Department, Rescue Squad, Police Department.

Closed-Circuit television quickly became the media for dissemination of information regarding the condition of the Cumberland River. When reports were given, these included the latest river gauge readings and the relaying of pertinent messages. Men who worked in the U.S. Steel Mines and who were unable to get home at midnight as the shift ended, due to flooded road conditions, were reported on by U.S. Steel Police in communiques to the message center and as a result the immediate families were spared the worry and concern of their not arriving home.

Extensive use was also made of the corporation's industrial two-way radio which tied them in with the Rescue Squad and other individuals. The cooperation of home owners who were making individual riverside checks and calling in the information possibly saved many homes and most certainly reduced the possibilities of loss of life. In any event, the overall cooperation was tremendous and illustrates what many can do when they're all pulling together.

**NEW... from Benco**  
**PACEMAKER JUNIOR**

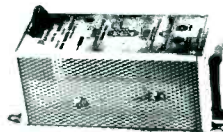
An entirely new and economical broadband amplifier with a gain of 10 DB on the high band and low band, and 8 DB on the F.M. band. This amplifier has 75 ohms input and output and is ideal for small apartment and motel installations.



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- ★ ULTRA-STABLE CIRCUITRY

**PLUS PACEMAKER II**



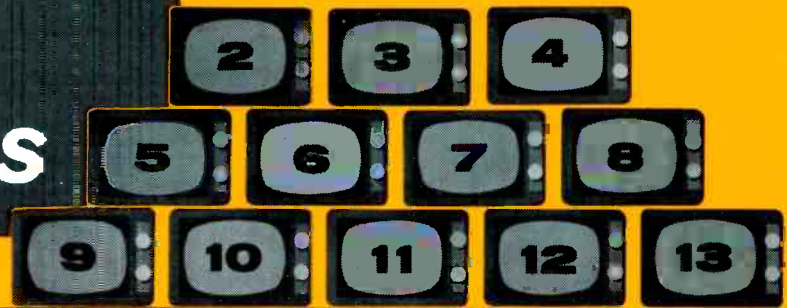
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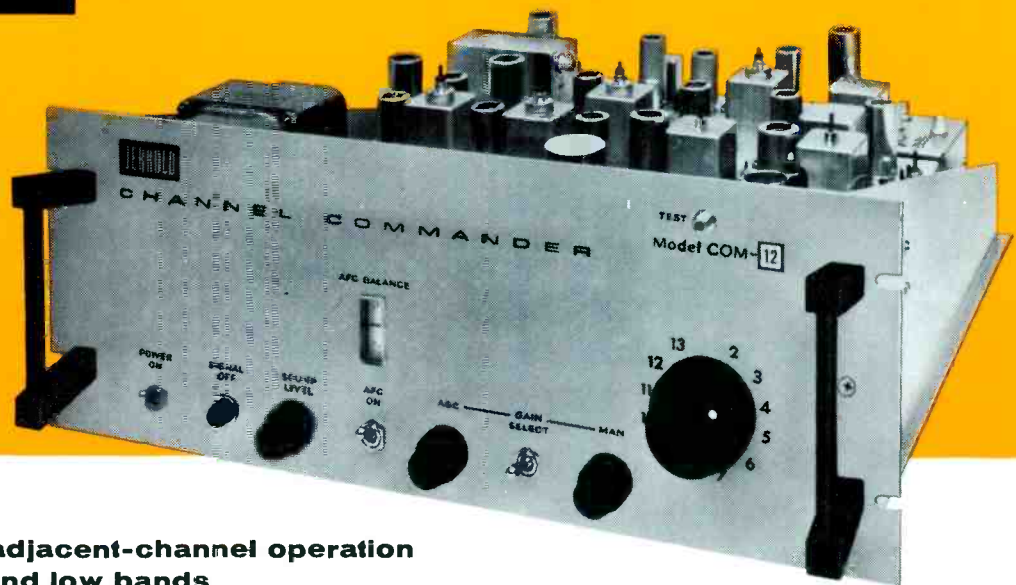
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**12**  
**CHANNELS**



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In conjunction with Jerrold microwave and all-band-system equipment, the Channel Commander gives you command of the entire VHF band, lets you offer CATV subscribers the widest choice of entertainment possible over their present TV sets.

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The top quality of SKL CATV equipment lies only partly in the selection of its premium components, the painstaking care in its assembly and the rigid demands of its high test standards. Such quality really starts with the unique engineering concepts applied in the equipment's design and ends with the unparalleled reliability of its performance.

This performance has a long record. It began more than a decade ago with SKL's introduction of the wide band distributed amplifier system for CATV. It has maintained SKL's unquestioned leadership in all-channel systems. Today, it puts SKL years ahead in the wide band field.

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