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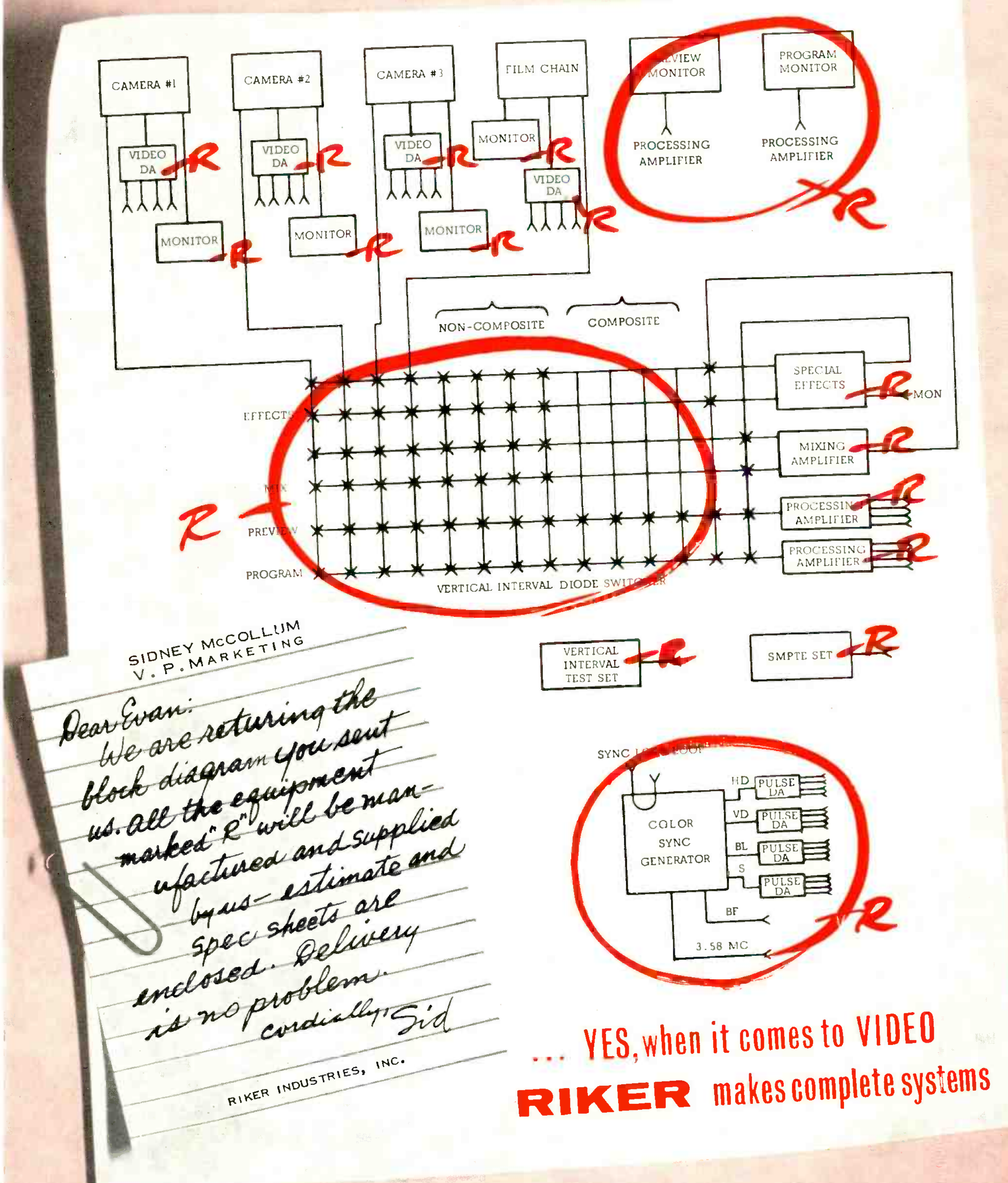
Broadcast Engineering

the technical journal of the broadcast-communications industry



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the technical journal of the broadcast-communications industry

®Broadcast Engineering

Volume 7, No. 6 **June, 1965**

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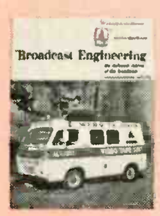
The interesting mobile unit pictured on our cover is the topic of discussion in the feature article beginning on page 12. Planning and execution both exhibit imaginative use of standard items to provide a specialized service.



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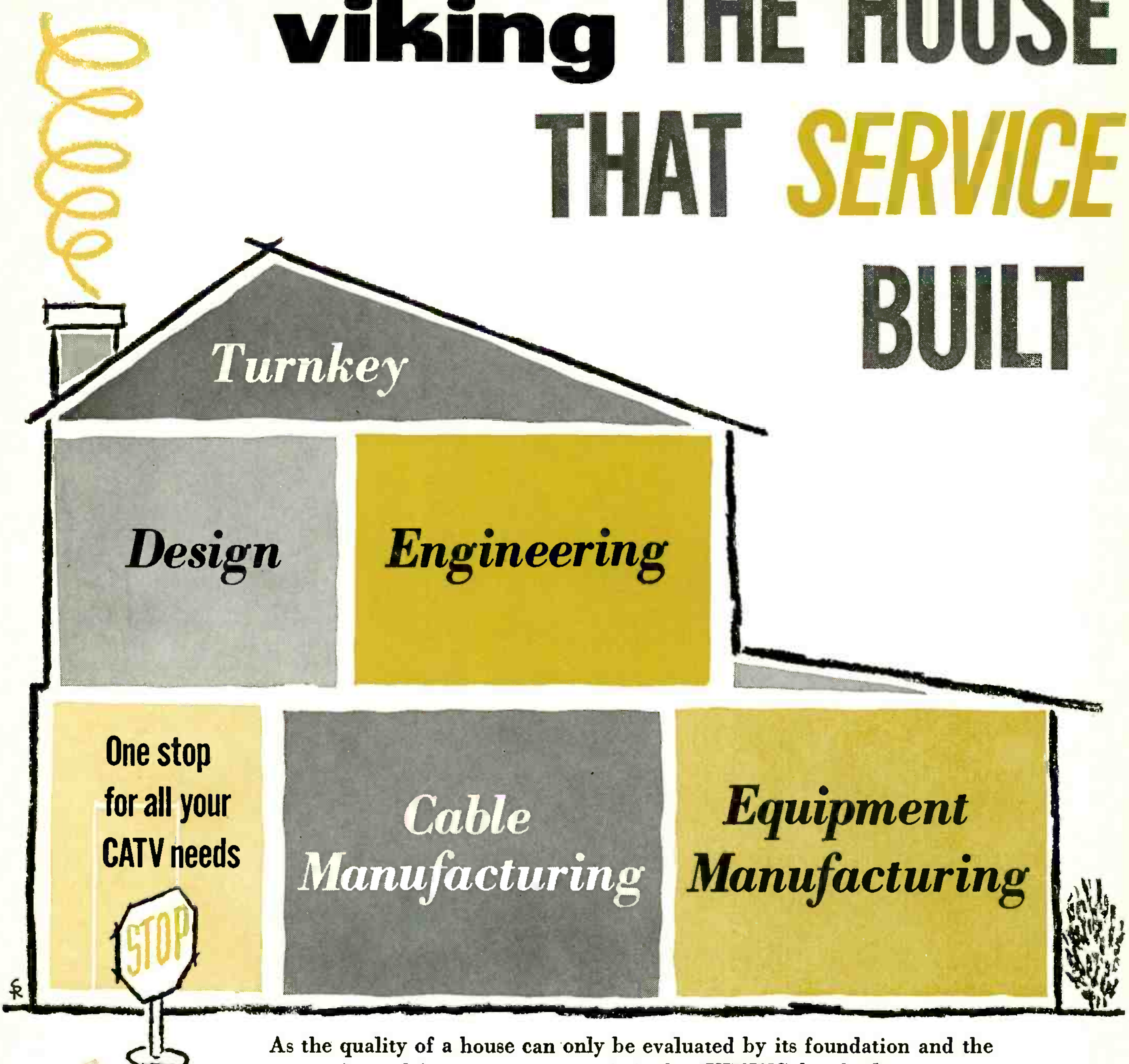

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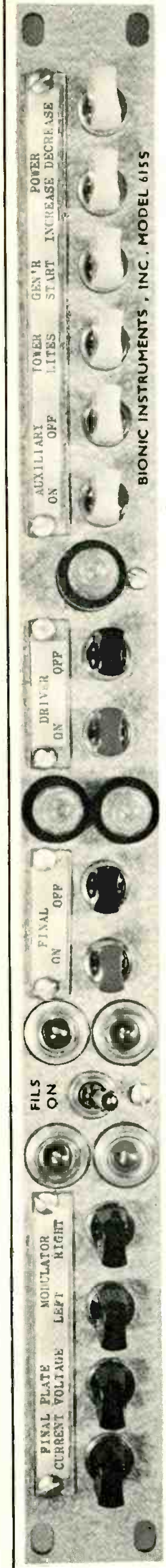

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LETTERS
to the editor

DEAR EDITOR:

Just an additional note regarding my article "Part 73 and the Broadcaster," which appeared in April BROADCAST ENGINEERING. A recent FCC inspection of a radio station in my area has disclosed an item of interest; i.e., if your station is in the snow belt, be sure to make tracks to the tower base huts after every snow storm! The station in question ran into an embarrassing situation by indicating on the log that they were reading the base currents nightly . . . the trouble was, they couldn't explain to the inspector how the engineer on duty could get to the doghouses without leaving footprints in the snow. Two citations resulted from this misrepresentation.

LAWRENCE L. PRADO, JR.
Rochester, New Hampshire

This example only serves to illustrate once again the importance of assuring compliance with established FCC Rules and Regulations. Regardless of what member of the staff is responsible directly for a citation resulting from failure to comply, it is the Chief Engineer upon whom the final responsibility must fall. He must establish a firm set of procedures, and then, equally importantly, he must see that the entire staff is aware that each task must be performed at the proper intervals and in the manner prescribed. The Chief must be prepared to suffer any penalty or criticism resulting from his failure to fulfill his obligation. —Ed.

DEAR EDITOR:

There is a slight mixup in paragraph six of my article "A Tower Emergency," which appears in April BROADCAST ENGINEERING, that should be corrected. Because of the transposed line, the paragraph is nearly unintelligible and may even be misleading. The copy should read:

"Of course the main idea was to get back on the air as soon as possible. It was decided to drive the remaining tower with the 10-kw transmitter so as not to risk putting the full voltage of the 50-kw output across the antenna tuning coils at the base of the tower."

I hope you will be able to make the correction in the next issue.

LEN SPENCER
CKAC, Montreal, Quebec

This is an example of the sort of gremlin that manages to plague all editors from time to time, Len. Through some mystical quirk, they never show up until the copy has appeared in its final form and it is too late to make corrections. We hope our readers were able to decipher the typesetter's code. —Ed.

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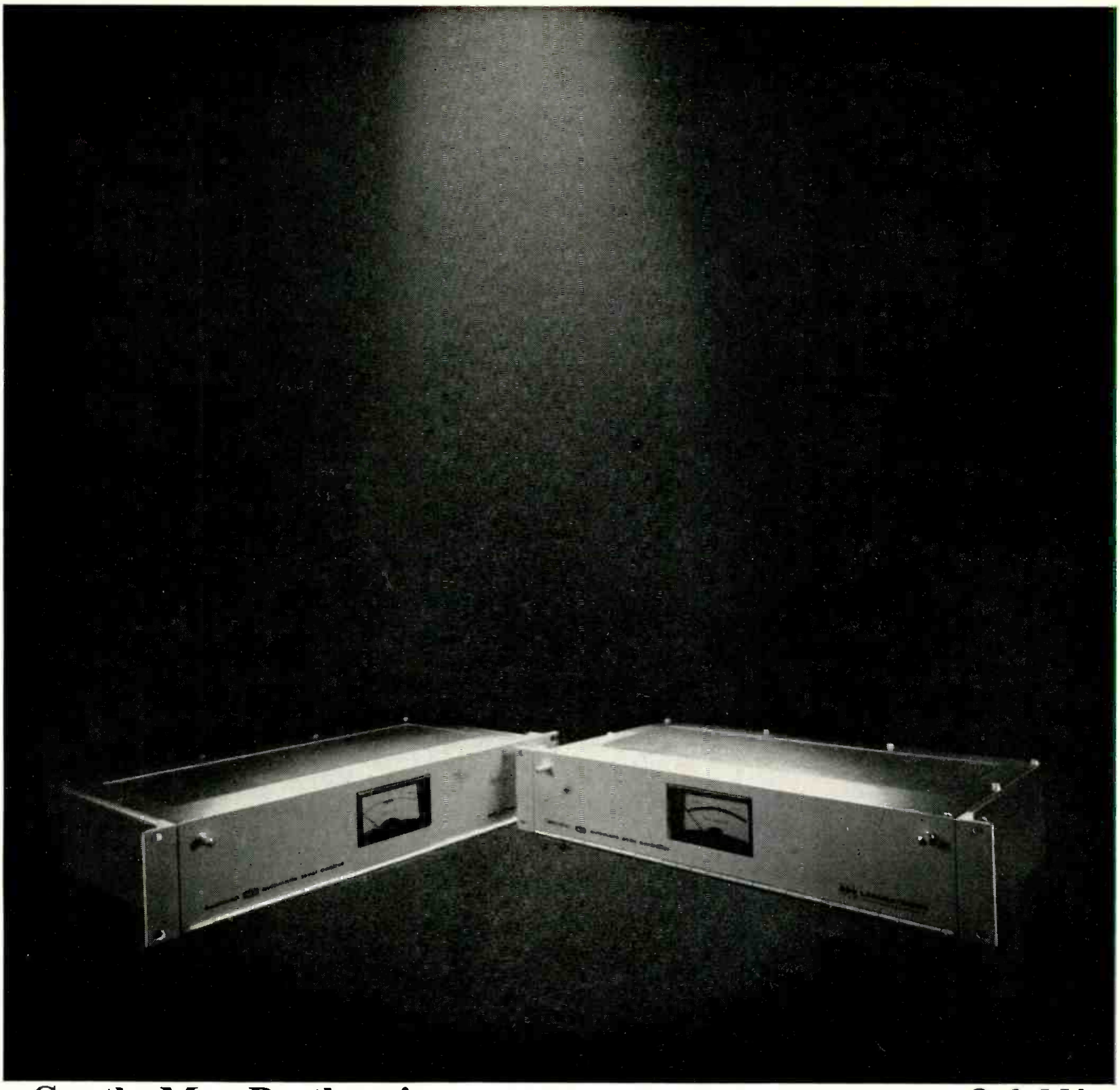

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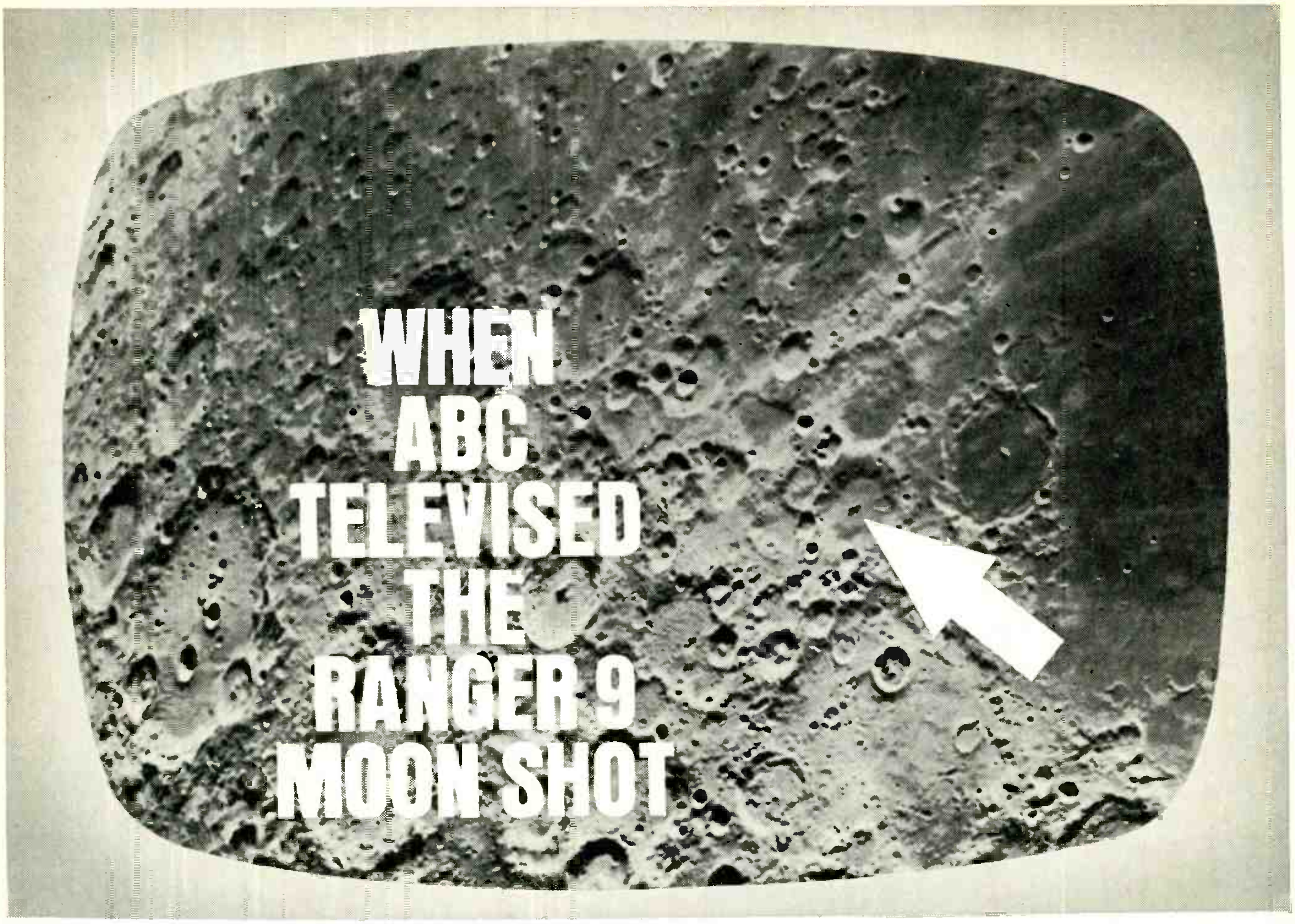

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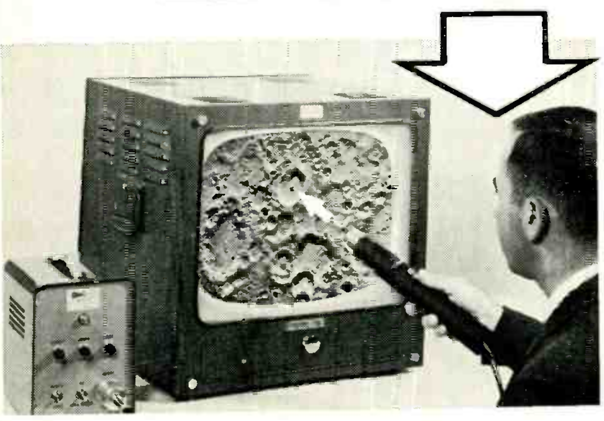

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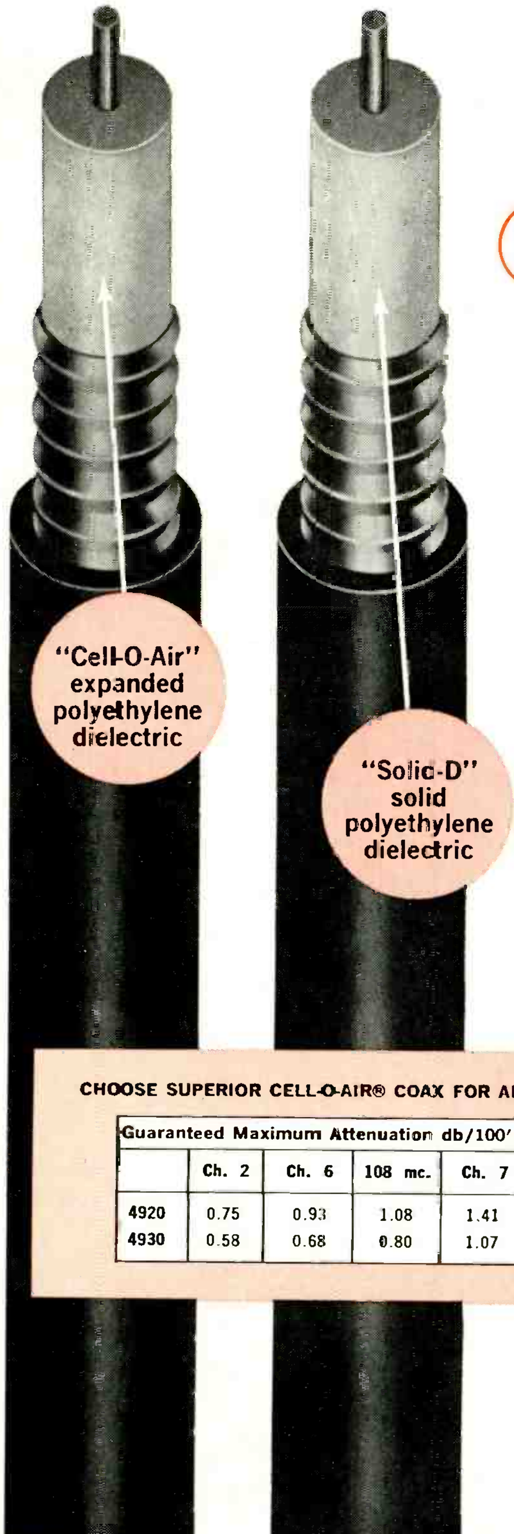

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AUTOMATION AT THE TRANSMITTER SITE

by Thomas R. Haskett, Regional Editor Central Area, Cincinnati, Ohio — General comment on equipment and techniques used to provide remote control and automatic logging of transmitters located away from the studio.

In broadcasting's early days, transmitters were more often than not unstable, temperamental devices. Crystal-controlled oscillators were practically unheard of, and power amplifiers had no overvoltage or overcurrent relays to protect power tubes and other high-level components. The constant attention of a licensed operator was required to keep the transmitter on the air and functioning correctly.

Today, things are very different. Transmitters are quite stable and employ crystal control, protective relays, and broad tuning. Most are conservatively rated. Even AM stations feeding complex directional arrays can be engineered to attain acceptable stability. For these reasons, automation at the transmitter site has become a useful reality. It simply is no longer sensible or economically feasible to have an operator record meter readings every half hour when the readings seldom vary throughout a full day's operation. Personnel can be employed more profitably doing something else, provided an engineer is on immediate call if the rig **does** exhibit difficulties.

Differences Between Remote Control and Auto-Logging

In many instances, the best location for a transmitter is not necessarily suitable for studio operation. For years, FCC rules required a man on duty at the transmitter. With increased transmitter stability and subsequent rule changes, however, more and more stations go remote and move the transmitter man to the studio. There, he can handle control-board operation, do production taping, and perform many other engineering duties, while he remains on immediate call if the transmitter gets into trouble.

Remote Control

The concept that permits this method of operation is known as **remote control;** a simple system is outlined in Fig. 1. There are two basic types.

The land-line system illustrated employs telephone lines and uses straight-DC loops. Measurements are made by converting the pertinent parameters (plate voltage, antenna current, etc.) to small DC voltages, which are then applied to the line. A microammeter at the studio is used to read the value and is regularly calibrated against a mercury-battery source to insure accuracy. Selection of the various parameters is accomplished by operating a telephone-type dial at the studio, which transmits pulses along the control line to a stepping switch at the transmitter end. The stepping switch selects the parameter to be sampled.

The other type of remote-control system utilizes a studio-to-transmitter link (STL). Basic functions are the same as for the land-line system, but a pair of transmitters and receivers, operating at microwave frequencies, replaces the land-based lines. FM stations need only a single transmitter and receiver, since they can use an SCA subcarrier to provide a link to meter the transmitter parameters.

Turning the transmitter on and off and raising and lowering the plate voltage are also accomplished by remote control. A separate deck on the stepping switch activated from the studio performs these functions. An operate switch at the studio applies a fixed DC voltage to the control line. This fixed voltage triggers a relay which then turns on the transmitter. The power-control rheostat in the plate supply is varied by using a small DC motor to turn the rheostat shaft. When an STL is used for remote control, frequency discrimination is normally employed for control purposes.

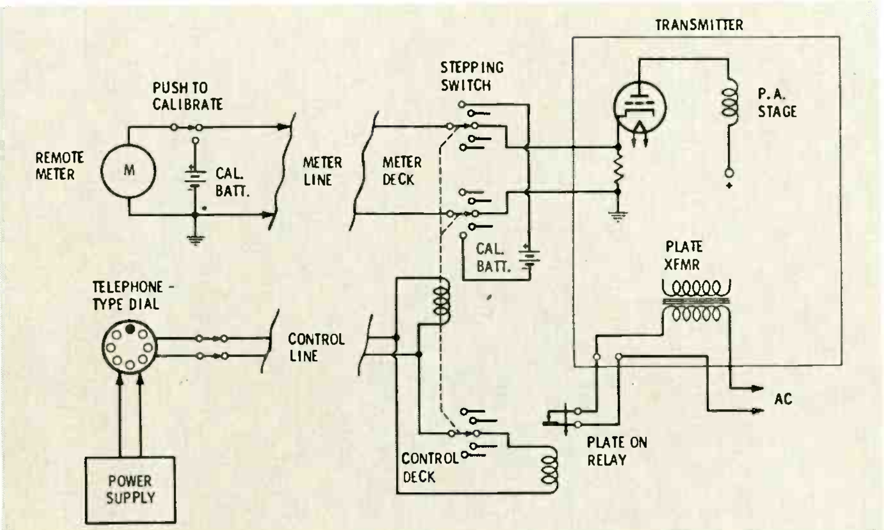

Fig. 1. Basic remote-controlled circuitry using land-based lines and DC signals.

Automatic Logging

Automatic metering techniques led quite naturally to the develop-

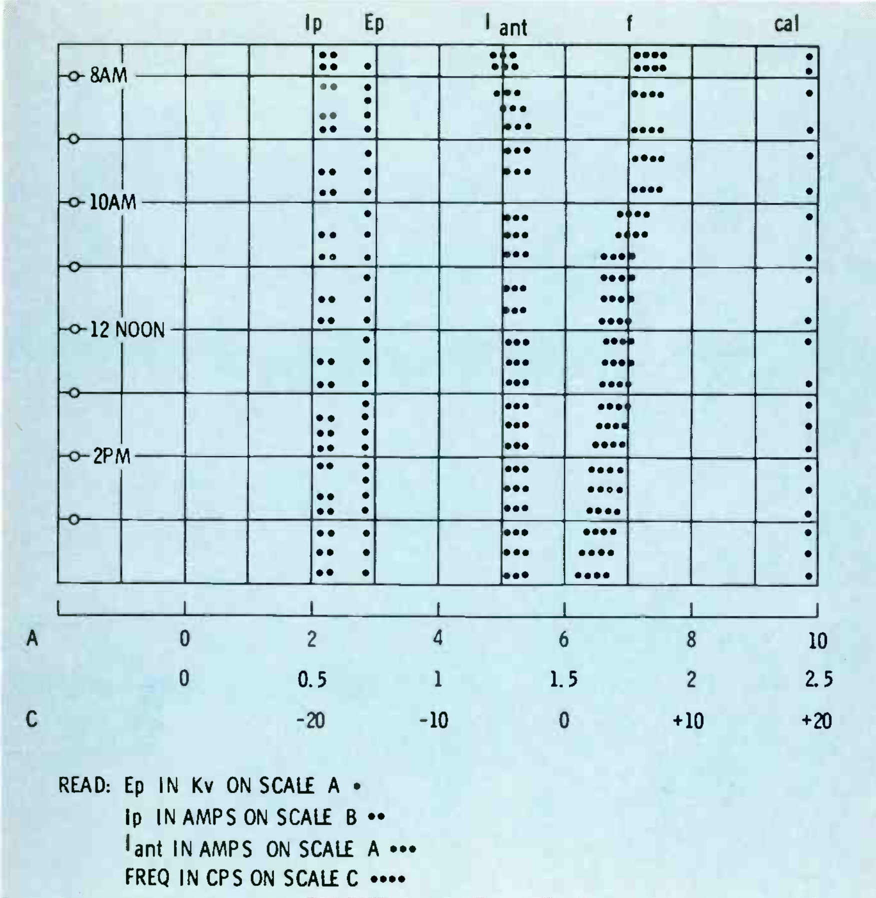

Fig. 2. Example showing how data is recorded on chart of automatic remote logger.

ment of automatic transmitter-logging equipment. The usual arrangement employs a strip-chart recorder on which a stylus records coded information corresponding to various operating parameters — plate voltage, antenna current, etc. Fig. 2 illustrates a chart representing features of various systems in use today. Where the transmitter and its associated logging equipment are at the same location, normal practice is to sample and record all parameters continuously. Where logging is done by remote control, the logger samples each parameter in sequence, utilizing the same remote-control principles as outlined earlier. The illustration shows a remote-control logger, which uses various combinations of dots to identify the particular values being sampled (also see Fig. 3).

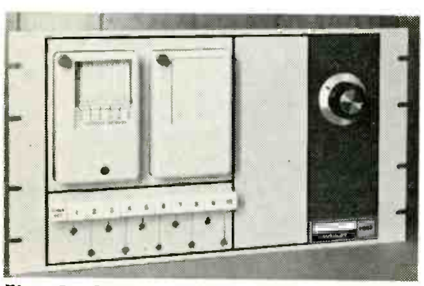

Fig. 3. Buttons select each parameter.

Sampling is done on a continuous rotational basis, with calibrating signals being interspersed between the values being monitored. The calibrated reference signal allows the operator to determine whether the transmitter values have really shifted or the trouble is actually in the line or studio equipment. If preset limits for the various parameters are exceeded, a visual/aural alarm is activated to summon the operator. Fig. 4 shows a recorder using meter/switch assemblies to provide sensing for over or under power and/or frequency.

The operator must periodically inspect the logging equipment to be sure it is operating properly. He must authenticate the strip charts by taking actual meter readings several times during the day. The equipment must also be calibrated weekly against the regular meters. Fig. 5 shows typical remote-control equipment with the transmitter bay (right) and studio recorder (left) shown in rack cabinets.

Fail-Safe Concept

Regardless of whether the term "fail-safe" is applied to remote-control or auto-logging equipment, the basic meaning is the same: The transmitter is energized through a relay which is held in the ON position by a current from the control gear. Should the control equipment fail for any reason, or should the remote line open, the current to the transmitter ON relay also fails, completely shutting down the transmitter. Thus, if anything goes wrong, the failure is "safe" — the transmitter goes off the air.

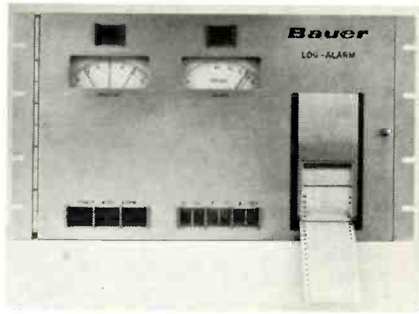

Fig. 4. Auto alarm gives chart record.

Applicable FCC Rules

Remote control is authorized by Sections 73.66, 73.67, and 73.68 for AM; by 73.274 and 73.275 for FM; and by 73.676 for TV. Nondirectional AM stations of 10 kw or less, all FM stations, and UHF TV stations may be remotely controlled as a matter of routine. Directional AM stations, or those over 10 kw, may use remote-control devices after a period of study to assure that the array and other ancillary equipment are stable. At the present time, VHF TV stations may not be remotely controlled, although the Commission is presently being asked to consider a comprehensive NAB proposal (dated 2/24/65) to pro-

• Please turn to page 32

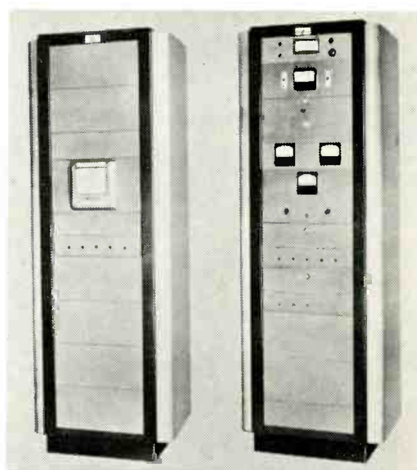

Fig. 5. R-C equipment in racked form.

A COMPACT UNIT FOR MOBILE VIDEO TAPE RECORDING

*by **Richard L. Kline,** Chief Engineer WFBG TV, Altoona, Pa.* — Lightweight transistorized equipment assembled into a compact and highly mobile unit for remote news coverage, special events, and commercial taping on location.

Construction of the compact video tape television-remote truck described here should interest many special-events directors, managers, and chief engineers of stations.

The recently constructed unit enables WFBG to video tape remote broadcasts, news events, and commercial spots where the action occurs, using minimum manpower and equipment. The mobile production unit also provides a means of immediate playback to determine whether additional takes are necessary. The basic block diagram of the system is shown in Fig. 1.

Equipment Selection

Only the development of transistorized broadcast equipment enables the engineer to use the totally independent-and-mobile recording concept. Low-power-demand recorders, cameras, and monitors have provided a great reduction in AC power consumption. Typical of this equipment is the Ampex Model 660 transistorized video-tape recorder, which enables WFBG engineers to reduce the mobile video-tape remote truck from the familiar and massive van dimensions to a highly compact package.

Vehicle

The basic vehicle had to be small, yet of sufficient size and power to accommodate and transport the necessary equipment, even over rough terrain. Several van-type vehicles were examined by WFBG's engineering department, and the Chevrolet Model G1205 ½-ton panel truck was selected.

The body of the van was altered by a local fabricating company according to specifications developed for the special application. A roof deck of cleated aluminum plate completely covers the vehicle's roof except for a 3′-square hatch. The hatch accommodates a revolving turret with an elevated camera mount. The cameraman stands on a platform above the motor housing, (see Fig. 2); this gives him a good vantage point for shooting over crowds and general obstacles. The inside-the-van mount is a definite advantage when the script or action calls for shots while the van is in motion.

A large battery box, which houses the two batteries used to provide 24 volts DC for the inverter, was constructed on the right side of the vehicle to balance the weight load (the VTR and the equipment bench are on the left). Batteries are accessible from the outside of the van only, and the entire battery compartment is isolated from the interior of the van, thus eliminating fumes inside the vehicle body. Service to the batteries is achieved by means of a steel frame which folds out allowing the batteries to slide out of the box on rails. They are then fully exposed for servicing (see Fig. 3).

The left side of the vehicle contains a terminal box (Fig. 4) which houses 250′ of interconnecting cable to distribute the AC power, video for camera operation, and intercom communication for the operator. The connector panel contains the

Fig. 2. Operator stands on engine cover.

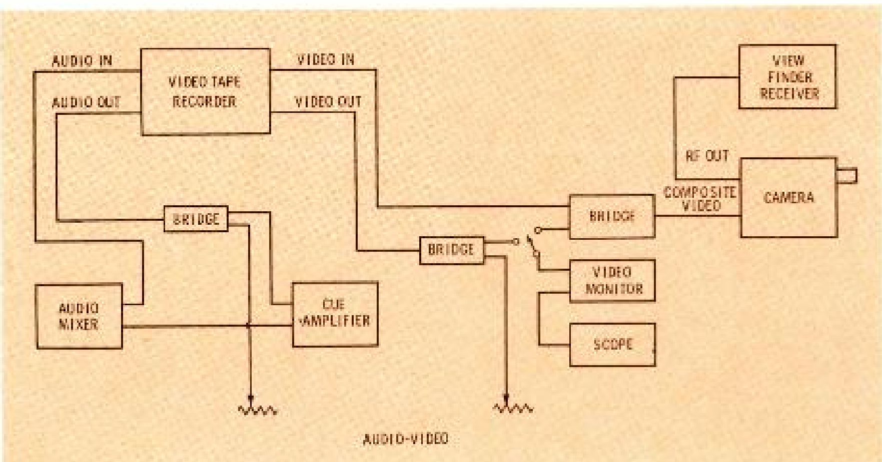

Fig. 1. Unit uses transistorized gear throughout to obtain low power consumption.

Fig. 3. Batteries have separate box.

following connections:

- External AC power input.
- External or internal AC power output.
- 2 audio outputs.
- 2 high-level audio inputs.
- 4 microphone inputs.
- 2 intercom connections.
- 4 coax connections (video).

AC Power

AC power for the equipment can be supplied either by the built-in inverter system or by external means. A double-pole, double-throw switch feeds all AC outlets in the van. One position of the switch feeds the AC outlets from the external power source, and the second position feeds them from the internal power source.

DC-to-AC Inverter

Modifying the vehicle's existing alternator mount and adding new pulleys permitted installation of a Leece-Neville Model 2032A 24-volt alternator in addition to the existing unit. The second alternator is used for charging the two 12-volt 205AH batteries. (During cold-weather operation, the added alternator placed an extremely heavy load on the engine of the vehicle. To remove this load when the motor was cold, a switch was installed to disconnect the alternator field voltage.) The two 12-volt batteries supply 24 volts DC to the input of a Power Sources Sineverter Model 24A102 (see Fig. 5). The Sineverter output supplies a well-regulated 1000 VA, 110-volt, 60-cps sine wave. The inverter is also capable of frequency-lock operation using an external sync voltage, but output stability for most purposes to date has been adequate without external sync. With all of the equipment operating, the maximum AC load is 5.2 amps. The AC-power setup is diagramed in Fig. 6.

Video

The camera (to be used on the turret mount or remotely located from the mobile unit) had to be small, portable, completely self contained, and have very low power demands. The transistorized Sylvania Model VRF 800 (with an internal EIA synchronizing generator) was modified to use an RCA 8507 high-resolution, high-sensitivity vidicon. Since the camera had no viewfinder — but did supply an RF output plus a normal 1-volt composite video output — a small transistorized TV receiver was mounted on top of the camera for use as a viewfinder. The lens on the camera is a manually operated Angenieux 10-to-1 zoom lens with a maximum aperture of f1.9.

To achieve fast setup, the camera is mounted on a pan/tilt head in the roof-hatch assembly. When the unit arrives at a scene, it is only a matter of minutes before picture

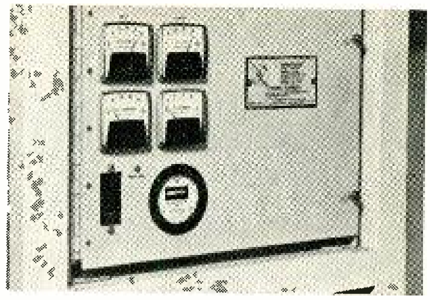

Fig. 5. Batteries power AC inverter.

and sound are ready for recording.

For local monitoring of the video information, a second, larger, portable TV receiver was mounted on the bench inside the van.. A transistorized Tektronix Model 321 oscilloscope is used for waveform monitoring and also for servicing the equipment.

Audio

To provide audio facilities, an RCA BN6C transistorized mixing amplifier is used as a four-channel mixer, and an RCA BA84 transistorized cueing amplifier provides ten channels of audio for all monitoring facilities. For additional versatility, two-way communication equipment enables the mobile crew

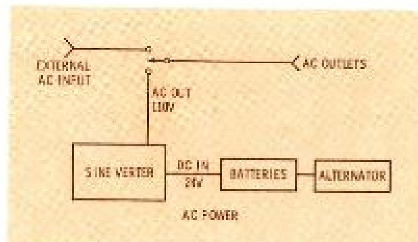

Fig. 6. Switch provides two AC sources.

to keep in constant contact with the studios for up-to-the-minute audio reports when the unit is used for news coverage.

Conclusion

A straightforward approach to compact mobile recording, using lightweight and reliable transistorized equipment, has resulted in a useful unit for diverse assignments. Similar or identical equipment installations may solve other stations' remote production problems as well. Imaginative engineering concepts provide additional tools for increased revenue and more flexible programming. Perhaps this unit from WFBG-TV will supply some answers for others. ▲

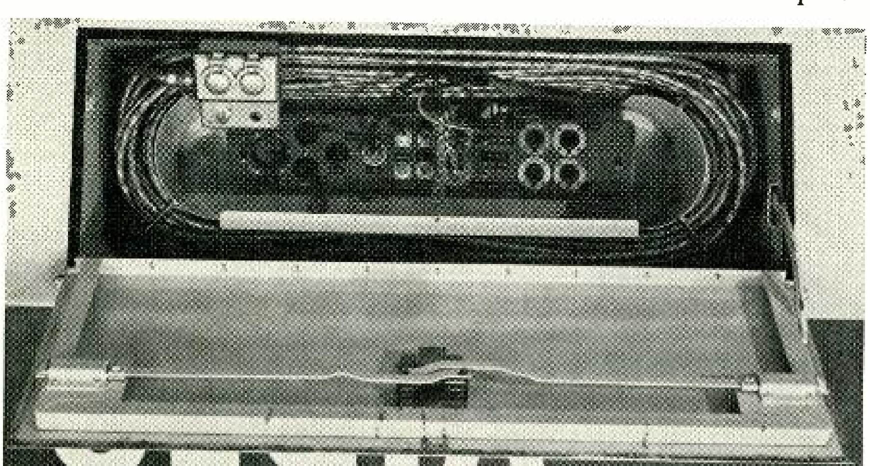

Fig. 4. Terminal on left side of van contains power, video, and audio cables.

BUILT-IN MULTIMETER FOR VOLTAGE CHECKS

by *Hal Houston,* Chief Engineer, KSUE, Susanville, California—A little "Quickie" aid to assist in normal maintenance and troubleshooting procedures.

Table 1. List of Required Parts

Quantity	Part
13	10 megohm resistor, 1 watt
1	two-section rotary wafer switch
1	multiple contact (nine or more) plug
2	eight-point terminal boards
1	0-50 ma meter
1	aluminum panel (6" x 8")
1	bakelite panel (optional)
1	meter cabinet
1	switch knob

To facilitate troubleshooting procedures and provide a means for testing the low-voltage and bias rectifiers and their associated circuits, this unit has been incorporated into the transmitter at KSUE. A similar installation could be adapted to any similar transmitter with little modification.

When in use, the 0-50 ma meter and switch unit are connected to the transmitter by means of a nine-wire cable from the resistor panel. In our setup, the panel is mounted in the transmitter cabinet, with the interconnecting leads running to the various test positions.

This method of reading voltages provides a means for checking the low-voltage and modulator-bias circuits while the high-voltage circuit is turned off. And, as employed at KSUE, the No. 8 position provides a measurement of the power-amplifier screen voltage with the high voltage on. Using the switching method shown, the negative bias voltages can be read directly just as are the positive voltages. By noting the various voltage readings obtained when the transmitter is operating properly, periodic checks may indicate possible future trouble or help to locate existing circuit problems.

A two-section rotary wafer switch with 14 contacts was used in this instance, simply because it was available; eight or nine contacts are all that are required in most cases.

Table 2. Voltage Ranges

(All ranges are 20,000 ohms/volt)

Position	Range
1	0-250 volts (−)
2	0-500 volts (−)
3	0-250 volts
4	0-500 volts
5	0-500 volts
6	0-1000 volts
7	0-1000 volts
8	0-1000 volts

While the multimeter described here is simple to construct, it has proved to be valuable for quick checks. It also has provided (through its simplicity) an incentive to conduct more-frequent-than-normal voltage checks. ▲

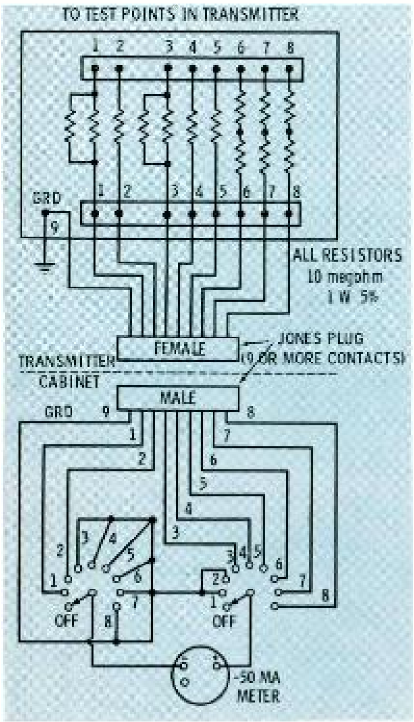

Fig. 1. Resistor board and switch/meter.

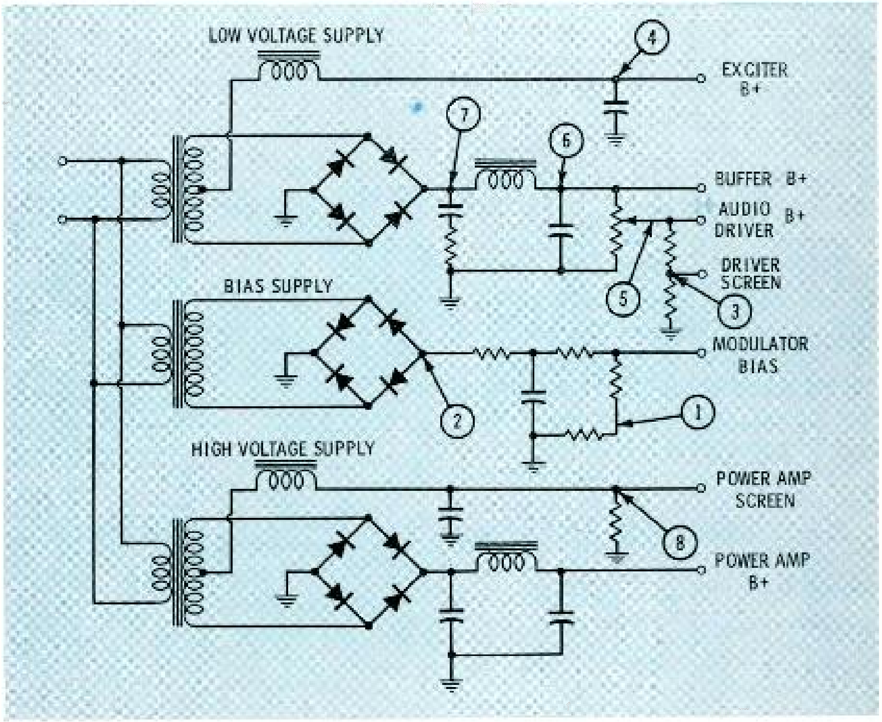

Fig. 2. Test points are selected to provide most useful information quickly.

SERVICING TAPE-RECORDER ELECTRONICS

by Larry J. Gardner, Chief Engineer, WCKY, Cincinnati, Ohio — Practical and thorough discussion of the methods used to keep tape equipment in "like-new" condition.

Modern professional tape recorders are capable of many years of excellent service, but all too often their recording quality starts to deteriorate shortly after they are purchased, as components begin to age. Fortunately, all that is required to keep them in top-notch condition is a thorough understanding of proper alignment techniques, care with regard to the type of tape used, and a little work.

Many problems with recorders are the direct result of something wrong in the electro-mechanical recording and playback processes. We will therefore concern ourselves with making sure the tape heads and associated circuit elements are properly aligned — enabling the instrument to record and reproduce to the highest broadcast standards.

Head Alignment and Equalization Adjustments

When a recorder "doesn't sound right," the obvious step is to check head alignment. Most of the commercially available alignment tapes are suitable for this purpose. Before adjusting the playback head, however, be sure to demagnetize all heads thoroughly. Also, be sure the tape is properly centered over the head surface and is riding flat on the head. Some heads develop a ridge on one edge because they are not properly centered on the tape; generally, this will not impair playback response, provided the tape is not allowed to ride up on the ridge.

When making the adjustment, it's a good idea to rock the head alignment screw a turn or so on each side of the indicated peak output, because some heads show small secondary peaks on each side of the major peak. The correct setting will produce an output level at least

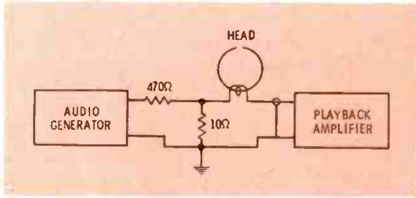

Fig. 1. Audio gen checks head response.

10 db greater than any minor peak. With machines that have a REEL SIZE switch, it is helpful to set this for LARGE to increase tape tension. This makes the output more nearly constant, due to improved head-to-tape contact. On two-track stereo machines, it is sometimes necessary to adjust the head for a compromise setting which will produce maximum output on both channels. The proper setting for such machines is midway between the maximum points for the two channels, so that any deficiency in response may be corrected by adjusting the equalization controls.

Playback Equalization

To adjust the playback equalization, use a standard tape, such as the Ampex No. 5563. With most machines, it is necessary to adjust only the playback-equalization control to secure equal output at the 250-cps and 10-kc reference frequencies. If adjusting the control in this manner doesn't produce the desired response, something is wrong with the head, the equalization network, or the coupling circuits in the amplifier. If the response is poor at the low end (50 and 100 cps), check the coupling capacitors or grid resistors and the capacitors in the equalizing network. If it's not possible to secure equal output at 250 cps and 10 kc, recheck the head alignment. If the output level is higher at 10 kc than at 250 cps, the trouble is probably in the equalizing network. In case the 250-cps output is higher, look more closely at the playback head.

Heads Checked by Substitution

The simplest way to check a head is by substitution. If a similar machine is available, connect its head to the amplifier of the machine in question. If overall response is improved to the required figure with

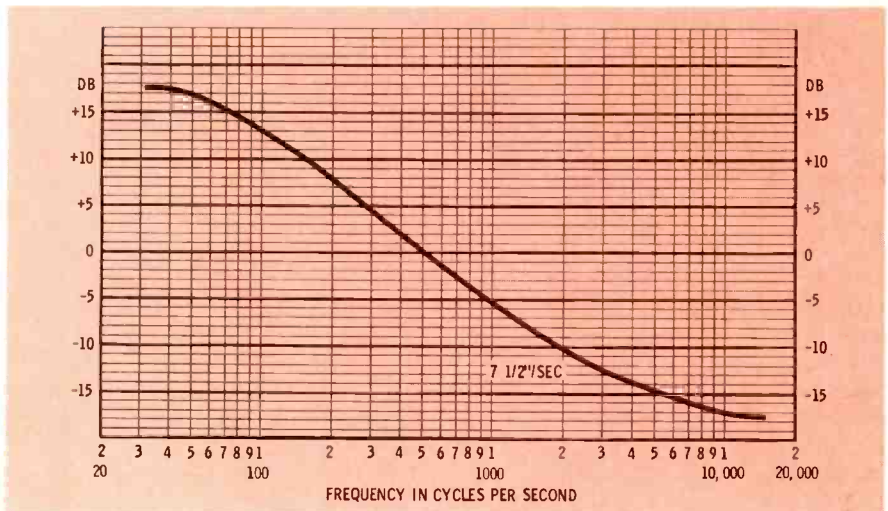

Fig. 2. Curve shows typical frequency response of tape-recorder playback amplifier.

the substituted head, prepare to face the manager with a bill for a new head. If no similar machine is available, system response may be checked by putting a signal from an audio generator into the playback amplifier, as shown in Fig. 1, and measuring the response curve of the amplifier. It should correspond, within about 2 db, to the curve shown in Fig. 2 for 7½ or 15 ips. (For other speeds, consult the recorder instruction book.) An acceptable response obtained in this manner will indicate the head is at fault when playback response has deteriorated. If the response obtained is incorrect, check the values of the resistors and capacitors in the first two stages of the playback preamp, including the equalizing network. It is important to have the head in series with the signal source, because its inductance and resistance are effectively in series with the input in normal operation. With stereo recorders, the response often shows a rise of about 2 db at 50 cycles when checked with a full-track alignment tape. This is normal and is due to "edge effect" causing some pick-up from the recorded signal which exists between the tracks normally scanned by the head. To be absolutely sure about the low-end response on stereo machines, use the audio-generator method described above or a stereo test tape.

Get the response as close to flat as possible, using the test tape, and record the readings in your maintenance log so that you will have an accurate reference for adjusting the record amplifier. Also, set the playback-level control to coincide with the normal level of the test tape so that you can adjust the record section for proper level.

Record-Head Adjustment

Record-section adjustments are similar to those performed during playback except that the reference is the playback level instead of the test tape. The first step is to align the record head, an adjustment which should be made at the highest operating speed. For a test signal, use an audio generator connected to the line input at 15 kc for 15 ips, 10 kc for 7½ ips, or 5 kc for 3¾ ips. Set the input level for a reading of about —10 on the VU meter, then adjust the record-head alignment screw for maximum output as observed on the playback amplifier level meter. (If the machine uses the same head for record and playback, the head will be properly aligned for recording if it is aligned for playback.) Be sure, as during playback adjustments, that it is properly positioned and centered on the tape.

Evaluation of the Bias Signal

The most important part of the alignment procedure in the record mode is the bias level. Before adjusting the bias, however, two preliminary checks should be made—especially if distortion or high noise level has been a problem. First, check the bias frequency by connecting the vertical input of an oscilloscope to the record head and the horizontal input to the audio generator. The bias frequency can be determined by adjusting the oscillator to produce a stationary circular or eliptical pattern. The bias frequency is then the same as the generator frequency. A quicker, but much less precise, method requires running a tape through the machine in record mode with the output tube of the recording amplifier removed. Then a whistle as the tape is moved back and forth very slowly by hand over the heads (playback volume set very high) indicates that the bias frequency may be too low. With some older machines, it is normal for some bias signal to be left on the tape at 15 ips; if you do hear the whistle, however, measure the bias frequency just to be sure. Most machines employ bias frequencies in the range between 50 and 100 kc—check your instruction manual for the correct frequency. When the frequency is too low, readjustment is necessary. Some machines have a bias-frequency adjustment (usually a slug-tuned coil); others determine the bias frequency only with fixed components. If there is no control or if the control won't bring the frequency to normal, check for bad capacitors or grid resistors in the bias-oscillator circuit. If the bias frequency is too high, it will be impossible to adjust for the optimum bias level, as will be seen later.

Be Choosy About Tape

Before you adjust the bias level, decide what **brand** and **type** of tape you are going to use and stick with it. You may discover significant differences in frequency response and output level among various brands of tape. The machine may be adjusted for any type, but you can't get the best results with a type other than the one you used during alignment. Once you decide what specific tape you're going to use, fight rather than switch.

Adjusting the Bias Level

The bias level is set for maximum playback level at a specified input frequency and tape speed — usually 500 cps at 7½ ips. Check your instruction manual to be sure. It is preferable to adjust the bias a little on the high side to allow for drift, because too little bias will cause more trouble than too much. Where bias metering is employed, adjust the BIAS CALIBRATE control for the correct reading.

When you have adjusted for optimum bias frequency and level, adjust the NOISE BALANCE control with the machine in recording mode, again with the output tube removed. Adjust for minimum noise as indicated on the playback-level meter. There should be a definite null near the middle of the control range. When no null is found or when the noise output is excessive, change the bias-oscillator tube. If this doesn't help, check the cathode and grid resistors of the oscillator. Also, check the coupling capacitor at the plate of the record amplifier output stage for leakage. Some machines use a bridge-type noise-balancing circuit at the output-tube plate. In these machines, noise can sometimes be traced to one of the resistors in the bridge. Measure the noise on an audio-type VTVM or noise-and-distortion meter connected to the playback-amplifier output.

When Noise Is A Problem

In cases of severe noise, check the bias waveform directly across the erase head with a scope. The waveform should be perfectly sinusoidal, with no evidence of clipping. If the noise level is satisfactory with the output tube removed, the trouble is probably in one of the low-level stages of the amplifier. In some ma-

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RUNNING THE RADIAL

by *Elton B. Chick,* Consulting Author, General Manager, WLOU, Louisville, Kentucky — When antenna-performance measurements are required, a little planning goes a long way toward simplifying the survey.

Recently, there has been a renewed interest by the FCC in the performance of directional broadcast-antenna systems, particularly in existing arrays where there is evidence of long-term drift and resulting pattern alteration. In some cases, a station is required to re-evaluate the performance of its antenna system by making an abbreviated series of measurements often called a skeleton proof; that is, a proof of performance with minimum measurements and data. The purpose of this article is to describe the planning and field work necessary for such a proof.

Planning Makes It Easier

Generally, a skeleton proof will be completed under the supervision of the station's consulting engineer. He will often lay out the work in precise detail so that gathering the required data is simply a matter of going out and making a series of field measurements. On the other hand, much of the planning may be left to station personnel. If this is the case, several important things should be considered before a field survey is begun.

Determine first what data must be collected — that is, how many radials, what azimuths, and how many points on each radial. Once these criteria are selected, maps must be procured to plot the radials and identfy suitable measurement points.

Obtaining the Maps

Perhaps the best maps for use in field surveys are those published by the U.S. Coast & Geodetic Survey. Unfortunately, these maps are not always current. Because of this, it is desirable to have supplemental maps of the outlying area. Many states publish useful county maps, and most cities have good local maps. As a rule, these are up-to-date and accurate. The Chamber of Commerce maps are seldom intended for survey work; oil-company road maps are often in the same category. Obtain several copies of each map so that duplicates can be attached to the engineering report.

Layout of Radials

To plot the radials on your maps, it is first necessary to pinpoint the position of the station. Using the station's geographic coordinates (taken from the license or construction permit) and the Coast and Geodetic Survey maps, the location can be spotted by using the lines of latitude and longitude marked along the margins (see Fig. 1).

Next, the path of a true meridian (a line running from the North Pole to the South Pole) must be established through the station's coordinates. Do not use compass readings or deviation charts for this determination. The best method involves direct reference to the lines of longitude shown on the map. A line drawn through the station coordinates and parallel to any nearby longitudinal line will establish the desired true meridian. This must be done with considerable care, since an error here would cause an equivalent error in each radial.

The radial lines can now be drawn, using a good protractor (preferably 6″ or 8″ in diameter). The protractor is placed across the true meridian with the station coordinates at the center and the 0° mark indexed to the meridian line, north of the station. The 180° mark should then fall on the meridian line south of the station. Using a sharp pencil, mark each required radial azimuth on the map with a single point. (A small circle around the point or the use of a colored pencil will help in locating the points later.)

Assume, for example, the following radials are to be plotted: 0°, 45°, 150°, and 323°. These headings would be marked as shown in Fig. 2. To plot the radial lines, simply draw a line from the station coordinates outward through the point to the map margin. Mark the heading of each radial in degrees as shown in Fig. 3. Whenever a radial line must extend across several maps to achieve enough distance, it can be drawn easily by folding one map at its margin and aligning the lines of latitude and longitude of the adjoining map. The radial is extended using a straightedge.

Table I Tabulation of Data Obtained Along One Radial.

POINT NO.	DISTANCE	MV/M	MV/M	REMARKS
1	.35 Mi.	610		Clear, lake shore at large rock
2	.47	370		Clear, North lake shore, old stump
3	.79	200		Clear, end of street
4	.88	190		Clear, 20 ft. from end of street
5	.96	150		Clear, in center of intersection
6	1.11	115		Wires, point on sidewalk
7	1.25	130		Clear, across st. from service station
8	1.35	110		Wires, poor null. Front, No. 101
9	1.60	95		Clear, beside park sign
10	1.85	75		Wires, at bend in road, good null
11	2.27	59		Clear, 100′ N. of large Sycamore
12	3.00	35		Clear, at intersection sign
13	3.15	37		Clear, at Jones mail box
14	3.42	30		Clear, 30′ west of speed limit sign

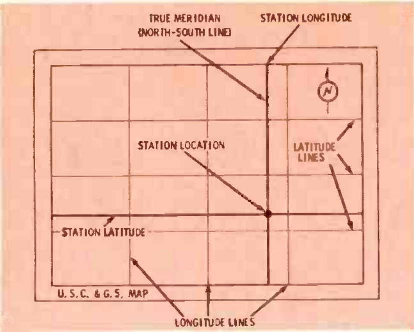

Fig. 1. Locating a station's coordinates.

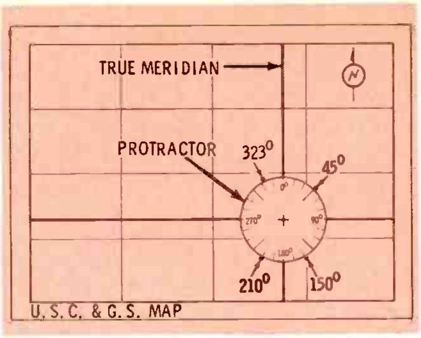

Fig. 2. Protractor determines headings.

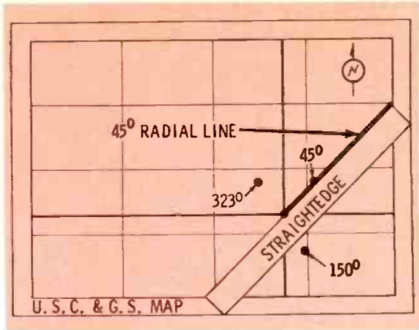

Fig. 3. Drawing radials on survey map.

Selecting Points

To a degree, the selection of sites for field-strength measurement will depend upon the nature of the survey. If the measurements are to provide a complete proof (or to gather extensive data on a single radial), a large number of points will be required, and greater freedom can be exercised in their selection. On the other hand, if the survey is for a skeleton proof, more caution should be taken in site selection. For the latter purpose, only six or eight measurements may be required on each radial; therefore, there is less room for questionable measurements due to poor sites — each point must provide a reliable measurement. A good policy in any case is to select the best sites available. In judging a site, several things should be considered. Power lines, telephone lines, large metal objects, and other towers can distort the field-intensity pattern as the signal is reradiated in scattered directions. Sites with obvious obstructions should be avoided whenever possible. If a sufficient number of unobstructed sites is unavailable, an increased number of measurements should be made along the radial. When the results are graphed, a larger number of points permits a smooth curve to be drawn, even if some of the values do not fall on the curve.

One way of judging the intensity of reradiation at a given site is to measure the strength of the signal that arrives at right angles to the radial. To make this observation, the loop of the field-strength meter is turned 90° from its normal position. A good, sharp null indicates a low-intensity stray field, while a higher-than-normal null shows the presence of reradiation at the test point. The extent to which the null is filled suggests the relative strength of the reflected signals.

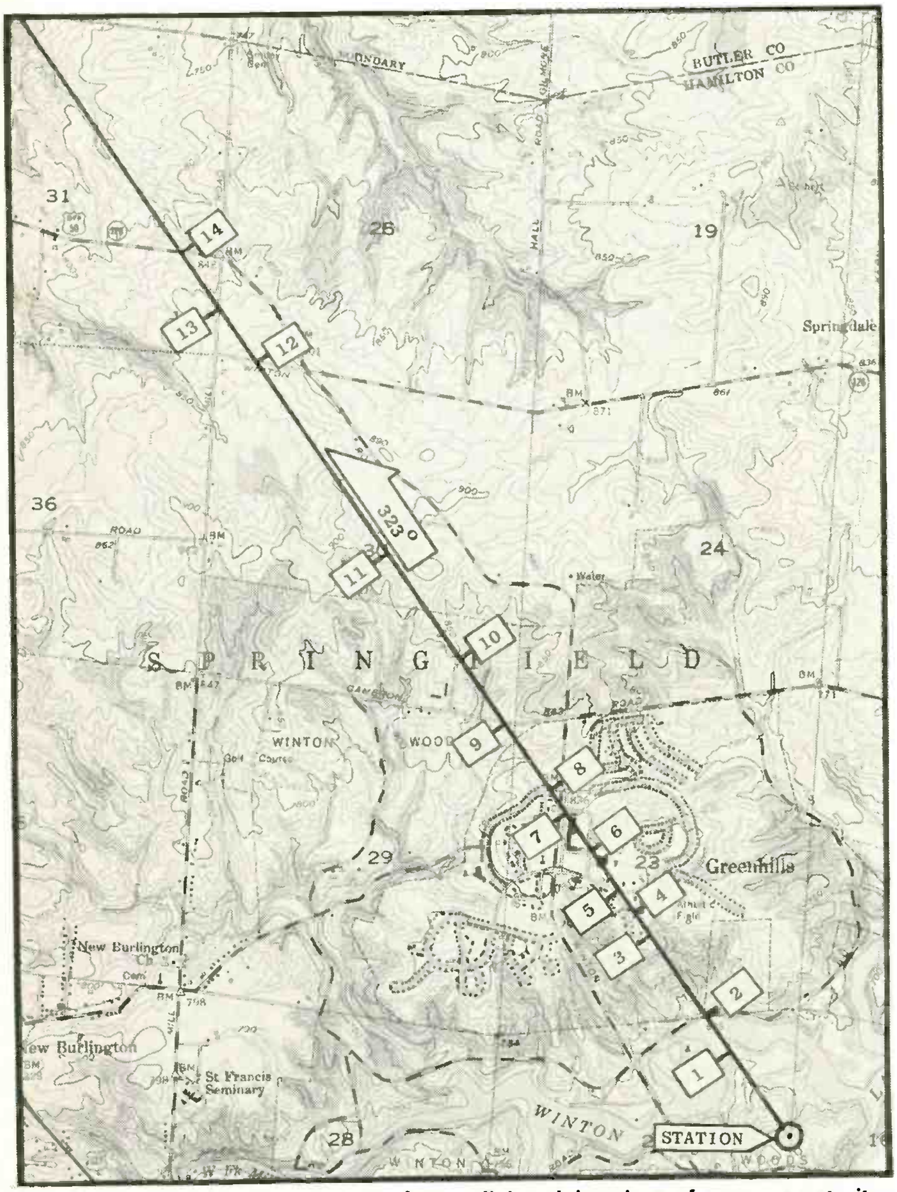

Fig. 4. Example of map marked to show radial and locations of measurement sites.

Recording the Data

It may be desirable to relocate as many as possible of the antenna system's original proof-of-performance measurement sites. In this case, a copy of the original performance report should be carried on the survey. Whether one is trying to recheck old points or is starting anew, it's important to keep accurate records of every measurement.

In logging the field-strength readings, space also should be provided for indicating each point by number, the reading in mv/m, the distance from the station to the point, a brief and accurate description of the point, and the time and date. A spare column for subsequent meas-

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BRIDGING THE ANTENNA

by Robert A. Jones, Regional Editor, Consulting Radio Engineer, LaGrange, Illinois — The proper methods to use in measuring the resistance and reactance of an AM-station antenna.

Every standard broadcast station is required to measure the amount of power delivered into its antenna. This is quite simply accomplished by employing the familiar equation $P=I^2R$. But there is a catch; to use this equation, one must know both the antenna current and the antenna (or common-point) resistance, in ohms. The first quantity is easy to determine, since all that is needed is to place a high-quality ammeter in the circuit and see what it reads. Unfortunately, there isn't any simple meter or gadget that can be inserted in the antenna circuit to read resistance. The latter quantity can be determined accurately, however, by use of a radio-frequency bridge.

The RF Bridge

In your high-school physics class you may have studied the Wheatstone bridge circuit. Today's RF bridge works on the same basic theory. Fig. 1 shows the basic circuit for most RF bridges. A generator introduces a signal at the right and the left ends of the network. The detector is placed at the opposite terminals. Usually an RF signal generator and a broadcast-band receiver are used with the bridge. When R1 is the same as R2 and R3 equals R4, the RF voltage between points a and b is zero, and no signal is heard in the receiver. This is referred to as the "null" of the bridge. Practical bridges contain both resistances and variable capacitors, and they are capable of measuring resistance and reactance simultaneously.

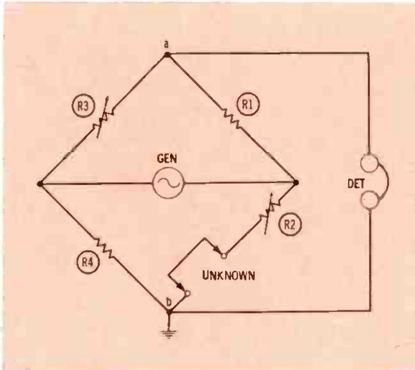

Fig. 1. Basic circuit of an RF bridge.

In addition to the Wheatstone-type RF bridges, there are in common use standing-wave bridges. These employ a different basic circuit and have one weakness; they can be used to measure only on one frequency (the carrier frequency). To meet the FCC requirements concerning antenna resistance measurements, one must take six to eight readings over a frequency range centered on the operating frequency. The logic behind this method is very sound. Anyone can easily err on a single-frequency, "one-shot" reading. By carefully taking readings over a range of several kilocycles and then plotting the results graphically, the engineer can make a smooth-line analysis and tell precisely the resistance at any given frequency.

ANTENNA MEASUREMENT DATA SHEET

CALL W E R K   LOCATION Muncie, Indiana

FREQ 990 kc   POWER 250 W.   ANT N-D

DATE 12/15/64   TIME 3:45 pm EST

Wx Condx Cold, Cloudy 24 degrees, no snow on ground

ENGINEER Robert A. Jones

Frequency	Resistance	Reactance	Logging
960 kcs	49.5 ohms	+j 63 ohms	
965	51.0	66	
970	52.0	68	
975	53.0	71	
980	54.0	75	
985	55.5	78	
990 kc	56.5	+j 83	22.7
995	57.5	86	
1000	59.0	88	
1005	60.5	93	
1010	61.5	97	
1015	63.5	102	
1020	64.5	104	

Fig. 2. Sample of field data sheet shows orderly tabulation of the measured data.

Measurement Procedure

It cannot be stressed too much that you should be careful and thorough in making antenna-resistance measurements. A small error in reading could cause you to be operating over or under the power limit for your class of station. The FCC is quite specific on power limits, and as all operators know (or should know), the maximum tolerance is 5% above and 10% below the licensed power.

Fig. 2 is a facsimile of a portion of the field data sheet of a recent nondirectional - antenna resistance measurement. Note that the operating frequency is 990 kc. Resistance and reactance readings were made at 5-kc intervals from 960 kc to 1020 kc.

The measurements were made in the following manner. First, the RF bridge, RF signal generator, and detector were installed in the No. 2 tower tuning house. The ground post of the RF bridge was connected to the 2" copper ground strap on the tuning shelf. As shown in Fig. 3, this connection should be a heavy, flexible copper lead. Copper braid about 1" wide usually works best. A large, heavy-duty battery clip is ideal for clamping this strap to the tuning-unit ground point. Next, the antenna lead was removed from the **tower** side of the ammeter. This was so that the bridge would look directly into the antenna and no other circuitry in the tuning house would affect the readings. Finally, the antenna lead from the bridge was connected to the lead coming from the antenna and the receiver was tuned to the carrier frequency (990 kc in the example).

The starting frequency can be identified in either of two ways. One way is to turn on the transmitter oscillator and monitor for a loud whistle. An alternate way is to listen for and identify a co-channel station. Once the detector is tuned to the carrier frequency, adjust the RF signal generator to the same frequency. If the receiver and generator have logging scales, it's a good idea to note the settings so that you can return to the center frequency easily.

With the receiver and generator set on the desired frequency, the bridge may be balanced and readings taken. The first step is to set the initial balance. This is done as follows. Remove the bridge antenna lead and connect it to the tuning-unit ground point, then adjust the reactance and resistance dials on the bridge to zero. The audible signal in the receiver should now be very weak. By use of first one and then the other of the initial balance controls, bring the audio level in the receiver to the point where it cannot be heard even with the receiver gain advanced quite high. At this point the bridge is calibrated.

Now return the bridge antenna lead to the antenna meter lead; immediately, the audio signal in the receiver should become quite loud. By using the resistance and reactance controls on the top of the bridge, adjust the audible signal back to the null condition. When

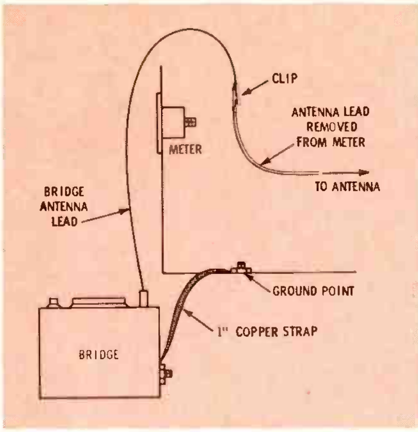

Fig. 3. Method of connecting the bridge.

this null has been obtained, the values of resistance and reactance can be read. Having taken the reading at 990 kc, move to 995 kc. First adjust the receiver to the point midway between 990 kc and 1000 kc. This point is easily determined by listening to the "cross-over point" of the hetrodyne beat between the BFO and adjacent carriers. As you tune from 990 kc toward 1000 kc, you will hear the 990-kc station carrier whistle rise in pitch. As you near 995 kc, you will begin to detect the 1000-kc station carrier beat as a very high audio tone. By adjusting these two beats, or whistles, until they are equal in frequency, you can tune the receiver 5000 cps, or midway, between 990 and 1000 kc. With the receiver tuned to 995 kc, bring the RF generator to the same frequency. You are then ready to adjust the R and X controls on the bridge to find the true resistance and reactance of the antenna at 995 kc. It is not necessary to recheck the initial balance of the bridge for each different frequency.

The next frequency is 1000 kc. This frequency is easily found by tuning the receiver for a zero beat with a 1000-kc station. The process of adjusting the generator and balancing the bridge is then repeated. After reaching 1020 kc, return to 990 kc and work down in frequency, stopping at 5-kc intervals until 960 kc is reached.

Using the Data

Fig. 4 shows a plot of the data for WERK. Ohms values are shown on the vertical scale and frequency on the horizontal. Each point represents the resistance or reactance value measured at a specific frequency. When the dots are connected by a smooth line, the resistance and reactance at 990 kc, the operating frequency, can be determined closely. Notice that the values of reactance shown on the graph are not exactly the same as those tabulated in the data sheet. This is because the bridge cannot take into account the variations in reactance of its internal variable capacitor with variations in frequency. The standard method is to calibrate the bridge at 1000 kc. Since reactance is inversely proportional to frequency, the reading on the bridge X dial is divided by the measuring frequency in megacycles to determine the true reactance at that particular frequency. For example, the value shown on the bridge X dial at 990 kc was 83 ohms. Dividing this by .99 (frequency expressed in mc) gives a true value of 84 ohms.

Other Applications

The standard RF bridge is a very useful tool around the station, particularly in setting up and tuning directional antennas. In addition to its use in determining antenna resistance, it has several other functions. The bridge can be used to adjust the values of coils and capacitors in any of the antenna networks. It can be used to measure the electrical lengths of the respective transmission lines. It can also be used to determine the locations of opens or shorts in buried transmission lines. Most consultants prefer that the phase-sampling lines in an array be of equal length. To

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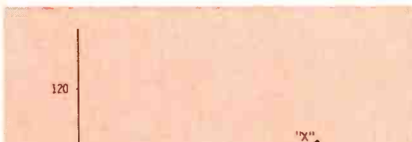

Fig. 4. Smooth curves permit determination of antenna resistance and reactance.

THE THREE P's OF CHASSIS CONSTRUCTION

by ***Terence King,*** Chief Engineer, WILI, Willimantic, Conn. — How to make your home-built unit look professional.

A while back I was standing in our control room looking at the new piece of equipment I had just installed. Everything checked out . . . it worked fine . . . but squint as I might, it still had that distinctive touch of the "Engineering Workshop Special."

So I stopped squinting, brought my latest creation into painfully sharp focus, and ruthlessly compared it to the "storeboughten" unit next to it. Nope, it just didn't have IT (that clean, shiny commercial look).

Well, engineers are supposed to be able to look at things objectively and scientifically, so I took out my little notebook, looked objective, and proceeded to write down just what IT was the commercial unit had that mine didn't.

One difference was immediately obvious . . . paint, a simple thing, but very effective in hiding the myriad fingerprints and small scratches.

Next? The front panel. Very professional lettering and . . . paint again. So I looked back at my recent project, squinted again, and mentally applied a nice paint job and a nicely lettered panel. It looked better. Much better.

But the three knobs on the front didn't look quite right . . . they were sort of bunched together in the center, even though I had carefully spaced the mounting holes evenly. I measured them again. They were still spaced evenly, but the knobs just didn't look evenly spaced. Why? After about five minutes of measuring, the secret became evident: You don't space the mounting holes evenly, you make the spaces between the knobs even.

So I had another one of those little lists that clutter up my desk; this one contained the three P's: Plan, Paint, Panel.

Planning

The first step . . . planning . . . is primarily to assure that things will fit in the right place and that a pleasing and functional front-panel arrangement will be arrived at. Two drawings are normally made: (1) A chassis layout showing the position of most components and their mounting holes, and (2) A front-panel layout showing all controls, knobs, meters, and similar components.

Once you have the electronic design settled and have some idea of what you would like the unit to look like, the next step is the selection of components to be used. When choosing components, keep in mind the mounting and space problems they will present. Check the manufacturers' catalogs for exact dimensions. Consider their appearance if they are exposed. Many panel components (meters, knobs) can be bought in modern styles that will enhance the appearance of the finished equipment.

Chassis Layout

Component layout and chassis selection go hand in hand, so it is somewhat difficult to say which comes first. Perhaps the best approach is to: (1) Make a rough chassis layout on paper to determine what chassis size fits your components; (2) select the exact chassis you will use, or design the chassis you will have constructed; then (3) make an exact chassis layout drawing.

The layout drawing should always be done full size and as accurately as possible. It should show each component and its mounting holes. Decide the size of mounting hole needed in each instance, and mark this information on the drawing. Small holes can be marked with size or drill numbers; large or irregular holes should be drawn to exact scale. Small solder-in components are not shown, although some consideration must be given to the space they will take up.

In most cases, components are mounted both above and below the chassis top. One way to check for interference among components is to lay out the component positions on the top and bottom of the same sheet of paper; the relative positions of components on the chassis can be seen by holding the paper up to a light.

From your drawing, you can select a chassis. This choice will depend on the components and the basic size, mechanical requirements, and ultimate purpose of the unit. Since the equipment built by broadcast engineers varies so widely (from a small box with earphone jack to a complete audio console), the possibilties of chassis size and type are endless. For many of the small projects, the ready-made utility chassis or the chassis-rack-panel combination will suffice.

You should not overlook the possibility of having a chassis made if commercially available ones don't seem to fit the bill. This can be done at any sheet-metal shop, and you will have a chasis made exactly for the particular unit. The cost for a 1/16″ aluminum specially shaped piece is not too much more than for a ready-made chassis, and you can eliminate the square-box look so common in home-built equipment.

Draw a scale diagram of the chassis you want; this will save shop time and therefore money. Remember to specify whether dimensions where bends are to be made are inside or outside—especially when one piece is to fit inside another. Normally, you would make two drawings for each chassis piece you

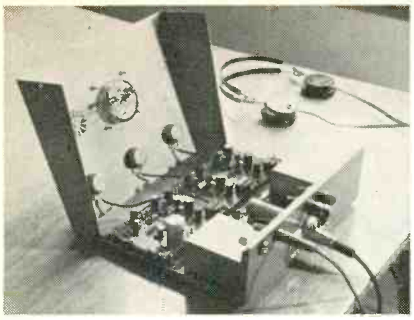

Fig. 1. Top raises for accessibility.

want made. One sketch should show the chassis "unfolded"; this is a template that can be used to cut out the material. The second drawing should be a sketch or diagram showing the way the piece is to be bent into its final shape. This second drawing can show the piece in three dimensions in some kind of perspective or can consist of two or more drawings showing the details of the piece from different angles.

In designing the chassis and general layout, bear in mind that you will have to get at the components for servicing once in a while. Notice the accessibility of components in the unit shown in Fig. 1.

Mountings

One other thing I found out the hard way: Use the right hardware for the job. Machine screws that fit the holes, solder lugs, terminal strips, spacers, and so on—all help greatly in making a solid and cleanly built unit without "Rube Goldberg" mounting arrangements.

Panels

A drawing (Fig. 2) of the component layout for the front panel (and the back panel, if it is at all complicated) should be made full-scale, showing mounting centers for all control knobs, meters, etc. Often you can shuffle the position of components so that a more pleasing or functional arrangement will result. As mentioned in the beginning, the spaces between knobs on the front panel should be equal; the spacing of the actual mounting holes does not always end up equal. The layout drawing of the panel helps spot this kind of thing before the holes are drilled.

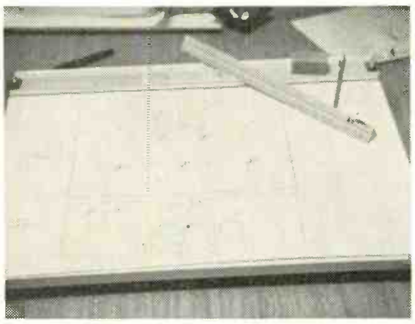

Fig. 2. Drawings help assure symmetry.

If the unit you are building has a top cover, or if the chassis is some irregular shape, make a sideview drawing that shows the chassis and the larger components; this drawing will assure that the top of the unit and other moving parts can move without interference.

The planning stage of building equipment takes time at the point when you're rarin' to get out the tools. Don't be tempted too strongly, for the time is easily regained in the course of construction. Planning helps eliminate those long silences while you sit and stare at the component there isn't room for.

Painting

Now let's take a look at paint. The main problem in painting electronic equipment is in painting only the chassis and not the wiring and components too. The commercial manufacturers don't have this problem because their chassis are painted before any components are mounted. This is difficult in prototype equipment, for it seems you always have to drill "one more hole." The best solution is a compromise.

If you have made chassis and panel layout drawings, most of the drilling and cutting can be done at one time. The easiest way to go from drawing to chassis is to place the drawing directly on the chassis (Fig. 3). Position the drawing exactly, and tape it in place. Then use a center punch as shown to mark the position of each hole. Irregular and large holes can be marked with the punch at enough points to locate them exactly. Most of the holes can be drilled with the paper in place. This protects the chassis from scratches. Even tube-socket holes can be punched right through the paper. When the paper is finally removed, all you should have to do is finish the larger holes and remove burrs from the underside.

Now mount all bolt-on components and any chassis subsections. This doesn't take much time and

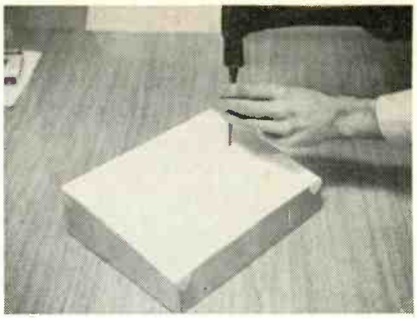

Fig. 3. Layout is used as a template.

allows the inevitable filing and adjusting to be done before painting. When you are satisfied that everything fits and all mechanical functions are normal, remove the components. Remove any burrs or rough edges. Round the sheet metal edges a little with sandpaper so that the paint will be less likely to chip there.

If you feel ambitious, and the type of chassis and equipment makes it feasible, you can fill the cracks made by sheet metal edges, round off edges, and so on. Aluminum solder and some of the plastic auto-body fillers work well. This type of work can smooth the corners of a cabinet and give it that coveted one-piece appearance found in some commercial equipment.

You should now have a bare chassis with all the mounting holes drilled. You're ready to paint.

Aluminum is used almost exclusively today for electronic chassis. Since it does not corrode or rust, there is no real reason to paint it. Unfortunately, raw aluminum does do a good job of showing dirt and fingerprints, and there is no easy way to keep it clean. A good job of painting chassis and panels is not difficult and truly makes a world of difference in their appearance.

The secret to a tough, nonchip paint job lies in proper preparation of the surface. With aluminum, this always means a thorough cleansing with a special oxide remover

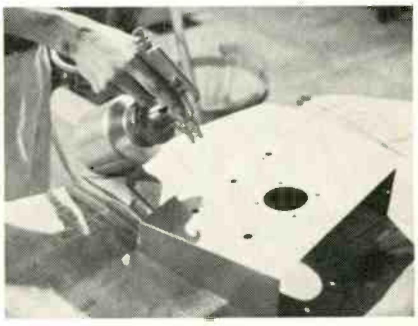

Fig. 4. Commercial sprayer is better.


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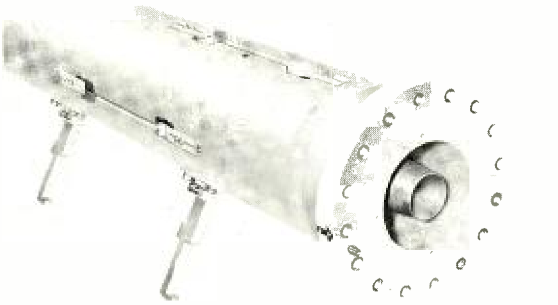
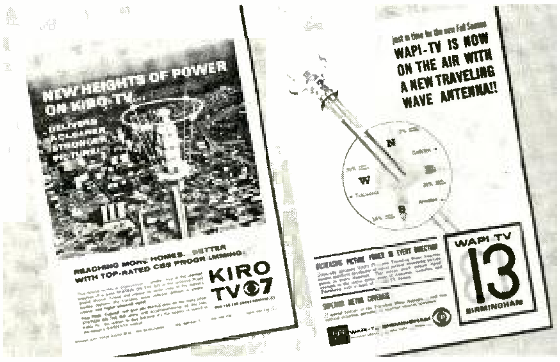


View showing simple design of "Pylon" Antennas



Two of the stations that have "switched" to "TW" Antenna.

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and then a coating with some type of primer. A lead-base primer is used on steel, while a zinc-chromate primer is better for aluminum. Poor paint adhesion occurs if enamel or lacquer is applied to the raw metal.

One inexpensive way of cleansing aluminum for painting is by dipping it in a caustic solution prepared by dissolving a can of household lye in two gallons of water; use a plastic container and a nonmetal stirring rod, and be careful to avoid skin contact. Use enough of the solution to cover each piece completely. A distinct bubbling will occur; fifteen minutes or so in the bath will produce a good surface for paint adhesion. Longer periods —up to two hours—will produce a sheen or etched finish. On removal from the bath, rinse the chassis in cold water and remove the dark deposit with a rag dipped in vinegar.

Apply the zinc-chromate primer sparingly. Spray cans are very convenient for this.

A vast number of colors are available in spray cans, and an excellent job of painting can be done using them. Use a good quality of paint; some of the "bargain" cans don't spray very evenly. If a regular spray outfit (Fig. 4) is available or if you know someone in a body shop, one of the attractive metallic automobile colors can be used. The trend in new equipment is toward lighter and brighter colors rather than the traditional gray and black.

Pick as dust-free an area as possible for the painting operation. Dust that settles into the drying paint makes for a rough surface. Use of lacquer or other fast-drying paint helps decrease this problem.

One real secret to effective spray painting is plenty of light on the work surface, positioned so that you can see the reflection. Hold the sprayer at least 12″ from the surface and spray evenly and slowly from one side of the work to the other. Stop the spray, return, and then make another pass. As the paint is applied, the first few passes will look rough in texture. Don't be in a hurry to cover the surface; several light coats are better, with some time between coats. When just enough paint is applied, usually after at least four or five passes, the surface will "flash" or become glossy. This is the time to stop. With less paint, the surface will be rough; with more, you risk a run or sag. Having the surface as nearly horizontal as possible will be helpful in controlling tendencies to run or sag.

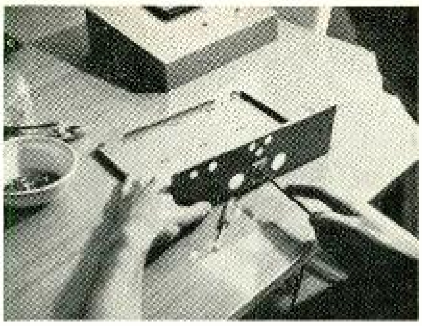

Fig. 5. Parts come after the finish coat.

At least two finish coats should be applied in all cases. Panels or other frequently handled surfaces may benefit from three or four coats.

When the paint is thoroughly dry, the components can be mounted permanently—Fig. 5—and the wiring begun. Unless your planning is complete, a few more holes will have to be drilled here and there for terminal strips and whatnot. Center-punching and drilling through a piece of masking tape helps prevent scratches and mars.

Paneling

The professionally lettered panel is the real mark of most commercial equipment. Today there are a great number of ways to accomplish this goal—some quite complicated, others more simple.

Conventional Decals — These are available with titles suitable for most electronics equipment. They adhere poorly in some cases, particularly on wrinkle-finish panels. Plastic backing can't be eliminated and gives a characteristic decal appearance.

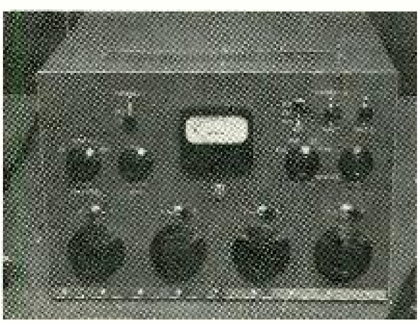

Fig. 6. Engraved panel looks professional.

Dry-Transfer Lettering — This is a recent development that is about the best low-cost lettering method. The letters are printed on plastic sheets from which they may be rubbed; their adhesion is quite good, and results look very professional. They are available in black and white, with electronic titles and alphabet sheets, in letters up to 3″ high. Symbols, meter faces, and dial markings are also available.

Engraved Formica Panels — These professional-appearing panels (Fig. 6) must be custom-made by a firm specializing in formica signs. A full-size formica panel with the lettering engraved in it is both durable and washable. Various styles of lettering are possible, but this method is fairly expensive.

Pressure-Sensitive Labels — Printed metal-foil labels adhere quite well. Titles that are available are somewhat limited compared to other systems, but they are inexpensive.

Embossed Plastic Tape—This labeling method consists of words stamped on tape units. These don't give a very professional appearance, and adhesion is a problem in some cases. Cement can be used for a more permanent attachment.

Photoengraved Panel — This type can be made by many printing firms. A full-size drawing with professionally done lettering must be provided to the printing shop. The finished panel will be a metal plate with the lettering etched into it. The panel can be painted in any desired color. White paint is then wiped into the depressed lettering to contrast with the panel. The panel is usually fairly thin and so should be supported by sandwiching with a thicker panel. This system of labeling is very durable but quite expensive.

Hand Lettering — Such lettering is very difficult, even for a professional, due to the small size of lettering usually needed.

It's a good idea to make a full-scale drawing of the front panel showing all controls and the exact lettering. Rotary switches should be mounted temporarily and the knob attached to find the exact pointer position for each function.

The type of lettering employed in any particular case depends upon budget and application. If you are

take me out to the ballpark...

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The Blonder-Tongue Observer 2 is a broadcast quality vidicon viewfinder camera. It's extremely light and portable, making it ideal for remotes. Also, picture quality is so close to that of an image orthicon, you can use it for up to 80% of your studio work.

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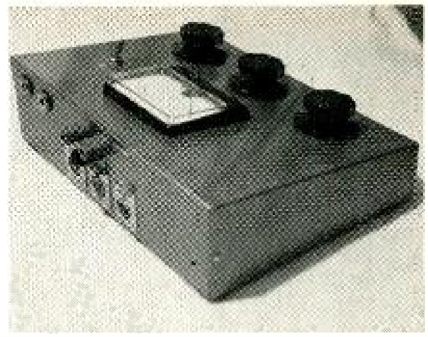

Fig. 7. Finished unit looks professional.

building a large piece of equipment and are investing several hundred dollars, it is not unreasonable to spend a few dollars on a formica or photoengraved panel. This is especially true if the unit will be exposed to constant use and view. Obviously, this treatment is unnecessary if the piece of equipment is inexpensive or is to be rack-mounted.

When using dry-transfer lettering or decals, follow the directions on surfaces preparation closely to assure good adhesion. In no case wax the panel before lettering is applied. Spraying a clear lacquer or varnish over dry-transfer or decal lettering will make it truly permanent.

Maintenance of panels and equipment consists mainly of cleaning and waxing. Panels painted with enamel should not be waxed for a month or so after the paint is applied. Dirty panels can be cleaned very effectively with one of the "wash 'n' wax" automobile products.

Conclusion

No matter how good a job you do electronically designing a unit, or how many brilliant innovations you include in it, the sad fact remains that the front office sees only the outside of your creation. Put the same professional effort into the outer appearance of a piece of equipment as you apply to the mysteries within. The "oohs" and "ahs" that will accompany the unveiling of your latest effort (Fig. 7) can be tolerated with a minimum of practice. ▲

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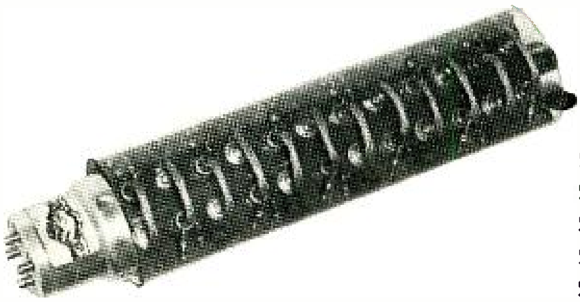

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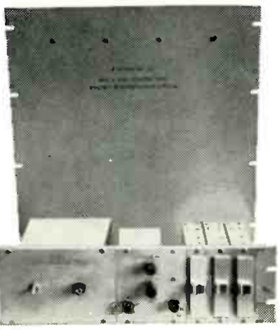

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Circle Item 11 on Tech Data Card

Transmitter Automation

(Continued from page 11)

vide remote authorization for VHF's.

In general, to go to remote operation you must insure that only authorized persons have access to the remote-control equipment, that any malfunction or failure of the control gear will shut down the transmitter, and that the licensed operator at the remote-control point can satisfactorily perform all functions in the manner prescribed by the FCC rules. Additionally, directional AM stations must take actual common-point, base-current, and phase-monitor readings at the transmitter site once each day for each pattern employed.

Automatic transmitter logging is authorized by Sections 73.113(b) for AM; 73.283(b) for FM; and 73.671(b) for TV. The regulations are similar and require that: logging equipment must not affect operation of transmitter circuits, nor accuracy of meters; recording devices must be at least as accurate as authorized meters; logging equipment must be calibrated against authorized meters at least once a week and the results noted in the maintenance log; when any parameter exceeds the required limits, an alarm must notify the operator; unless the alarm operates continuously, equipment that records each parameter in sequence (rather than simultaneously) must sense each parameter at least once every 10 minutes. (This rule applies in practice to auto-logging equipment used at a remote-control point.) The logging equipment must be located at the control point, which means at the studio for remote-control operation and at the transmitter for manual operation. Also, the gear must be located near the responsible operator and must be inspected periodically during each broadcast day.

Automatic Power Control

Some manufacturers provide power control as an accessory function to their remote-control and automatic-logging equipment; others provide it as a separate package. A meter relay is often used so that when antenna current (and resultant power output) drops below a preset value, the relay operates a motor which drives a rheostat that increases plate voltage and restores the power to normal. The system works both ways, decreasing as well as increasing power, to maintain it within either the user's or the FCC's limits, whichever are closer. It is particularly valuable in the case of a remotely-controlled, auto-logged transmitter located where the AC service dips during the day and soars at night.

Conclusion

Wherever separate transmitter and studio locations pose operational or staff-centered problems, remote-control concepts can provide a means for relieving licensed personnel from menial tasks. Reliable control of the transmitter from remote sites can be accomplished by using type-approved commercial equipment for all services except VHF TV — and that exception may soon be eliminated. ▲

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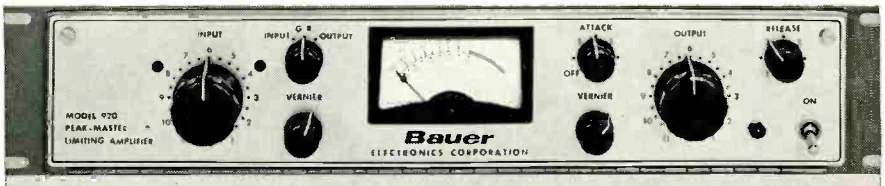

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Circle Item 12 on Tech Data Card

June 1965

We interrupt this magazine to bring you...

Late Bulletin from Washington

by Howard T. Head

Commission Acts to Regulate CATV

The Commission has firmed up proposed rules governing microwave relays employed to serve CATV systems and has announced its intention to extend its regulatory powers to all CATV systems, including those functioning solely by means of off-the-air reception. CATV systems employing microwave equipment are required by the new rules to carry the programs of all local television stations without degradation in the quality of the signals. CATV systems are also required to avoid duplicating the programs of local commercial stations within 15 days before or after the program is carried locally. The station entitled to protection has the obligation to inform CATV systems which programs.

In asserting jurisdiction over CATV systems that do not use microwave equipment, the Commission has expressed its concern over the influence that CATV systems in the larger markets may have on UHF development, the problems of "leap-frogging" (the practice of bringing in distant stations instead of locals), and the relationship between CATV and pay-TV.

Shortly after the Commission acted, CATV legislation was introduced in the House of Representatives by Congressman Harris of Arkansas, Chairman of the House Committee on Interstate and Foreign Commerce. This bill asserts Congressional prerogatives in the area of national CATV policy and would make any Commission determinations concerning CATV subject to Congressional review. At the present writing, no hearings have been set on the House Bill.

"Early Bird" Satellite Begins Operation

Following a highly successful launch in April, the communications satellite "Early Bird" demonstrated its capability for two-way television transmission between the United States and Europe with special shows on May 2. Regular commercial operation is scheduled to begin in June, carrying telephone circuits as well as regular two-way television transmissions.

The satellite is "parked" over the equator at approximately 27.5° west longitude. Television and telephone relaying will be conducted between terminals in the United States and in the United Kingdom, France, West Germany, and Italy.

Call-Letter Policy Modified

The Commission has modified its policy concerning AM, FM, and TV call-letter assignments to allow commonly-owned broadcast stations in the various services, licensed to adjoining communities, to employ common call-letters. A showing is required that the stations involved serve substantially the same areas and populations. This is a modification of previous policy under which the use of common call-letters was authorized only to stations licensed to the same community.

Applications Must Be Available to Public

Controversy has broken out over the recent action of the Commission requiring all broadcast stations to make reference copies of all major applications available for local public inspection. These include applications for new construction permits, major changes in facilities, license renewals, assignment or transfer of control, and extensions of construction time. Additionally, all minor applications involving changes in programing or ownership are required to be made available. According to the Order, the new Rules became effective May 14, 1965.

U. S. Fares Well at CCIR

American delegates have returned from recent meetings of CCIR Study Groups X and XI in Vienna, pleased with successes in several important areas. International recommendations were agreed on for FM-stereo broadcasting employing the pilot-tone system, the principle of FM-stereo operation in the U. S. These recommendations are subject to approval of the CCIR itself at the 1966 Plenary Meetings.

An interim compromise was reached with respect to color TV standards, with the U. S. and Western European nations agreeing on a hybrid system known as QUAM, embodying features common to the American NTSC system and the West German PAL system. The USSR backed the French SECAM system.

Even commercial loudness got into the act. A paper on the subject read by a U. S. delegate evoked surprising interest among European delegates, whose countries' national broadcasting systems are generally commercial-free. (Seems that listeners everywhere complain about loudness -- commercial or otherwise.)

Howard T. Head...in Washington

Jim W. Cooper, Director of Engineering, WFAA-TV.

G-E 4-V wins WFAA-TV's "slide test"

Jim W. Cooper, Director of Engineering at WFAA-TV, Dallas-Fort Worth, came to the recent NAB Convention in Washington to make a decision.

WFAA-TV wanted the finest 4-V color film camera available. Jim had carefully compared all the available data on the two competing cameras. The final, deciding item on his check list was to be his own personal evaluation of picture quality.

He had his own resolution chart slide put up first in the competing unit, then in the General Electric 4-V. Immediately he saw the difference. G-E 4-V picture quality won Jim Cooper's unqualified vote — and the WFAA-TV order.

Two G-E 4-V's will be installed at WFAA-TV this summer. *This is the kind of customer acceptance that will put more than 100 G-E 4-V's on the air by autumn. No other manufacturer can even approach this record of field-proven performance and market approval. For details on broadcasting's most-accepted 4-V color film camera — the G-E PE-24 — contact your G-E Broadcast Equipment Representative, or: General Electric Company, Visual Communications Products, #7-315, Electronics Park, Syracuse, N. Y. 13201. (Phone AC 315, 456-2105).* GE-16.

Visual Communications Products

GENERAL ELECTRIC

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Circle Item 13 on Tech Data Card

Cathode Follower

(Continued from page 15)

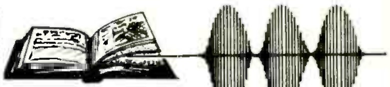
isolation and for matching high-impedance inputs to low-impedance outputs. Its advantages, compared to the vacuum-tube version, are the same as for other solid-state circuitry: small size and weight, no heater voltage needed, operation with low-voltage supply, no warmup time required, and low drain from the power supply.

Applications

As previously stated, cathode and emitter followers are used primarily for impedance matching and isolation. They may be used in the input stages of high-gain amplifiers to prevent undue loading of high-impedance sources. Another use is in the outputs of TV cameras and sync generators. These units feed their signals into low-impedance lines, and the impedance-matching characteristics can be used advantageously in these and similar applications. By using a cathode follower at the output of a pulse generator or other similar equipment, the undesirable effects caused by the shunt capacitance of a transmission line are minimized. Cathode and emitter followers are also used in voltage-regulated power supplies, usually as the series-connected stage.

There are many other applications in broadcast, industrial, and consumer equipment in which the use of these stages provides better operation than would be obtained by using an impedance-matching transformer. ▲

BOOK REVIEW



Planning the Local UHF-TV Station: Patrick S. Finnegan; Hayden Book Co., Inc., New York, New York: 296 pages, 6" x 9", hardbound; $10.00. Several considerations, such as the advent of the all-channel UHF television receiver and relaxation of several financial and technical criteria for acquiring a construction permit, have generated a great deal of interest in broadcasting circles for the use of UHF TV in a manner similar to that applied to local radio. This book is written from an unusually practical standpoint, without deep involvement in the technical aspects, as a guide for establishing a new station in the UHF spectrum. Mr. Finnegan, a long-time contributor to BROADCAST ENGINEERING as a Consulting Author, presents the complete planning picture in a clear manner, going so far as to include present cost figures for individual items in equipment and service categories.

Each element integral to the completed UHF station is given detailed treatment, from selecting a site, to planning the physical plant, to operating the equipment. Two chapters of particular interest are Chapter 11 (Test Equipment) and Chapter 12 (FCC considerations). In the latter chapter, Mr. Finnegan outlines the requirements set forth by the regulatory body and provides a virtual goldmine of information.

Chapters 9 and 10 (Planning the building and the equipment layout, respectively), while certainly not purporting to solve all such problems, do suggest several methods by which costly errors may be prevented.

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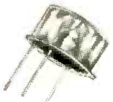
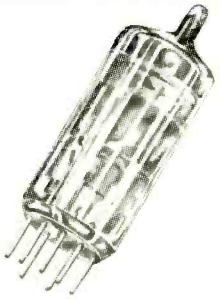


THIS IS NOT...



In a tube-type cable system of any size at all . . . one man and one truck must devote full time to replacing defective and expensive tubes. Vacuum tubes spell "trouble." They burn out in a hurry . . . and this kind of trouble will cost you much more than the price of the tubes and the labor of a technician. This kind of trouble will cost you subscribers and a bad name in the community. ■ On the other hand, with Ameco solid-state equipment, you can "set it" and "forget it." Transistors last from ten to twenty years. Combine this longevity with Ameco quality and know how and you have the closest thing to a trouble free CATV system. ■ If it is trouble you want . . . go the tube route. Trouble you will get. ■ If it is reliability you want . . . go the Ameco route. Reliability you will get. Ameco solid-state, "the Cadillac of the industry."

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see page 43

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Here are a few of the functions performed by this unit:

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- Provides a clean video signal at the output even if the input signal is mixed with as much as 10 volts of hum or other low frequency disturbances. More than 50 db. reduction of extraneous 60 cycle hum in the video signal is achieved by means of driven sync. tip clamps. There is less than 1% tilt on a 60 cycle square wave.
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- A white stretch circuit (which may be completely switched out) has great flexibility of adjustment to more accurately match the compression characteristics of transmitters.
- Four identical video outputs are provided with 40 db. isolation at 3.58 mcs. between outputs.

Applications include:

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- At the inputs of video tape recorders, microwave systems and transmitters.

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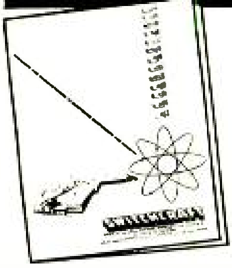

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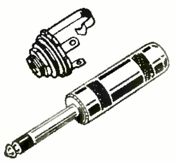

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The largest selection of Lever-Switches in the industry offering the first illuminated lever switch, the "Lever-Lite". Available in various circuits, locking and non-locking types and permanent lock type, such as the "Lever-Lock". There is a Switchcraft Lever-Switch in single or multiple stations ("MLK") to meet every application.

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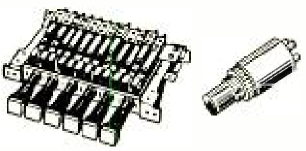

Developed by Switchcraft in single and multiple station types for industrial, commercial, communication and audio equipment. Illuminated or non-illuminated in a wide variety of contacts, switching circuits, stations, mounting centers, lamp voltages and switching functions. For all applications where dependable leaf-type switching is needed.

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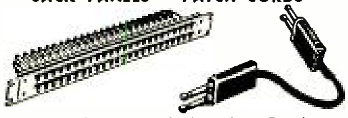

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Servicing Tape

(Continued from page 20)

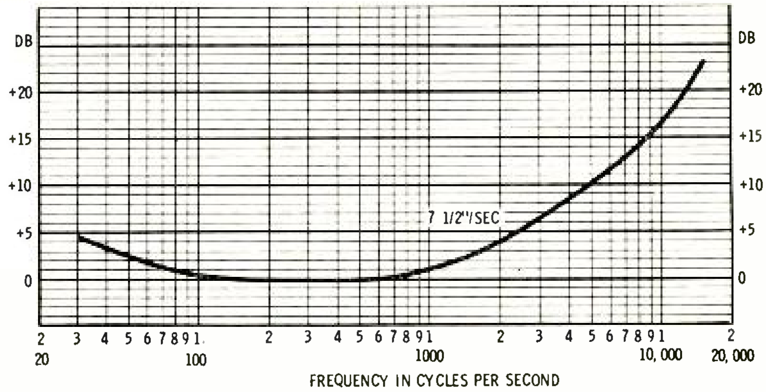

Fig. 3. Typical recording amplifier exhibits frequency response shown by curve.

chines, a bias trap is used in the plate circuit of the output stage. This must be properly tuned for minimum noise. Tune the trap for the lowest residual bias signal at the plate of the output tube, as seen on the scope.

Hints and Suggestions

When adjusting the record-mode equalization, it is important to use a low input level (about —15 db) to prevent saturation of the tape at the higher frequencies. Adjust the equalization control to produce equal input and output levels at the middle and upper frequencies. In most machines, this control has little or no effect at low frequencies; major deviations indicate amplifier trouble in the low-frequency range. After the equalization is properly adjusted, any frequency within the operating range of the recorder should be recorded and played back at the same level.

Usually, if a playback head is satisfactory, its companion record head will also be good, since record heads have a longer gap and are less subject to wear. You can check the response of the amplifier by removing the bias-oscillator tube and substituting a 1000-ohm resistor for the head. Read the output level across the resistor. The response should agree closely with the curve in the instruction book (a typical curve is shown in Fig. 3). Poor response in the amplifier can usually be traced to a defective component in the equalizing network.

Here is a brief rundown of possible causes of difficulties in recorder electronics:

1. Poor frequency response—Check bias level, record- and playback-head alignment, equalization, dirty heads.
2. Noise—Check bias level, noise-balance control, tubes, bias-trap adjustment, low-bias frequency, filter capacitors.
3. Distortion — Check bias level, incorrect input levels, tubes, coupling capacitors, improper equalization.

All of the above procedures and checks apply to both cartridge and reel-to-reel recorders, except that most cartridge machines require recording tests to be made using spot checks, rather than direct playback of the tape as you record. Because of the great diversity of features in the various types of machines, mechanical or control failure can best be tackled using the information in the instruction manual.

Conclusion

While it is not expected that all tape-recorder problems have been discussed, the material presented in this article should enable studio-equipment engineers to keep their equipment in peak condition. Normal troubleshooting techniques in combination with these suggestions should be equally helpful to all maintenance technicians. ▲

STOP You lose two turns for going too far. Turn back to page 6 for Instantaneous Selection Remote Control by Bionic Instruments.

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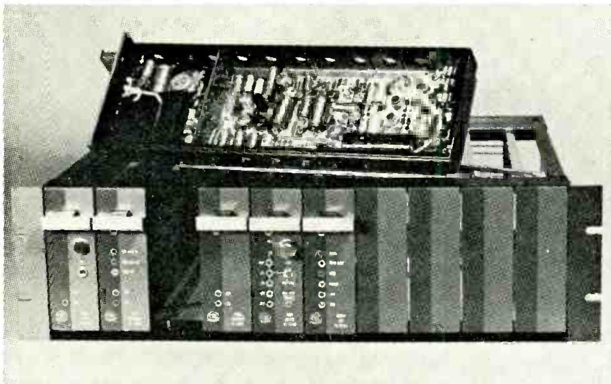

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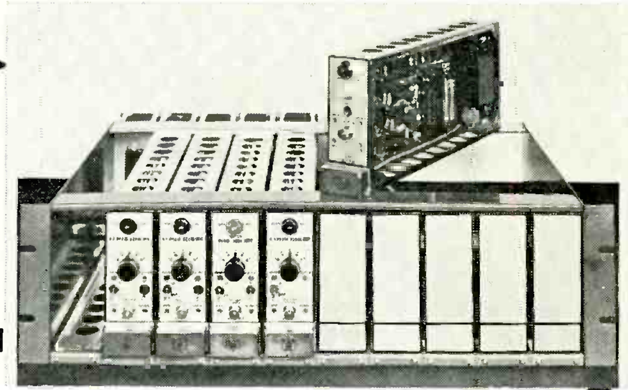

WARD VIDEO LOW PASS FILTER & COLOR PHASE EQUALIZING SYSTEM. Features built-in Solid-State Isolation Amplifiers & Regulated Power Supplies.

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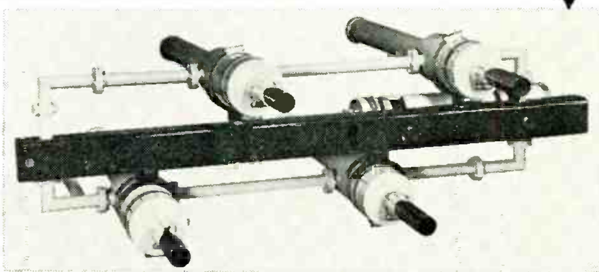
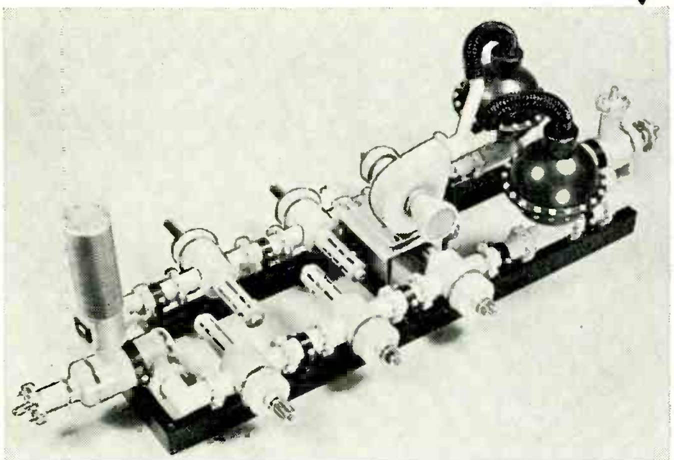
CO-EL UHF VESTIGAL SIDE BAND FILTER FOR KLYSTRON TRANSMITTERS.





CO-EL UHF FILTERPLEXER — No Gases Needed — For use with up to 50 KW Transmitters.

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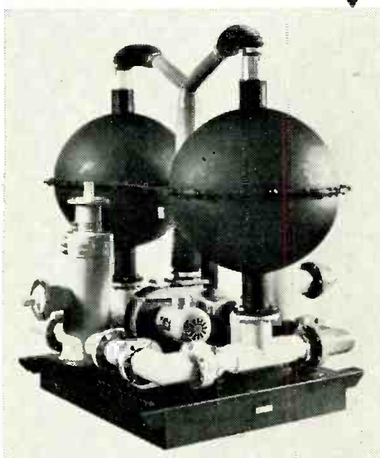

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There's nothing like it for portability and performance. It's rugged, reliable and stable. It provides studio quality pictures under field conditions. It makes remote pickup possibilities as varied as the imagination, and is unexcelled for many studio jobs.

The American Broadcasting Company selected the BX-8A camera and proved its value during the Winter Olympics, the political conventions, the Summer Olympic tryouts, and other special events.

Here are some of the features that attracted ABC:

- Small size, light weight (camera unit 25 lbs.)
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- Very low power consumption
- Meets all EIA standards for broadcast television
- Compatible with normal broadcast facilities

We can't tell you all of the other features of the camera here. But we would like to give you the complete story. To get the picture first hand, contact us for details at Baltimore, Maryland.

Bendix Radio Division

THE Bendix CORPORATION

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The Radial

(Continued from page 22)

urements at the same site may also be helpful (see Table 1). Site locations should be clearly marked on the map being used. This can be done as shown on the map in Fig. 4. The measured field strength at each point is shown in the table. The distance from the station to each point is determined by using the scale of miles on the map.

When the survey has been completed, all information may be transferred to other maps and data sheets. In this manner, all the original notes can be kept on file at the station for subsequent surveys required by a suspected change in level at one of the monitor points (see "Winter-to-Summer Conductivity Effects" by R. A. Jones, BE, June 1964).

The field-intensity survey provides tabulated data for each radial and shows azimuth, site number, distance to that site from the station, and field intensity in mv/m. This assembled data is plotted on graphs to determine overall antenna performance. ▲

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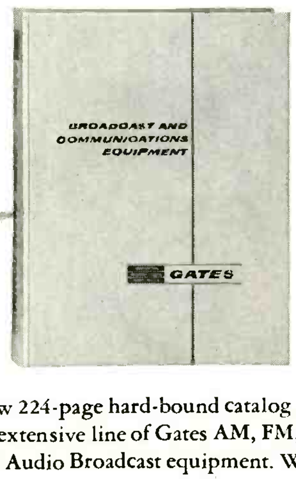

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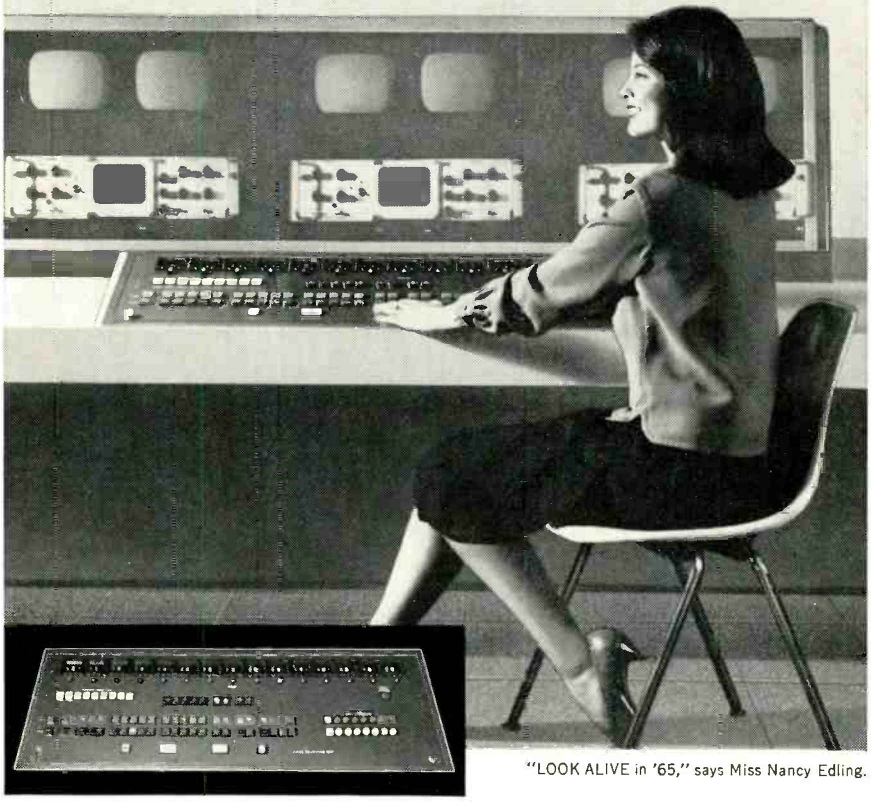

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LOOK ALIVE

with a reliable and completely flexible Visual Video Switching system, featuring ■ solid-state crosspoints and amplifiers for stability and long-term, maintenance-free operation ■ lap switching timed for eye-appealing transitions ■ synchronous and non-synchronous signals requiring only one crosspoint for VTR, network or remote inputs ■ automatic lap-fade-super controls which can be pushbutton-operated or controlled from external automation equipment ■ preset video switching systems with thumbwheel selection of 15 or more events into a preview bus.

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LOOK TO VISUAL FOR NEW CONCEPTS IN BROADCAST EQUIPMENT

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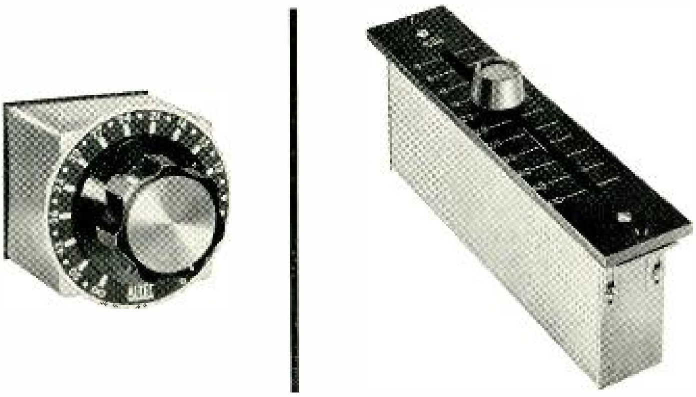
MORE NEW STUDIO EQUIPMENT FROM ALTEC

LATEST ATTENUATOR LINE ACHIEVES LESS THAN 1 MILLIOHM CONTACT RESISTANCE, LOWER NOISE, EASIER UPKEEP, LONGER LIFE



The hoped-for possibility has developed into working reality—we've managed to come up with the finest attenuators yet developed. More than 300 types are available with either solder terminals or as plug-ins, either rotary or straight-lines, and in such categories as mixers, calibrated controls, calibrated grid control pots, VU range extenders, decade attenuators, impedance matching networks, decade resistors, faders, and stereo pan potentiometers. And they're all listed in the new Altec Attenuator Catalog which we've printed as a convenient reference for your aid.

A LITTLE ABOUT A LOT OF IMPORTANT IMPROVEMENTS

You might like to know how some of these improved attenuators were engineered. For instance, "coin" silver, which is normally used to make brushes, contains copper and is subject to oxidation—reducing conductivity and raising noise level, among other things. So we've made our brushes of "fine" (pure) silver because it doesn't oxidize—it sulfides. Silver sulfide does not reduce conductivity; in fact, it actually has a helpful lubricity. We use dual brushes on all our attenuators—both rotary and straight-line models. They are independently sprung and so guided as to eliminate "stumble" from contact to contact.

ADDED DEVELOPMENTS

Our new attenuator line is designed so that we'll be able to gang up to 8 of them in tandem, enabling you to operate the whole group with one control. We've produced rotary attenuators that will give you more steps in less space. How? Instead of putting them in the conventional round cans—we're building ours in square ones. And we're using the corners (space that previously went to waste) for the wiring.

DON'T FORGET THE CATALOG

The new Altec Attenuator Catalog we mentioned above has all the technical characteristics and other relevant data on the new line. We'll be delighted to send it to you. So write today, Dept.BE-6.

ALTEC LANSING

ALTEC LANSING
A Division of LTV Ling Altec, Inc.
ANAHEIM, CALIFORNIA

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Bridging the Antenna

(Continued from page 24)

achieve this, the station chief engineer usually lays all the cables on the ground, side-by-side, and then cuts them to the same physical length. This method provides fairly close results, but with a bridge the lines can be trimmed to precisely equal lengths.

It might also be of interest to mention some of the things you cannot measure with an RF bridge. You cannot measure the dynamic impedances of towers in a directional array. This is because the standard RF bridge is a very delicate instrument and would be damaged if even a 100-watt transmitter were to be connected to its balancing circuits. Also, standard bridges are not capable of measuring directly large values of resistance and reactance. High values can be measured by employing additional calibrated components.

Precautions

There are a few precautions that should be observed in obtaining accurate bridge measurements. First, always keep the bridge leads—both the ground strap from the bridge and the bridge antenna lead—as short as possible. This is to avoid adding any significant amount of reactance to the circuit being tested. Second, opening a phasor or tuning-unit door will sometimes affect the readings. Since in all stations these doors must be closed in normal operation, it is best that they be so while your measurements are being made. This should cause no problem in getting to the back of the meter and its antenna lead. This can be done by removing the meter, or its glass window, and passing the bridge antenna lead through the opening.

A good-quality RF bridge is really a laboratory instrument. And while it is expensive, it can be a most helpful tool in the hands of the consulting engineer or station operator. ▲

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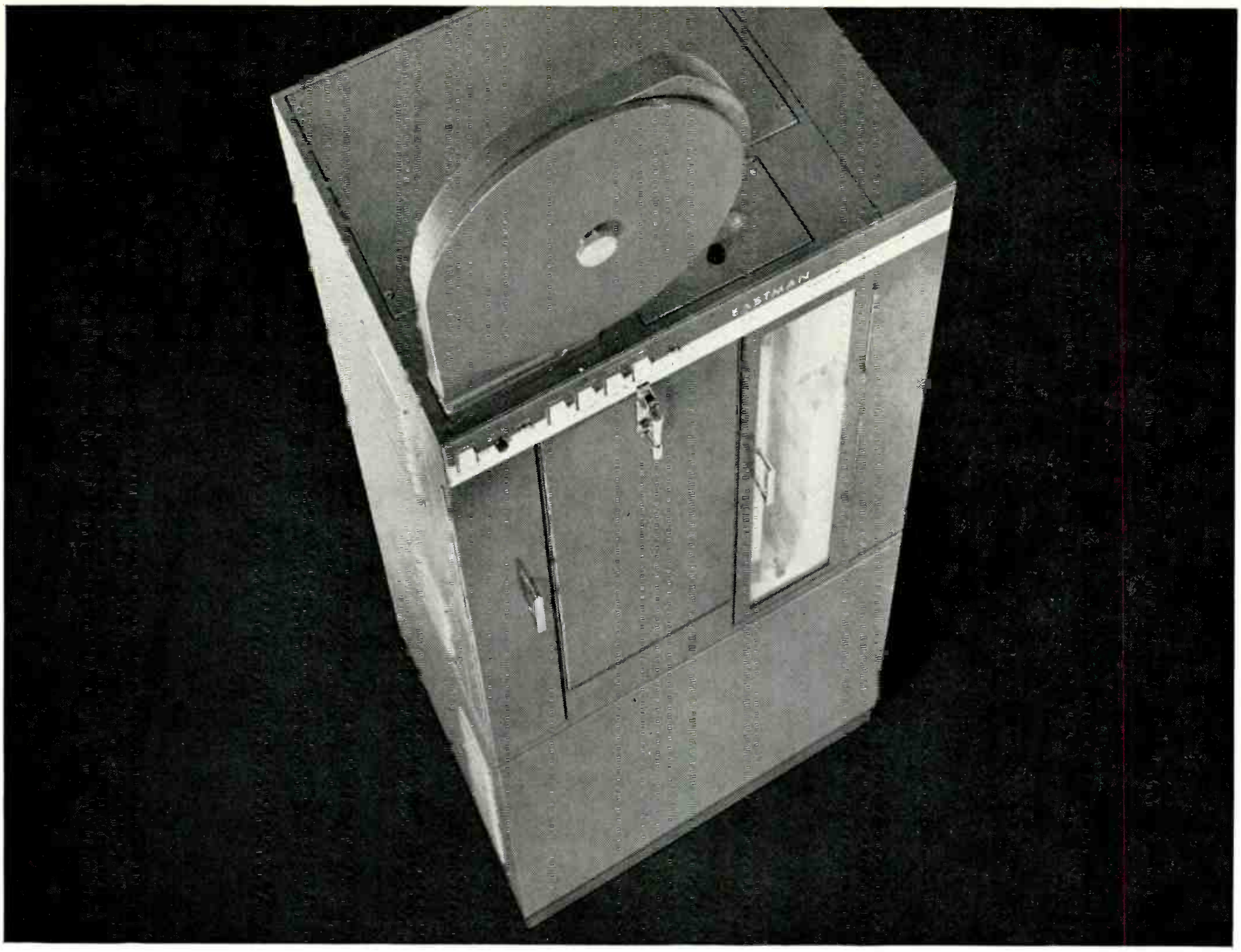

It processes films of superior image quality at projection speed. It provides finger-tip control... 1200-foot capacity... flexible development time.

But—**What are the Viscomat Processor economics?**

1 Because the operation of the Eastman Viscomat 16mm Film Processor is so automatic, skilled technicians are free to handle other functions. Processing is merely a matter of threading a leader, selecting the type of process, and pressing the "start" button. This is true push-button simplicity.

2 Chemicals aren't wasted, as they often are in conventional processing. Just the right amounts of viscous chemicals are applied to the film. And because the by-products of processing are washed away, film is always treated with fresh chemicals. What's more, the system prevents oxidation of the supply chemicals.

3 There's no time spent in mixing chemicals—they're packaged and pretested for immediate use. And since chemicals are used only once—then eliminated from the system—you never encounter the technical problems of replenishment. Now you can forget about running control strips, testing solutions and making complex adjustments and compensations.

4 Clean-up is a matter of a mere 20 seconds. The operator simply flips a switch and the interior sections are thoroughly washed. With conventional equipment, it might take a whole day to strip down and thoroughly clean a processing unit.

5 Only three square feet of floor space is required, thanks to the Eastman Viscomat Processor's compact design. This may represent a major economy—as well as a major convenience—for you. Service requirements are minimal—tempered water, a drain, and electricity.

The Eastman Viscomat Processor is part of a rapid-access 16mm film system that includes camera, films, processor and projector. For a booklet with complete details, write to:

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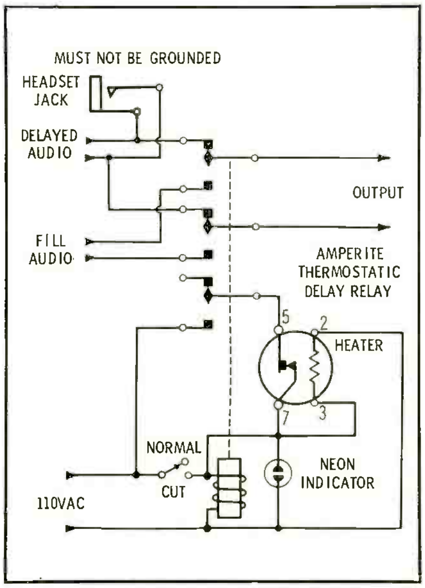
ENGINEERS' EXCHANGE

Tape Delay Using One Transport

by Kenneth Knecht, Chief Engineer, WCIT, Lima, Ohio

Faced with the start of a new WCIT program which included listeners' telephone calls being placed on the air, we thought it best to come up with a short delay to eliminate feedback and give us the opportunitity to cut questionable material before it could be aired. We also had to come up with a foolproof switching circuit to provide fill with other program material, when a cut was required. Since we have only one tape machine in each of two studios, we could not use the usual method of delay; i.e., recording on one machine and playback on the other, the length of tape between the machines determining the delay time. After trying a few other ideas which didn't work, we came up with this solution.



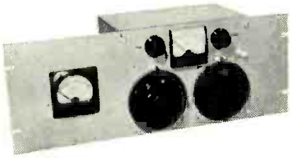
We purchased a Cousino Model U-310 tape cartridge and loaded it with ten seconds of tape. An extra playback head was added to our Magnacord P-75 to provide the delay. We then added a switch to a panel below the transport, which enabled us to switch between the two playback heads. To use the delay unit, we simply patch the program output of the console into the tape recorder and patch the output of the tape recorder playback amplifier into our AGC amplifier. To use this system, one must have a tape machine which has separate record and playback heads and separate record and playback amplifiers.

Our switching system is shown in the schematic. It consists of a 3PDT 110-volt AC relay, a 110-volt AC thermostatic delay relay with a 12- second delay, and a 1/4" phone jack all mounted in a small box. There is also a neon indicator to show whether the relay is on delay or normal, and a SPDT toggle switch to cut program. The relay is used to switch between delayed program and fill audio. We use an instrumental record for fill.

Ordinarily, the relay is de-energized, the toggle switch is in normal, and the neon indicator is unlit. If the program moderator hears something he thinks he might cut, he has ten seconds to make up his mind. If he decides to cut, he switches the toggle switch to the

IMPEDANCE BRIDGES FOR BROADCAST ANTENNA SYSTEMS

MODEL CPB-1



For permanent installation in the common point of a directional antenna system.

Frequency Range — 500 - 1650 KC.

Power Rating—
CPB-1 5KW - 100% Amp. Mod. Continuous.
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Accuracy—Resistance ±2% ±1 OHM.
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Measures common point resistance and reactance while operating at full or reduced power.

Permits minor adjustments of the common point resistance control thus allowing the operator to maintain radiated power at the full license value at all times.

PRICE - CPB-1: $395.00, CPB-1A: $475.00.

MODEL OIB-1

Portable instrument for measuring "in circuit" impedance of network inputs, transmission line terminals and common point of directional antennas.

Frequency Range - 500 KC to 5 MC.
Power Rating - 5 KW VSWR - 3.
Accuracy - Resistance ±5% ±1 OHM.
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Measures operating resistance and reactance while operating under power.

Can be used with signal generator and receiver as a normal bridge.

No signal generator or receiver required for measurements under power.

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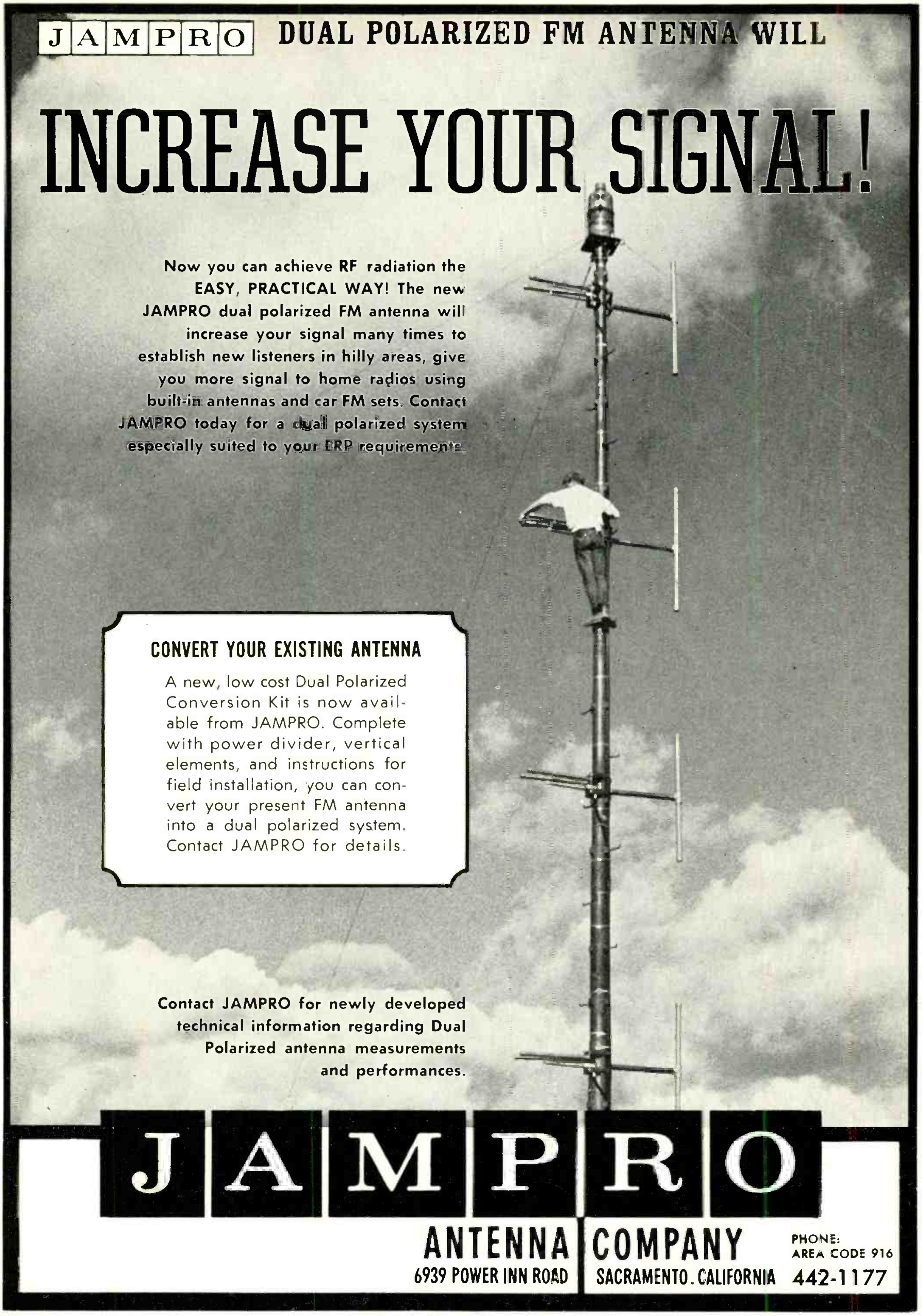


Circle Item 25 on Tech Data Card

cut position. This energizes the relay and puts the fill music on the air. It also latches the relay through the normally closed contacts of the delay relay so that program cannot go back on the air for the 12-second period set by the delay relay. This guarantees that the portion of the program desired to be cut can not be put back on the air before it is cut. If the toggle switch is left in the cut position longer than 12 seconds, the system will cut until switched back to the normal position. If it is switched to cut and returned immediately to normal, the system will cut for 12 seconds and then automatically switch the program back to normal operation. The usual procedure is to hit the cut switch and listen to the delayed audio through a headset plugged into the phone jack until the portion desired to be cut has gone by; the toggle switch is then returned to normal. Regardless of the position of the toggle switch, the neon indicator will show whether the system is in cut or normal function.

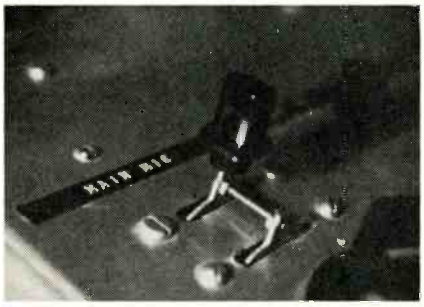
We have used this system for more than a year, and (aside from some tape-loop trouble) it has worked perfectly. The tape-loop tightness is quite critical, and the loops will not work very well until the right tension is discovered through trial and error. Whoever puts the loop on the tape machine must be cautioned to handle the tape gently and not to stretch it.

Adding Switch Contacts

by Ronald Pesha, Tatoe Valley, California

We needed speaker muting and warning lights coupled to the microphone switch, but the switch had no unused contacts for adding the necessary wiring. We purchased a new switch of the same type (in this case a Centralab Series-1400 lever switch) and mounted it on the front panel of the board directly under the existing microphone switch. This required some work with drill and file to make a new hole in the front panel to accept the shank of the new switch.

We then mechanically coupled the switches together above the front panel by drilling holes through the shanks of the switches and inserting one long bolt through both holes as shown in the photo. Now, whenever the microphone switch is operated, the new switch follows. The terminals on this new switch may be used for wiring warning



lights, for speaker muting, or for any other purpose. This trick is useful any time an existing switch does not provide extra terminals for new wiring.

An additional advantage not to be overlooked is that it's also possible to install shielding between the original switch and the new switch and achieve greater electrical isolation than is possible when using terminals on the same switch.

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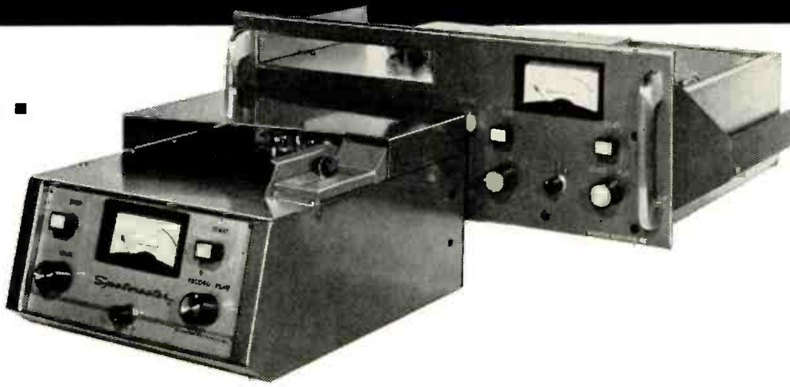

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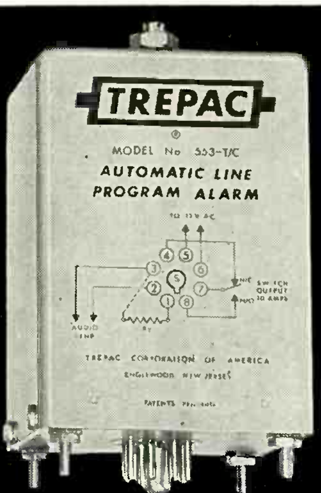

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Solid State Electronics for Telecommunications

Circle Item 28 on Tech Data Card

Low-Cost Low-Current Relay Supply

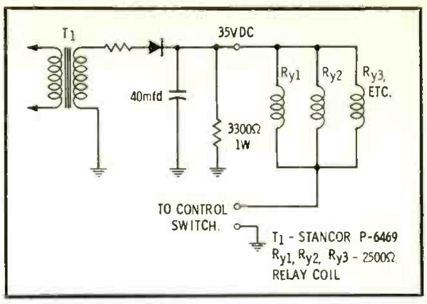
by Tad Jones, Director of Engineering, KAYO, Seattle, Washington

It is often necessary to provide additional control relays to already overloaded circuitry used in the station console. Modernization often requires construction of a relay supply using heavy components to handle the large current requirements of typical relays . . . on the order of 250 to 500 ma per relay, depending on coil voltage and resistance. These comments are offered as a means of developing an inexpensive relay power supply that will provide the required control voltage for low-current relays, thus reducing many of the problems of heavy and costly components, switching arcs, etc.

Using a standard 25-volt filament transformer (available at any wholesale distributor or surplus outlet) and a capacitor-input filter, a supplly can be made that will provide an output of 35.25 volts DC (25 volts x 1.41). With 35 volts DC as the activating voltage, it is possible to use plate-circuit relays to accomplish the necessary switching. According to one manufacturer's specifications, a 2500-ohm relay requires 10 ma for closure and a 5000-ohm relay requires 7.2 ma. Operating potentials of both these DPDT relays fall within the voltage range provided by the supply.

In our application, 2500-ohm DPDT plate-circuit relays were used. By the use of Ohm's law, we find that with 35 volts DC from the supply, the current drawn by the relay is 14 ma. It was decided to run the relays at the full supply voltage, 4 ma above the actual current required to make closure. The relays were left in the "keyed-on" position for three weeks and showed no detrimental effects or coil heating from the additional current.

The illustration shows the diagram of the relay supply. If all parts for this supply are purchased new, the cost still should be under five dollars. Engineers faced with the problem of providing expanded versatility in existing equipment will find many applications for a supply of this type.



Similar or identical supplies also could be used to equally good advantage in designing new equipment requiring a large number of remotely controlled relays. The simplicity and low cost of this power supply should appeal to many station engineers.

Phase Change Without Pattern Change

by Robert A. Jones, BE Midwestern Regional Editor, Consulting Engineer

At WFRL we adjusted the two-tower directional array during the winter, and everything was normal. But, as warm weather came, we noticed that the phase reading of early morning, but as the day went by it would shift until by midafter-the west tower would be fine in the noon it would have changed several degrees. At first we suspected that the pattern might be drifting, but a check of the monitor points proved the pattern was steady.

The fact that every morning the phase was correct was puzzling. Further thought indicated that it must be shifting due to the heat from the sun—but why? The phase-sampling lines were equal in length, and the surplus from the east tower (the one closest to the building) was coiled up and stored in the attic of the transmitter building. We quickly removed this extra cable to a cooler location, and the problem was solved—no more shifting in indicated phase. Obviously the excessive summer heat was changing the electrical properties of the sampling line and thus effecting the phase shift.

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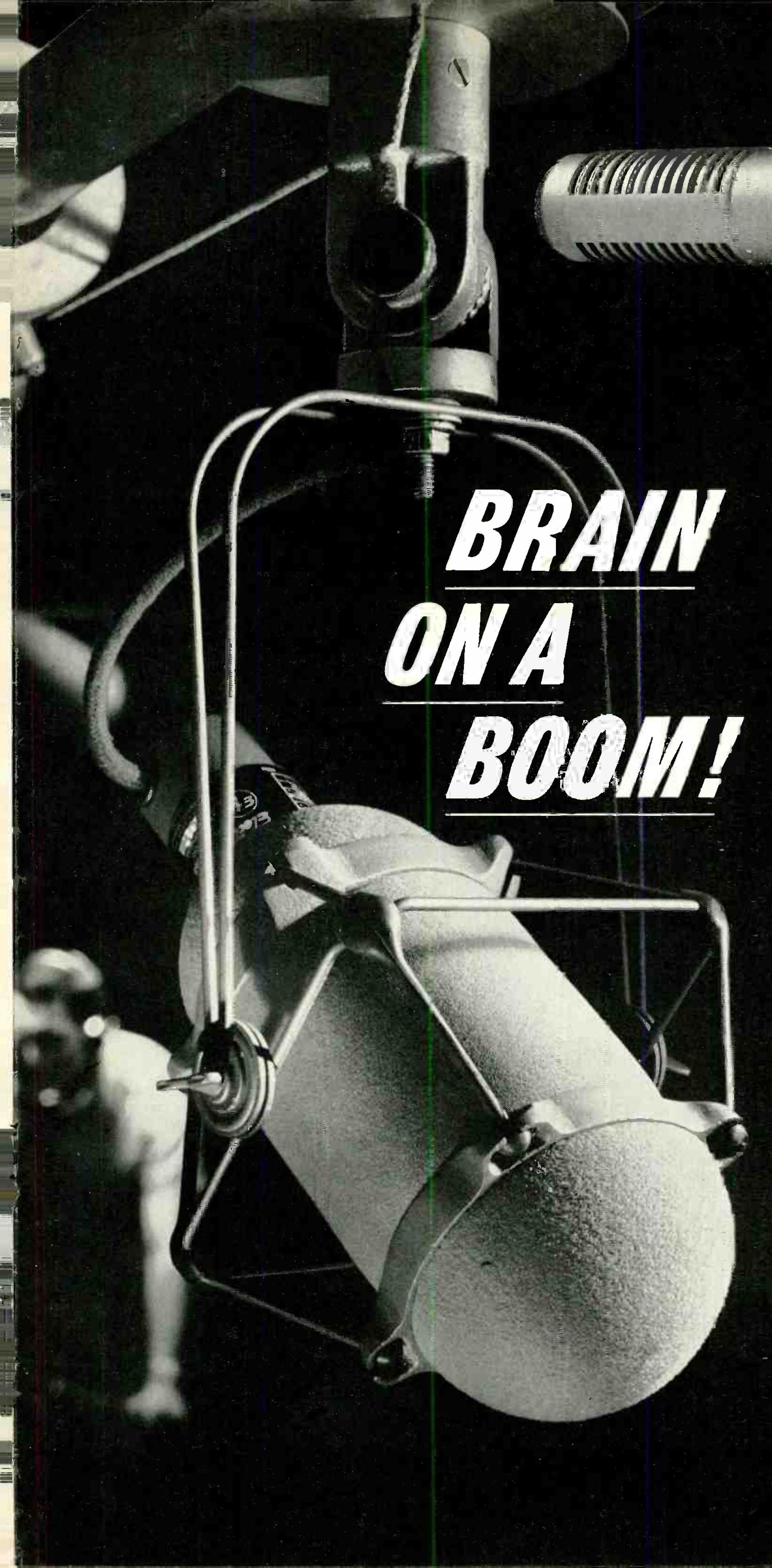
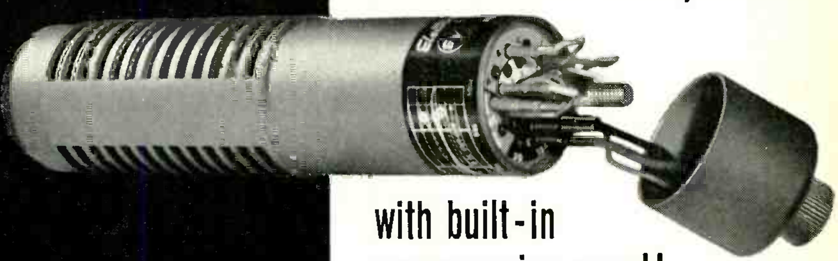


New E-V Model 668 Dynamic Cardioid Boom Microphone



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It's just like having 36 microphones in one, at the end of your boom! Simply match the computer-style programming pins to the color-coded jack field inside the new E-V668. You'll get any combination of flat response (40 to 12,000 cps), bass and/or treble rolloff, treble rise, and 80 or 8,000 cps cutoff. The 668 built-in passive equalizer matches response to need precisely without loss in output level—mixes perfectly with any other microphone.

The 668 cardioid pattern is symmetrical in every plane with excellent rear cancellation at every program setting. Two independent Continuously Variable-D* systems provide this uniformity, yet permit high output (—51 dbm) for distant pickup without added equipment or special cables.

Light in weight and small in size, the 668 with integral Acoustifoam™ windscreen and shock mount minimizes shadow problems while allowing noise-free fast panning, indoors and out. Its 1 lb., 11 oz. weight eliminates "fishpole fatigue" and counterbalancing problems.

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NEW! MODEL 667 Identical to Model 668 except sharp cutoff filters and HF-rolloff eliminated. List price: Model 667, $345.00; Model 668, $495.00 (less normal trade discounts).

* Patent No. 3115207 covers the exclusive E-V Continuously Variable-D design.

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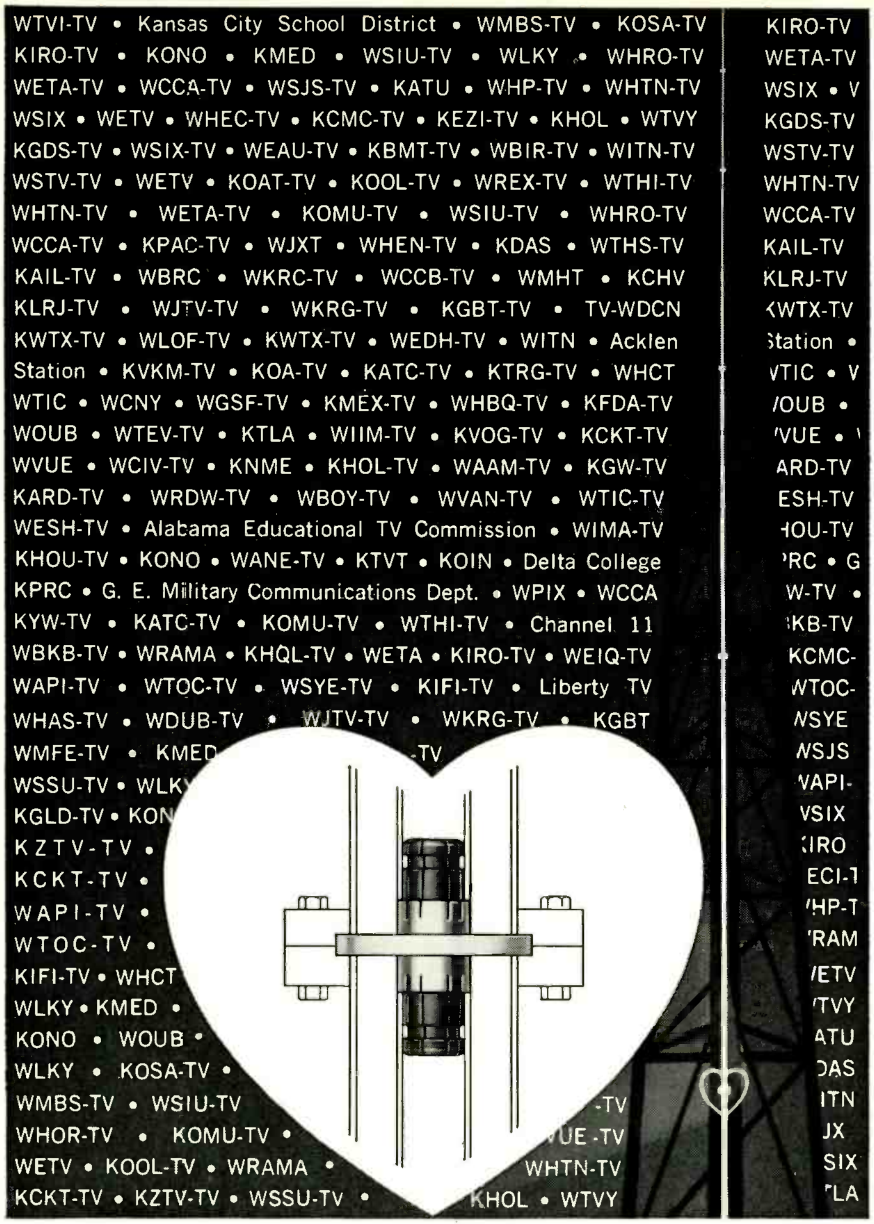

Avoid "Heart Failure"

The artery of high power RF transmission line systems is the anchor insulator connector. There are often hundreds of these anchor insulator connectors in modern high tower installations . . . yet with one failure complete "loss of life" in the entire system results. Prodelin Rigid "800" High Performance Air Dielectric Transmission Line is the RF vein supply used by broadcast stations throughout the world. Some of these top stations are listed here. Not one has ever experienced failure due to metallic connector galling. Each installation was made with Prodelube #8, a unique lubricating technique, pioneered by Prodelin and never equalled for performance and reliability. It's one of the little detail considerations that has made Prodelin the most respected name in its field. Rigid "800" High Performance Transmission Lines Systems are now available with a VSWR of 1.04:1 maximum on runs up to 2000 ft. Write for Bulletin #108.

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Circle Item 31 on Tech Data Card

Solid-State Devices

(Continued from page 17)

and load, blocking the passage of current through the load. When action is wanted, an AC control voltage lights the lamp which is optically coupled to the photoconductor. When illuminated, the photoconductor has a resistance of approximately 100 ohms, and the source-to-load path is effectively closed, or turned on. This circuit is simple and provides excellent isolation between control and signal circuits.

Others

The unijunction transistor, the tunnel diode, and the trans-switch are other switching devices using semiconductors. Most of these relay circuits are used for small-signal applications. The gate-controlled switch or gate-turn-off (GTO) switch has recently appeared as an outgrowth of the basic SCR. This device overcomes the turn-off problem of the SCR by permitting a reversed-polarity gate signal to turn it off, without resorting to the special two-SCR circuit already shown. A positive pulse applied to the gate terminal will latch the GTO into conduction; a negative pulse will turn it off again. This GTO switch has been made to operate speeds up to 100 kc—one-hundred-thousand on-off actions every second!

The wide variety of recently developed solid-state relays utilizes one or more of the principles described here, and has enabled engineers to design many systems previously impossible to construct. For example, it is now possible to build 100-word-per-minute telegraph polar relays, AC power contactors, tower-light flashers, signal relays, and motor-starting contactors—all of semiconductor construction — which exhibit vastly improved characteristics over their electromechanical counterparts. In military applications, static relays have been developed to a point where special technical standards have been written. It is certain that the variety of broadcast equipment using these devices will increase as the cost of the components continues to decrease, and the solid-state switch or relay will become a very familiar component. ▲

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Circle Item 33 on Tech Data Card

NEWS OF THE INDUSTRY

NATIONAL

Seeks Nationwide Pay TV

Zenith Radio Corp. has asked the FCC to authorize subscription TV on an "extended nation-wide basis" and to make it available to all operating or proposed TV stations as a supplemental broadcast service. Supporting the petition, filed jointly with **Teco, Inc.,** was a detailed analysis of the Hartford, Conn., subscription TV test, making public for the first time the factual, public-interest data developed during the nation's only large-scale, over-the-air trial of box-office TV. Now in its third year, the test is being conducted over WHCT, Hartford, by RKO General, who made the test data available. The operation uses the Phonevision subscription TV system and equipment developed and manufactured by Zenith.

The Zenith-Teco presentation asserted that the Hartford test results show that subscription TV is of the greatest importance to families who can least afford the higher prices of theater box-office admissions, adds significantly to TV program choices available, has the potential to increase the number of TV services available to the public, and attracts a level of audience support that can make it a sound business undertaking.

The results of the Hartford test indicate that subscription TV has broad appeal, particularly to middle- and lower-income families: 40.8% of subscribers had average incomes of between $4000 and $7000 annually, and 43.3% had incomes from $7000 to $10,000. Only 14.4% had incomes over $10,000. During the operation's first two years, average spending per week was somewhat higher in the $4000-$7000 income group and was lowest for subscribers with incomes over $10,000. As the number of subscribers increased, the proportion of those in the $4000-$7000 income group consistently increased.

SMPTE President Calls for Increased Member Support

The president of the **Society of Motion Picture and Television Engineers,** Ethan Stifle of Eastman Kodak Co., called for strong support from members in comments addressed to a luncheon meeting during the recent 97th SMPTE Technical Conference held in Los Angeles. The Society, Stifle said, has made an attempt at adjustment by the addition of five new vice presidencies in the areas of motion pictures, television, instrumentation and high-speed photography, photoscience, and education. In his discussion of the new positions, Stifle stressed education and photoscience as the newest fields of interest within the Society and noted that the chairman of the education committee is Reid Ray, SMPTE past president. The primary goal of Ray and the committee is to establish more courses in institutions of higher learning, with stress on degree programs in photographic engineering.

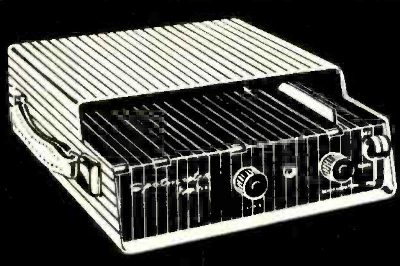
Stifle also called for wider support of the SMPTE through increased membership, pointing out that the Society grew 5% last year and now boasts more than 6300 members.

INTERNATIONAL

Rise in Soviet Radio-TV Audience

Citizens in the Soviet Union presently own 11 million television sets and 70 million radios, according to a Radio Moscow reported monitored by **Radio Liberty.** The government-controlled Soviet radio also disclosed that 2½ million television sets and 5 million radios and radio consoles were produced in the USSR last year. Radio Moscow cited the figures as part of its coverage of a large exhibition of Soviet radio equipment at the Polytechnical Museum in the Soviet

SPOTMASTER



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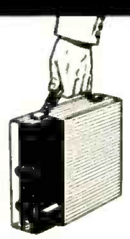

Your time salesmen will wonder how they ever got along without it! Completely self-contained and self-powered, PortaPak I offers wide-range response, low distortion, plays all sized cartridges anywhere and anytime. It's solid state for rugged dependability and low battery drain, and recharges overnight from standard 115v ac line. Packaged in handsome stainless steel with a hinged lid for easy maintenance, PortaPak I weighs just 11½ lbs. Vinyl carrying case optional.
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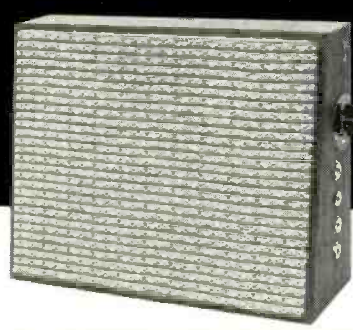

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THE CHIEF ENGINEER

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In our AM installation, we use a make-before-break switch at the tuning house to connect the antenna base current meter for use in calibrating the remote meter. When the base meter is switched in, the remote meter shows that the antenna current changes by about .5 amp (from a nominal 2.77), apparently due to the inserted impedance of the RF ammeter. I have heard of using a constant-impedance switch in such cases so that no change in current occurs, regardless of the position of the switch.

Can you supply me with information regarding such a switch?

This problem is caused by the make-before-break switch which provides a shorting path having less inductance than does the path which exists when the meter is in the circuit. In order to avoid the effect, the shorting bar should be replaced by a loop of tubing or other heavy lead that will match the inductance of the meter circuit.

You can replace your present switch with a new one equipped with an inductive shorting bar, or you can build an inductive bar for your present switch to replace the existing straight-through shorting bar. Cut a small piece of tubing of appropriate size and bend it in a loop which will clear ground and any other conductors. Make it slightly too long, and continue to shorten the loop until no effect is observed as the meter switch is operated. If you have an RF bridge available, you can simplify the task by measuring the inductance through the switch as it is operated between the two positions.

It might be desirable to have a qualified consultant check your antenna tuning unit and assure that it is in proper adjustment, since such a serious shift as you report is unusual in a nondirectional antenna, particularly one near one-quarter wavelength in height.

We have, for some time, had a problem with voltage fluctuation in our power system when the tower lights are operating. We have a single tower with standard A-3 lighting. The 110-volt line serving the tower lights is fed through a lighting transformer.

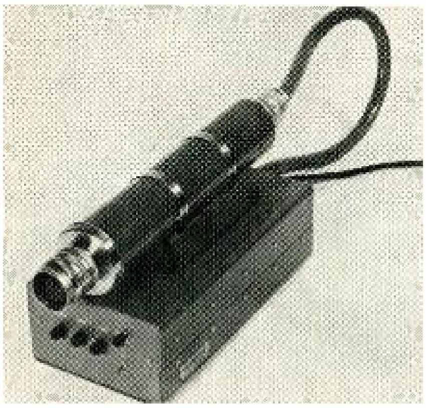
We purchased a new tower-light flasher unit to try to eliminate the problem, but there was no improvement. All power for the station comes from the same transformer bank. We have tried switching legs, but this just puts the problem on the other leg of the 220-volt circuit. Any suggestions will be greatly appreciated.

Your basic problem is one of poor AC power-line regulation. This occurs when the wire size is too small for the current flowing. When the flasher closes to illuminate the top beacon, additional current flows, and the IR drop in the line increases. There are three places to look for the trouble. First, your own circuits in the transmitter building or those supplying AC to the tower may employ wire that is too small. Take an AC voltmeter and measure the voltage change on the tower side of the lighting chokes as the flasher operates. Compare this change with the voltage change where the AC service enters the transmitter building. If the variation measured at the choke exceeds that at the service entrance by more than two or three volts, the circuits in your transmitter building carrying the lighting power are too small and should be replaced with larger wire.

If there is a substantial voltage fluctuation where the service enters the transmitter building, the fault lies with the facilities supplied by your local power company. If your service transformer is just outside the transmitter building, the regulation may be materially improved by installing a transformer having larger capacity. If the transformer is not located relatively close to the transmitter building, the drop may be occurring in a long run of service wire. This can be avoided by installing a separate transformer near the radio station.

Lastly, the regulation is sometimes poor even on the high-tension circuit if you are at or near the end of a lightly-loaded AC line. Power companies are often reluctant to go to the expense necessary to improve this regulation on rural lines. In any event, if your voltage measurements indicate the problem rests with the power company, you should work out the best solution with them.

NEW PRODUCTS



New Closed-Circuit TV Camera

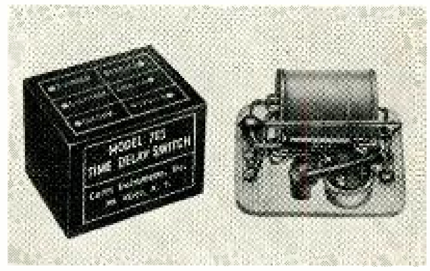
A closed-circuit TV-camera system which incorporates ultra-high resolution with minimum size and weight has been announced by **DuMont Labs,** division of **Fairchild Camera and Instrument Corp.** The solid-state vidicon camera uses Fairchild's silicon Micrologic® integrated circuits. Termed type TCS-950, the camera produces 1000-line center horizontal resolution at all scan rates and vertical resolution of 700 lines using a 1029 line-per-frame format. Typical scan rate formats available with the TCS-950 are 525, 625, 875, 945, and 1029 lines per frame. At 525 lines/frame, video signals produced are in conformance with EIA standard RS-170. Signals produced at the other rates conform to the RS-170 format. The new camera system utilizes a 25-mc bandpass to achieve corner-to-corner sharpness. Typical signal-to-noise performance is 36 db at 1.0 foot-candle faceplate illumination and 30 db at .5 foot-candle faceplate illumination, using a fully transistorized preamplifier. The camera weighs 16 lbs, and a complete operating system, less lens and monitor, lists for $4500.

Circle Item 100 on Tech Data Card

In-Line Microphone Transformer

A new microphone-matching transformer (Model M8027) designed for matching low- and medium-impedance microphones to high-impedance amplifier inputs, was recently announced by **Microtran Co., Inc.** Useful for applications requiring cable runs of up to 200′ between microphone and amplifier, the transformer uses mu-metal and electrostatic shields to minimize hum pick-up. The unit is supplied with an integral 20″ shielded cable to be terminated with the desired connector to match the amplifier. Housed in a miniaturized high-impact plastic case (with removable cover to provide instant access to terminals), the transformer has an impedance ratio of 1:400 with a primary impedance of 200 ohms nominal balanced or unbalanced and a secondary impedance of 40,000 ohms, nominal. The frequency response is 50-20,000 cps ± 2 db. Price of the 2-oz. unit is $9.00.

Circle Item 101 on Tech Data Card



High-Range Miniature Time-Delay Switch

The Model 701 time-delay switch, utilizing an electrochemical principle to provide delays from 30 sec to 350 hrs and occupying less than 1 cu. in. is now available from **Curtis Instruments.** Running current is less than 10 ua with a maximum of 2 ma at time out. Contacts are electrically isolated and rated at 4 VA. The basic timing element is

NEW! LANG MASTER REMOTE CONTROL

Let s You Operate Up to Six Tape Recorders Simultaneously!

For the owner of 2, 3, 4, 5 or six tape recorders — the new LANG MASTER REMOTE CONTROL provides single push-button control. Just plug in master tape recorder and make up to 5 copies simultaneously. Built-in safety lock prevents unit from erasing a master tape. No modification of your present equipment is necessary. Comes complete with cable and plugs. Mounts in standard rack.

For complete details and new Lang Catalog write

LANG ELECTRONICS INC. 507 FIFTH AVE., N.Y. 17

For all your audio needs — Look to Lang!

Circle Item 42 on Tech Data Card

PROGRAM DIRECTORS
CHIEF ENGINEERS
EXECUTIVES

SAVE TIME

Identifying, Evaluating, Cataloging, Inspecting 16mm Motion Picture Film on the

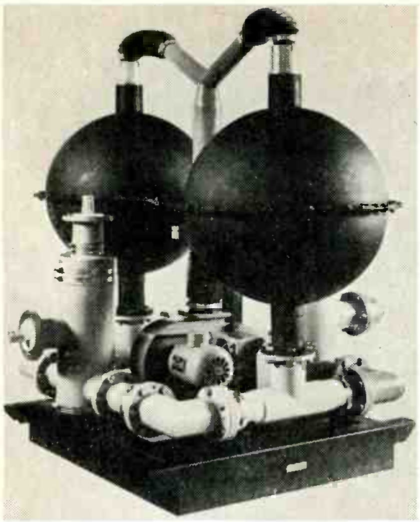
moviola LIBRARY READER

- View at up to five times sound speed.
- View at governed sound speed.
- Twelve sided prism, high quality, projection system.
- Rapid rewind without switching reels.
- Performs all functions forward and reverse.
- Available with or without sound.

moviola manufacturing co.
motion picture / tv equipment

5539 Riverton Ave., North Hollywood, Calif.
Telephone: 877-2173
Cable Address: Moviola, North Hollywood, Calif.

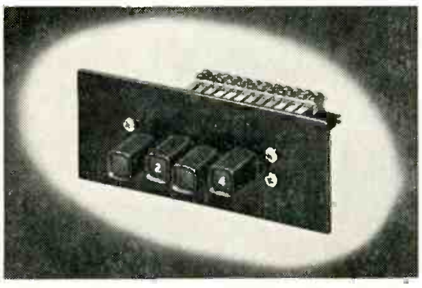
Circle Item 43 on Tech Data Card



Gasless High-Power Notch Diplexers

Ward Electronic Industries has introduced a new line of CoEl high-power UHF notch diplexers which do not use any special gasses for pressurization. The notch diplexers are available for transmitters up to 50 kw. Excellent amplitude response is said to be maintained at color-subcarrier frequencies for high-quality color transmissions. The units are designed for ceiling mounting to conserve valuable floor space and are factory tuned to the customer's specific channel. No operational adjustments are required.

Circle Item 106 on Tech Data Card



New Unpowered Illuminated Pushbutton

The Glo-Button, X Series, manufactured by **Switchcraft, Inc.,** looks and functions like an illuminated button, but requires no bulb or electrical power.

The button has a translucent front screen upon which a desired legend is marked. An opaque color provides the background for the legend, while the legend itself remains clear. An internal fluorescent illuminator is carried on a pusher which has two legs extending out from the rear.

When the button is pressed, the rear legs of the pusher bring the orange-red fluorescent illuminator flush with the screen. The legend then lights up due to reflected ambient light and projects a clearly visible legend or symbol that signals the switch-control status. When the illuminator is recessed, in the unactuated position, ambient light is not reflected, and no illuminator color is apparent. Present legends are available for numerals 1 through 18, letters A through R, plus ON and OFF.

Circle Item 107 on Tech Data Card

NEW

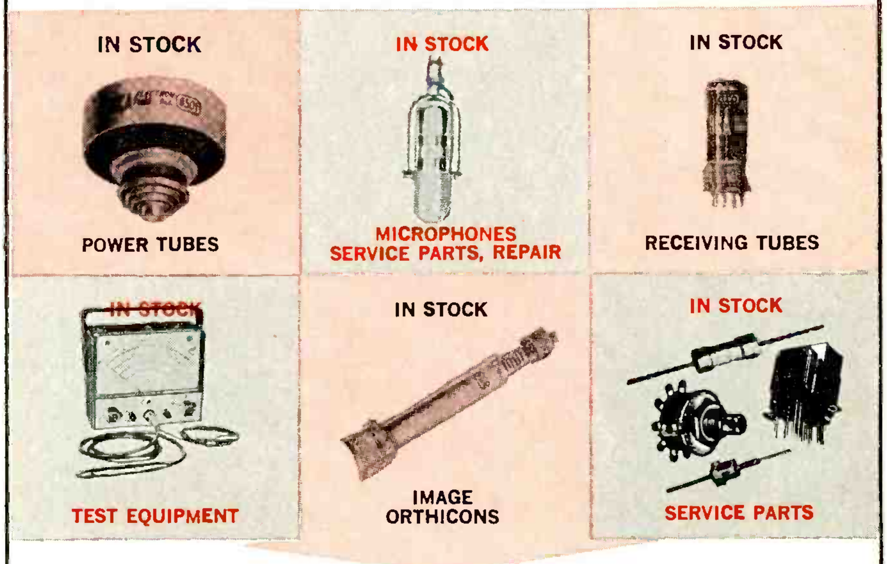
RCA

SUBMINIATURE LAVALIER DYNAMIC MICROPHONE
Type BK-12A

FEATURES

- Lightweight, subminiature dynamic microphone with excellent speech balance when talking "off mike"
- Wide frequency response — 60 to 18,000 cycles
- Easily concealed in hand . . . in clothing . . . on stage settings
- Non-directional pickup . . . improved efficiency . . . rugged construction withstands rough usage
- Comes complete with clip type lanyard, tie clip holder and cable clip
- Easily installed replacement cartridge makes factory repair unnecessary
- Size: 3/4" dia. x 1 1/2" long. Wt. 3/4 oz.

WRITE FOR COMPLETE DESCRIPTION AND SPECIFICATIONS



Terminal-Hudson Electronics, Inc.

236 WEST 17th STREET, NEW YORK 11, NEW YORK
CHelsea 3-5200, TWX: 212-640-4744

HOLLYWOOD RADIO & ELECTRONICS, INC.

NORTHERN CALIFORNIA DIVISION
1135 O'Brien Drive, Menlo Park, California
Phone 322-3431, TWX: 415-492-9366

SOUTHERN CALIFORNIA DIVISION
5250 Hollywood Blvd., Hollywood 27, California
Phone 466-3181, TWX: 213-468-1115

Circle Item 46 on Tech Data Card

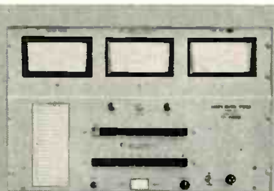
BROADCAST EQUIPMENT

"reliable profit makers"

REMOTE PICK-UP SYSTEM

Unequaled 160 mc/s performance for quality broadcasting

- ± 1.5 db 50-10,000 cps.
- 1.6% max. distortion



REMOTE CONTROL SYSTEMS

For AM-TV-FM via single AC phone line or STL

- Push-Button
- 21 Channels
- Silicon Solid-State

PCL-2B

950 mc/s AURAL STL

For AM, FM, Stereo and TV

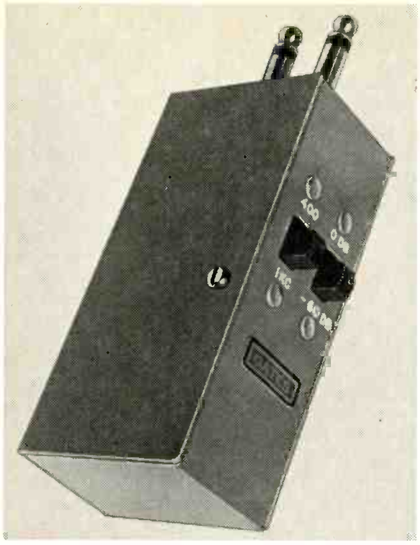
- ± 0.5 db 50-15,000 cps
- Less than 1% distortion

Provision for SCA Multiplex, Remote Control and Order Circuits

MOSELEY ASSOCIATES, INC.

135 NOGAL DRIVE
SANTA BARBARA, CALIFORNIA
(805) 967-0424

Circle Item 47 on Tech Data Card



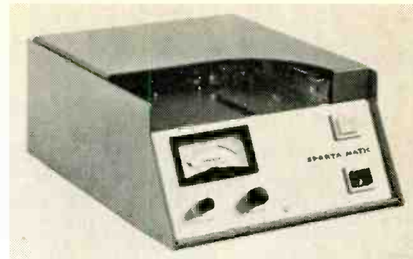
Plug-In Audio Oscillator

The Model M6120 Patch-in Oscillator supplies audio signals for checking radio and television broadcasting, telephone, and sound-distribution systems. The unit, manufactured by **Gates Radio Co.,** is automatically energized from a self-contained battery when inserted into the patch panel. Frequencies of approximately 400 and 1000 cps and levels of 0 dbm and −60 dbm are available by operating two switches. The output impedance is 600 ohms at 0 dbm level and 150 ohms at −60 dbm level for microphone circuits. The output, connected to the two plug tips, is ungrounded and may be fed into balanced or unbalanced circuits. The two sleeves of the patch plug turn on the oscillator when shorted together by insertion of the plug in the jacks. Battery life is approximately 40 hours with normal intermittent use.

Circle Item 108 on Tech Data Card

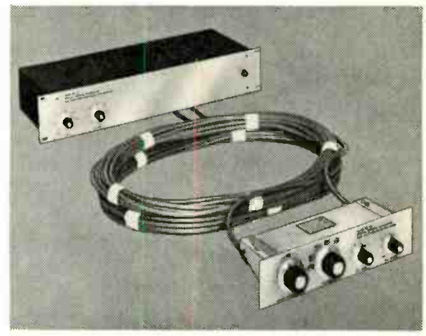
Table-Top Cartridge Equipment

The new SPARTA-MATIC 400 Series is a table-top-sized tape-cartridge system consisting of a playback model and a record and playback model, both of which display quiet operation and easy cartridge insertion and release. The tape heads are precision lapped, hyperbolic, metal-face types. The heads plug into an improved mount to give fast adjustment and positive locking of tape-head azimuth and vertical position. Amplifier



modules are constructed on individual epoxy-glass printed-circuit boards. Anodized, brushed-aluminum control panels feature illuminated stop-start buttons. The equipment is manufactured by **Sparta Electronic Corp.**

Circle Item 109 on Tech Data Card



Remotely Controlled Special Effects Generator

Ball Brothers Research Corp. special-effects generator is now available with provisions for remote control. Like the manually operated Mark VI-A generator, the remote-control version, Mark VI-AR, was developed to fulfill the need for a compact special-effects generator. The solid-state Mark VI-AR produces horizontal, vertical, and corner wipes and has an external key for keyed inserts. Matting or lettering is accomplished by means of a unique circuit which allows the operator to select any lettering shade between black and white, independently of the amplitude of the matting video signal. The Mark VI-AR has its own internal power supply (117V AC) to operate the special-effects generator and associated remote-control circuits. The equipment is provided with a one-year warranty. ▲

Circle Item 110 on Tech Data Card

Scala Precision Antennas

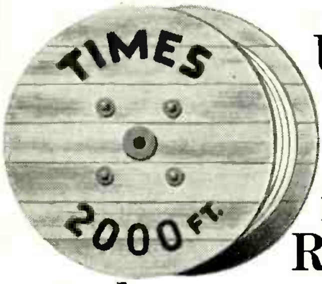
- ★ OFF-THE-AIR PICKUP — FM or TV
- ★ LOW POWER UHF, VHF TV TRANSMITTING
- ★ STL AND TELEMETERING ANTENNAS

Engineered to meet rigid FM and TV station specifications, and to endure the tests of weather and time.

Built to your specifications by

SCALA RADIO CORP. 2814 19th STREET SAN FRANCISCO 10 VA 6-2898

Circle Item 48 on Tech Data Card



Until April 16, 1965, you couldn't buy 2,000 ft. continuous seamless aluminum sheath CATV cable for love or money. Now Times is shipping it. Read why this revolutionary new cable makes every other CATV cable a compromise.

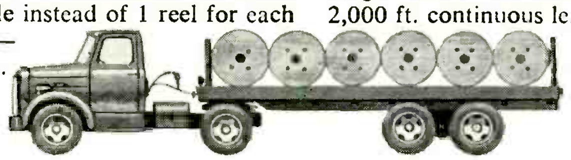
Everyone in the CATV business knew it: the longer the cable, the fewer the splices, the lower the maintenance, the better the performance ...the higher the profits.

But no one did anything about it until Times, the company the industry expects to be first*, took up the challenge of longer-length cable.

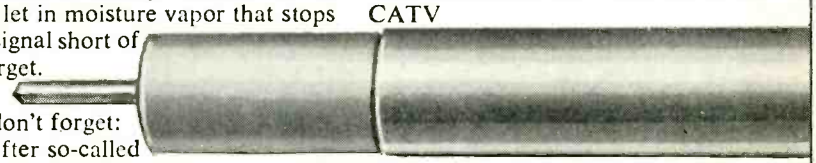
The result: Times made the breakthrough with its 2,000 ft. continuous lengths of seamless aluminum CATV cable. Even more exciting, Times is shipping this cable right now!

Here's what this new 2,000 ft. cable can do for you that no other cable can:

- **It easily saves you 10% on installation and shipping costs.** 2,000 ft. lengths mean fewer splices—8% saved. Only 1 reel needed for 2,000 ft. of cable instead of 1 reel for each 1,000 ft.—2% saved.



- **It increases profit.** The fewer the splices, the less maintenance needed. Less maintenance means less labor cost and more profit.
- **It improves electrical performance.** Times JT-1000 cable guarantees 26 db minimum return loss—a must for minimum ghosting. Moreover, it won't let in moisture vapor that stops your signal short of the target.



And don't forget: long after so-called economy cable has been replaced (it starts deteriorating the day you install it), Times 2,000 ft. JT-1000 cable will still be a top performer, keeping pace with your system's planned potential.

Why compromise when you no longer have to...now that Times 2,000 ft. continuous lengths of seamless aluminum CATV cable are on the shelf and ready to be shipped to you.

Times' Family of Firsts*—
The Standards of the Industry

First to design a long life cable specifically for CATV

First with foam dielectric cables for CATV

First with cable that made all-band systems economically feasible

First to make aluminum tube sheathed coaxial systems economically feasible

First to offer 26 db minimum return loss guarantee

First again with 2,000 ft. lengths of seamless aluminum sheath CATV cable

TIMES WIRE & CABLE
DIVISION OF THE INTERNATIONAL SILVER CO.
Wallingford, Conn.

Transmission System Design and Engineering/Standard & Special Coaxial Cable/Multiconductor Cable/Complete Cable Assemblies/Teflon* Hook-Up Wire *A Du Pont Trademark

Circle Item 49 on Tech Data Card

AUDIO & RECORDING EQUIPMENT

57. ALTEC LANSING—Folder describes equipment for use in commercial recording and broadcasting.

58. AMPEX—Details of VR-2000 high-band VTR offered in brochure.

59. ATC—Data sheet on "Micro-set" adjustable head-mounting assembly for tape-cartridge studio equipment.

60. BROADCAST ELECTRONICS—Packet contains specifications and price information on Spotmaster tape-cartridge systems, including: Ten Spot; 400A Series; Portapak I; and Super "B" Series.

61. CINE SONIC—Data sheet describes rental service which supplies background music on 7", 10½", and 14" reels, stereo or mono.

62. ELECTRO - VOICE—Folder describes and illustrates line of microphones with various finishes and gives complete catalog listing of all E-V microphones and PA equipment.

63. EUPHONICS—Eight - page brochure illustrates "Miniconic" semi-conducter cartridges and tone arms in four-color picture-story form.

64. FAIRCHILD—Information available on "Reverbertron" electro-mechanical reverberation system designed for use in broadcasting and the recording studio.

65. GATES—Complete line of campact and portable transistorized remote amplifiers is illustrated and described in eight-page brochure.

66. MAGNASYNC—Brochures and booklets describe magnetic-film sound equipment for use in television motion-picture work.

67. NORELCO — Technical specifications and brochures on microphones, headphones, professional recording equipment, and transistorized modules.

68. QUAM—New general catalog No. 65 lists speakers for color-TV replacement, PA systems, high-fidelity, and general replacement.

69. RCA—Specification sheet gives details of new BK-12A sub-miniature dynamic lavalier microphone.

70. SCULLY — Specification sheets and brochures give data on Model 280-S P/14 recorder/reproducer.

71. SENNHEISER — Data sheet describes Model MD 31 professional floor-stand microphone.

COMPONENTS & MATERIALS

72. METHODE—Crimp-style socket and pin contacts in bulk or reel form are described in two-page illustrated brochure.

73. SPRAGUE—Twelve-page folder shows line of transistors and "Unicircuit"® networks.

74. SWITCHCRAFT—Data Bulletin No. 150 introduces Series 10,000 "Lo-Cap"® lever-actuated switches using phosphor-bronze actuator and contact springs.

MICROWAVE DEVICES

75. JERROLD—Technical data sheet gives particulars on 15-kc bandwidth program-carrier system, Model JP-15.

76. MICRO-LINK—Brochures on Model 420A microwave relay link and Model 600 link, with application notes.

MOBILE RADIO & COMMUNICATIONS

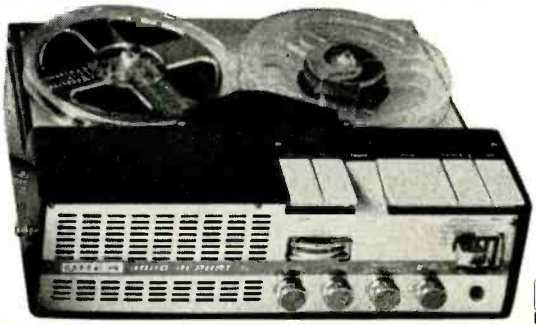
77. MOSELEY—Data sheet outlines specifications and uses for 160-mc remote-broadcast pickup system.

78. MOSLEY—Literature describes Citizens band antennas.

POWER DEVICES

79. ACME—Specification sheet 09-B03 pro-

"Hear me out. I'm the New Uher 4000-S. the greatest little professional tape recorder in the whole wide world. There is no end to my versatility. I have traveled everywhere...from the top of Mt. Everest to the bottomless pits of Africa (take me anywhere, I weigh less than 9 lbs.). Here is just a resume of my most important features: (I hope I'm not going too fast for you). RANGERTONE: exclusive accessory for lip synchronization for professional and home movies. AKUSTOMAT: (a tape saver) You simply speak and I record. You stop speaking I stop. (quite intelligent.) DIA-PILOT: Impulse transmitter for fully automatic control of slide projectors and animated displays. Fully transistorized, four speeds (15/16, 1⅞, 3¾, 7½) Records up to 8½ hours on 5" reel. Piano keyboard for rewind, start/playback, pause stop, record and fast forward. Built-in battery "pak" or AC powered. Large illuminated VU meter. My references: Well ask any professional radio or TV commentator, reporter, engineer or anthropologist. Thank you for your time. Additional information furnished upon request or see your dealer for a full demonstration. Sound begins and ends with a Uher Tape Recorder."*

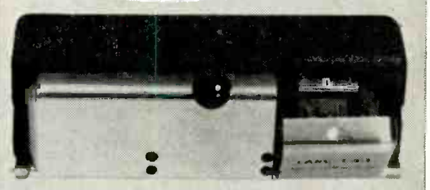


(*PRONOUNCED U-ER)

martel
MARTEL ELECTRONICS
LOS ANGELES: 2356 SOUTH COTNER, NEW YORK CITY: 1199 BROADWAY, CHICAGO: 5445 NORTH LINCOLN AVENUE

Circle Item 50 on Tech Data Card

Precision Tape Editing Starts With the New L & D EDIT!



Just a flip of the swing-open gate and presto you're ready to mark the exact spot on your tape. A must for those who use the more precise grease pencil technique of tape editing, the L&D EDIT lets you mark your tape while it is firmly held in contact against the playback head. L&D EDIT does not change the normal function of the head gate. New L&D EDIT is used by more and more audio engineers to provide more accurate tape editing!

Price: $45.00
with your old head gate

For complete details and new Lang Catalog write:

LANG ELECTRONICS INC.
507 FIFTH AVE., N.Y. 17

For all your audio needs — Look to Lang!

Circle Item 51 on Tech Data Card

FIRST TO MEET INDUSTRY NEEDS!

ANOTHER KEY TO . . . SPARTA SUCCESS

STEREO

The AS-500 CONTROL UNIT only $1350.

SPARTA'S thorough knowledge of broadcasting problems has yielded yet another product exclusive, the new AS-500. It is designed for almost every stereo broadcasting need at a reasonable cost.

EXCEPTIONAL SOUND REPRODUCTION

SPARTA incorporates quality components that meet the highest standards of discriminating FM broadcasters. The professional three speed turntables with solid state equalized preamplifiers and removeable audio console give sensitive yet dependable reproduction even on remote locations.

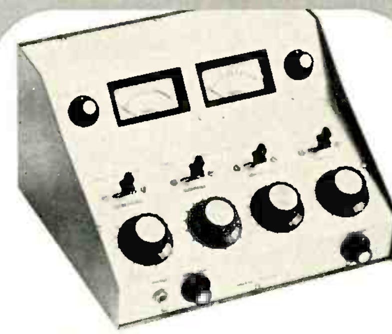
OPERATOR CONVENIENCE

This compact unit puts everything within easy reach; controls, tone arms, and turntables. The handy fold-up work table with plenty of leg room, the built-in monaural monitor and all channel cue amplifier, are a few of the thoughtful features for operator convenience.

MODERN CABINET STYLING — the woodgrain plastic laminate finish is rugged as well as beautiful. The cabinetry is strategically styled to protect the quality tone arms and control equipment during remotes and day to day production useage.

Also available in Monaural, model A-500, only $950.

Contact Sparta today for further information.



ANOTHER SPARTA EXCLUSIVE
The AS-100B Stereo Console

(Also shown at left in the AS-500 Control Unit). This unique Stereo Console is completely transistorized with balanced inputs and outputs. It contains four Stereo/Mono inputs and controls for muting, cueing, monitor and cue level.

Price: only $525.00 including power supply.

LOOK TO SPARTA FOR THE KEY TO BETTER BROADCASTING

SPARTA ELECTRONIC CORPORATION
6450 FREEPORT BLVD. • SACRAMENTO, CALIF. 95822

Circle Item 52 on Tech Data Card

vides general information on "Voltrol"® voltage stabilizers and describes line of control devices.

80. HEVI-DUTY—Bulletin 7-12 supplies data on line-voltage regulator which uses saturable-corne reactor.

REFERENCE MATERIAL & SCHOOLS

81. CLEVELAND INSTITUTE—Booklet outlines courses in electronics, including those for broadcast engineering and FCC-license preparation.

82. JAMPRO—Technical paper entitled "A Study of the Effects of Vertical Polarization in FM Broadcasting" evaluates performance of several systems.

83. VIKING—Comprehensive catalog provides information on broad line of CATV equipment and also offers suggestions for system design and operation.

STUDIO & CAMERA EQUIPMENT

84. CBS LABS—Literature is now available on the new Solid-State "Audimax" (automatic level control) and "Volumax" (automatic peak controller).

85. CLEVELAND ELECTRONICS — Data concerns modifications using new delection yoke and alignment coil to update 3" image-orthicon cameras.

86. ZOOMAR—Information in brochures gives particulars on Angenieux zoom lenses for IO and vidicon cameras, describes remote-controlled pan-and-tilt head.

TELEVISION EQUIPMENT

87. DAGE-BELL—Specification sheets give particulars on portable video-tape recorder using broadcast-approved stabilizer for remote-recording applications.

88. INTERNATIONAL NUCLEAR — Completely transistorized Model TVA1 stablizing amplifier (featuring plug-in units for stripped video, white stretch and clip, and monitoring amplifier) described in brochure.

89. MIRATEL—Data available on new line of general-purpose, transistorized TV monitors ranging in screen size from 8" to 23".

90. VITAL — Product report describes Model VI-500 video clamper stabilizer.

TEST EQUIPMENT & INSTRUMENTS

91. GOTHAM—Distributor offers information on line of test equipment imported from West Germany for EMT Wilhelm Franz.

92. INDUSTRIAL INSTRUUMENTS—Bulletin describes new ground-resistance testers for use in evaluating potential antenna sites.

93. TRIPLETT—Catalog No. 46-T contains complete information on entire line of test equipment and accessories.

TRANSMITTER & ANTENNA DEVICES

94. CCA—Catalog sheets describe AM transmitters.

95. CONTINENTAL—Eight-page color brochure gives description and specifications of Model 317C 50-kw transmitter.

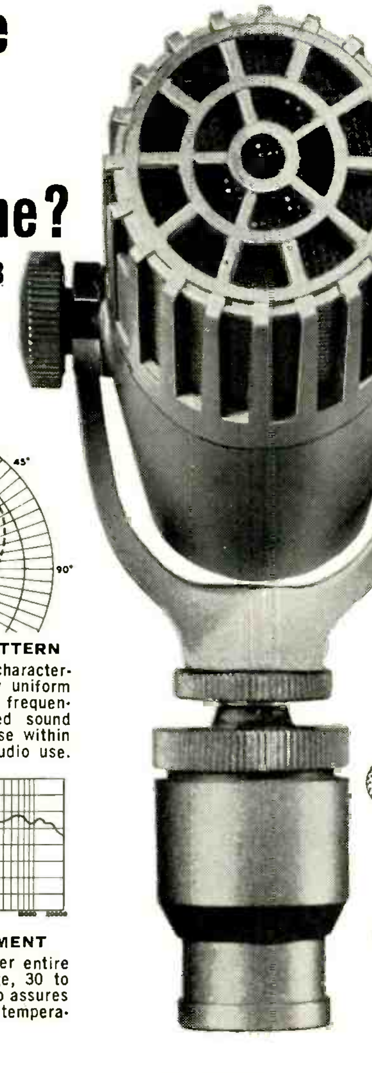
96. CORNELL - DUBILIER—Brochure gives information on rotor assemblies.

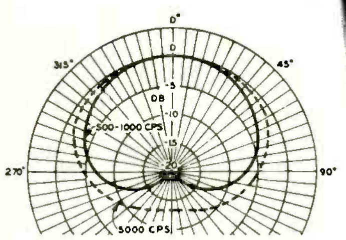
97. ENTRON—Product release provides data on broadband, transistorized bridging amplifier for use in CATV systems.

98. RUST—Catalog contains data on complete line of FM stereo transmitter and automatic-logging equipment.

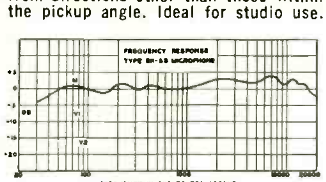
what more do you need in a microphone?

WHEN THE RCA BK-5B HAS SO MUCH...





IMPROVED CARDIOID PATTERN
The improved unidirectional characteristic provides an exceptionally uniform response over a wide range of frequencies, and attenuates unwanted sound from directions other than those within the pickup angle. Ideal for studio use.



SENSITIVE RIBBON ELEMENT
Uniform frequency response over entire audio spectrum. Effective range, 30 to 20,000 cps. Ribbon element also assures low hum pickup, immunity to temperature and humidity variations.

CHOICE OF MOUNTING

WITH BOOM MOUNT AND WIND SCREEN

DESK OR FLOOR STAND

You're looking at the business end of an RCA BK-5B ... a superb unidirectional studio microphone—ideal for all broadcast, public address and recording applications. 3-position voice-music switch provides optimum response for any application. Blast filter eliminates damage from sudden noises. Inconspicuous TV gray finish. Exceptionally good shielding permits operation in high-hum fields.

ASK TO SEE THE BK-5B AT YOUR NEAREST AUTHORIZED RCA MICROPHONE DISTRIBUTOR.

For complete specifications write RCA Commercial Engineering Dept. E115MC, 415 So. 5th St., Harrison, N.J.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

RCA The Most Trusted Name in Electronics

Advertisers' Index

MOVING?

Don't Lose Touch . . .

Receive B-E as usual at your new address

Write:

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4300 West 62nd St.
Indianapolis 6, Ind.

Next Month In BROADCAST ENGINEERING

Checking the Pattern

●

Broadcasting the 500-Mile Race

●

Antenna and Transmission Line Measurement

●

Choosing Cable for CATV

●

Several other wide-ranging feature topics

Plus: Engineers' Exchange, Book Review, Washington Bulletin, Letters, Products, News, and a host of timely features.

Reserve your copy now! Just fill out and in the convenient subscription card bound in this issue—youll receive the Broadcast Engineers' Maintenance Guide free of charge.

Instant, automatic film processing... check the savings!

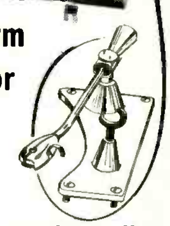
see page 43

Circle Item 54 on Tech Data Card

RUSSCO BROADCAST Turntables

Price $169.50

Separate Tone Arm mounting plate for easy installation



- Single lever controls 33, 45, 78 speeds
- Plays 45 RPM's without adapter
- Illuminated speed indicators
- Sold with or without arm(GREY or REK-O-KUT)
- Instant acceleration
- Heavy duty—professional quality
- Competitive low price
- Call or write for folder

Unconditionally Guaranteed
—against defects in material or workmanship when given normal maintenance

SOLD DIRECT —OR TO DEALERS

RUSSCO Electronics Mfg.
6879 N. SUNNYSIDE, CLOVIS, CALIF.
PH. 299-4692

Circle Item 53 on Tech Data Card

Professional Services

VIR JAMES
CONSULTING RADIO ENGINEERS
Applications and Field Engineering
345 Colorado Blvd.
Phone: (Area Code 303) 333-5562
DENVER, COLORADO 80206
Member AFCCE

JAMES C. McNARY
Consulting Engineer
National Press Bldg.
Washington 4, D. C.
Telephone District 7-1205
Member AFCCE

LAWRENCE BEHR ASSOCIATES, Inc.
RADIO ENGINEERING CONSULTANTS
FM Applications and Field Engineering
also
AM — Communications — CATV
LAWRENCE BEHR, PRESIDENT
2501 East Fourth Street
Greenville, North Carolina
919-PL 8-3966

OSCAR LEON CUELLAR
Consulting Radio Engineer
AM-FM-TV
411 Phoenix Title Building 623-1121
Directional Antennas Design
Applications and Field Engineering
Tucson, Arizona 85701
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CARL E. SMITH
CONSULTING RADIO ENGINEERS
AM, FM, TV and CATV
8200 Snowville Road
Cleveland, Ohio 44141
Phone: 216-526-4386
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CAMBRIDGE CRYSTALS
PRECISION FREQUENCY
MEASURING SERVICE
SPECIALISTS FOR AM-FM-TV
445 Concord Ave. Phone 876-2810
Cambridge, Mass. 02138

AMPEX HEAD ASSEMBLY RECONDITIONING SERVICE for all Ampex professional model recorders. This professional service features precision relapping of all heads for maximum head life. Your assembly is thoroughly cleaned and guides are replaced as required. Price includes optical and electrical inspection and complete testing on Ampex equipment in our plant. Full track or half track assemblies . . . $35.00. One to two day service. "Loaner" assemblies available, if necessary. Audio assemblies from Ampex and RCA Video Tape Recorders also serviced. LIPPS, INC., 1630 Euclid St., Santa Monica, California 90404. (213) EX 3-0449. 6-65 1t

Classified

Advertising rates in the Classified Section are ten cents per word. Minimum charge is $2.00. Blind box number is 50 cents extra. Check or money order must be enclosed with ad.

The classified columns are not open to the advertising of any broadcast equipment or supplies regularly produced by manufacturers unless the equipment is used and no longer owned by the manufacturer. Display advertising must be purchased in such cases.

EQUIPMENT FOR SALE

Will buy or trade used tape and disc recording equipment—Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 295 Main St., Tuckahoe, N. Y. 1-64 tf

Ampex Head Assemblies for 300 and 400 series recorders reconditioned. Service includes lapping and polishing all three head stacks, cleaning entire assembly, readjusting and replacement of guides, and realignment of stacks as to azimuth and zenith. Full track assemblies—$60.00. Taber Manufacturing & Engineering Co., 2619 Lincoln Ave., Alameda, California. 5-64 tf

Audio Equipment bought, sold, traded. Ampex, Fairchild, Crown, McIntosh, Viking. F. T. C. Brewer Company, 2400 West Hayes Street, Pensacola, Florida. 3-64 tf

Television/Radio/communications gear of any type available. From a tower to a tube. Microwave, transmitters, cameras, studio equipment, mikes, etc. Advise your needs—offers. Electrofind Co., 440 Columbus Ave., NYC. 212-EN-25680. 8-64 tf

COMMERCIAL CRYSTALS and new or replacement crystals for RCA, Gates, W. E., Bliley, and J-K holders; regrinding, repair, etc. BC-604 crystals; also service on AM monitors and H-P 335B FM monitors. Nationwide unsolicited testimonials praise our products and fast service. Eidson Electronic Company, Box 96, Temple, Texas. 5-64 tf

Everything in used broadcast equipment. Write for complete listings. Broadcast Equipment and Supply Co., Box 3141, Bristol, Tennessee. 11-64 6t

AMPEX 350 SERIES reconditioned capstan idlers for $7.50 exchange. Send us your old ones, or order them for $10.00 and get $2.50 back after sending the old ones in. Ours have new bearings, the rubber softened and surface precision ground. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California. 1-65 12t

AMPEX 350 SERIES reconditioned capstan drive motors (BODINE NCH-33 only) $85.00 exchange. Send us your old one, or order for $100.00 and get $15.00 back after sending old one in. Ours have new bearings and rewound stator. Package motor well. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda California. 1-65 12t

Parabolic antenna, 4-ft. diameter. New solid surface aluminum with hardware and dipole, $85 each. Empire Device heads for NF 105, half price. Jericho Electronics Supplies. Sid Gordon Electronics, 80 West Jericho Turnpike, Syosset, Long Island, N.Y. (516) WA. 1-7580. 3-65 3t

CO-AXIAL CABLE Heliax, Styroflex, Spiroline, etc. Also rigid and RG types in stock. New material at surplus prices. Write for list. Sierra-Western Electric Co., Willow and 24th St., Oakland, Calif. Phone 415 832-3527. 5-65 tf

New and Recondtioned Remote Pickup and 2-way radio equip., Fire and Police Receivers. All brands and models. Sales Manager, Box 238, Phone 817-594-5171, Weatherford, Texas. 5-65 12t

ELECTRONIC TUBES—Top Brands SOLD at substantial savings; (Minimum Order $15.00). Authorized GE, Amperex, Dumont and Eimac Distributor. Send for FREE Buyers' Guide for all your Tube Requirements. TOP CASH PAID for your excess inventory. (New Only—Commercial Quantities). Metropolitan Supply Corp., 443 Park Avenue South, New York, N.Y. 100161 (212) MU 6-2834. 3-65 5t

TAPE-A-THON — Continuous-play tape players/pre-amp 7" reels, 3¾ I.P.S. in case, used, very good condition, $100.00 each; two or more, $75.00 each. Write Broadcast Engineering, Dept. 129. 6-65 1t

Personnel

TRANSMITTER/STUDIO SUPERVISOR—First class maintenance technician, with over 20 years in broadcasting, seeks employment opportunity. Available in July, when present 3-year overseas contract on 100 kw installation, operation, maintenance and training of nationals is fulfilled. Write Broadcast Engineering, Dept. 130. 6-65 1t

FIRST PHONE ENGINEER—Experienced in operation and maintenance of directional AM, desires permanent position with medium or large AM-FM or Radio/TV operation in Miwest or West. Age 25 and married. Write Broadcast Engineering, Dept. 131. 6-65 1t

Employment

OPPORTUNITY for technician familiar with CATV maintenance. Must have at least second phone. Right man can start at $750. Write to Ketchikan Alaska Television, Box 1852, Ketchikan, Alaska. 6-65 1t

Business Opportunities

EXCLUSIVE FRANCHISE

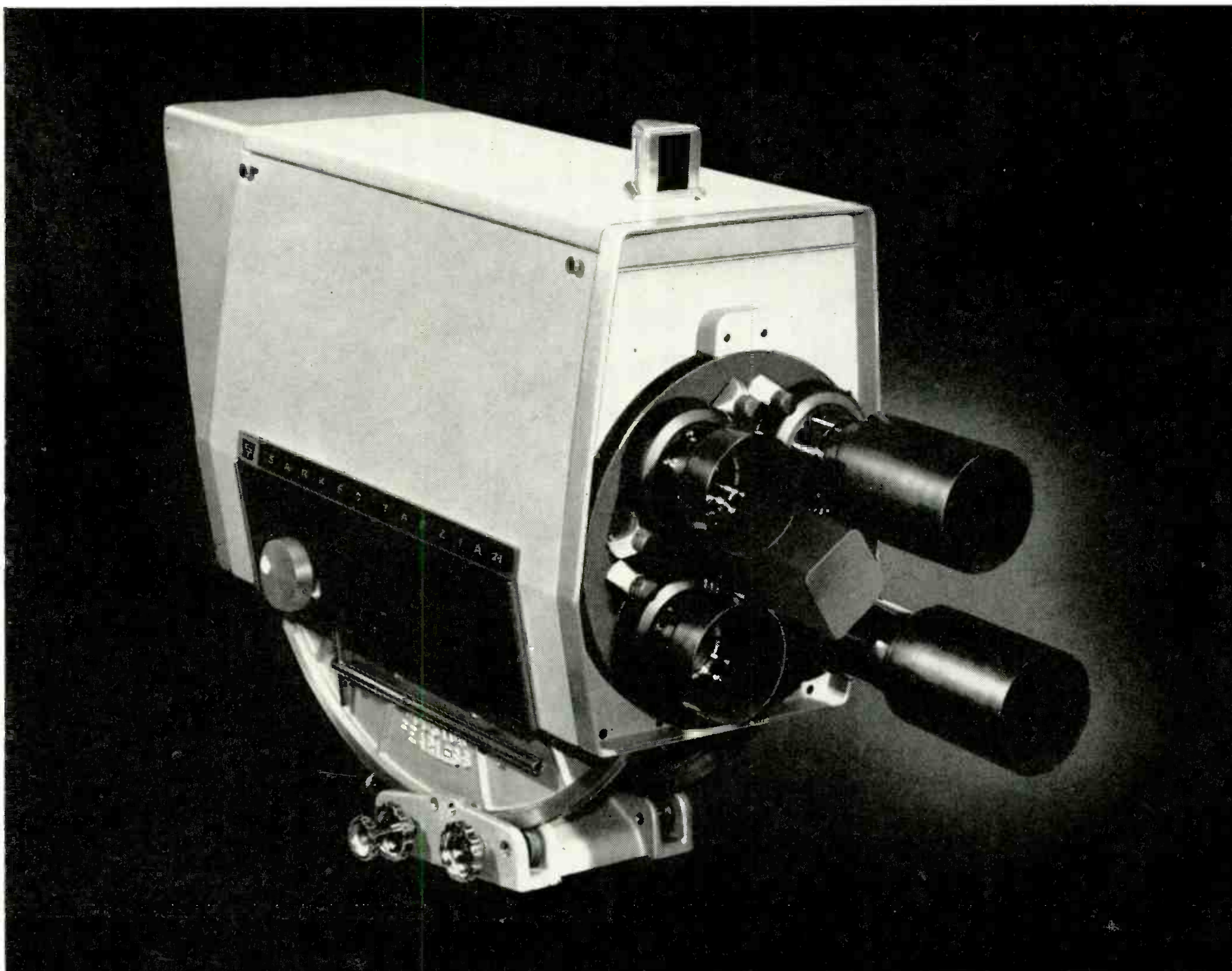
Amazing new liquid plastic coating used on all types of surfaces interior or exterior. Eliminates waxing when applied on Asphalt Tile, Vinyl, Linoleum, Vinyl Asbestos, Hard Wood, and Furniture. Completely eliminates painting when applied to Wood, Metal, or Concrete surfaces. This finish is also recommended for boats and automobiles.

NO COMPETITION

As these are exclusive formulas in demand by all businesses, industry and homes. No franchise fee. Minimum investment—$300. Maximum investment—$7,000. Investment is secured by inventory. Factory trained personnel will help set up your business.

For complete details and descriptive literature write:

CHEM-PLASTICS & PAINT CORP.
1828 Locust, St. Louis 3, Mo.



PLUMBICON

Field proven? Tarzian's is. Tarzian plumbicons are in use today . . . in actual station operation. And, Tarzian's on-the-job experience verifies plumbicon as the first really significant improvement in television camera pickup tubes in years.

Here's a camera with a high sensitivity and the ability to handle wide contrast ratios, like an IO, combined with an exceptionally high S/N ratio (48 db) . . . especially well-suited for taping. The new plumbicon tube is excellent for both color and monochrome use, exhibits no lag, and has an exceptionally long life of several thousand hours.

For your early delivery or additional information on the Tarzian plumbicon, contact your Tarzian regional manager, or call or write direct.

SARKES TARZIAN

BROADCAST EQUIPMENT DIVISION — BLOOMINGTON, INDIANA

Circle Item 55 on Tech Data Card

it pays to use the best

Before RCA's new solid-state silicon rectifiers became commercially available as direct plug-in replacements for mercury vapor and gas rectifiers, they had to be the best. At stake was RCA's reputation with the broadcasters.

Now, after 1,000,000 hours of cumulative life tests on prototypes and same-socket plug-ins, RCA types CR273/8008, CR274/872A, CR275/866A/3B28 are available for high-reliability performance in your broadcast equipment.

Here are benefits you can count on when you use RCA Silicon Rectifiers:

1. NEW SOLID-STATE RUGGEDNESS—nothing to vibrate or deteriorate.
2. INSTANT-ON—No warm-up time, no cool-down necessity.
3. INTERFERENCE-FREE—No arc-backs, no rectifier "hash."
4. LESS TO MAINTAIN—Long life—replacements minimized.
5. LESS EQUIPMENT—No filament transformer required.
6. SAME-SOCKET REPLACEMENTS—Type numbers identical to those of your present mercury vapor and xenon rectifier types.

RCA Silicon Rectifier plug-ins are available *only* through your RCA Industrial Distributor. Call him for price and delivery information.

RCA Electronic Components and Devices, Harrison, N.J.

The Most Trusted Name in Electronics

Circle Item 56 on Tech Data Card