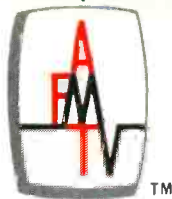




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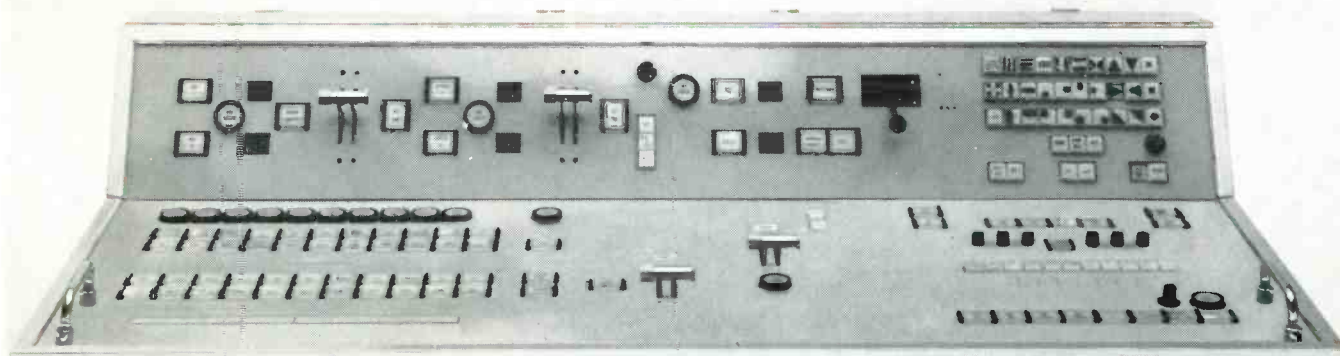
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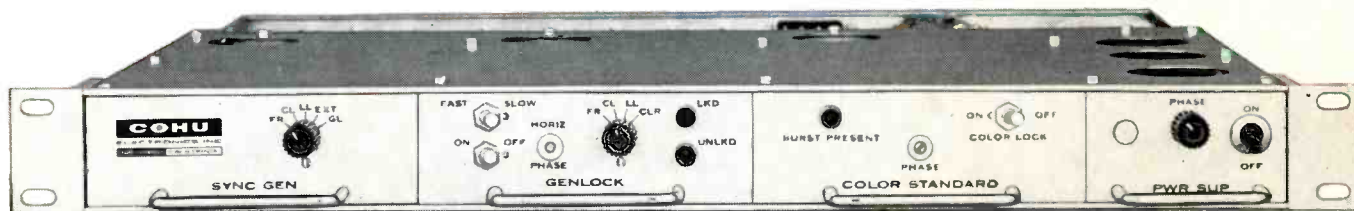


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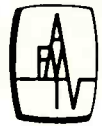
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# Broadcast Engineering

Volume 8, No. 6

June, 1966

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The growth of color continues to be evident throughout the industry.

The scene on our cover was typical of the activity at the 1966 NAB Convention.

(Photo courtesy of Visual Electronics Corp.)



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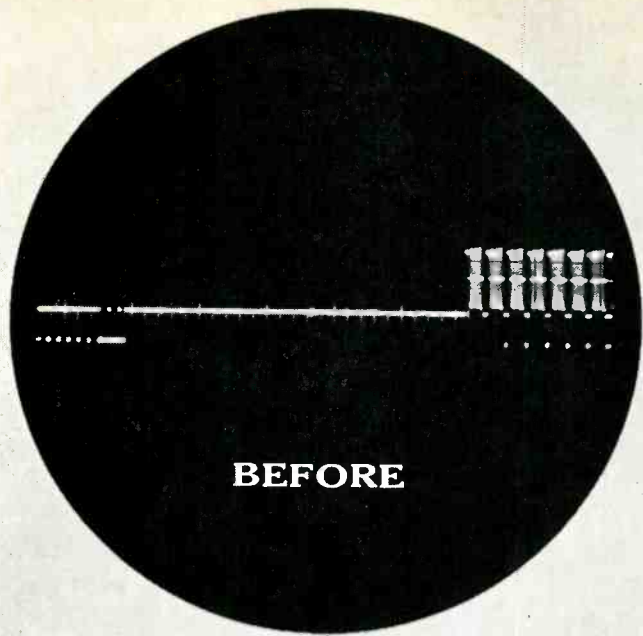
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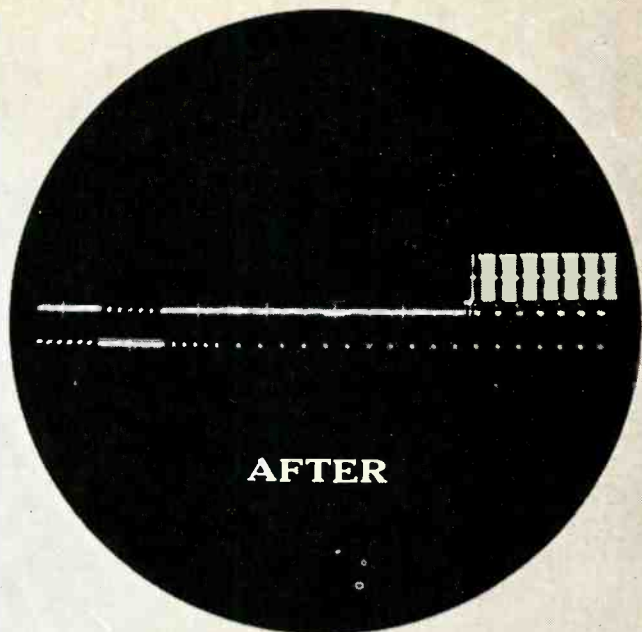
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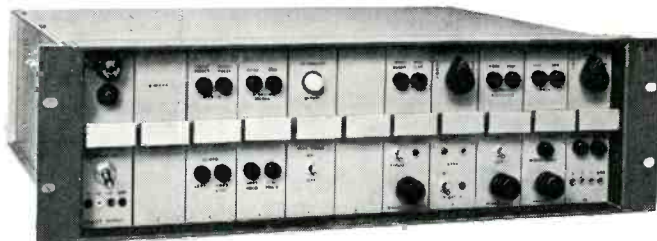
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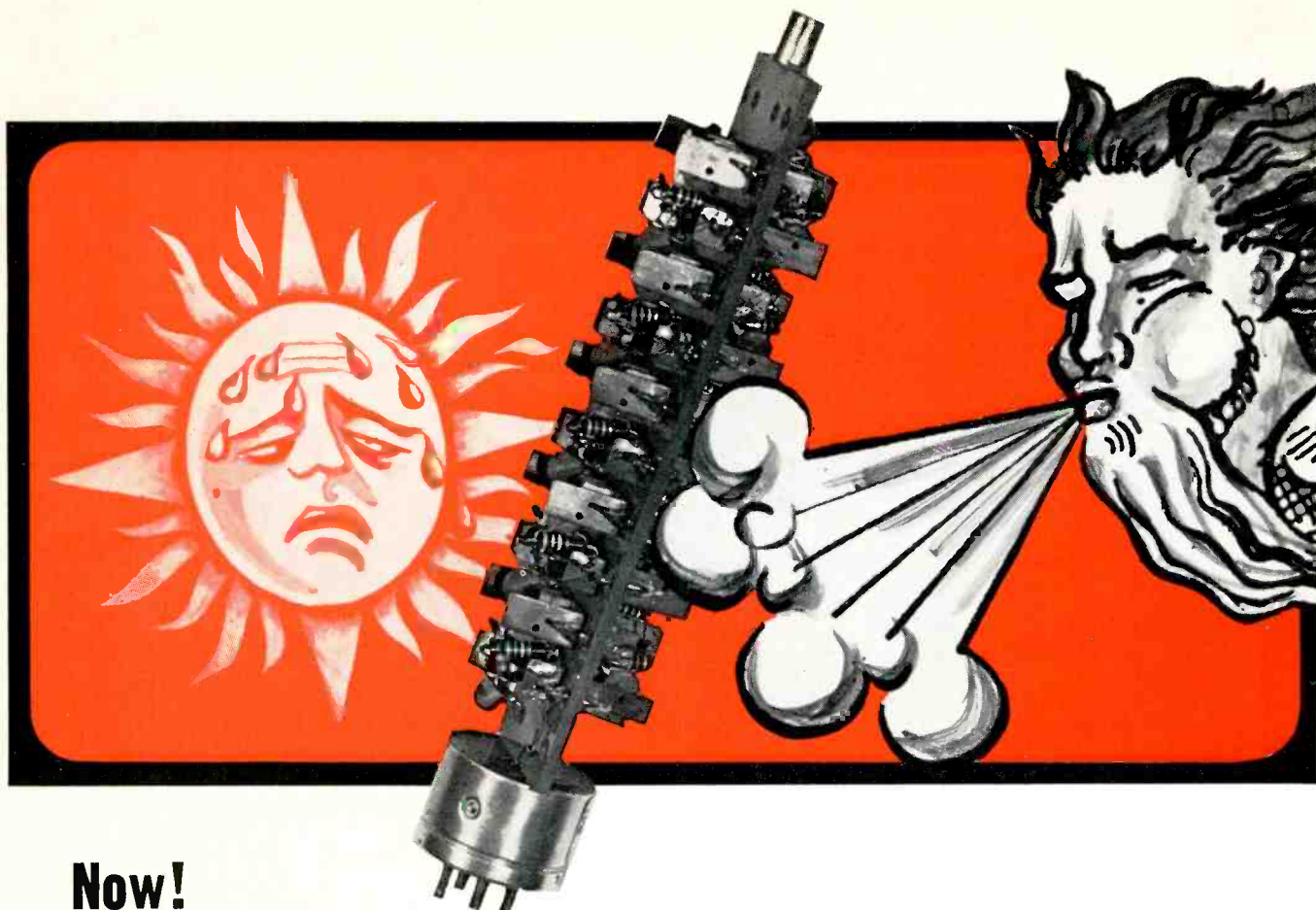
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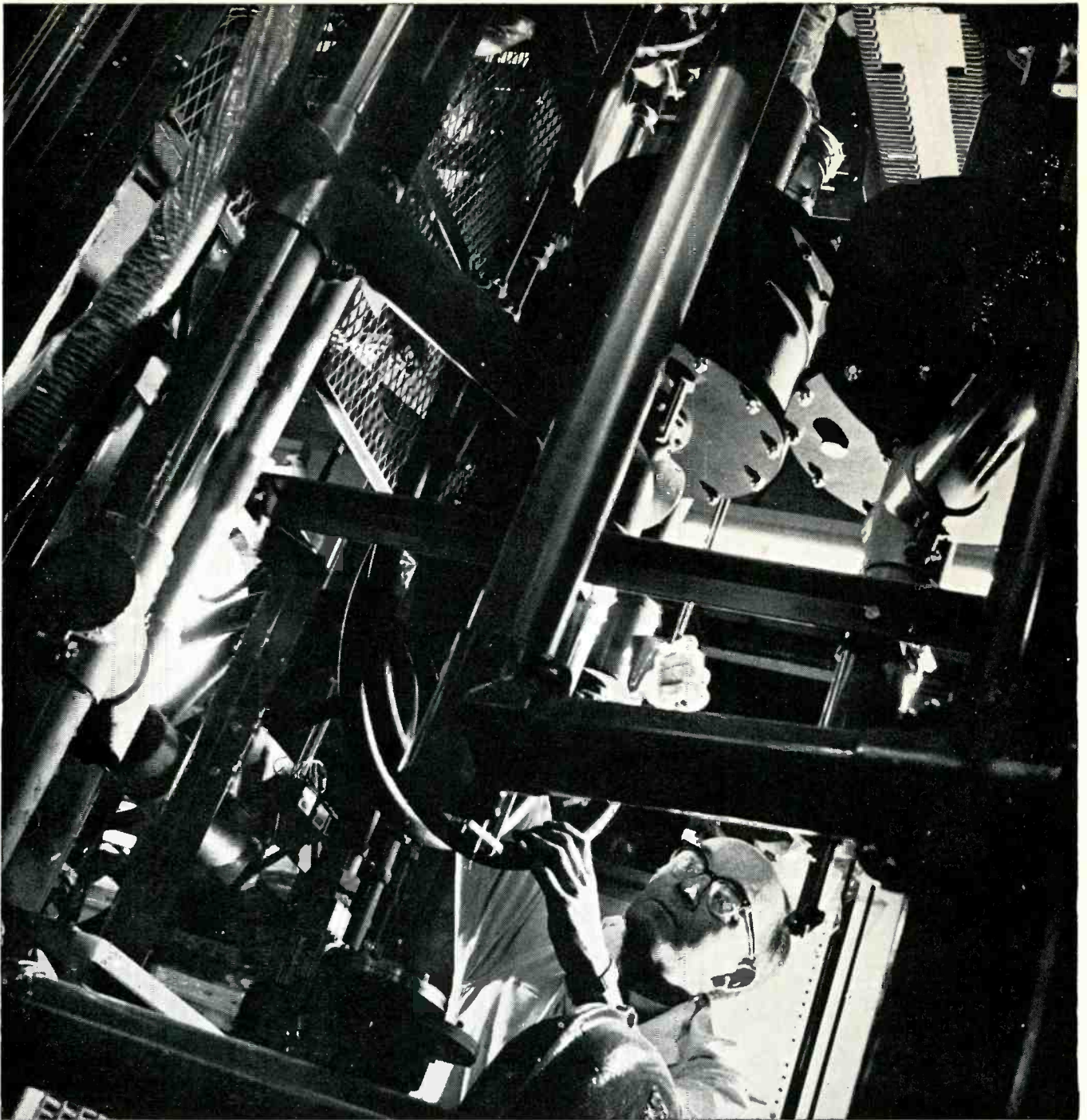
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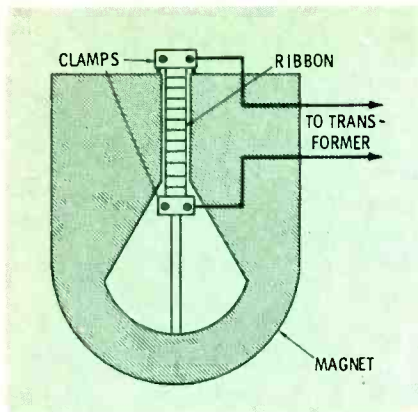


Fig. 2. Velocity-microphone layout.

an extremely sharp directional pattern and is designed to permit much greater distances between the sound source and microphone. Its major application is in TV "boom" work, where the performer is several feet from the microphone. While it lacks the wide frequency response of some of the other types, the greater working distance and relative freedom from background noise make it a good choice in many applications. It cannot be used, however, in confined areas such as a small studio or announce booth, since the reflections within the room cause the sound to enter the microphone from many directions and destroy its directional characteristics. Neither is it possible to work very close to a shotgun microphone because sounds enter the various ports at different levels of volume, and cannot maintain the proper amplitude balance on both sides of the diaphragm.

The dynamic microphones described are versatile and are frequently used in the broadcast field, particularly in television. They are rugged, lightweight, and are not affected by extremes in humidity. Their principal defect is that of re-

sponse irregularity, particularly at the very high and very low frequencies. This is created by the difficulty of building the mechanical link between the diaphragm and the voice coil. Other types of microphone have much better response curves, but have disadvantages of their own.

### Velocity Microphones

The velocity or "ribbon" microphone operates on a different principle. As shown in Fig. 2, a corrugated aluminum ribbon is suspended between the poles of a powerful "horseshoe" magnet so that the edges of the ribbon are very close and parallel to the magnet pole pieces. Movement of the ribbon in the magnetic field causes a very small voltage to appear at the ends of the ribbon. The ends are connected to a small step-up transformer with a turns ratio of about 1 to 500, which brings the microphone impedance up to a standard value. As the name implies, the ribbon is moved by air velocity rather than air pressure. Because of this, and because of the shape of the ribbon, the velocity microphone is inherently "dead" on the sides and "live" in directions at right angles to the ribbon surface. Therefore, it has a "figure-8" directional pattern. Some models obtain other directional patterns by using baffles on one side of the ribbon. This shapes a directional pattern in much the same way as the cardioid dynamics.

Because the ribbon has very low mass and is itself the voltage-generating element, there is no need for a mechanical linkage to a voltage generator. Thus, a velocity microphone has a very good frequency response and is character-

istically very smooth over its range. The disadvantages of the velocity type include its sensitivity to wind, shock, and vibration; its relatively large size; and its weight, resulting from the heavy magnetic structure required. (Modern types have largely overcome the weight problem.) The output level is also quite low as compared to other types. The velocity microphone also suffers from what is known as the "proximity effect." Sounds originating close to the microphone produce combined pressure and velocity modes on the ribbon at low frequencies, overemphasizing the bass response. This effect is responsible for the familiar "boominess" of the announcer who works very close to a velocity microphone of older types. (Announcers with thin voices often prefer the bass boost this effect gives.) Consequently, some manufacturers have minimized this problem by incorporating a switchable bass cutoff filter in the microphone. Without this filter, the microphone should be used at distances of two feet or more from the sound source. Working at such a distance requires a very quiet studio, but a velocity microphone produces naturalness of sound that is difficult to match.

### Condenser Microphones

The third type of microphone used in broadcasting is the condenser, or capacitor, microphone. Its construction, shown in Fig. 3, is similar to any capacitor, with the diaphragm (usually made of metalized polyester film) forming one plate and the back plate forming the other. The diaphragm is stretched tightly so that its resonance occurs above the audio range. As with the ribbon type, there is no mechanical linkage between the moving element and the voltage generator. The microphone capsule is connected in series with a very large resistor (100 megohms or more) to a source of polarizing voltage, usually between 50 and 150 volts. The operating principle is simple. With no sound present, the microphone capacitor charges to the full value of the polarizing voltage. When a compression wave strikes the diaphragm, thickness



(A) High-frequency type



(B) Low-frequency type

Velocity microphones of the type used in broadcast and recording facilities.

of the air dielectric is reduced, capacitance is increased, and the capacitor can hold a larger charge. Current then flows through the series resistor into the capacitor. When compression is released, the capacitance decreases, but the charge must remain the same; the capacitor voltage must increase. Then the capacitor tends to discharge through the series resistor. The grid circuit of a vacuum tube (or in some cases the gate circuit of a field-effect transistor) is connected across the series resistor through a blocking capacitor. The AC portion of the voltage on the microphone capsule then controls the plate current of the tube. Usually the tube is connected as a cathode follower and supplies no voltage gain. It simply converts the very high impedance of the microphone itself into a lower, more usable impedance, and is sometimes called an "impedance inverter." At times, a transformer is also used to lower the impedance still further.

A condenser microphone is essentially a pressure-operated device, but varied directional patterns are obtained in two ways. The diaphragm back may be ported, as with other cardioid microphones, or two capsules may be placed back-to-back and phased to produce the desired pattern.

Condenser microphones excel in extremely wide and smooth frequency response, low noise level, and fair immunity to wind noise; they are small and lightweight in construction. The chief disadvantages are the requirement for a source of polarizing voltage, and, in most cases, filament and plate voltage for the impedance-inverting tube. The advent of semiconductor devices has created a condition whereby cumbersome power-supply boxes and cable can even be made a part of the microphone body, and this problem will soon be a thing of the past. In general, condenser microphones are an excellent choice for high-quality studio use where superior high-frequency response is required.

### Matching

Matching a microphone to a console input poses a few problems

not encountered in other audio work. Microphone outputs and console inputs are manufactured in three standard impedances: 50, 150, and 250 ohms. The peculiar thing is that neither the microphone outputs nor the console inputs have these impedances inherently. The microphones usually have a lower impedance, while the console inputs are higher. The inputs are coupled to a transformer with the secondary connected directly to a tube grid, or a high-impedance transistor input, with no resistive termination. The actual input impedance is about five to ten times the nominal value at other than very low frequencies. Loading the microphone with a lower impedance would force it to deliver power to the load, rather than pure voltage. This would cause increased losses at the high frequencies where transformer windings have a greater inductive reactance. Usually, connecting a microphone to its rated nominal impedance input achieves a desirable compromise between output level and frequency response. Better frequency response may be obtained by connecting the microphone to a higher load impedance (i.e., a 50-ohm microphone to a 250-ohm input); somewhat higher output level will be obtained by connecting the microphone to a lower load impedance (a 250-ohm microphone to a 50-ohm load). Where the impedances are matched, a 50-ohm connection allows long runs with minimum high-frequency loss, but with some loss of output level, while a 250-ohm connection allows the greatest signal transfer with some high-frequency loss. Either connection is satisfactory for short runs (up to 250').



Example of a condenser microphone without the customary shock mount.

### Summary

To summarize, these are the best uses for the three microphone types:

1. Dynamic microphones—general-purpose use, especially in remotes where rough handling and severe environmental conditions are commonplace.

2. Velocity microphones—general studio use, high-quality indoor remote broadcasts where sound source is not too close to the microphone, and where superior bass response is desirable.

3. Condenser microphones—high-quality studio and recording work, particularly with respect to high-frequency response, and where a separate power supply can be used conveniently and will not be abused.

While many volumes have been written about microphones, these pointers should help the broadcast engineer make better use of an important broadcast tool. ▲

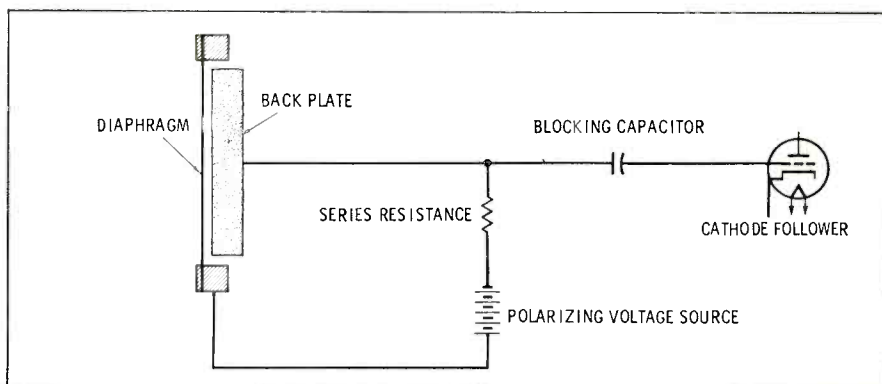


Figure 3. Typical condenser microphone construction with attached power supply.

# SMALL-BUDGET AUDIO-PROOF PACKAGE

by **Thomas R. Haskett**, Central  
Regional Editor—Well constructed kits  
with proper modifications can provide  
adequate instrumentation for  
audio proofs.

To insure that equipment is operating within specifications, all AM, FM, and TV stations are required by the FCC to perform annual audio-frequency proof-of-performance measurements. These measurements are also useful in maintenance of audio equipment. Since test equipment required for this proof must be sensitive, accurate, and stable, most available gear is expensive; a proof package can easily cost between \$300 and \$500. While this equipment has several advantages—it comes ready for use, has been calibrated, is well built, and is easy to operate—it is difficult for a small, low-budget station to purchase. There is, however, a way to obtain accurate and dependable gear at modest cost—from kits.

Although not of laboratory quality, many kits and/or low-cost audio generators, VTVM's, and harmonic-distortion analyzers can be modified to meet proof-of-performance specifications. Among these are Eico, Heath, Paco, LaFayette, Knight, Hickok, and Triplett units. The proof package described here was built around the Heath IG-72 Audio Generator and IM-12 Harmonic Distortion Meter; and the system achieved performance as indicated. Frequency range of the generator is from 10 Hz to 100 kHz, with a guaranteed frequency accuracy of  $\pm 5\%$  and, in this case, a measured accuracy of  $\pm 3\%$  (within the range used for proofs). Residual distortion of the generator is less than 0.1% from 20 to

20,000 Hz. The lowest full-scale distortion range on the HD meter is 1.0%, and you can read 0.01% easily. Noise is readable down to at least  $-62$  dbm, and to  $-80$  or so if careful techniques are used.

Present cost of these two kits is \$96.90. Some modifications, including a couple of accessory units, must be made before the units are ready for proof work. Cost for parts was about \$35 (including accessories); it takes from 14 to 20 hours for construction and modification, and the total investment should not exceed \$135. The equipment will do most jobs as well as gear costing several times as much.

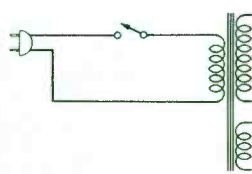
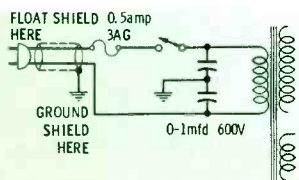
## Kit Construction

Careful and accurate construction is vital to the purpose for which the kits are being built. It is best to use a small industrial-type iron of about 47-50 watts, with temporary heat sinks used during soldering of all precision resistors and diodes. A gun can easily overheat and damage these components. Read the instructions carefully, then follow them explicitly, giving special attention to wire dressing. Changing the location of wires can easily lead to hum and noise pickup.

When construction is completed, make certain that each instrument operates exactly as the manufacturer specifies. If anything is wrong, use the guarantee and replace defective components. When guaranteed performance is achieved, run both instruments continuously for about four days to age the tubes. This is important to achieve stability. Check performance again to make sure that equipment meets specifications, calibrating each unit according to the instruction manual. When the gear is performing as guaranteed, it may be modified

## PARTS LIST

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|--------------------------------------------------------------|----------------------------------------------------------------|
| 4—Capacitors, 0.1 uf, 600V, Sprague Mylar® 6TMP10            | 1—Switch, SPST, Toggle, A.H & H. No. 209-94-NV                 |
| 1—Capacitor, 51 pf, 500V, disc ceramic, Aerovox Type D1      | 2—AC plugs, clamp type, Amphenol No. 61-M11                    |
| 1—Capacitor, 220 pf, 500V, disc ceramic, Aerovox Type D1     | 10—Tie-lug strips, Cinch 52-A                                  |
| 1—Capacitor, 330 pf, 500V, disc ceramic, Aerovox Type D1     | 1—Tube shield, Cinch Jones No. TR6-6020-B                      |
| 1—Capacitor, electrolytic, 25 uf, 25V, Aerovox PTT82         | 2—Handles, Bud H-9111                                          |
| 1—Resistor, 510 ohms, 5%, ½ watt                             | 1—Double assembly 5-way binding posts, Superior No. DF30-2-BBC |
| 1—Resistor, 200 ohms, 5%, ½ watt                             | 1—Single assembly 6-way binding post, Johnson No. 111          |
| 1—Resistor, 120 ohms, 5%, 1 watt                             | 2—Double plugs, banana type, Pomona MDP                        |
| 1—Resistor, 51 ohms, 5%, 1 watt                              | 1—Single plug, banana type, Johnson No. 108                    |
| 1—Resistor, 620 ohms, 5%, ½ watt                             | 1—Microphone connector, male, Cannon XLR-3-12C                 |
| 1—RF choke, 10 mh, National R-100                            | 30 ft—Shielded cable, 2-conductor-plus shield                  |
| 1—Diode, 1N34                                                | 25 ft—Hookup wire, Belden 8529                                 |
| 2—Fuseholders, Littlefuse No. 342004                         | 1—Minibox, aluminum 4 in x 5 in x 6 in, Bud No. CU-3007-A      |
| 2—Fuses, 0.5 amp                                             | 1—Minibox, aluminum 2¼ in x 2¼ in x 4 in, Bud No. CU-3003-A    |
| 1—Transformer, UTC A-20                                      | 5—Grommets, ¼" hole, H.H. Smith No. 2170                       |
| 1—Switch, 6-section, 4-position, shorting, Centralab PA-1022 |                                                                |



(A) Before modification

(B) After modification

Fig. 1. AC input circuits of audio generator and harmonic distortion meter.

safely. (Once these instruments are modified, the manufacturer's warranty is void).

### Modification

Refer to parts list for components used.

1. Remove the cabinet from each instrument and replace handles. The handles supplied are too small for most male hands and are not very sturdy. Ream the cabinet holes slightly to clear the mounting screws for the Bud metal handles. (Of course, this step isn't absolutely necessary, as it has no effect on instrument performance.)

2. Carefully disconnect wires from the meter movements and remove the movements from the front panels. Replace shorting jumpers supplied with meter and removed before construction. This is necessary to protect the delicate movements from vibration. Remove all control knobs from the generator, and all knobs except FREQUENCY knob from the HD meter. Note the position of the set screw and the index line on each knob, and set each control shaft to a known position. Using a medium-tooth metal file, file flats on each control shaft at the point where the set screw makes contact. The shafts are supplied round, and in use the knobs twist off index. After filing, the knobs will retain index position and not slip.

3. Drill panel holes and install fuseholders and line fuses in each instrument. On the HD meter, the fuse is mounted above the power switch, on the generator, below the power switch. Connect each fuse in series with the respective power switch on the line side. Refer to Fig. 1. The fuses protect instruments from internal shorts.

4. Remove AC line cords and plugs from both instruments, as well as plastic strain reliefs used where line cords enter chassis. Replace with shielded two-conductor cable and clamp-type two-conductor AC plugs. (Two-conductor plugs are used because it is not desirable to ground instruments at the AC wall receptacle.) Use rubber grommets to protect cable where it enters chassis. Conducting wires should connect input of power transformer

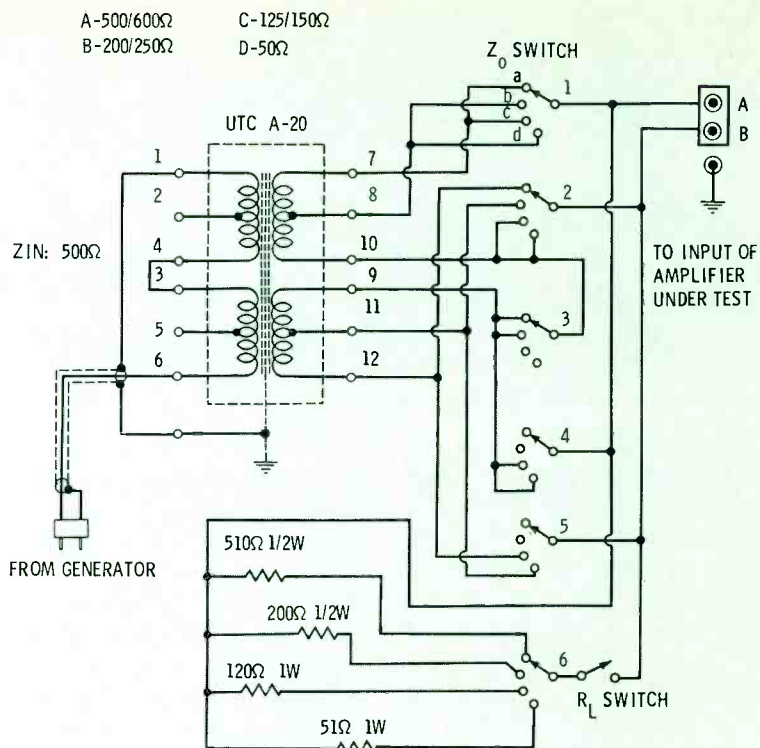


Fig. 2. Circuit of input matching box showing necessary ground connections.

to plug. Leave shield disconnected (floating) at plug end and ground to chassis near the power transformer input to chassis.

Connect 0.1 md, 600 V capacitors from each side of power transformer input to chassis.

It will be necessary to add a tie-lug strip to each instrument for mounting the capacitors and AC input. This may require drilling additional holes. Remove all tubes from sockets while this is done, and put masking tape over each tube socket to prevent stray pieces of aluminum from wedging into socket holes. The bypass capacitors and the shielded line cord decouple each instrument from the AC power line, minimizing noise and feedback pickup.

5. Remove JAN-type tube shield from 5879 tube in HD meter, and replace with heat-dissipating type. This will extend tube life.

6. Lubricate HD-meter tuning shaft with petroleum jelly. This shaft passes through bracket where it binds slightly. The lubricant permits smooth operation.

7. Remount meter movements, taking care not to overtighten mounting nuts.

### Accessories

Fig. 2 shows the circuit of the input matching box, and the completed box is shown in Fig. 3. This box is needed because the generator output is 600 ohms unbalanced, while nearly all station microphone in-

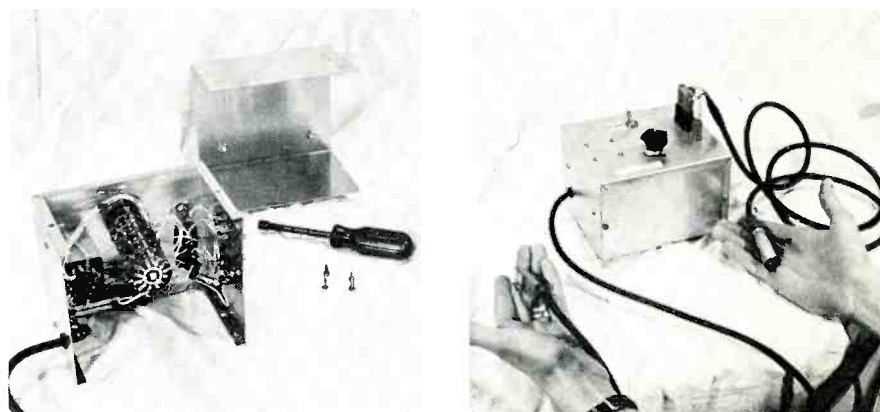


Fig. 3. Construction details of the input matching box with appropriate cords.

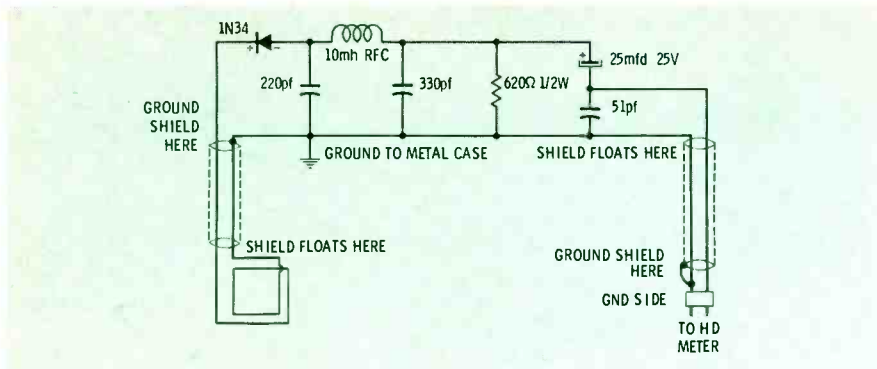


Fig. 4. Schematic of RF detection box. Note location of shield grounding.

puts are balanced, and several input impedances are used. The box will match 500/600, 200/250, 125/150, and 50 ohms, and has its own internal load resistor, which may be switched in or out of the circuit. The unit is easily assembled in a 4" x 5" x 6" *Minibox*; parts placement isn't critical.

Fig. 4 shows the RF detector circuit. It is easily assembled in a *Minibox*, and parts placement is not critical. Fig. 5 shows the unit assembled. *Note*: This accessory is not necessary if the proof gear is used at a station employing a modulation monitor with a "noise and distortion" output. However, the box costs little to make, and may be useful for checking the system without the monitor, or if the monitor is located at another point.

### Final Calibration

After kits are assembled and accessories are constructed, it will be necessary to calibrate the package and run a few curves. Set up all items in the package on a table or bench, plug into AC, and let them warm up for fifteen minutes. Use a 20,000-ohms-per-volt VOM, with accuracy of  $\pm 3\%$  or better in the

AC voltage function (*not* db or output meter function—the blocking capacitor distorts frequency response). Representative models are EICO 565, Heath MM-1, Hickok 455A, RCA WV-38A, Simpson 260, and Triplet 630. If a standard AC voltmeter with higher accuracy is available, use it. But the VOM will do, and is to be preferred over a VTVM.

Set the generator output to 0 dbm in the internal-load position, couple the generator output to the HD meter input, and parallel the VOM leads across the generator output, with the VOM set to read AC volts on the 1.5- or 3-volt range. Since the generator output is 600 ohms, it will not be affected by the loading effect of the VOM, even when set on the lowest range. The HD meter will read low because of the VOM, but disregard this effect for the moment. Set the VOM, if possible, to read 0 dbm direct—this will usually be on the lowest range—and be sure that 0 dbm equals 1 milliwatt in 600 ohms. Then carefully adjust the generator OUTPUT CONTROL for a reading of 0 dbm on the VOM. Next adjust the generator panel meter, using the MET-

ER CONTROL, to agree with the VOM reading of 0 dbm.

Disconnect the VOM, observing that deflection of the generator panel meter does not change. Set the HD meter SENSITIVITY switch to the 1-volt position, and adjust CALIBRATE CONTROL so that the HD panel meter reads 0 dbm, as does the generator meter.

Adjust the generator oscillator control according to the manufacturer's instructions, but note that greater than full-scale deflection at 20 Hz is unnecessary. Set for just over 0 dbm on the red scale, where most readings will be. By adjusting to this lower reading, a smaller residual distortion in the generator is obtained.

Fig. 6 shows the error in indicated frequency of the example generator as checked with a frequency counter. Note that while the manufacturer specified  $\pm 5\%$ , between 30 and 15,000 Hz — just where proof measurements are made—the actual error was only  $\pm 3\%$ . Next, residual distortion of the generator was measured with both the kit HD meter and a laboratory-type distortion analyzer. The readings obtained were identical, thus proving the kit meter accurate.

Next the kit generator was connected through the input box to the HD meter to check meter tracking referred to frequency. Although it would be desirable to know that both meter movements are not frequency sensitive, they probably are. However, so long as they are equally sensitive, they can still be used with accuracy in proofing. Being the same type of meter, they are substantially in agreement, as Fig. 7 illustrates. Note the effect of the



Fig. 5. RF detector for making proofs.

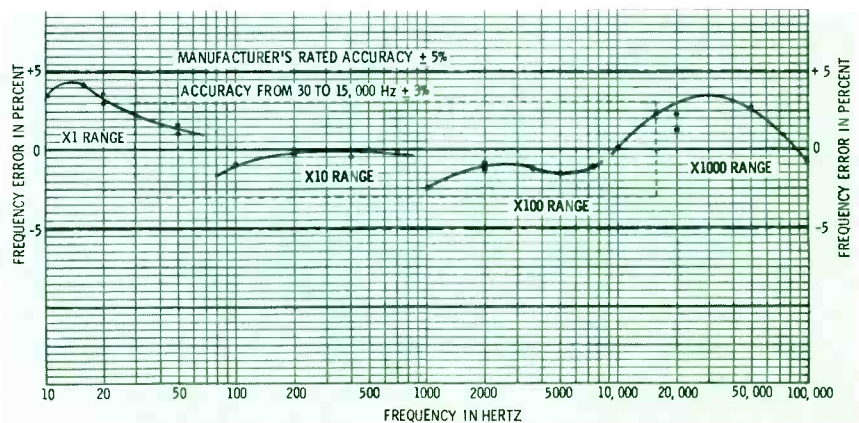


Fig. 6. Comparison of manufacturer's rated accuracy with measured accuracy.



matching transformer on the ends of the curves at higher output levels. The UTC A-20 transformer is a highly shielded model rated at  $\pm 2$  db from 10 to 50,000 Hz, with a maximum level of +15 dbm.

This transformer limitation becomes more apparent in the next test, shown in Fig. 8. Generator output of -8 dbm was fed to the HD meter and the residual distortion measured. In the direct mode, distortion never exceeded 0.09%. However, with the input matching box in the circuit, distortion at the low-frequency end of the curve increased, due to the transformer. This is not serious—the lowest distortion reading required is at 50 Hz, where residual is below 0.1%. Also, distortion caused by the matching transformer decreases with level; since this test was made with -8 dbm into the transformer, and a microphone input is usually driven with -40 dbm or less, the residual will be even lower at 20 and 30 Hz.

#### Further Notes

The HD meter uses a VR tube for plate-supply regulation. Voltage regulation is not necessary on the generator, for two reasons: (1) The output level is constantly monitored by the generator meter, and (2) due to the feedback lamp in the circuit, power-supply current is relatively constant at 47 milliamperes throughout the audio range of the generator.

Some engineers prefer to use a *gainset*, a box containing two or three switch attenuators calibrated in db, between the generator and the console microphone input. By switching the gainset to keep the transmitter output constant, frequency response is read from the gainset control knobs. Although convenient, this method is not absolutely necessary with the kit gear if meters are read carefully, since it is possible to read to at least 0.5 db, and to estimate to 0.2 db.

During the first proof with this gear, be sure to make a frequency-response run and a residual-distortion run using *only* the generator, the input box, and the HD meter *before* including the console and transmitter in the circuit. If the test

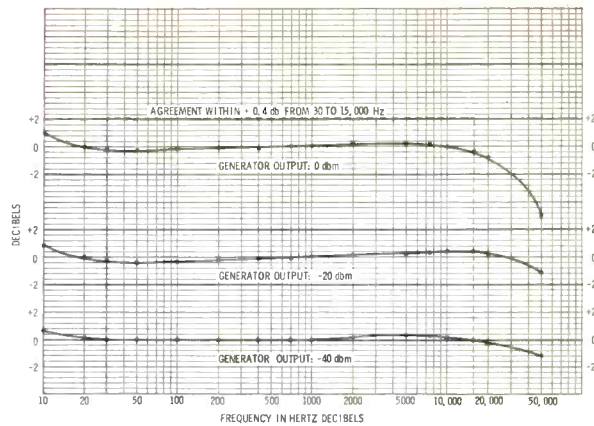


Fig. 7. Agreement of audio generator with HD meter through input matching box.

gear curves look reasonably good, forget about correcting the figures obtained when station operating equipment is measured.

When running a proof at a station control point which is remote from the actual transmitter site, there will usually not be a high ambient RF field. Grounding of the instruments will then be relatively simple. The generator output goes to the input matching box, ground included, and a balanced line with accompanying ground circuit goes from the box to the console microphone input. Connection to the system ground bus should be made at this point. Since the transmitter is located remotely, the HD meter will probably be driven from the modulation monitor, which may be fed from an RF pre-amplifier. The HD meter input connection will ground this instrument to system bus where it is connected to the modulation monitor. Only one ground should be used per instrument — Avoid ground loops. Experiment with the generator-to-microphone-input connection for the lowest hum and noise reading. Sometimes, a lower reading can be obtained by using copper strap or braid to carry ground directly into

a rack to the system ground strap, and not grounding the generator and box at the microphone input.

When a proof is made where studio and transmitter are under one roof, the high ambient RF field can get into the instruments if proper grounding is not employed. Strap or braid is a must, as well as shielded cables for both instruments. Again, there must be only a single ground per instrument, and it should be as short and direct as possible to the station ground strap.

When using the HD meter in a high ambient RF field, one special technique must be used. Internally, one side of the output is grounded and the other goes to the meter movement. When making frequency response and HD measurements, OUTPUT terminals should either be open or connected to a scope input having an impedance of at least 2 megohms and a shunt capacitance not exceeding 100 pf. But for reading residual hum and noise within an RF field, the OUTPUT terminals should be shorted with a short piece of solid wire. If they are not shorted, RF will get into the bridge circuit and prevent valid noise reading. ▲

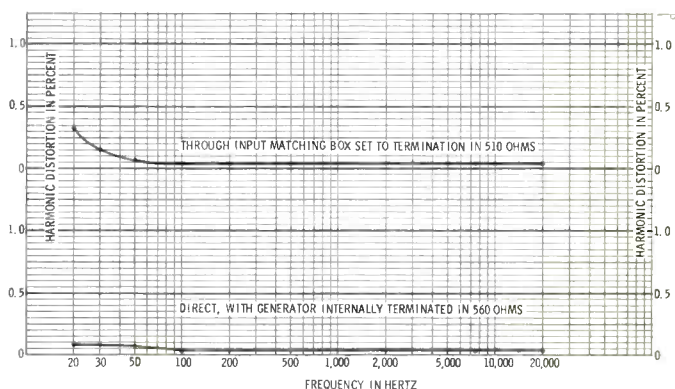
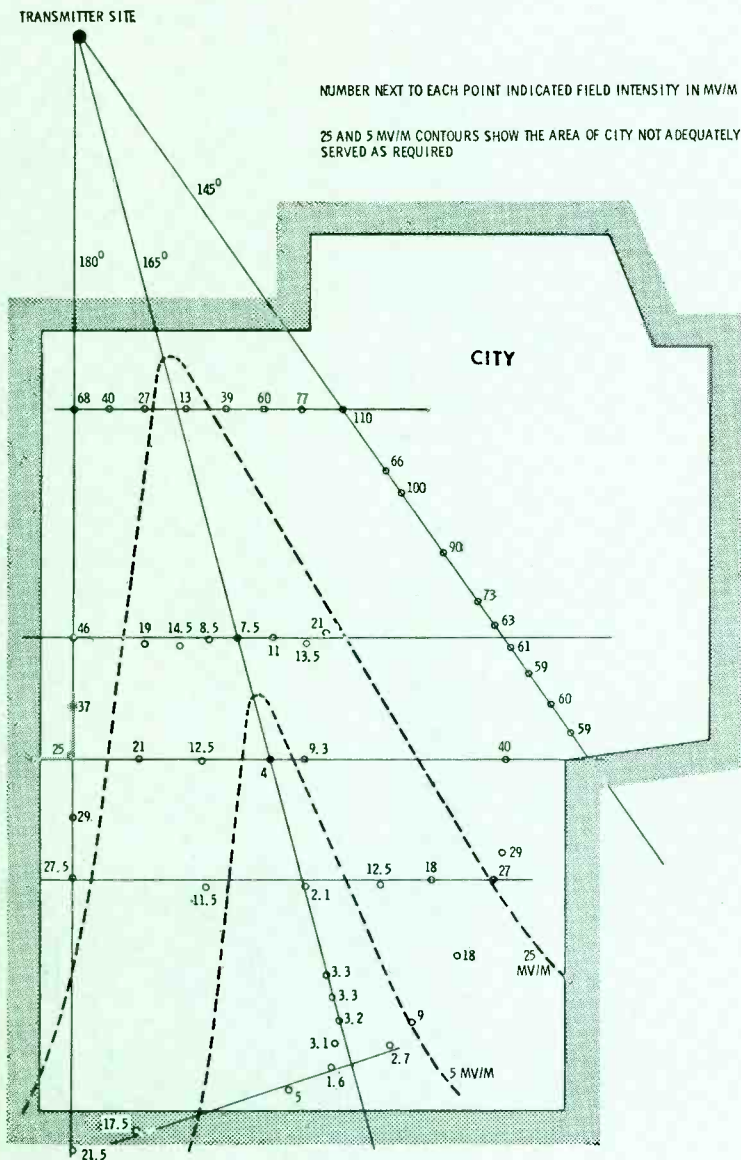


Fig. 8 Residual harmonic distortion of audio generator measured by HD meter.

# THE UNWANTED PATTERN NULL

by Robert A. Jones, Midwest Regional Editor—Sometimes the antenna proof of performance doesn't tell you all you should know.



The problem of unwanted directional pattern nulls with proper FCC-approved monitor-point readings is rare and may not appear until complaints are received from listeners living in the affected area. Unwanted nulls are most likely to be brought to light in areas recently developed, or after the installation and proof of a new array or major pattern change. This case occurred after an increase from 1,000 to 10,000 watts, with an attendant new directional-antenna pattern. The null lay across a densely populated section of the station's principal city, and many low-signal complaints were received shortly after operation with increased power began. It is hoped the techniques employed in the solution of this problem will be of assistance to stations experiencing the same or similar difficulties.

In order to understand better the specific problem involved, it may be helpful to review briefly the normal procedures for proving a pattern, then to show that errors can occur. First, the FCC normally selects a few specific radial bearings to be measured. These are the directions and limits specified in the construction permit. It is assumed that these bearings will act as an indicator of whether the pattern is initially correct, and whether it stays in tune. Then current ratios and phases are carefully set up to correspond, as nearly as possible, to theoretically predicted values. With careful adjustment, these values normally give a satisfactory proof. In the case to be described, these procedures were followed, and, with none of the distracting factors fre-

Fig. 1 Map showing field-intensity measurements used to find unwanted null.

quently encountered, the pattern appeared to be perfect—until the complaints came in.

### Listener Complaints

Soon after operation with increased power began, numerous complaints of low signal were received from the southern part of the city. At first these were ignored—believed to be the consequence of faulty receivers or crank complaints from those who expected ten times greater signal strength. Their consistency, however, prompted an investigation to determine whether the pattern had changed since the proof.

Parameters at the transmitter site were found to be unchanged. Field-intensity measurements at each of the three daytime monitor points were below FCC limits and nearly the same magnitude as the original readings. As a further check, readings were taken at two or three points on each of the proof radials; these proved to be substantially correct. All our data indicated that the daytime pattern had not shifted or changed from the original adjustments. The pattern was believed to be perfect.

### Further Investigations

During the following months complaints of low-signal from the affected area continued. In order to define the trouble area, a series of field-intensity readings was taken on each of several streets crossing the low-signal zone. Plotting these readings indicated a sharp null at a bearing of approximately  $165^\circ$  true. Since there were no significant changes in base currents, phase angles, or monitor-point readings, and since the antenna design and proof of performance were in agreement, this null was hard to believe.

Fig. 1 represents a map of the antenna site and the principal city to be served. Drawn on this map are two original proof radials,  $145^\circ$  and  $180^\circ$ . In addition, a new radial at  $165^\circ$  shows the unwanted null. Each small circle on the map is labelled with the field intensity in mv/m measured at that location. The readings along  $145^\circ$  and  $180^\circ$  agree with the original proof.

### Cross Radials

Cross-radial measurements are

taken along a line other than a radial. While this type of reading is not generally used, or referred to in FCC rules, it is useful in detecting lobes or nulls in a pattern. The measurements are not sufficiently precise to predict the unattenuated field strength at one mile. Fig. 1 shows the five cross-radials that were taken in the original survey. Each of these cross-radials supports the null at approximately  $165^\circ$ .

Also shown on Fig. 1 are the 25-mv/m and 5-mv/m contours. Clearly, these contours show that the originally adjusted 10-kw pattern failed to serve a large portion of the city, as FCC rules require. The complaints were justified.

### What To Do Now

After the complaints were investigated and a null was confirmed, there arose the question of what to do about it. Assuming there was no error in the original pattern design, a course of correction lay in one of these directions: (1) There could be a serious reflection, such as that encountered several years ago by WJIL<sup>1</sup>; (2) Possibly there was a faulty ground system or a tower that was not radiating circularly; or (3) The problem might be a misadjustment in the directional pattern. The last possibility would have had to occur at the time of the original proof, since no changes had taken place since then.

Experience indicated that an undesirable reflector was the most likely source of trouble, so a thorough search of the area close to the transmitter site was made. No source for reflections was found; there were no powerline towers, no metal smoke stacks, and not a single water tank in sight.

Our next check was the ground system and the multiple-tower installation. We reasoned that if the major antenna equipment were at fault, a distortion would occur in the 1000-watt night pattern. The comparison of a skeleton proof made on the night pattern with the original night proof showed no such distortion, and we felt safe in rejecting the ground system and towers as the source of trouble.

Since the original adjustment of the phasing equipment had been made by an experienced and highly

regarded firm of consultants, it was difficult to conclude that a misadjustment in the pattern had occurred, but logic now pointed to a re-evaluation of the original tuning adjustments.

### Vector Study of Null

A theoretical study was made at  $145^\circ$ ,  $165^\circ$ ,  $180^\circ$ , and  $210^\circ$ . These vector calculations indicated that a null at  $165^\circ$ , without a measurable shift at  $145^\circ$  and  $180^\circ$ , would require a major change in the phase angle of the number four tower—probably as much as  $70^\circ$  to  $90^\circ$ . Fig. 2A shows the vector relationships at  $165^\circ$  for the theoretical condition, and Fig. 2B shows what is believed to be the incorrect original adjustment.

A comparison between the night and day, theoretical and measured, phase angles for tower four was made. For the nighttime adjustment, a difference of  $20^\circ$  between theoretical and measured was found. This substantiated our finding of no unwanted nulls in the night pattern. For the day pattern, however, a difference of more than  $70^\circ$  was discovered. Since the installation had equal-length sampling lines, the measured results should have been close to calculated values. Certainly a difference of  $70^\circ$  indicated something wrong, particularly when a difference of only  $20^\circ$  occurred with the night pattern.

### Pattern Correction

Certain that the problem was a tuning error, we adjusted the phase angle of tower four from  $90^\circ$  to near the theoretically correct value of  $20^\circ$ . With some luck, we achieved  $29^\circ$  without significant

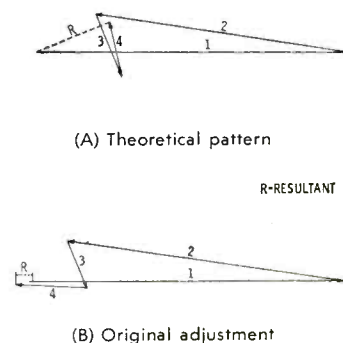


Fig. 2. Vector diagram employed to study null formation on  $165^\circ$  radial.

change in any other phase angle or base current. At this time field-intensity measurements were made along the 165° radial. At one point an increase from 3.8 mv/m to 33 mv/m had been achieved. Our null seemed to be gone. Readings at the three monitor check points revealed all points below FCC limits with the 180° reading 50% lower than allowed.

Returning to the vector mathematics, we determined that tower-two current was 10% higher than

calculated. Reducing this current should increase field strength on the 180° radial to its proper value. Current was lowered from 91.1% to 83% of the reference-tower feed, and field readings at the 180° check point came up to normal. A further increase, from 33 mv/m to 44 mv/m, was also observed on the 165° radial. It was dramatically apparent that the closer we readjusted to theoretical parameters, the closer we came to the proper pattern shape.

Fig. 3 shows the shape of radiation pattern minima before and after readjustment. The unwanted null was a very deep one, particularly for a power output of 10,000 watts.

As a precaution, the readings of the regular three monitor points were supported by a skeleton proof. The results revealed no pattern shift or change in any other than the desired direction. Further, cross-radial checks were made in several directions. No unwanted lobes or nulls were found.

### Conclusions

The lesson learned was a good one: In spite of careful calculations, tuning, and measurement, a pattern can appear to be correct when it is not. A pattern of consistent complaints or a wrong phase angle or current should not be dismissed as the result of imagination, faulty receivers, or instrumentation errors. An unwanted null can reduce area coverage seriously; and conversely, an unwanted lobe could interfere with the signal of another station.

Two steps, taken at regular intervals, should be adequate to prevent the occurrence of unwanted lobes and nulls. First, the pattern should be adjusted as carefully as possible to establish base currents and phase relationships. If these values and relationships cannot be attained, an investigation should be made to determine why, and corrections made. Second, regular field-intensity readings, even though correct, should be supported by in-between measurements. The cross-radial technique was employed to good advantage in this case to eliminate a serious problem.

If your pattern is in doubt and all parameters are satisfied, check the pattern with circular cross-radials at frequent intervals. When large areas are to be covered, one practical approach is the use of aircraft<sup>2</sup>. Vigilance can detect pattern errors and effect better pattern coverage. ▲

<sup>1</sup> Robert A. Jones, "The 'Hot' Water Tank at WJIL," *Broadcast Engineering*, January 1963, p. 19.

<sup>2</sup> Robert A. Jones, "Aeronautical Field Intensity Measurements," *Broadcast Engineering*, March 1965, p. 16.

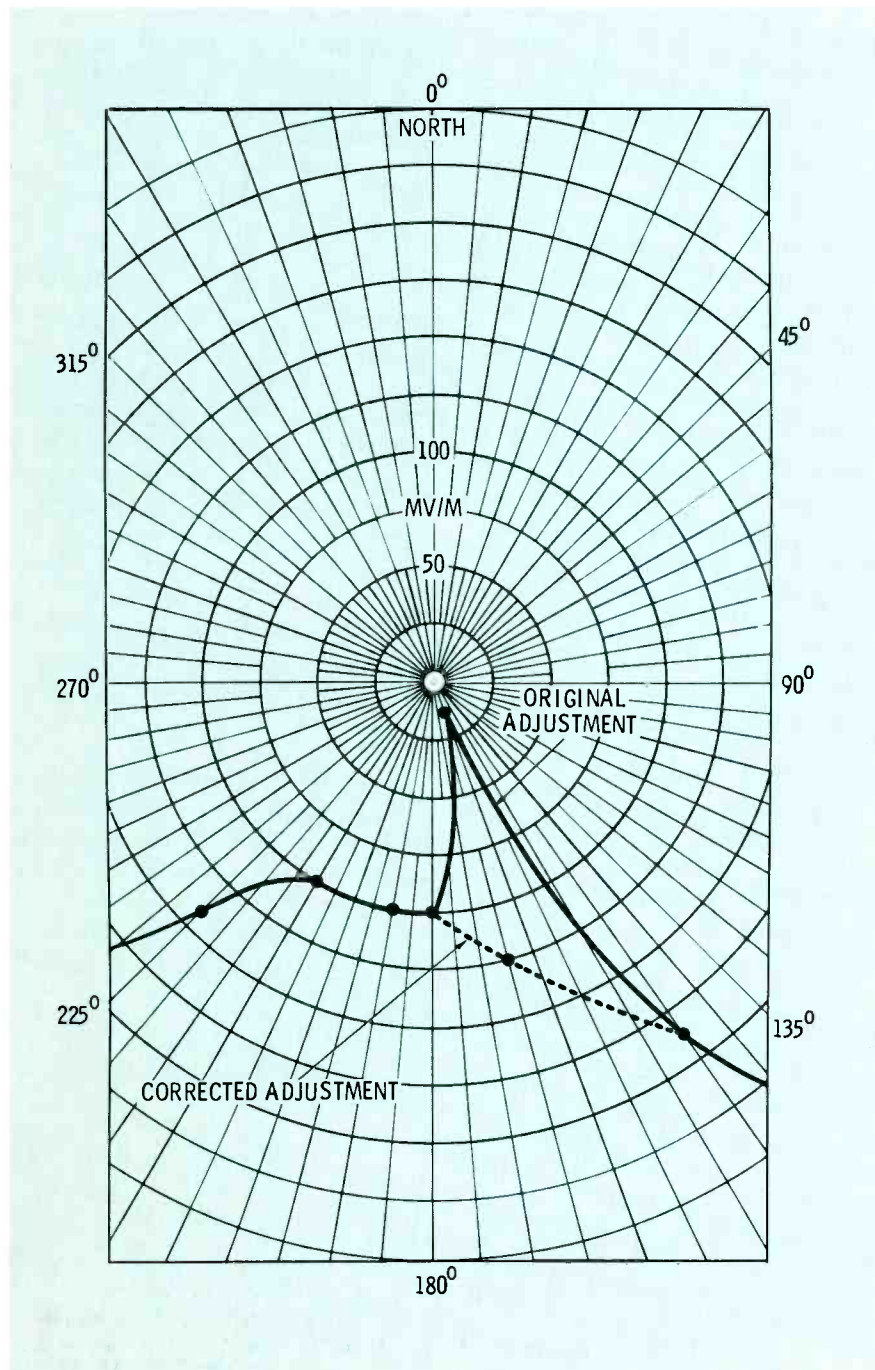


Fig. 3. Erroneous adjustment of array produced a deep null in the pattern.

# EIMAC

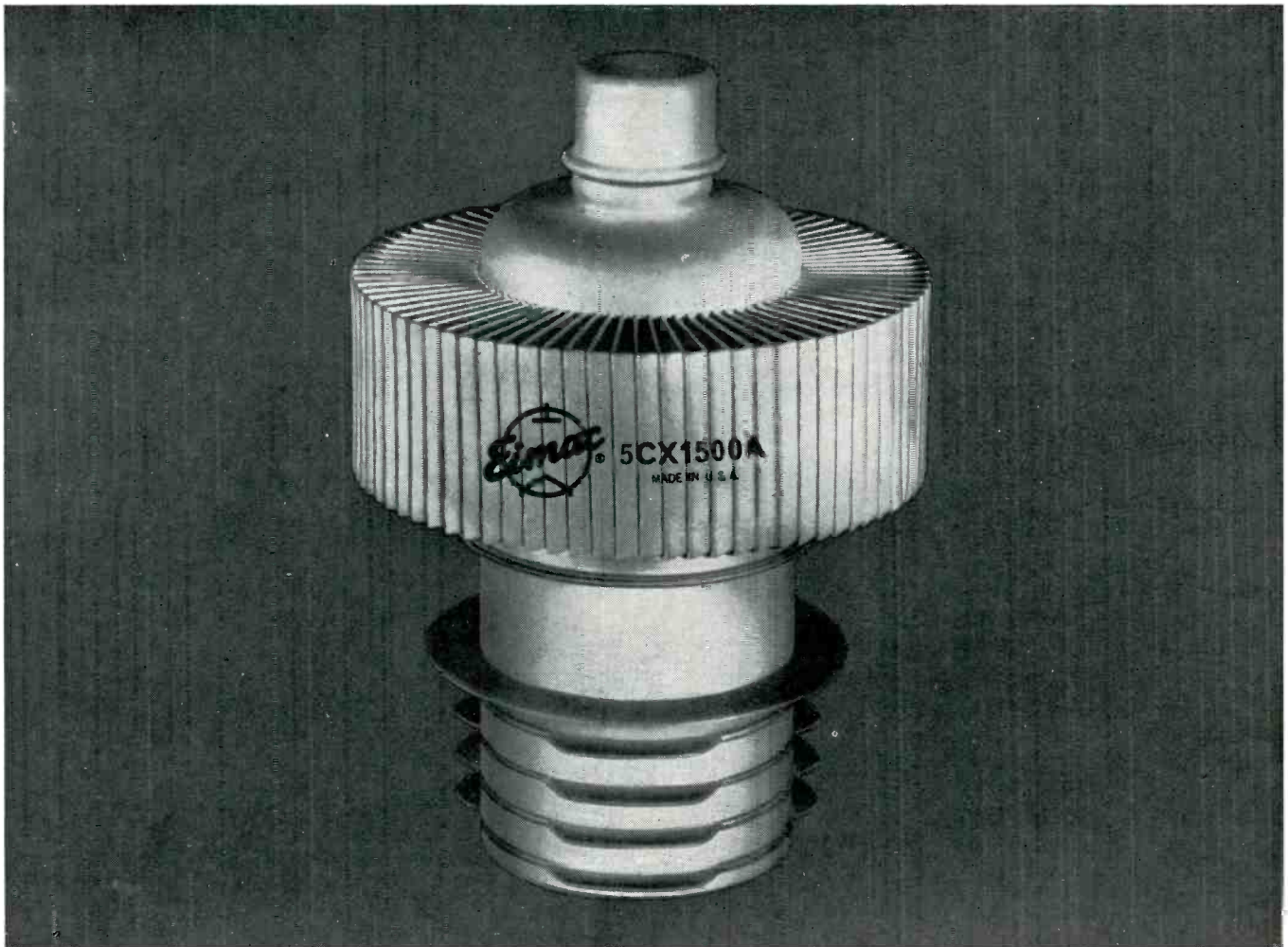
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| 5CX1500A<br>CLASS C MAXIMUM RATINGS |          |
|-------------------------------------|----------|
| DC PLATE VOLTAGE                    | 5000 V   |
| DC PLATE CURRENT                    | 1.0 Amp. |
| DC SCREEN VOLTAGE                   | 750 V    |
| PLATE DISSIPATION                   | 1500 W   |
| SCREEN DISSIPATION                  | 75 W     |
| GRID DISSIPATION                    | 25 W     |
| SUPPRESSOR DISSIPATION              | 25 W     |

| TYPICAL CLASS AB <sub>1</sub><br>LINEAR AMPLIFIER MEASURED VALUES<br>IN TWO TONE TEST |        |
|---------------------------------------------------------------------------------------|--------|
| DC PLATE VOLTAGE                                                                      | 4000 V |
| DC PLATE CURRENT (No Signal)                                                          | 250 mA |
| DC PLATE CURRENT (Two Tone)                                                           | 485 mA |
| DC SCREEN VOLTAGE                                                                     | 500 V  |
| PEAK ENVELOPE POWER OUT                                                               | 1785 W |
| THIRD ORDER IM MAXIMUM                                                                | -35 db |

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Circle Item 11 on Tech Data Card

# LIGHTING A VARIETY SHOW FOR COLOR

by **George C. Sitts**, Eastern Regional  
Editor—Careful planning is the key  
to successful production.

At the close of the 1965-1966 television season, viewers had a choice of 18 network variety shows each week. Seventeen of these were broadcast in color. Developing any one of these shows from talent booking to a color telecast requires close planning and coordination among several departments, as well as expenditure of vast amounts of money and manpower weekly.

Typical of the "brute force" weekly color productions is the Ed Sullivan Show, first planned on Tuesday morning and finally aired as a live one-hour colorcast on Sunday night. To discover the "trade secrets" of such a color production, we followed the Sullivan staff through a typical work week.

The cycle actually begins several weeks in advance of each production when talent bookings are made, but the show itself swings into action the Tuesday morning of its broadcast week, when the "creative" meeting takes place. Director Tim Kiley, producer Bob Precht, music coordinator Bob Arthur, associate producer Jack McGeehan, and scenic designer Bill Bohnent meet to block out the show.

The first item on the agenda is the line-up of acts for the show. Three factors determine the order of acts: (1) a well balanced show; (2) strong acts at the opening of the show and after the mid-break (these act as "hooks" to hold the audience until it's too late to turn to another station); and (3) the sequence in which the stages will



Ed Sullivan strikes familiar pose as "on stage" crew waits for "red light."

be used. Item 3 requires some explanation. Effectively, there are three stages, all part of one long stage. "In one" is the front of the stage. "In two" is the middle of the stage, or the area between curtains, and "full stage" is from the second curtain to the back wall. Time must be allowed to reset stages between acts. A large or complicated set requires more set-up time than a lesser one. Consequently, a big set on "full stage"

may require two short acts "in one" and "in two," in order that "full stage" can be set up.

Once physical requirements are set, discussion of aesthetic requirements begins. What color behind Barry Sadler? What music fits Jackie Vernon's act? What moods of lighting and staging for Dinah Shore, for the Four Tops, for the Les Feux Follets?

Following the meeting, scenic designer Bohnent spends the remain-

Plain Talk from Kodak about tape:

Kodak  
TRADEMARK

## Giving your tape library a longer prime of life

How long can you keep a recorded tape? As of today, nobody knows for sure. Recording companies have tapes dating back to the late 1940s that are still in fine shape. Actually, the aging problem for tape is somewhat akin to the ones faced by movie-makers. Their problems are tougher, though . . . movie-makers have to worry about latent chemical reactions, greater mechanical strains, etc. And yet, we can see movies made more than a half century ago if the films have been given proper care and expert duping. Like photographic films, many audio tapes are made on ace-

goes for tapes. One obvious safeguard is to keep tapes away from strong magnetic sources like large electric motors or transformers which could demagnetize a recording.

**Keep it clean.** Tapes hate dirt just as much as regular records do. Thanks to sturdy, one-piece construction, Kodak's new "library décor" box helps keep dirt out . . . won't fall apart over the years as conventional tape boxes sometimes do. And this new box looks better. Play it clean too, of course. Clean your recorder heads, capstans, rollers and guides regularly with a cotton swab moistened with one of

keep your tapes in the "tails out" format rather than rewinding them. The uneven winding induced in the tape by fast rewinding can cause physical warping of the tape over a period of time. Here too, you're better off with KODAK Tapes because KODAK 5" and 7" Thread-Easy Reels are of dynamically balanced, one-piece construction. This gives you freedom from wobbles and pulsations on both "record" and "rewind" . . . keeps the tape under smoother tension . . . just what the doctor ordered for long tape life. The need for smooth winding can not be overemphasized.

Last but not least, it's a good idea to dupe your really old tape recordings onto fresh KODAK Tape in order to standardize on KODAK Tape quality. That's an interesting subject all by itself, and we'll try to devote a "Plain Talk" to it soon!

KODAK Tapes on DUROL and polyester bases are available at electronic, camera and department stores. To get the most out of your tape system, send for free 24-page "Plain Talk" booklet which covers the major aspects of tape performance. Write Department 940, Eastman Kodak Company, Rochester, N. Y. 14650.



tate base. Ours is Kodak's famous DUROL Base, the stronger, tougher triacetate (we also make KODAK Tapes with a tempered polyester base for extra toughness or for long-play applications). Lab tests show that DUROL Base holds up as well as photographic film. So . . . tape wise, there's no reason your great grandchildren won't be able to enjoy your present efforts.

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**Keep it cool.** Tapes should be kept away from extremes of temperature and humidity. High temperatures may affect the plastic support and increase the possibility of print-through . . . the transfer of magnetic signals from one layer of tape to the next.

**Keep it "backwards."** For truly valuable recordings, a good trick is to



EASTMAN KODAK COMPANY, Rochester, N.Y.

der of that day and all of the next designing "sets." Each "set" is sketched, developed, and then drawn into final form. This set design includes coloring, mounting and bracing hardware, and sectioning details. Scenic designs then go to the carpentry shop, where construction begins with the first prints, and usually before the last designs are completed.

On Thursday the first production meeting is held at 10:30 a.m. The stage manager, studio manager, production manager, costume designer, scenic designer, director, associate director, lighting director, music coordinator, and assistant to the producer meet to determine what each act does and needs in the way of facilities. Although nine dressing rooms are required, 11 more are reserved to allow for "contingencies." In addition, two chorus rooms, four make-up rooms, three rehearsal halls, and three meeting rooms are ordered. Acts are blocked out for space on stage.

The meeting determines that Dinah Shore will open in one with a blues number; then the hardwall (curtain) will open to expose the orchestra, and she will sing up-stage, full stage. How will Markworth and Mayana, an archery team, be staged? The decision is for full stage, shooting left front to right back stage. Is there time to re-set full stage between Barry Sadler and Dinah Shore? This meeting, scheduled to end at noon, often requires the participants to skip lunch.

Following the production meeting is a lighting conference. The scenic designer, Bill Bohnent; lighting director, Bill Greenfield; and stage manager, Ed Brinkman, determine lighting requirements. The Four Tops set will look best with several colored lights; the Barry Sadler number demands a strong, saturated green lighting of the rear cyclorama. Dinah Shore's lighting should change twice during her number. Jose Feliciano, classical guitarist, needs a low-key, dramatic lighting.

At the end of the lighting conference, Greenfield roughs out a lighting system on a grid-system print of the studio. On this he blocks out the "aces" (one-kilowatt Fresnels), "deuces" (two-kilowatt

Fresnels), "fives" (five-kilowatt Fresnels), and the scoops in their approximate positions. Then he determines where each light will connect into the strip connectors, on which patch it will appear, to which dimmer it will be patched, and into which master dimmer it will ultimately connect.

A bank of scoops for base, and Fresnels for keys and back lights is typical of Greenfield's straightforward lighting. Each act is lighted individually, but wherever convenient, fixtures are used for more than one. Two fives are trained on the audience, particularly the VIP section from which Ed Sullivan introduces audience celebrities.

By Friday morning lighting plans are complete, and most sets have been built, painted, and set to dry in the paint shop. A 10:30 audio meeting is called for the technical directors, audiomen, and music coordinator. Special attention is given to problem numbers. Barry Sadler, the two comedians, and Sullivan are all right on the boom microphone. A hand microphone is best for Dinah Shore. Sixteen microphones have to be set on stage for the orchestra in the Dinah Shore number.

While audio problems are being resolved, Bill Greenfield has begun directing the hanging of lights in the studio. Referring to his diagrams for appropriate location, he calls to lighting hands on the catwalks for lateral and vertical moves, addition and deletion of color filters, and positioning of barn doors. Although the talent is not present, the area for each act is lighted with all sets in place. This allows the stagehands to adapt to problems when moving the sets about. By 6:00 p.m., most sets are lighted. The exception is a large relief map of Canada for the Les Feux Follets group. It has not been completed.

Although the lighting group normally works through the night until set lighting is completed, the lighting director ceases work to start again early Saturday morning.

At 8 a.m. Saturday, the lighting job is completed. Camera rehearsal begins at 9:30 with a piano for accompaniment. Each musical act is rehearsed and timed. Staging changes are made as the rehearsal progresses, and notes on lighting

changes are taken. These are chiefly improvements in face lighting on the talent. Currently, CBS is particularly careful to maintain reference white (3100°K) light on performers' flesh areas. This practice helps viewers to avoid confusing colored light for a misadjustment of the tint control. During the breaks between acts and following rehearsal, lighting corrections are made.

The Saturday afternoon schedule calls for a full orchestra rehearsal beginning at 2 p.m. This rehearsal is similar to the morning rehearsal in that it includes only the musical numbers. However, it does afford an opportunity to touch-up Dinah Shore's lighting (she had not been scheduled for the morning rehearsal), to check the effectiveness of orchestra lighting in the on-stage number, and to adjust low-key lighting on the classic guitarist. Rehearsal, scheduled to end at 4:30 p.m., ends at five. The lighting director spends the rest of the day making major changes he has noted. The scenic designer and the stage manager work out some scenery location problems, and supervise touch-up of marks and damage occurring during rehearsal.

Sunday begins early for the Sullivan crew. Audio men, boom operators, and cameramen report at 7:15 a.m. to align and check out their equipment. Nine-fifteen brings a full orchestra camera rehearsal of all acts. This run-through is used principally to check timing and lighting, and to acquaint performers with their "spot."

Bill Greenfield makes a few more notes on lights. Bill Bohnent and Ed Brinkman discuss a problem of hardwall alignment and camera angles—one shot of Dinah Shore leaves the edge of the hardwall showing. When the rehearsal recesses for lunch, they decide to move the camera slightly and move in an extra piece of hardwall.

Dress rehearsal is scheduled to begin at 1 p.m. Bad weather holds up Ed Sullivan and some other participants, delaying the "dress" until almost two. This final rehearsal takes place before a live audience and is video-taped. Taping this rehearsal allows some protection in case an act is prevented from ap-



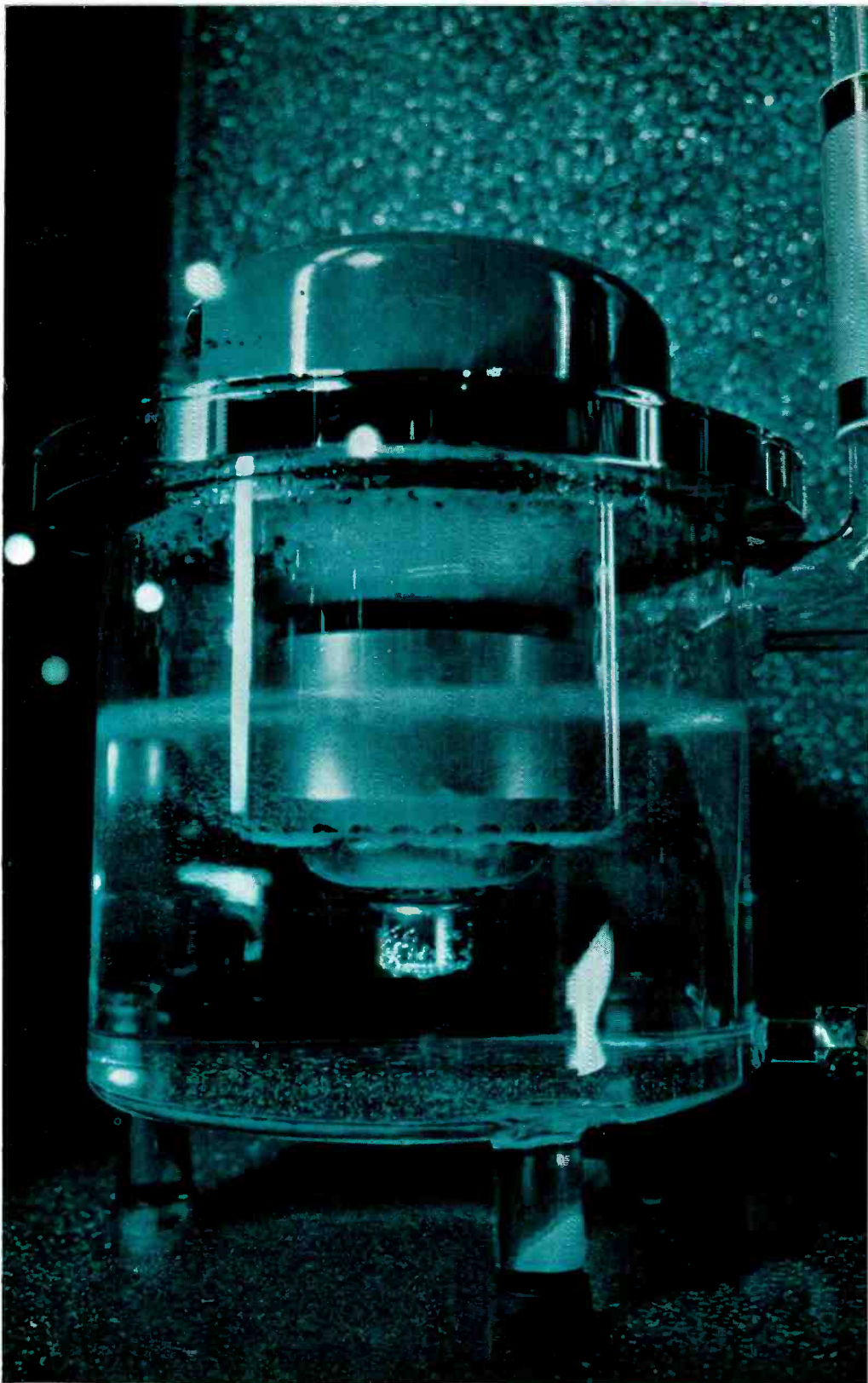
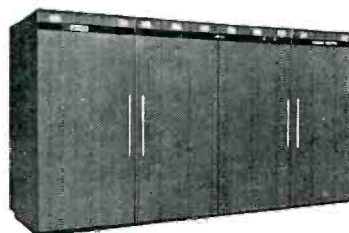


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pearing on the live broadcast. Dress rehearsal, although before an audience, is less formal than the actual show. Each act is timed; each commercial is in place; each musical bridge is paced.

Several problems develop during the rehearsal. The new camera angle on Dinah Shore degrades her lighting. Some corrections are needed on the lighting of the Four Tops. There is insufficient time to change scenery between Barry Sadler full stage and Dinah Shore full stage. Following dress rehearsal, these problems are worked out; Dinah Shore is relighted; the Four Tops are slightly repositioned; Barry Sadler's set is changed from full stage to "in two."

Background music for Jackie Vernon's comedy act is pretaped. This frees the orchestra for an earlier move to "on-stage." A special opening for servicemen in Viet Nam is also pretaped. This consists of an interview between Barry Sadler and Ed Sullivan, and will be cut into the overseas kine later. At six, cast and crew break for dinner, returning about seven.

At 7 p.m., one hour before air time, the tension noticeably increases. Lighting men check their dimmer circuits and lamps. Video men check camera levels. Props and sets are given a final inspection. The audience enters and is screened by the doormen.

At 7:40 p.m., a color model comes on stage for final aligning of the cameras. She tells us that when CBS first purchased cameras of the three-Plumbicon® type, she was required to model for an hour before rehearsals and an hour before a show. Model time has now been reduced to 15 minutes. This decrease in check-out time, according to a video operator, is due to operators' familiarization with the equipment, and by better-than-expected equipment stability.

The model walks off at 7:55. Ed Sullivan warms up the audience briefly. All eyes are on the monitors, and the show begins at 8:00:30 as scheduled.

By 9 p.m., we knew that it was not "trade secrets" that kept the Ed Sullivan Show on schedule, but skilled professional planning by a large and competent staff. ▲



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LOOK TO VISUAL FOR NEW CONCEPTS IN BROADCAST EQUIPMENT

## BOOK REVIEW

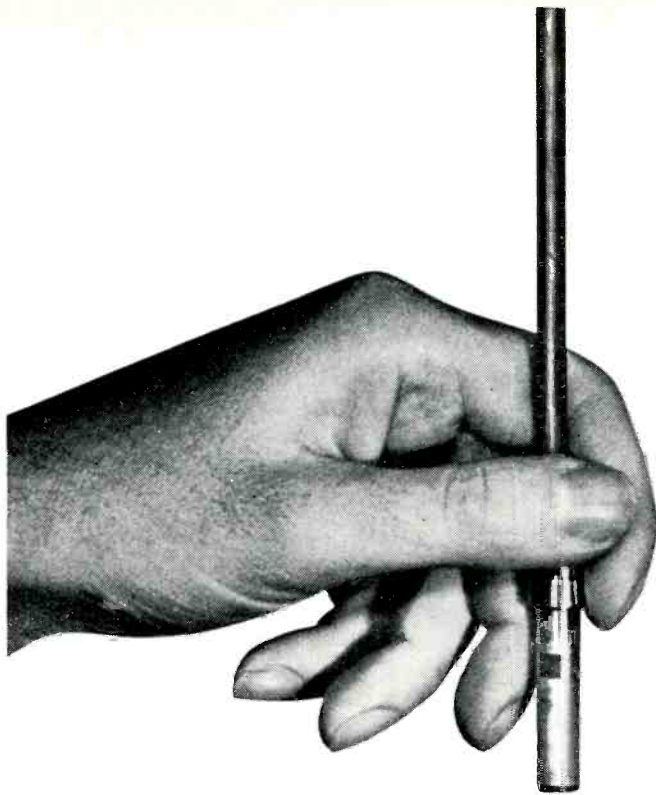
**Basic Microwaves;** Bernard Berko-  
witz; Hayden Book Company, Inc.,  
New York, 1966; 167 pages. 6" x  
9"; clothbound \$5.95, paperbound  
\$3.95.

This book is intended for the reader who desires to undertake a broad study of microwave technology, either as an end in itself or as a background for more detailed study later. The text begins with a chapter on the behavior of waves in free space. The subject is introduced in terms of physical concepts, and then the mathematical relationships are introduced and related to the physical principles.

Succeeding chapters introduce theory with increasingly specific application to microwaves. The second chapter describes the interaction of waves with objects. Topics include reflection, index of refraction, Snell's law, Fresnel equations, VSWR, and rectangular wave guides. Chapter three is concerned with antenna theory. The discussion includes horns, lenses, paraboloid reflectors, antenna patterns and gain, and other subjects. Chapter four describes several types of antennas. Chapter five is concerned with transmission lines. Considerable theory is included, and the use of the Smith chart in solving transmission-line problems is explained. The last chapter describes a number of microwave components, such as the directional coupler, magic tee, attenuators, detectors, etc.

The book has been written without the use of calculus, but the reader will need at least some familiarity with algebra, trigonometry, and geometry. Some prior knowledge of fundamental electrical and magnetic principles is also necessary. The text is liberally supplemented with line drawings and a number of photographs. A summary concludes each chapter, and a list of review questions (answers are not given) follows each chapter but the last.

While this text is designed as an introduction to microwaves, there is considerable information contained within its covers. The reader will not gain much from a superficial reading of the book; but if he is willing to expend a moderate amount of effort, he should acquire a basic understanding of microwave theory. ▲

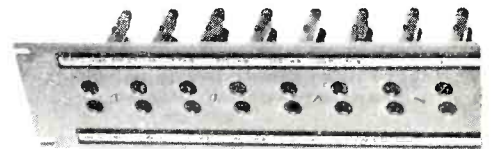


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# THE NEW FCC CATV REGULATIONS

A summary of the new Rules and what they mean.

When the Federal Communications Commission issued its Second Report and Order on March 8, 1966, establishing jurisdiction over all Community Antenna Television (CATV) systems and adopting new rules for their regulation, it tried to include something for everybody. Generally speaking, however, the television broadcast stations and their big trade associations think the Commission has been too easy on CATV systems; the CATV operators and their trade association (NCTA) think the new regulations are too restrictive; and various members of Congress are pulling and pushing in different ways, depending on the predominant feelings in their individual districts. Here's how things shape up.

## Jurisdiction

First of all, the Commission has asserted jurisdiction over all CATV systems, except for apartment-house master antenna systems and CATV's serving fewer than 50 subscribers. This jurisdiction applies to all CATV's, including those relying solely on off-the-air pickups, whereas the Commission formerly regulated only those systems employing microwave relays to bring in distant programs.

## Carriage of Local Stations

Here's what the CATV systems may and may not do. First, each CATV system must carry the signals of all television stations placing a Grade B or better signal over the community served by the system. Translators having 100 watts or more are treated the same as television broadcast stations.

In case this would require the CATV system to carry more signals than available channel capacity, a priority system is set up. First priority is given to signals of principal-city grade, second priority to Grade-A, third priority to Grade-B, and fourth priority to translator signals. (See Table 1.)

This carriage must be put into

effect upon request of the individual broadcast stations. An effective date of April 18, 1966, was established. (Existing nonmicrowave CATV systems were given an additional 60 days to comply.)

The CATV system is required to carry the signals of the local stations "without material degradation." However, no definite engineering standards have been adopted to define technical quality of CATV pictures, although broadcasters asked that this step be taken. A particularly difficult problem arises where, for technical or other reasons, the signal of a local station is carried on the cable on the same channel as it is broadcast over air; in areas of strong radiated signal, very objectionable ghosting may occur. Broadcasters generally express a distinct preference for cable carriage using the same channel as the broadcast signal in order to preserve channel-number identification. CATV operators, on the other hand, commonly resort to the practice of shifting local stations to unused cable channels to avoid interference.

## Nonduplication

The Commission's new regulations require that CATV systems, upon request of local broadcast stations, not bring in distant signals which duplicate the programs of the local stations. In contrast to earlier conditions imposed on microwave-served CATV systems, however, the new requirements are considerably relaxed. For one thing, only same-day nonduplication is now required, whereas the previous requirements forbade duplication of local-station programs by CATV systems for a period 15 days before and after the local broadcast. Furthermore, the new nonduplication requirements do not apply to color programs broadcast locally in black and white, nor do they apply to "prime-time" network programs which are not carried locally in prime time.

The principal effect of the non-duplication requirements on network programs is to protect television broadcast stations from distant CATV importation, especially across time-zone boundaries. For non-network programming, however, such as feature programs and syndicated shows, no significant protection is provided.

## Other Requirements

The foregoing requirements are the only operating restrictions imposed on CATV systems located outside of the nation's top 100 markets as established by ARB ranking. All CATV systems are required, however, to notify the Commission of ownership interests, number of subscribers, television stations carried, and local program originations. Furthermore, all new systems and existing systems proposing to add new distant signals, or to extend service into new geographic areas, are required to give prior notice to local television broadcast stations.

## Top 100 Markets

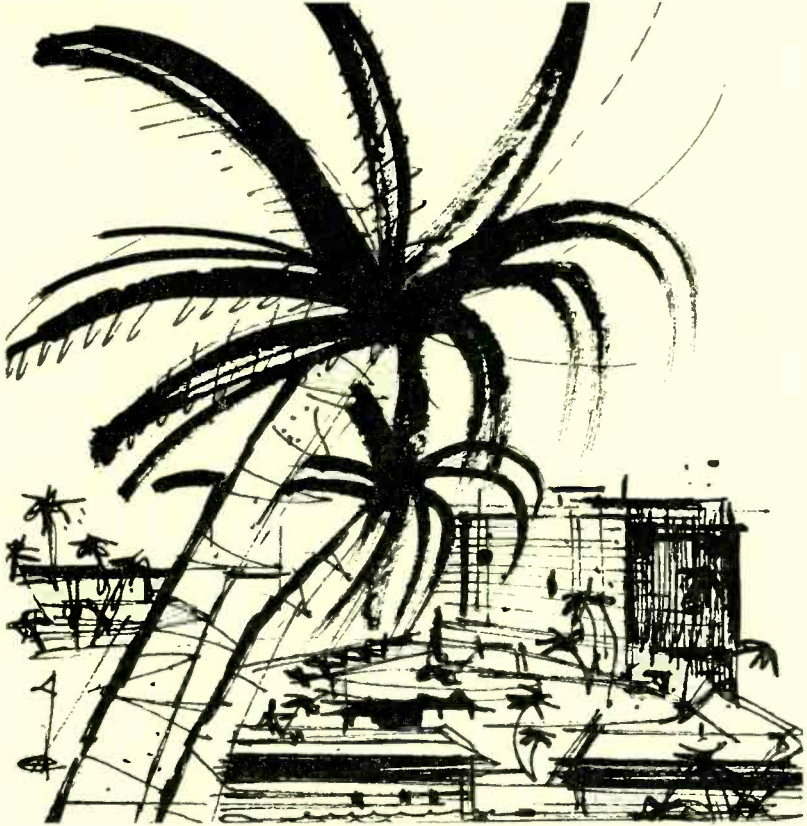
CATV systems serving a community within the predicted Grade A contour of any television station in the 100 largest television markets have different ground rules. The carriage and nonduplication requirements are the same as for the smaller markets. However, the Commission's prior approval will be required for CATV systems to carry the signals of any distant station which does not have Grade B or better service in the city where the CATV system is located. The Commission intends to hold full-dress hearings on any application for importation of distant signals by CATV's in the top 100 markets. One of the most important considerations in passing on such requests will be the potential impact upon the actual or expected development of UHF stations in the affected market.



TM

# Broadcast Engineering

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**PREVIEW**

OF THE

## **1966 NCTA CONVENTION**

**AMERICANA HOTEL  
MIAMI**

## Preview Supplement

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## 1966 NCTA

### CONVENTION

Americana Hotel

Bal Harbour (Miami), Florida

June 26-29, 1966



## NEWS RELATED TO CATV

### **15th Annual NCTA Convention**

The NCTA Convention, to be held in Miami this year, will feature parallel sessions for management and engineering delegates. Subjects to be covered at the management sessions will include marketing, promotion, sales, finance, and taxes. For those interested in technical matters, a new-products session will feature new technical developments by NCTA Associate member firms.

Other highlights of the Convention are to be three luncheon addresses, including one by NCTA President Frederick W. Ford; the annual banquet; and special social functions sponsored by NCTA Associate member exhibitors.

The Convention officially begins June 26, with sessions on June 27, 28, and 29.

### **Arizona Group Elects Officers**

Election of officers highlighted the Arizona Community Television Association convention at Phoenix, April 22 and 23. The new ACTA president is Earl Hickman, owner of cable systems at Williams and Douglas. Jess W. Allen, owner of Clearvision Television at Nogales, was elected vice-president. Charles Wigutow, of American Cable Television, Inc., is secretary-treasurer.

The two-day meet, hosted by Allen Dean of Vumore Co., Roswell, N. M., outgoing ACTA president, was attended by 75 conferees.

### **International Equipment Agreement**

A CATV equipment licensing agreement has been signed with Teleng, Ltd. of Romford, Essex (near London) by the Jerrold Corp. Teleng is a subsidiary of Telefusion, Ltd., a British TV-set rental firm and operator of cable television systems. Teleng has equipped a number of cable TV systems in Great Britain and Europe.

Initially, Teleng will import Jerrold's Starline series of CATV equipment and accessories, to be marketed under the Teleng-Jerrold name. Later this year, the British firm will build its own version of the Jerrold equipment with special modifications for use in the United Kingdom and Europe.

The British system of cable television, known as TV Relay, differs from CATV in that it includes the rental of the TV set as well as the antenna service.

### **Operating Company Formed**

A new company, Continental CATV, Inc., will operate Viking's existing CATV properties throughout the United States and will develop franchises and acquisitions.

Heading the new company as executive vice-president is John F. Gault. Mr. Gault began his CATV career as operations manager and later as a systems manager for Teleprompter Corp. He then joined TeleVision Communications Corp. as Northeast regional manager and later as vice-president of operations before assuming his present position.

# MIAMI

## Things To Do and See

Here is a brief list of things to do and see while you're in Miami. Each item is keyed by number to the map on the next two pages.

In addition to the attractions listed here, Miami has 4000 restaurants, hundreds of hotels, miles of beaches, and 23 golf courses (12 public and 11 private). A short drive will take you to the Overseas Highway along the famous Florida Keys. For more detailed instructions about directions, bus service, and guided tours, contact your hotel or motel, or the Miami-Dade County Chamber of Commerce, 330 Biscayne Blvd., Miami.

### **1. ANCIENT SPANISH MONASTERY GARDENS:**

Open 10-5 daily. 823-year-old cloister brought to Miami by William Randolph Hearst from Granada, Spain, in 1954 and put together piece by piece. Oldest edifice in the United States.

**3. BAYFRONT PARK:** This is a lush 40-acre park containing Bayfront Park Auditorium, John F. Kennedy Torch of Friendship, the Miami Public Library, gardens, bandshell, monuments, rock gardens, and fishing.

**3. DOG RACING:** At this time of year, only the Flagler Kennel Club is open. This track features greyhound racing with pari-mutuel betting permitted. No minors allowed.

**4. CHINESE VILLAGE:** Unique architecture in private dwellings.

**5. CIRCUS CITY:** Hours are from 10-5 daily with an admission charge. Features circus zoo, museum, and trained porpoises.

**6. CRANDON PARK:** This beach on Key Biscayne is open daily from 5-12. It provides dressing rooms, showers, cabanas, beach accessories, picnic grove with tables, grills, shelters, zoological gardens, children's amusement park, and children's zoo. Other features are a miniature 18-hole golf course and an outdoor roller skating rink.

**7. CRANDON PARK ZOO:** This zoo has 1,000 animals and a special children's section where youngsters can mingle with tame animals and hear talking story books. Open daily from 9:00-4:30; there is no charge. A special feature is an aviary bird sanctuary.

### **8. EASTERN GARDEN AQUARIUM:**

This firm, which wholesales and retails tropical fish, has no admission charge to aquarium of tropical fish from the world's jungle streams.

### **9. EVERGLADES NATIONAL PARK:**

This park of 1,046,000 acres offers scores of facilities for sightseers and those interested in nature. Among its features are boat trips, restaurants, planned activities, fishing, lectures, and the famous "catwalk" through unspoiled nature. The park is some 75 miles from Miami. Admission is free.

### **10. FAIRCHILD TROPICAL GARDEN:**

This is the largest tropical botanical garden in the country. There is no admission fee, and the garden is open from 8:30-5:30. Guided tours are available.

**11. FIRE ENGINE LADDER #1/3:** A scaled-down but fully operational model of a modern fire engine. No admission charge.

**12. FLAGLER STREET:** Miami's famous shopping area.

### **13. FLORIDA PIONEER MUSEUM:**

Old Florida East Coast Railway house, furnished a la early 1900; also rare Indian-mound findings from the Florida Keys, and other Indian artifacts. Open 1-5 p.m. Wednesday through Sunday.

### **14. FUNLAND AMUSEMENT PARK:**

Kiddie and adult rides. Noon to 11:30 p.m. daily.

**15. GARDEN OF OUR LORD:** A lovely retreat containing shrubs, flowers, and trees mentioned in the Bible or Christian tradition.

**16. GOLD COAST RAILROAD AND MUSEUM:** Real steam-engine trains, cars, and caboose are operated every Sunday from 1-5 p.m. Includes presidential "armor-plated" car. Adults \$1 and children \$0.50.

**17. HISTORICAL MUSEUM OF SOUTHERN FLORIDA AND THE CARIBBEAN:** Contains historical materials and artifacts relating to Florida and the Caribbean. Open 1-5 p.m. Tuesday through Saturday. Donations accepted.

**18. HORSE RACING:** The Florida tracks are closed during June, but the gardens of Hialeah and Gulfstream are open to the public daily. Gulfstream (18A) features a sailing lake and Hialeah (18B) the famous flamingos, coral reef fish, and priceless collection of carriages.

**19. JAPANESE GARDEN AND TEA-HOUSE (SAN-AI-AN GARDEN):** A bit of Japan transplanted in Miami. Contains statues, garden, arbor, teahouse, stone lanterns, rock gardens, pagoda, waterfall, and lagoon. No admission fee. Open 9-6 daily.

**20. MIAMI WAX MUSEUM:** Over 40 life-like Dioramas depicting events of history, sports, and movies from Columbus to the Astronauts. Weekdays 9:30-9:30, Sundays 1:30-9:30. Admission charged.

**21. MINERAL SPRINGS:** Off-the-beaten-path tropical recreational area with huge waterfall. Sand beach, bath house, picnicking, Indian mounds, and archeological excavations. Famous Seminole battle site. Small admission charge.

**22. MIRACLE MILE:** Famed Coral Gables Shopping Center.

**23. MONKEY JUNGLE:** Monkeys roam wild and visitors are caged. Attractions include chimp show and Bulu, famous 600-pound gorilla. Daily 9:30-5:15. Admission charged.

**24. MUSEUM OF SCIENCE:** Contains exhibits of Florida natural history from

prehistoric creatures to the colorful fish and bird life of today. Open daily; admission free.

**25. ORCHID JUNGLE:** The world's largest outdoor orchid garden; every lady gets an orchid. Open daily 8-5:30. Admission charged.

**26. PARROT JUNGLE:** A natural jungle where hundreds of colorful, tame parrot-type birds fly free. Parrot Circus and "Flamingo Parade" of more than 100 marching flamingos. Admission charged.

**27. PENNEKAMP CORAL REEF PARK:** Nation's only underwater park with display of coral reefs. Fishing, camping sites. Open 8 a.m. to sunset. Charge for sight-seeing boats.

**28. PIONEER CITY:** A park with a western theme. Featured are interesting bits of Americana from 1860-1900, including trains, river boats, stagecoach, covered-wagon rides, gold panning, shoot-outs, and other entertainment. Daily from 10:30-sunset. Admission fee.

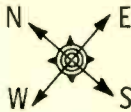
**29. SEAQUARIUM:** Divers hand-feed huge fish. Educated porpoises and sea lions perform tricks. Includes the South's only monorail ride. Open daily 9-5. Admission charged.

**30. SERPENTARIUM:** The only venom laboratory of its kind. Conducted tours are climaxed by a cobra venom extraction. Open daily 9:30-5:30. Admission charged.

**31. JOHN F. KENNEDY TORCH OF FRIENDSHIP:** Unique shaft with perpetually burning flame. Plaques of various neighboring republics mounted on wall.

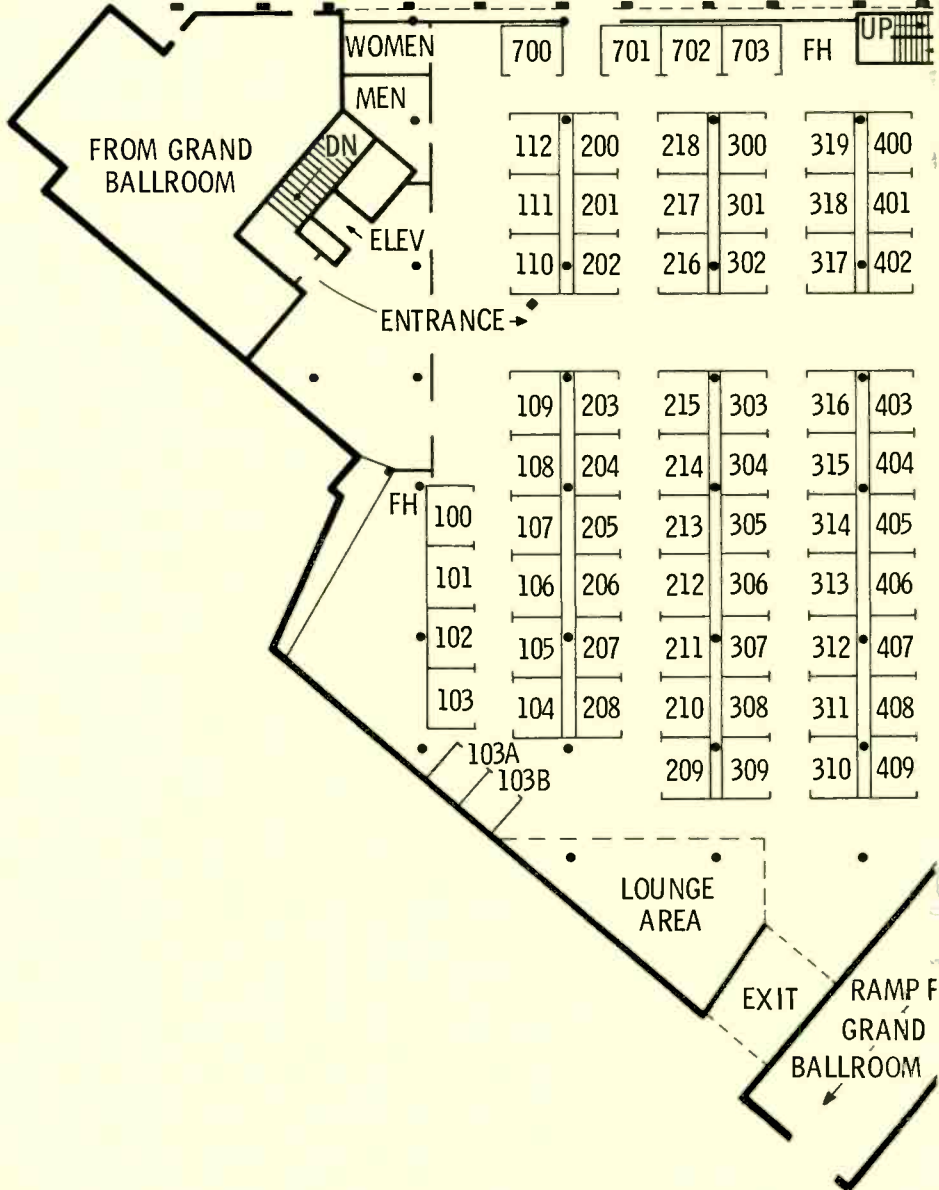
**32. UNIVERSITY OF MIAMI:** Spectacular 260-acre campus for 9,500 students features modern hurricane-proof buildings of steel, glass, and concrete.

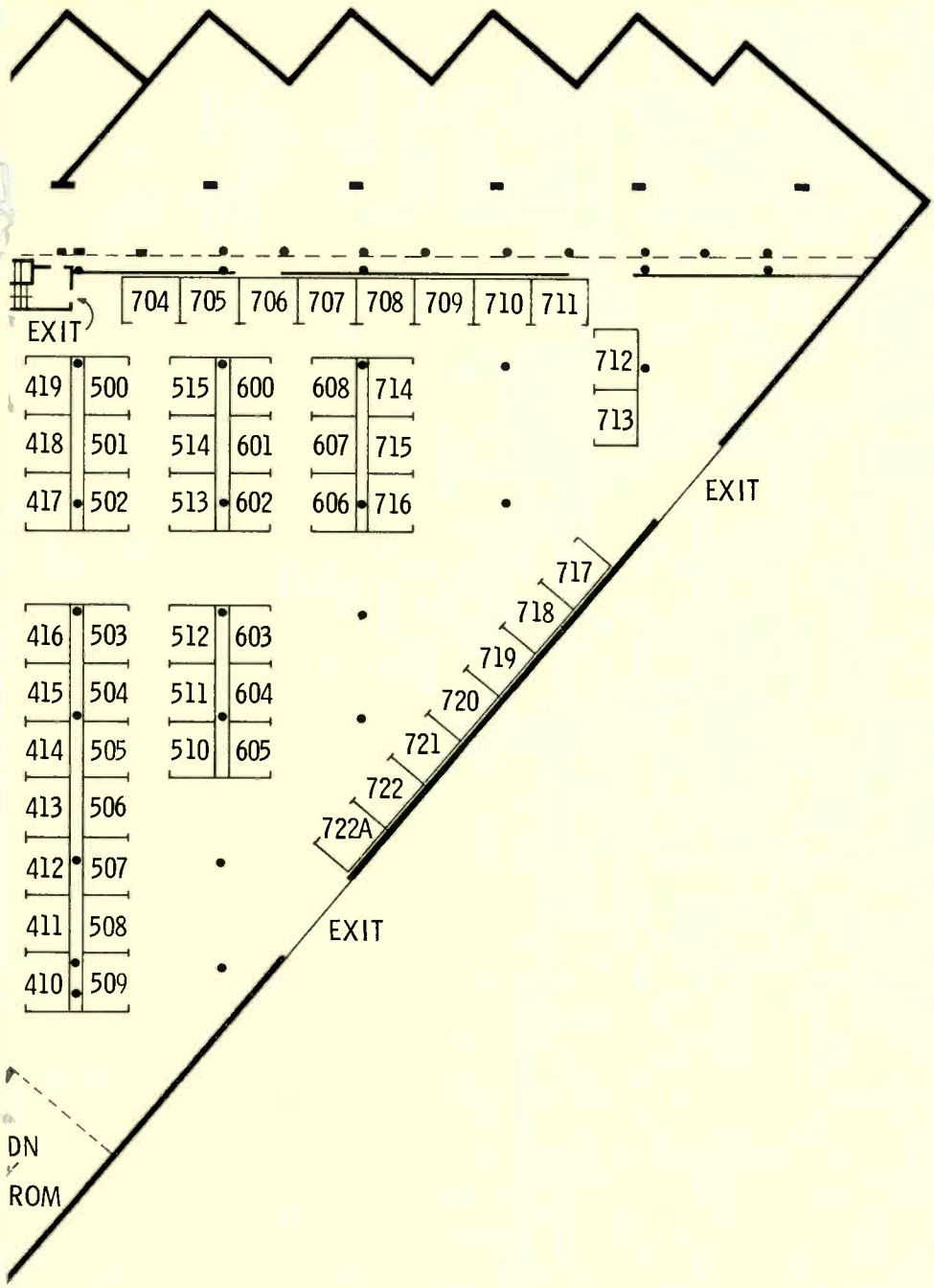
**33. WONDERS OF THE SEA:** A marine exhibit open from 9 a.m. to 10 p.m.

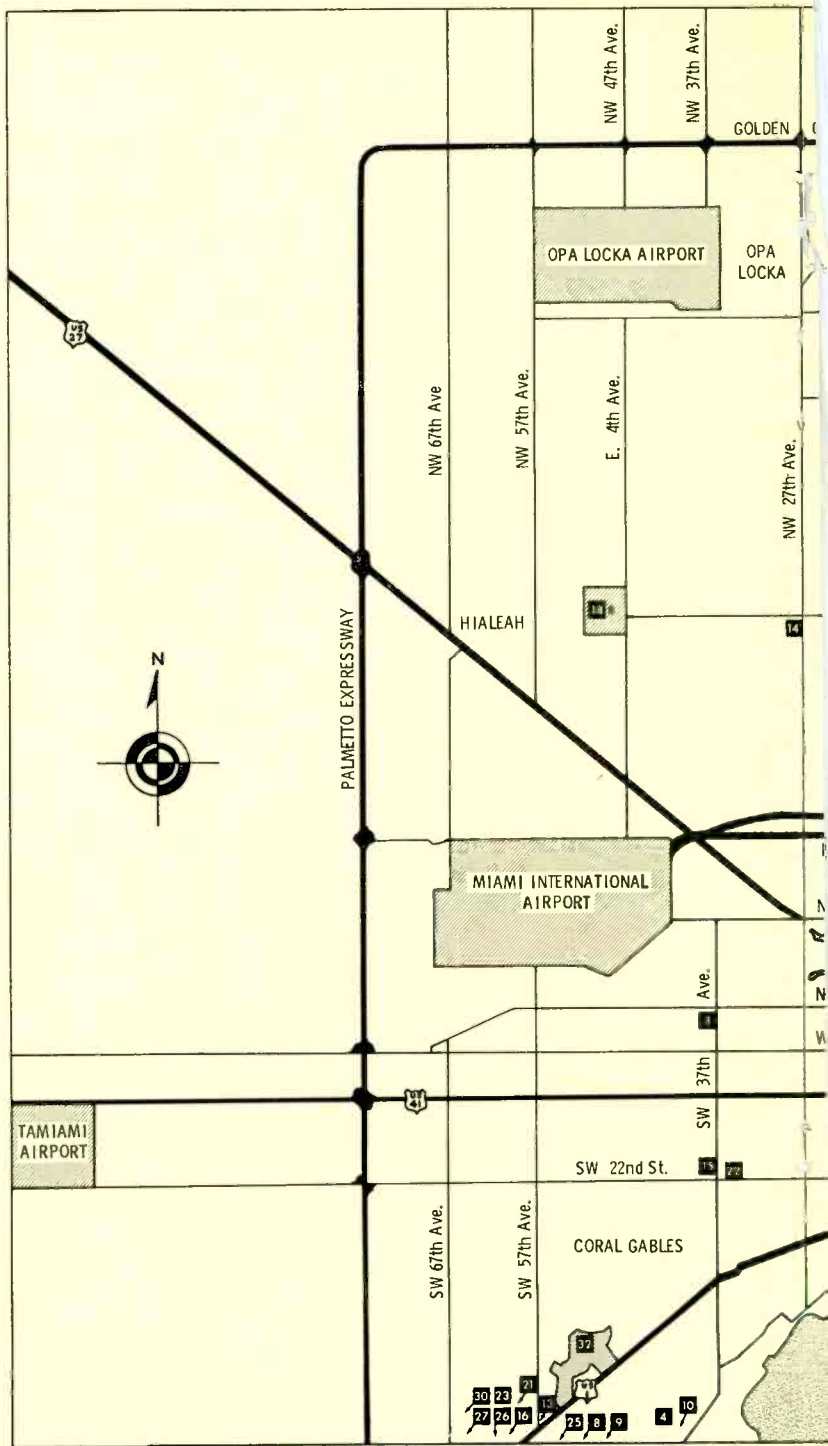


TO PATIO  
COFFEE SHOP

EXIT





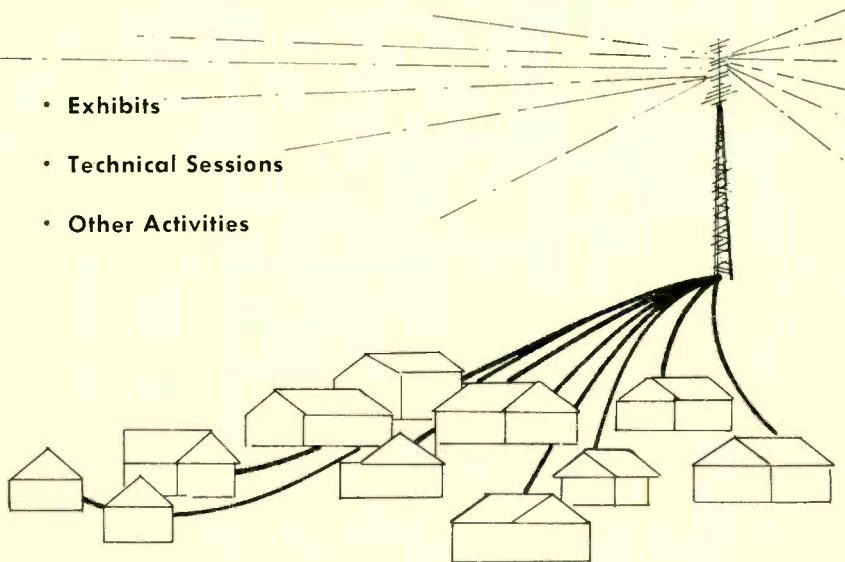




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## ***Read all about the NCTA Convention***

- 
- Exhibits
  - Technical Sessions
  - Other Activities



---

**A complete report in the September issue of  
Broadcast Engineering**

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P. O. Box 13654  
Atlanta, Georgia 30324  
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**Sigma Industries, Inc**  
1115 O'Brien Drive  
Menlo Park, California  
(Booth 718)

**Spencer-Kennedy Labs., Inc.**  
1320 Soldiers Field Road  
Boston, Massachusetts 02135  
(Booths 209-211)

**Stan Socia Corporation**  
634 Fair Petroleum Building  
Tyler, Texas  
(Booth 311)

**State Labs, Inc.**  
215 Park Avenue, South  
New York 3, New York  
(Booth 103B)

**Texas Electronics, Inc.**  
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Dallas, Texas  
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**Times Wire & Cable Company**  
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(Booths 114-116)

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8936 Comanche Avenue  
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**Viking Industries**  
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**Weather Scan**  
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1410 Dallas Street  
Wellington, Texas  
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 (Booth 503)

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**Jack Pruzan Company**

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 (Booths 412-413)

**Rohn Systems, Inc.**

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 Peoria, Illinois  
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 Hickory, North Carolina 28601  
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**Telemet Company**

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 Amityville, New York 11701  
 (Booth 515)

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Seattle, Washington  
(Booth 600)

**Entron, Inc.**  
2141 Industrial Parkway  
Montgomery Industrial Park  
Silver Spring, Maryland  
(Booths 203-205; 213-215)

**Federal Electric Corporation**  
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**Kaiser-Cox CATV**  
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**Lenkurt Electric Company, Inc.**  
1105 County Road  
San Carlos, California 94070  
(Booths 714-715)

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300 Park Avenue  
New York, New York  
(Booth 711)

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- Davco Electronics Corp.**  
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- Delta Electronics, Inc.**  
70 Ronson Drive  
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6360 Federal Blvd.  
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(Booth 309)
- Gilbert Engineering Company, Inc.**  
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**Burnup & Sims, Inc.**  
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**Collins Radio Company**  
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Mial Station 416-113  
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**Jack Kent Cooke**  
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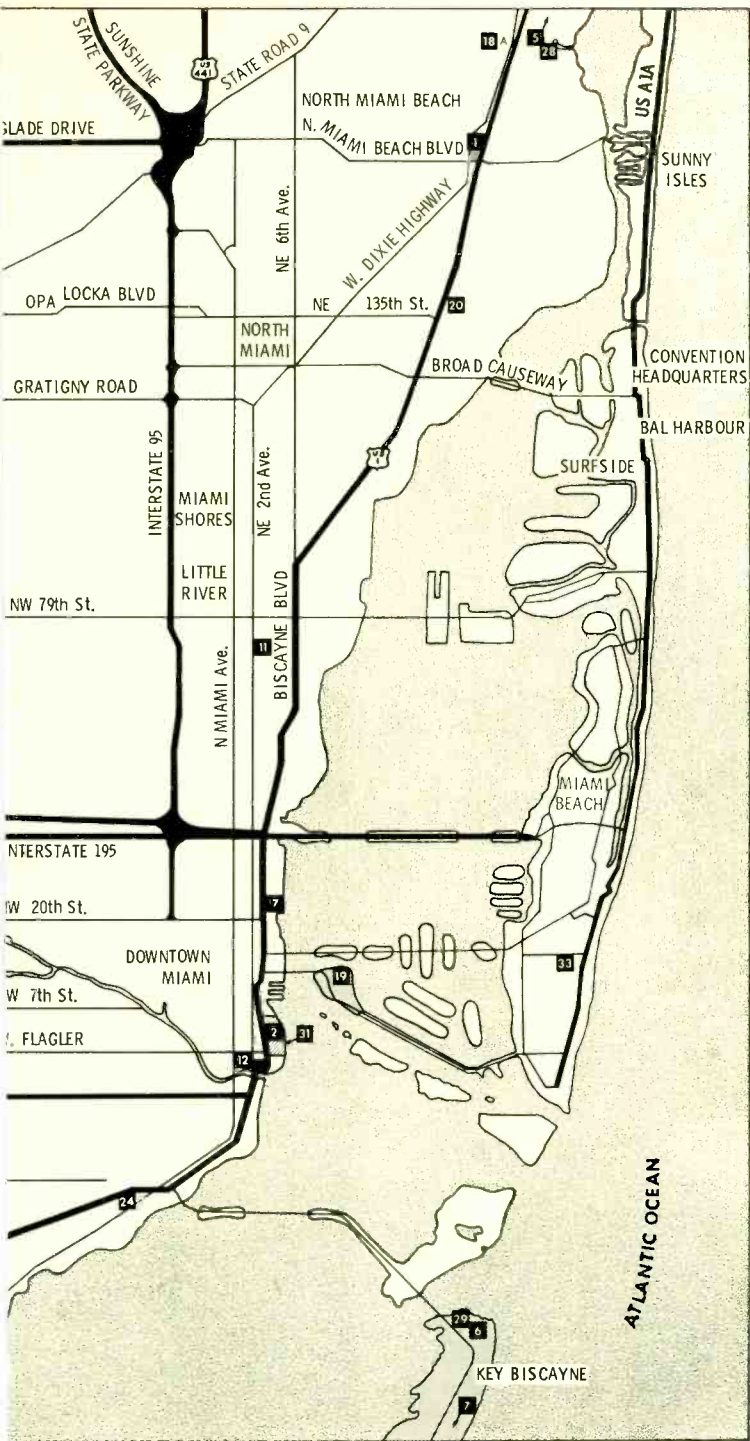
**Copperweld Steel Company**  
Frick Building  
Pittsburgh, Pennsylvania  
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**Craftsman Electronic Products, Inc.**  
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Manlius, New York  
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**Cummins-Chicago Corporation**  
**Allison Coupon Company**  
4740 Ravenswood Avenue  
Chicago, Illinois 60640  
(Booth 103A)

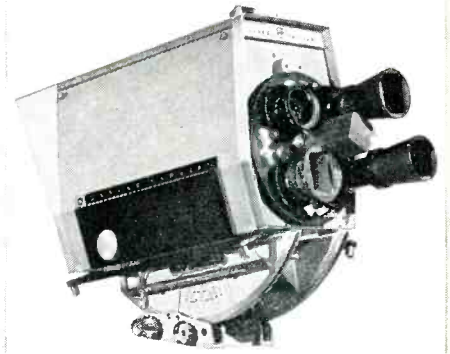
## LIST OF EXHIBITORS

- Aberdeen Company**  
3833 Wilshire Blvd.  
Los Angeles, California  
(Booth 409)
- Advance Industries**  
705 Douglas Street  
Sioux City, Iowa  
(Booth 405)
- Ameco, Inc.**  
2949 West Osborn Road  
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(Booths 200-202; 216-218)
- American Electronic Labs., Inc.**  
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Lansdale, Pennsylvania 19446  
(Booths 508-509)
- American Pamcor, Inc.**  
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Paoli, Pennsylvania  
(Booths 607-608)
- Cable Promotional Services, Inc.**  
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- Canada Wire & Cable Co., Ltd.**  
Postal Station R  
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(Booth 502)

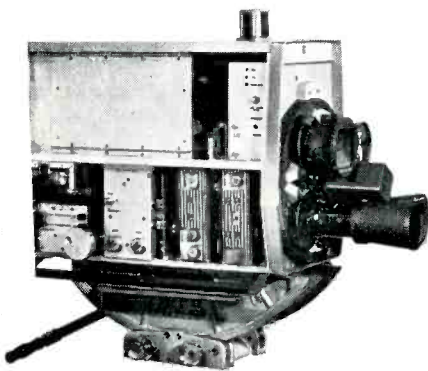




# A FEW REASONS WHY YOU CAN'T BUY A FINER TELEVISION CAMERA ...AT ANY PRICE



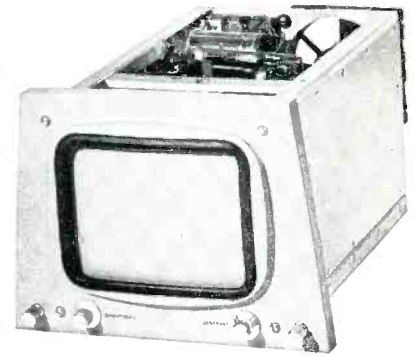
Impressive, designer-styled exterior. Clean lines, ultra-compact package houses field-proven Tarzian 3" Image Orthicon camera system. Highly portable. Easy to handle. Uses conventional camera cable.



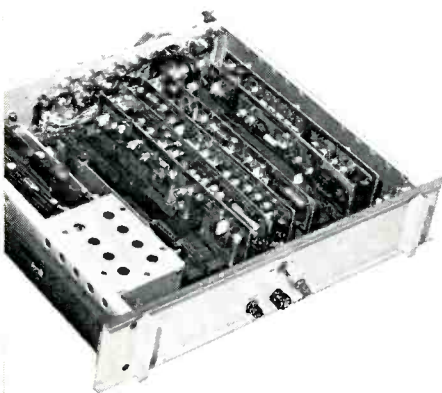
100% transistorized plug-in electronics for reliability and fast, convenient troubleshooting. Hinge out yoke assembly allows rapid change of IO tube.



Built-in remote iris control. Quick-change lens insert system accepts variety of lenses, fixed focus and zoom.



Plug-in, self-contained 8-inch viewfinder assembly, interchangeable with other Tarzian live cameras. All circuits accessible without removing viewfinder.



Modular proc amp completes camera system. (Also interchangeable between cameras.) Totally transistorized electronics on plug-in circuit cards. Compact, highly portable.

## SPECIFICATIONS

- Scanning rate . . . . . 525 lines, 30 frames, 60 fields, 2:1 interlaced
- Line repetition rate . . . . . 15,750 cycles per second
- Resolution (horizontal) . . . . . 600 lines picture center  
500 lines picture corners
- Signal-noise ratio . . . . . Limited only by image orthicon
- Remote iris control . . . . . Time for full range, 3 seconds accuracy of setting  
 $\pm 0.25$  lens stop
- Output signals . . . . . Horizontal drive, 4 volts  $\pm 0.5$  volts; Vertical drive,  
4 volts  $\pm 0.5$  volts; Sync, 4 volts  $\pm 0.5$  volts;  
Blanking, 4 volts  $\pm 0.5$  volts. Viewfinder video (external) 0.7 volts intercom audio.
- Viewfinder size . . . . . 8" tube
- Intercom . . . . . Dual transistorized

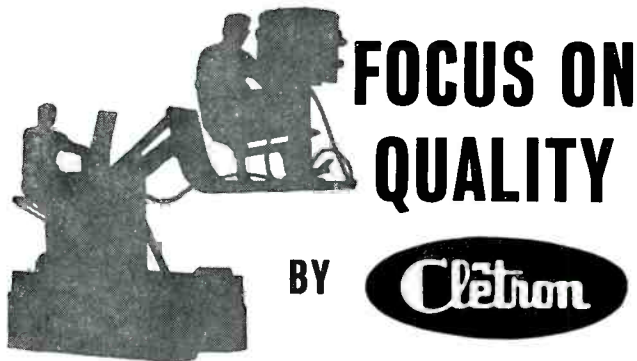
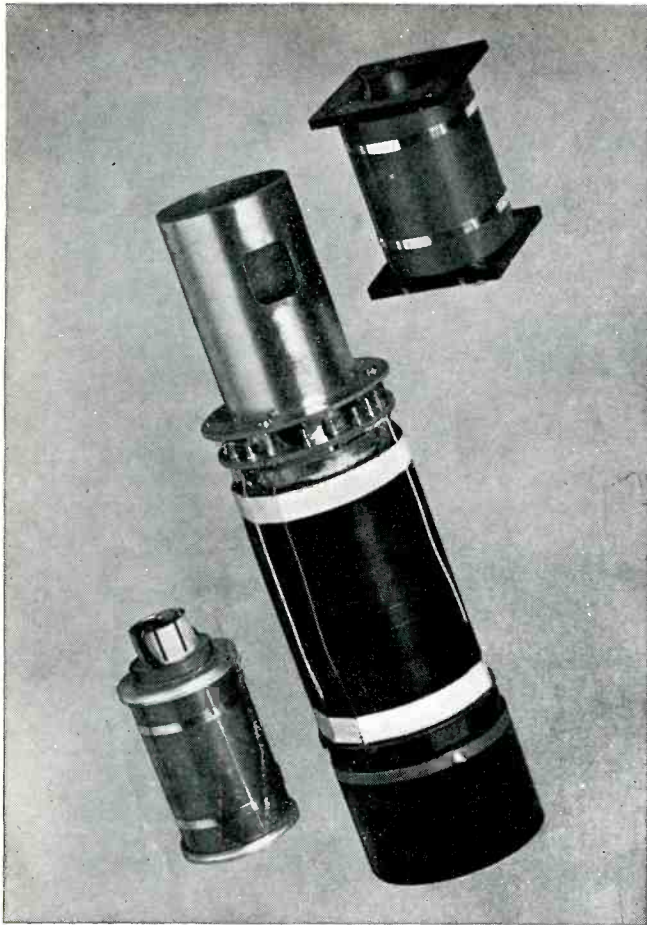
*These are but a few reasons. For all the rest, call, or write, for 8-page brochure, "3000L 3" Image Orthicon Camera System."*

**S A R K E S**  
BROADCAST EQUIPMENT DIVISION



**T A R Z I A N**  
BLOOMINGTON, INDIANA

Circle Item 17 on Tech Data Card



**CLETRON**, manufacturer of Orthicon and Vidicon Deflection Components for Commercial and Military applications offers you quality-engineered products and services that have been incorporated as standards in the country's leading manufacturing companies of Television Camera Equipment.

Write today for additional technical literature, drawings and engineering specifications on the complete line of Cletron Deflection Components.



*Quality products by Cletron...  
Manufacturers of Deflection Components, Custom  
Transformers and Sound Reproducing Devices...*

**Cletron CLEVELAND ELECTRONICS, INC.**

1974 East 61st Street, Cleveland, Ohio 44103, U.S.A.  
Circle Item 16 on Tech Data Card

The Commission has provided that importation of distant signals which was established in top 100 markets on or before February 15, 1966 need not be discontinued. Proposals to bring in new signals, however, will require a hearing, and the Commission will also consider on an individual basis the extension of lines by existing CATV systems into new locations.

### Effects of the Rules

The Commission's newly established requirements can best be summed up by stating that CATV systems in smaller markets are essentially unaffected by the new regulations. To be sure, the carriage and nonduplication requirements are applied for the first time to CATV systems not employing microwave, but there appear to have been few instances where CATV systems had not of their own accord already undertaken such measures. Concerning the top 100 markets, however, the Commission's order essentially imposes a "freeze" on CATV expansion. In these markets, the carriage of local stations may be undertaken without Commission permission, but one of the most attractive features offered by CATV systems proposing operation in the larger markets has been program fare not available locally.

### Reaction

The Commission's action has raised the expected hue and cry on Capitol Hill, and several bills on the subject have been introduced. These range from proposals which essentially nullify the Commission's action to proposals giving the Commission specific authority for CATV regulation. Some of these extend well beyond the steps which the Commission has already taken. Of particular interest is the matter of CATV program origination. The broadcasters are asking for absolute prohibitions against origination of any kind, and CATV operators are insisting that a CATV origination may be a new, or even an only, outlet for local self-expression. The regulations are silent with respect to CATV program origination, but the Commission has asked for Congressional guidance on the point.

The reaction of CATV operators and broadcasters to the Commission's action is varied. Many CATV operators have asked for exceptions to various provisions of the new rules, thus tacitly acknowledging the Commission's assertion of jurisdiction. A substantial number of applications for exceptions have already been received, and more are arriving daily. Some broadcasters have appealed the Commission's decision to the courts as being insufficiently restrictive on CATV. Other broadcasters have petitioned the Commission to enforce its regulations against CATV systems which allegedly have engaged in a wild scramble to construct or extend systems in great haste to circumvent the new regulations.

The CATV "question" is not yet fully answered. BROADCAST ENGINEERING will stay on top of developments and keep you posted as they occur. ▲

Table 1. Calculated Distances to Coverage Contours  
(Using [F50,50] Curves in FCC Rules)  
Chs 2-6, 100 kw (20 dbk) ERP  
Effective Antenna Height

| Contour                         | Effective Antenna Height |         |         |
|---------------------------------|--------------------------|---------|---------|
|                                 | 500 ft                   | 1000 ft | 2000 ft |
| Principal City                  | 20 mi                    | 28 mi   | 41 mi   |
| Grade A                         | 26                       | 37      | 50      |
| Grade B                         | 57                       | 70      |         |
| Chs 7-13, 316 kw (25 dbk) ERP   |                          |         |         |
| Principal City                  | 27 mi                    | 38 mi   | 52 mi   |
| Grade A                         | 31                       | 45      | 61      |
| Grade B                         | 51                       | 64      | 80      |
| Chs 14-83, 1000 kw (30 dbk) ERP |                          |         |         |
| Principal City                  | 24 mi                    | 34 mi   | 47 mi   |
| Grade A                         | 32                       | 43      | 56      |
| Grade B                         | 47                       | 59      | 75      |

June 1966

We interrupt this magazine to bring you...

## Late Bulletin from Washington

by Howard T. Head

### New Clear-Channel Proposals Expected Soon

After two years of study, the Commission is expected to act soon on eight pending proposals filed by Class I-A clear-channel stations for operation with powers ranging from 500 kw to 750 kw (July, 1964 Bulletin). At issue is the ultimate use to be made of the 24 U.S. Class I-A clear channels, reserved by treaty for the exclusive nighttime use of single stations operating with powers of not less than 50 kw.

The Commission has already provided for the assignment of a single Class II-A station to each of 12 clear channels. Each of these new stations must operate with at least 10 kw power, and must provide nighttime service to areas not now receiving primary service at night. In breaking down these 12 channels, the Commission reserved judgment on the remaining 12, postponing until a future date a decision as to whether to permit the clear-channel stations to increase power above 50 kw, or to open up these channels to new full-time and daytime-only stations.

### Substitute for CATV Trunk Cables to Be Tested

The Commission has authorized the testing of experimental equipment which promises to eliminate the necessity for a substantial amount of CATV trunk cabling in New York City. CATV franchise holders have stated that the laying of trunk cables in the city, where only underground wiring is permitted, would be extremely expensive, and that added construction might result in substantial disruption of traffic.

The system to be tested involves 5-watt operation in the 18 GHz band over paths up to five miles in length. A novel feature of the system is that the entire band from 54 MHz to 216 MHz, including all television and FM carriers, as well as any other signals present, will be amplitude modulated on the 18 GHz carrier, with the carrier and lower sideband being suppressed. By substituting television picture signals in the portions of the 54 MHz to 216 MHz band ordinarily used for other purposes, such a system could conceivably have an ultimate capacity of over 25 individual television channels.

### Date Extended for Filing CATV Data

The Commission has extended from April 18, 1966, to an indefinite future

date the requirement that all CATV systems file data with respect to technical characteristics and ownership. According to the Notice announcing the postponement, CATV systems will now be required to file the specified data only after a suitable form has been drawn up and approved for the purpose. The new required filing date will be 30 days after the publication of the form in the Federal Register.

In the meantime, since the adoption of new Rules providing for regulation of all CATV systems (see page 32 of this issue), the Commission has been deluged with filings of all sorts by numerous parties. Efforts are being made to dispose of various pleadings and protests as promptly as possible, but it is becoming apparent that the volume of such filings has far exceeded that expected by the FCC.

#### New Vacancy at FCC

Chairman E. William Henry of Tennessee, appointed FCC Commissioner and later Chairman by the late President John F. Kennedy, has resigned. Senior Commissioner Rosel H. Hyde, an Idaho Republican, has been named Acting Chairman.

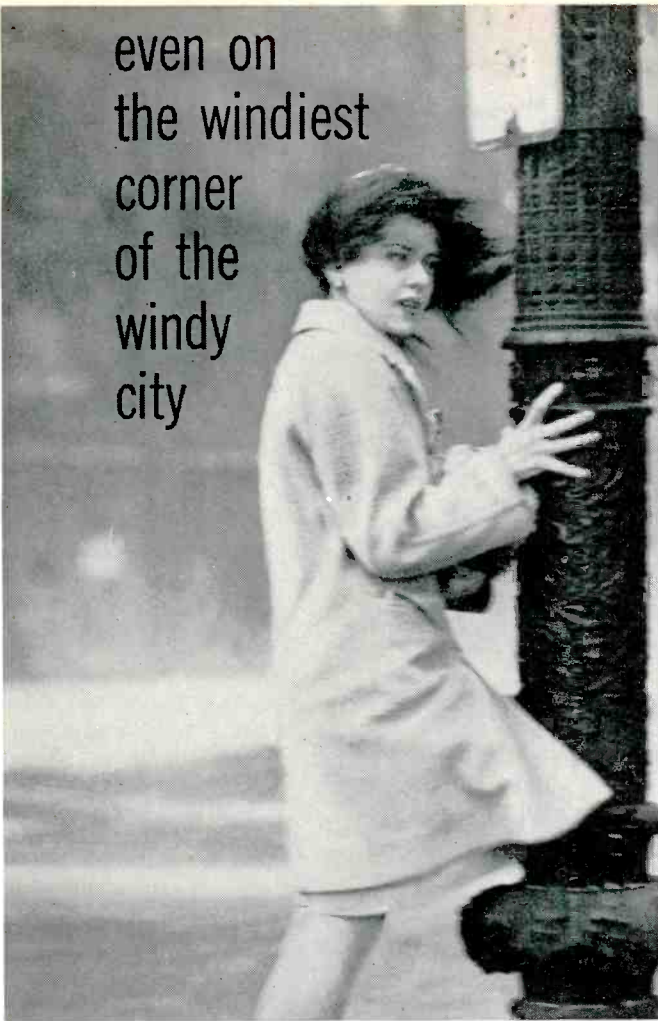
The usual Washington speculation has begun concerning Chairman Henry's successor on the Commission. The rumors include the names of various engineers, although the Commission has been without an engineer among its ranks since the retirement of Commissioner T. A. M. Craven in 1963. Many observers feel that the presence of an engineer among the Commissioners is more important now than it has been for many years in view of the increasing number of new and novel technical problems facing the Commission, such as those in space communication and CATV.

#### Short Circuits

A bill has been introduced in the House of Representatives providing for the operation of daytime-only AM stations from 6:00 a.m. to 6:00 p.m.. The requirement for code-wheel identification has been eliminated for 1-watt VHF television translators...The Commission has proposed to require prior coordination with the Agriculture and Interior Departments of proposals for the installation of radio transmitting facilities on land under the control of these Departments; this land includes many high elevations particularly suitable for FM and television broadcasting...An agreement has been signed extending the standard broadcast treaty (which now expires in June, 1966) between the United States and Mexico until December 31, 1967, subject to the approval of the legislatures of both countries (see April, 1966 Bulletin)...The Commission's proposed new FM and television propagation curves have been further revised (February, 1966 Bulletin)...The American Telephone & Telegraph Company has been ordered to place all CATV tariffs on file with the Commission.

Howard T. Head...in Washington

even on  
the windiest  
corner  
of the  
windy  
city



...this  
microphone  
needs no  
external  
windscreen

Shure's remarkable new SM50 omnidirectional dynamic microphone is SELF-WINDSCREENED! It is strikingly immune to wind noises and explosive breath sounds—making it ideal as a dependable “workhorse” microphone for remote interviews, news, sports pick-ups and a variety of field and studio applications. The five-element built-in windscreen makes it virtually pop-proof in close talking situations. And unlike other “built-in” windscreens, this one is “unitized” and self-contained with no bits or pieces to re-assemble after cleaning. In fact, you can actually rinse dirt, saliva, lipstick and other screen-clogging foreign matter out of the windscreen assembly under running water as often as needed—or replace the “unitized” assembly if necessary in a matter of seconds.

Additionally, the SM50 is the cleanest sounding professional microphone at anywhere near its price class. It delivers highly intelligible, natural and pleasing speech and vocal music that is especially full-bodied and rich in the critical mid-range.

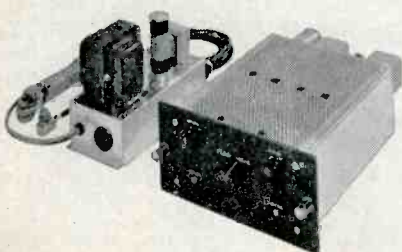
It is extremely rugged and will require little or no down time as the years go by. Too, when comparing it to other moderately priced omnidirectionals, it is lighter in weight, supremely well-balanced for “handability,” has a detachable cable, and a rubber mounted cartridge for minimizing handling noises. The SM50 is worthy of your most serious consideration.

For additional information, write directly to Mr. Robert Carr, Manager of Professional Products Division, Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois.

## SHURE SM50

OMNIDIRECTIONAL DYNAMIC MICROPHONE

### SHURE STATION-TESTED AUDIO CIRCUITRY EQUIPMENT



#### SE-1 Stereo Transcription Preamplifier

Provides precise RIAA equalization from magnetic phono reproducers at line levels. Separate high and low frequency response trimmers. Lowest distortion, noise level, susceptibility to stray RF fields.

#### M66 Broadcast Stereo Equalizer

Passive equalizer compensates recorded frequency to three playback characteristics: RIAA, flat, roll-off. Provides precise equalization from magnetic pickup at microphone input level.



Circle Item 19 on Tech Data Card

ANOTHER  
LITTLE  
BLACK  
BOX  
FROM



**FOR COLOR  
A NEW  
LAP AMPLIFIER**

**FEATURES:**

- \* VELVETY-SMOOTH TRANSITIONS
- \* GUARANTEED INHERENT TRACKING
- \* HI-PERFORMANCE DA SPECS
- \* ELIMINATION OF CLAMPING
- \* FAULTLESS COLOR RENDITION
- \* IDEAL UNIT FOR COLOR SWITCHING SYSTEMS
- \* DUAL OUTPUTS
- \* BRIDGING INPUTS
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- \* ALL SILICON SEMICONDUCTORS
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ON TODAY'S MARKET.**

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**Alexandria, Va. 22314**  
**703-548-2166**

Circle Item 20 on Tech Data Card

# ENGINEERS' EXCHANGE

## Emergency Beacon-Flasher Repair

by Henly McElveen, Jr.  
WJOT, Lake City, South Carolina

When lightning struck, our beacon flasher stopped flashing because the motor had been destroyed. The manufacturer informed us that it would be some time before the motor could be replaced, so we decided to "jury-rig" a temporary flasher.

Unable to find a suitable motor coil, we determined that a 117 V AC solenoid could furnish the coil. The solenoid coil core diameter, however, was too large, so we shimmed the core with laminations from the solenoid core. This made a better fit and improved magnetic coupling. Because the motor now generated too much heat, we put a fifty-watt light bulb in series with the motor, and the entire assembly was reinstalled in the tower-base housing.

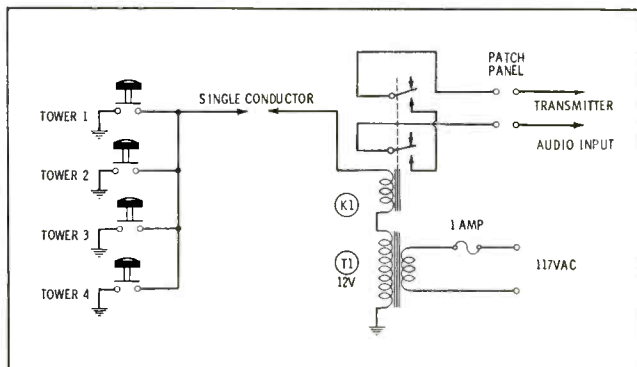
After six months, a genuine replacement arrived, but our temporary flasher had worked continuously all the time. It was necessary to adjust the cam speed control to obtain a flashing rate between 36 and 40 times per minute, but the unit has otherwise been satisfactory.

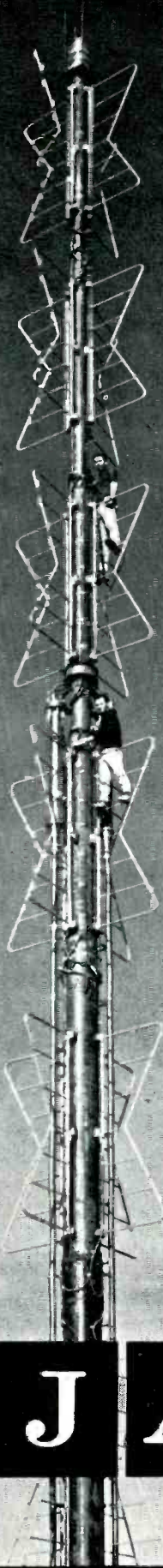
*Mr. McElveen's ingenuity wins the book prize for this month. Have you sent in your ideas for Engineers' Exchange?*

## Audio Killer for Antenna-Current Readings

Melvon G. Hart, Technical Director  
WIL, St. Louis  
KBOX, Dallas

FCC Rules require that antenna-base and common-point currents be read without modulation. At stations with a tight top-40 format, this is practically impossible unless some method is provided to remove modulation when the meter is read.





JAMPRO

# VHF SUPER TURNSTILE ANTENNAS

**COMPLETELY ASSEMBLED AND TESTED FOR YOUR SPECIFIC USE PRIOR TO SHIPMENT.**

Jampro makes antenna effectiveness a certainty with advanced in-plant test methods and a thorough knowledge of your coverage requirements. Choose from a wide range of gains as well as these Jampro exclusive features:

**EXCLUSIVE**

Every high powered Jampro Antenna contains copper jacketed inter bay 7/8" cable for years of trouble-free operation, even in corrosive environments

**EXCLUSIVE**

All cable connectors are solid brass with TEFLON insulation.

**EXCLUSIVE**

All hardware is stainless steel.

**EXCLUSIVE**

A wide range of power ratings are available from 2.5 KW per bay in the low power L Series, and 20 KW per bay in the high power H Series.

**BEAM TILTING & NULL FILL AT NO ADDITIONAL COST!**

**DE-ICERS:** *will be installed at NO ADDITIONAL COST when purchased with the antenna.*

**ACCESSORIES:** *Harmonic Filters • Co-axial transmission line • Steel Support towers • Tower lighting kits • Hybrid Duplexers • De-Icers*

JAMPRO

ANTENNA COMPANY  
6939 POWER INN ROAD SACRAMENTO, CALIFORNIA

Circle Item 21 on Tech Data Card

**KEEP TOMORROW'S  
NEEDS IN MIND  
TODAY WITH BELAR**



**ADD-ON  
MONITOR  
SYSTEM**



The Belar ADD-ON MONITORING SYSTEM allows the broadcaster to fulfill his monitoring requirements as the needs arise. The basic unit is the FMM-1 Frequency and Modulation Monitor for monaural use, and when requirements call for SCA, add the plug in SCAM-1 SCA unit. For stereo the FMS-1 Stereo unit completes the system.

Today's monitoring requirements make this system a must.

**BELAR ELECTRONICS LAB.**  
1204 Childs Avenue • Drexel Hill, Pa.

Circle Item 22 on Tech Data Card

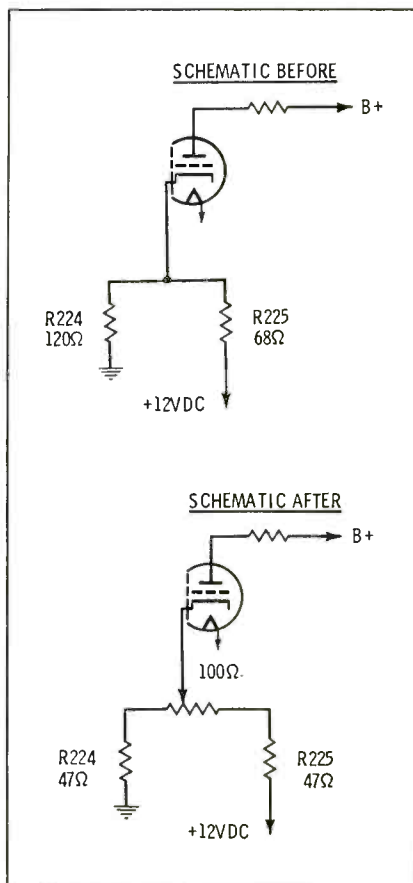
At WIL in St. Louis and KBOX in Dallas, a simple, foolproof system is in use. A momentary-contact push-button switch is installed next to each antenna tuning unit. This button controls a DPDT relay in the audio rack. The relay shorts the audio input to the transmitter, and allows the operator to make an accurate reading with minimum program interruption.

Since WIL is operated by remote control, the relay contacts are routed through the patch panel so that a malfunction will not cause program outage. A simple diode demodulator is used at each antenna tuning unit to monitor the program so that an appropriate time for killing audio can be selected.

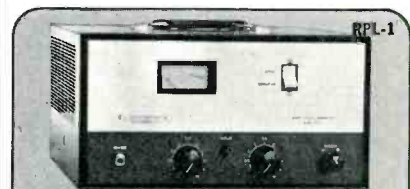
### Modification to Cartridge Tape Machines

Shelby H. Bristow  
Chief Engineer  
WERO, Fremont, Ohio

We have several Automatic Tape Control cartridge machines, and in order to make the "stop" cue sensitivity adjustable, we made the following changes: Change R224 and R225 to 47 ohms. Add a 100-ohm variable resistor between R223 and



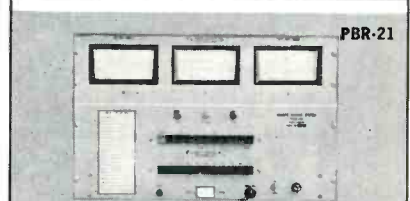
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EQUIPMENT**  
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profit makers"



### REMOTE PICK-UP SYSTEM

Unequaled 160 mc/s performance  
for quality broadcasting

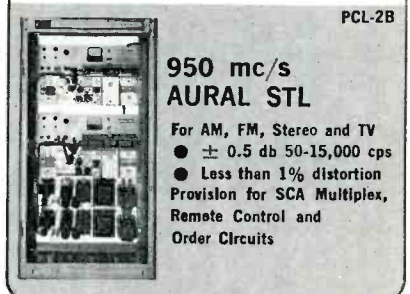
- $\pm 1.5$  db 50-10,000 cps.
- 1.6% max. distortion



### REMOTE CONTROL SYSTEMS

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

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



### 950 mc/s AURAL STL

For AM, FM, Stereo and TV

- $\pm 0.5$  db 50-15,000 cps
- Less than 1% distortion

Provision for SCA Multiplex,  
Remote Control and  
Order Circuits

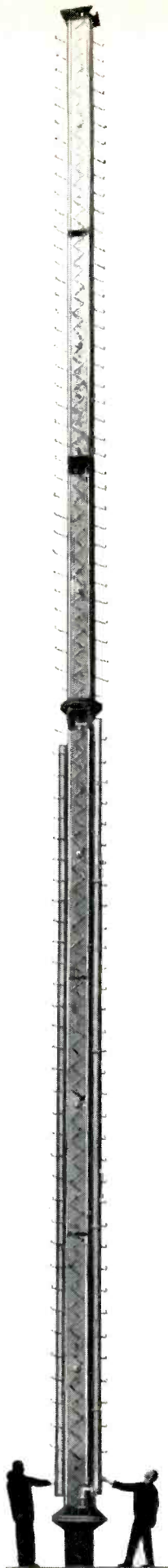
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(805) 967-0424

Circle Item 23 on Tech Data Card

BROADCAST ENGINEERING





## This is television's first UHF super gain zig-zag antenna.

Overmyer Communications Company just ordered 3 of them.

General Electric's new super gain antennas, series TY-97-A for channels 14 to 83, offer you an almost unlimited choice of directional patterns. The standard omnidirectional version has a power gain of 44.5—with 20% null fill-in and 0.75° beam tilt.

You also get these new features:

- Single or dual line feed.
- With dual line feed, antenna can be sectionalized for standby and/or emergency operation at full rated power.
- Rated power input 60-KW black level plus aural power—120-KW for dual line feed.
- Height, depending on channel, 63.5 ft. to 102 ft. less lightning protector.
- Low impedance—no high voltage points.
- Simplified electrical and mechanical design for high reliability and low maintenance.

- Simplified deicing system—deicing current passed through radiator. Plus separate feedpoint deicers.
- All Zig-Zag radiators grounded for lightning protection.
- Factory tested—no field tuning required.

The antenna shown here is 1 of 3 purchased by Overmyer Communications. It's for channel 24, and has a directional pattern giving a maximum power gain ratio of 131.3.

To get complete details on General Electric's new super gain antennas, call your G-E broadcasting representative.

General Electric Company,  
Visual Communications Products, 7-315,  
Electronics Park, Syracuse, N.Y. 13201

GE-31

**GENERAL  ELECTRIC**

Circle Item 24 on Tech Data Card

# Advanced, Solid State

## Spotmaster

### Super B Series

MEETS OR EXCEEDS ALL NAB SPECIFICATIONS AND REQUIREMENTS

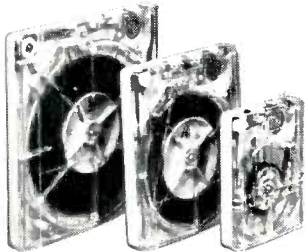


And Here's the New  
Economy King  
**COMPACT 400-A**



Don't let their low price fool you. New, solid state SPOTMASTER Compact 400's are second only to the Super B series in performance and features. Available in both playback and record-playback versions, these Compact models share the traditional SPOTMASTER emphasis on rugged dependability.

Top Quality  
**Tape Cartridges**



Superior SPOTMASTER tape cartridges are available in standard timings from 20 seconds to 31 minutes, with special lengths loaded on request. In addition, Broadcast Electronics offers a complete selection of blank cartridges, cartridges for delayed programming and heavy duty lubricated bulk tape. Prices are modest, with no minimum order required.

Introducing the Super B, today's truly superior cartridge tape equipment.

New Super B series has models to match every programming need—record-playback and playback-only, compact and rack-mount. Completely solid state, handsome Super B equipment features functional new styling and ease of operation, modular design, choice of 1, 2 or 3 automatic electronic cueing tones, separate record and play heads. A-B monitoring, biased cue recording, triple zener controlled power supply, transformer output . . . all adding up to pushbutton broadcasting at its finest.

Super B specs and performance equal or exceed NAB standards. Our ironclad one-year guarantee shows you how much we think of these great new machines.

Write, wire or call for complete details on these and other cartridge tape units (stereo, too) and accessories . . . from industry's largest, most comprehensive line, already serving more than 1,500 stations on six continents.



**BROADCAST  
ELECTRONICS, INC.**

8800 Brookville Rd., Silver Spring, Md.  
Area Code 301 • JU 8-4983

Circle Item 25 on Tech Data Card

R225, connect the center tap to the cathode (pin 8) of V204, and adjust for maximum usable sensitivity. This can be determined easily because the oversensitive point will not allow the "ready" light to come on after the machine has been stopped by a cue tone. Adding this pot makes the effective bias on V204 (2nd half of 12AT7) variable. Physically, this pot can be mounted just back of V203 on the cue amplifier module.

About one year ago, all of our ATC playback machines were revised in this way. Subsequently, cartridges have invariably stopped on cue.

### Interrupting Failsafe for EBS Tests

Raymond J. Millmaker  
Chief Engineer  
WMIX AM-FM  
Mt. Vernon, Illinois

Here is a method for interrupting transmitter carrier for EBS tests, using the failsafe circuit.

We have installed a normally closed push-button switch near the control-room operator's position. When the operator depresses the button, one side of the failsafe circuit is opened. This, in turn, opens the "hold" relay in the transmitter control unit, which subsequently opens the transmitter interlocks, thus killing the carrier. Releasing the button restores carrier.

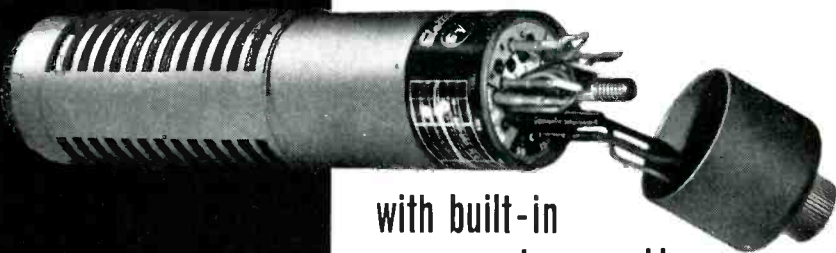
Alternately depressing and releasing the switch at prescribed intervals simplifies the operator's task of fulfilling EBS test and alert requirements. The connections would have to be adapted, of course, to the particular remote-control unit used.

### Telephone-Line Modification

by Walter L. Moring  
Engineer, WCSC-TV  
Charleston, S. C.

Have you ever been plagued by the station manager about the quality of incoming phone calls that are used on the air? Telephone quality can be improved considerably with the addition of a 3-mfd oil-filled capacitor in each side of the line. The audio quality is excellent, a lot of residual noise is eliminated, the

## New E-V Model 668 Dynamic Cardioid Boom Microphone



with built-in  
programming panel!

# **BRAIN ON A BOOM!**

**EY** 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™ wind-screen 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.

The 668 is guaranteed **UNCONDITIONALLY** against malfunction of any kind—even if caused by accident or abuse—for two years. And, like all E-V Professional microphones, it's guaranteed for life against failure of materials or workmanship.

The E-V 668 is the result of a three year intensive field testing program in movie and TV studios from coast to coast. It has proved itself superior to every other boom microphone available. Find out why with a no cost, no obligation trial in your studio. Call your E-V Professional microphone distributor today, or write us direct for complete specifications.

NEW! MODEL 667A Identical to Model 668 except sharp cutoff filters and HF-rolloff eliminated. List price: Model 667A, \$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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# NEWS OF THE INDUSTRY

## NATIONAL

### Daytime Broadcasters Association Meets

The Daytime Broadcasters Association met in Chicago just before the NAB Convention to discuss critical issues facing daytime broadcasters. Issues demanding urgent attention were cited as minimum fixed operat-

ing hours and the Mexico-U.S. Broadcast Agreement, which expires on June 9, 1966. Members were told that of 4,052 Standard AM broadcast licensees, 1,938 (or 48%) broadcast only during daylight hours.

Members were urged to contact congressmen regarding the introduction of minimum 6 a.m. to 6 p.m.

operating hours bills, to actively participate in congressional hearings, and to urge association participation in forthcoming Agreement negotiations. The meeting was told that portions of the Agreement prevent granting of extended operating hours, and that some 272 U.S. daytime operations use seven Mexican clear channel frequencies. Members were also told that since little time remains before the Agreement's expiration date, the Association recommended acceptance of an extension of the present document, for one year only, in order that more negotiation could be achieved.

Other matters of discussion were the problems faced by over 1,000 communities who suffer post-sundown radio blackouts, the circumstances which led to the allocation of only six local Class IV channels out of a total of 107 channels available, and the implications of proposed 750-kw operation by some stations.

### GAB Convention

The 31st Annual Summer Convention of the Georgia Association of

## 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.

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## NORTRONICS 8000 SERIES PROFESSIONAL REPLACEMENT HEADS!



Full Track, 2 Track or 4 Track in Record, Playback or Erase Heads as well as 3 or 4 Channel Heads in Record or Playback Types for...

**AMPEX, MAGNECORD, CONCERTONE, RCA, CROWN**

Now you can reduce "downtime" by using Nortronics replacement heads—available locally and immediately from your distributor! Pick the head and track style YOU want from Nortronics' full professional line. After initial changeover, replace heads or convert track styles in minutes! Precision engineered adapters and mounting brackets let YOU make the initial changeover... let YOU service your recorders according to your needs.

See your distributor today. Write for full details! Or call 612-545-0401.



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## LIKE DIOGENES

We are looking for honest, competent First Class engineers who seek a happy home where their talents will be appreciated. We offer: good salary, stability, good working environment where you can accomplish things under sympathetic management, profit-sharing plan and other benefits, company growth potential in AM & CATV.

Personal interview essential.

Near Philadelphia  
P. O. Box 156  
**BROADCAST  
ENGINEERING**

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BROADCAST ENGINEERING

**Broadcasters** will be held from June 25 to June 28 at the Carriage Inn, Jekyll Island, Georgia. The meeting will highlight the first state association address by FCC Commissioner James J. Wadsworth. Other features will include engineering and management lectures and conferences. Of special interest will be the "Miss See Georgia" Pageant, a number of banquets, and social activities for the ladies and children.

### Expands Burbank Plant

**Radio Corporation of America** has begun construction of an addition to its Burbank, Calif., plant to house expanded production facilities needed to meet increased demands for the RCA line of closed-circuit television equipment.

Gordon W. Bricker, manager, West Coast operation, for the RCA Broadcast and Communications Products Division, said the structure would contain approximately 8000 square feet of floor space and would boost the plant's total work area by more than 25%.

### NAB Studies Personnel Problems

The Small Market Radio Committee of the National Association of Broadcasters focused on the problem of recruiting and qualifying station personnel at the group's initial meeting. The Committee, composed of seven executives from stations in markets of less than 100,000 population, was established to recommend programs and activities especially valuable to smaller radio stations.

To help solve the station employment problem, the Committee recommended that: (1.) State broadcaster associations ask the FCC to send inspectors to each annual state meeting to conduct third-class radio-license examinations for station personnel and be on hand to answer questions on technical rules. (2.) The NAB staff continue to seek more convenient sites for giving these examinations. (3.) Contacts be made with the American Association of Junior Colleges to encourage the establishment of broadcasting courses at junior and community colleges. (4.) The NAB staff prepare a manual on organizing broadcasting clubs at high schools. (5.) Educational groups and schools be encouraged to include broadcasting in high school career-day programs.

Members of the Committee are Raymond A. Plank, owner, WKLA, Ludington, Mich., and a member of NAB's Radio Board of Directors, chairman; Frank Balch, general man-

ager, WJOY, Burlington, Vt.; Julian F. Haas, president and manager, KAGH, Crossett, Ark.; John Hurlbut, president and general manager, WVMC, Mt. Carmel Ill.; John W. Jacobs, president and general manager, WDUN, Gainesville, Ga.; Ted A. Smith, vice-president and general manager, KU-MA, Pendleton, Ore.; Robert E. Thomas, vice-president and general manager, WJAG, Norfolk, Neb.

### Contract For Apollo TV System

A contract to supply video distribution equipment for installation at Apollo Launch Complex 39 at Kennedy Space Flight Center has been awarded to **DYNAIR Electronics, Inc.** The equipment is to be part of a multi-million-dollar closed-circuit television system to be used to monitor preflight and launch activities for NASA's manned lunar flights. The equipment is being supplied under a subcontract to the **Convair Division of General Dynamics.**

### Gains Distributorship

**Visual Electronics Corp.** has been appointed national distributor for the broadcast industry in the U.S. for **Solari** direct-reading clocks and automatic "Teleindicator" units used to display election returns; weather data; and scores for bowling, football, baseball, and quiz shows. These clocks and display indicators are designed for use in radio, TV, closed-circuit, educational TV, and the military area of broadcasting.

### New Teaching Tool

**Triangle Stations** have unveiled a new approach to education using FM multiplex channels. Developed by **Educating Systems, Inc.**, the system uses taped lectures and supplementary texts prepared by **International Correspondence Schools.**

The technique consists of lectures and questions incorporated into a four-track tape. The student has a choice of four answers which correspond to four buttons on a special multiplex receiver. Each button activates a specific multiplex channel which indicates right or wrong answers. If wrong, the right answer is given with an explanation of the error. Preliminary courses, to cost the student \$50, will include the multiplex receiver.

A pilot course on business management will be given to 100 selected Philadelphia students starting in June. The course will last ten weeks and contain about 30 lecture hours. The FM station will be Triangle's Philadelphia outlet, WFIL-FM. Triangle also

holds the national franchise, and will lease the service to interested FM stations.

### Powerful Broadcasting Station

A contract was signed recently for the supply and installation of broadcasting equipment which will give Kuwait one of the most powerful broadcasting stations in the world. The contract, with the Ministry of Guidance and Information, covers three **Marconi** high-power transmitters, which will provide the Voice of Kuwait with medium-frequency program transmissions giving extensive coverage of the Middle Eastern countries. Each transmitter has an output of 750 kilowatts. This is nearly twice the power of the 200-kHz Light Program transmitter of the BBC at Droitwich, the most powerful national service in Britain.

Engineers from the company will install and commission the three transmitters, and the contract also provides for training six Kuwaiti engineers in the operation and maintenance of the transmitters.

### CATV Ruling Protested

The **National Association of Broadcasters** has urged the FCC to modify its proposed CATV rules to give all commercial television stations greater protection against the importation of distant signals and the duplication of network and film programs.

The Association emphasized its support of the FCC's basic approach in the CATV controversy, but said it felt the rules were only halfway measures. NAB's recommendations for revision were contained in a petition for partial reconsideration. The petition urged that importation of distant signals be restricted to all TV markets—not just the top 100—and should include Grade B contours as well as Grade A. Also, restriction should be based on a general rule and not case-by-case. Other points in the petition concerned return to the old 15-day rule for network programs and up to one year of protection for first-run feature and syndicated films.

### MOVING?

*Don't Lose Touch . . .*

Receive BE as usual at your new address

Write: **BROADCAST ENGINEERING**

Circulation Department

4300 West 62nd St., Indianapolis 6, Ind.

### Simulated Satellite TV Relay

A demonstration of how television programs will be beamed to and from orbiting spacecraft as part of a program to explore satellite stabilization and space communication techniques was conducted by **Sylvania Electric Products, Inc.**, a subsidiary of **General Telephone & Electronics Corp.** The taped telecast was transmitted to and from a simulated satellite by means of a 40-ft dish antenna which is part of a transportable ground sta-

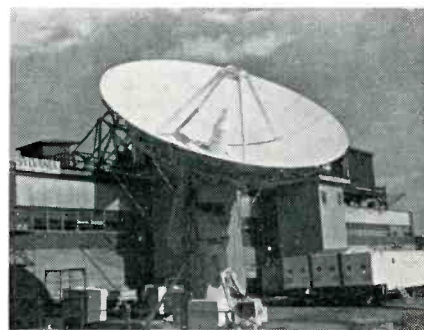
tion undergoing final tests before being used in a National Aeronautics and Space Administration satellite communications project.

The 40-ft antenna, capable of tracking medium-altitude satellites at 6,000 miles and synchronous satellites at 22,300 miles with an accuracy of 0.015°, will transmit and receive information from all five satellites in the NASA project.

The antenna system employs a cryogenic low-noise, high-gain ampli-

fier. The system includes a combination of maser and parametric amplifiers. Both are operated in the same refrigeration unit, the master at 4.2° K, and the parametric amplifier at 10° K.


In the demonstration, a TV program was beamed from the ground station to Sylvania's antenna test range one-half-mile away. A boresight facility at the range simulated a satellite's performance by accepting the TV signal, changing the frequency, and then transmitting the signal back to the ground station where it was picked up by the station's receivers. The frequency change permits the station to transmit and receive signals simultaneously. The same procedure would be followed in actual operation with an orbiting satellite.



## CARTRIDGE TAPE ERASER


**Guaranteed to Erase Completely in 3 seconds**

Designed specifically for tape cartridges.  
Absolutely NO sound carry over from previous recordings. Handles all cartridge sizes.  
Also sees tapes up to 1 1/2 inches. Entire process takes only 3 seconds. Price \$39.50



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# S-10

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SOLID STATE



## CONDENSER MICROPHONE

Self Contained Convenience

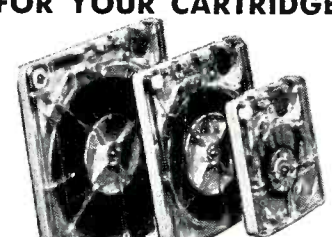
FET circuitry eliminates external power supply • Permanently polarized  
Powered by 1000-hour battery • Frequency Response: 40 — 20,000 Hz  
Pressure gradient • Mylar diaphragm • Cardioid Pattern • 20 db discrimination  
• No overload protection needed • Low noise (less than 23 db)  
High output (-53 dbm) • Connector on-off switch • Beautiful satin  
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screen • Elastic suspensor • Desk stand • Fully guaranteed • \$240 com-  
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## EXTRA LIFE FOR YOUR CARTRIDGES!



Properly serviced cartridges  
PERFORM BETTER-LAST LONGER  
It's Easy and ECONOMICAL  
DELIVERY IS FAST

### PROVE IT TO YOURSELF...


Send your worn cartridges to JOA  
for individual professional treatment.

- JOA will inspect, service and re-load your cartridges with ANY LENGTH tape
- NO MINIMUM
- NO EXTRA CHARGE for replacement of minor parts
- ALL cartridges PRETESTED under actual broadcast conditions
- 48-HOUR processing

If you need new cartridges fast, JOA will ship immediately, from stock, any size Fidelipac cartridge you may need.

**JOA—the cartridge service of authority—serving the broadcast industry**

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Circle Item 36 on Tech Data Card

BROADCAST ENGINEERING

# COLOR HI-BAND DROPOUTS

## Eliminated by Revere-Mincom Dropout Compensator...

Due to the shorter wave length and lower tip projection employed in Hi-band VTR, dropout problems are 5 or 6 times more prevalent than those encountered in low-band recording. These distracting white flashes destroy otherwise prime program content and good, clean video signals.

The Revere-Mincom Dropout Compensator restores the clarity and sparkle of Hi-band/Color VTR by detecting the dropouts as they occur and replacing the "lost" signal with stored information from the previous scan line of the same field.

Moderately priced, the Dropout Compensator features maintenance-free, solid-state circuitry, standard rack mounting and compatibility with all VTR equipment.

Rescue old tapes. Insure optimum playback quality in new COLOR/HI-BAND recordings. Save money by eliminating unproductive engineering evaluation time and unnecessary wear on expensive recorder heads and VTR equipment.

Call or write today for a demonstration of the remarkable Dropout Compensator.



Revere-  
Mincom **3M**  
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(805) 482-1911

Riker Industries  
Huntington Station, L. I., N. Y.  
(516) HA 1-3444

Circle Item 37 on Tech Data Card

# NOW! GIVE YOUR FM STATION 100% MODULATION CAPABILITY



## WITH THE FAIRCHILD CONAX!

■ Now! The FAIRCHILD CONAX enables FM radio stations to increase their signal strength and apparent loudness potential by the effective control of high frequencies which cause trouble when pre-emphasized. High frequencies add sparkle and "bite" to program material and pre-emphasis improves signal-to-noise ratios. When the two are combined, however, it often becomes necessary to decrease the station's power to eliminate over-modulation possibilities.

■ How can high frequencies, which normally contain less energy than mid or low frequencies, cause trouble when pre-emphasis is applied? Simple! High frequency information, such as the jingling of keys, the sharp "s", the muted trumpet, cymbals, or other high frequency sounds, often become high frequency "spikes" when pre-emphasized thereby exceeding the FCC 100% modulation limitation. By making high frequency information "spike-free" (through the use of inaudible super fast attack and release times) the FAIRCHILD CONAX now allows the use of the full high frequency pre-emphasis curve.

### HERE'S A STEP-BY-STEP GRAPHIC ANALYSIS OF THE FAIRCHILD CONAX IN ACTION...

FIG A - Normal program material with program information distributed in mid range—500 to 5000 cycles.

FIG B - Same program material pre-emphasized. Still trouble-free.

FIG C - Program material with a high percentage of high frequency material in its content—such as found on today's records.

FIG D - Same high frequency program material (hot) after pre-emphasis. Note high frequency "spikes" now exceed 100% of modulation.

FIG E - Same program material now controlled by the FAIRCHILD CONAX action.

\* Note even with pre-emphasis the lack of troublesome high frequency "spikes" that normally would cause over-modulation.

■ The FAIRCHILD CONAX has an exclusive patented preview circuit which applies a standard pre-emphasis curve to any entering signal. The patented FAIRCHILD CONAX frequency dividing and controlling network allows accurate and inaudible control only of the troublesome high frequency "spikes". This means you can transmit a signal with high average modulation level up to 3 db higher, utilizing the full apparent loudness possibilities of your rated power. In FM stereo and SCA transmission, the FAIRCHILD CONAX prevents splatter between the SCA channel and the stereo channel, allowing you to use both of these dollar producing signals to their fullest. Now full modulation capabilities can be realized without the danger of FCC citation or any change in the transmitted sound of your signal. Now FAIRCHILD CONAX gives your station that brighter and louder sound... the sound that sells. **AVAILABLE IN MONO OR STEREO COMPACT SIZE!**

Write to FAIRCHILD — the pacemaker in professional audio products — for complete details.

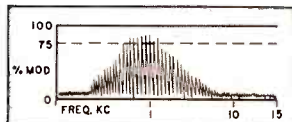


FIG A

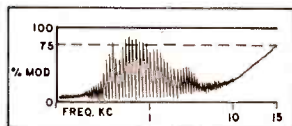


FIG B

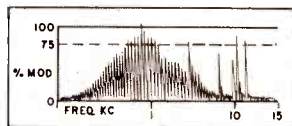


FIG C

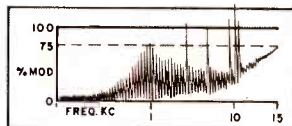


FIG D

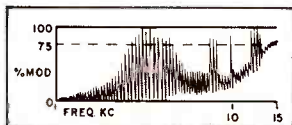


FIG E

The transportable ground station includes three 40-ft vans housing control equipment and a major portion of the control electronics. The three vans have removable walls which permit the units to be located side-by-side as a single unit.

The telemetry and command equipment that controls the satellite is housed in a fourth van. The station's parabolic antenna can be dismantled and, with the support pedestal, can be transported in two flatbed trailers, one of which carries the jacking equipment and boom crane necessary to erect the antenna. In addition, the station includes two power vans and five house-type trailers for office and maintenance space.

## PERSONALITIES

Earl Hickman has been named president and general manager of Ameco Engineering Corp., a wholly-owned subsidiary of Ameco, Inc. The new engineering service corporation, headquartered in Phoenix, will have more than 50 electronic and mechanical engineers on its staff. The organization will handle all research and development work for Ameco and its other subsidiaries. AEC will also provide complete engineering research and development service to outside firms.



Mr. Hickman was vice president and general manager of the Kaiser Aerospace and Electronics Plant in Phoenix for the past eight years. He is no newcomer to Ameco, where he served as chief engineer during the period from 1952 to 1957. Hickman also has been active in broadcasting since the early forties and was chief engineer for the Gila Broadcasting

# FAIRCHILD

RECORDING EQUIPMENT CORPORATION  
10-40 45th Ave., Long Island City 1, N. Y.

Circle Item 42 on Tech Data Card



# How to climb aboard the **color** bandwagon easily, economically, with RCA-4415/S,-4416/S image orthicons...

Color TV is really rolling in high gear... And now, you may be facing the question of creating a color facility—with new studios, lighting, air conditioning and other equipment.

Being old-timers at color, we anticipated some of these facility problems and developed the RCA-4415/S, -4416/S, a matched-set of three image orthicons. They perform well in cameras for color at lighting levels usually available in black-and-white studios and eliminate the need for extra air conditioning equipment as well.

Another good feature of these tubes is that they behave more like the old faithful 5820A or 7293A's that you have been using in black and white during the past years. In the color camera, they can stand more over-exposure and are a little less finicky on the operating controls. For example, when you have a suntanned actress working in a gleaming white kitchen, you can operate with the highlights fairly far above the image orthicon knee without having the color picture going to pot.

We make up carefully matched sets consisting of two 4415/S Image Orthicons for the red and green channels, and one 4416/S Image Orthicon for the blue channel where a lot of "umph" in blue sensitivity is needed. The three mates of the set are matched to track very well and produce a nice uniform color picture. In addition, the sensitivities are balanced so that each tube is just about working at its maximum sensitivity and you are not throwing away extra light in the optical system to favor one low sensitivity channel. The result is good color pick-up at black-and-white studio lighting levels.

For further information about RCA Image Orthicons contact your RCA Broadcast Tube Distributor.

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



**Available From Your  
RCA Broadcast Tube Distributor**

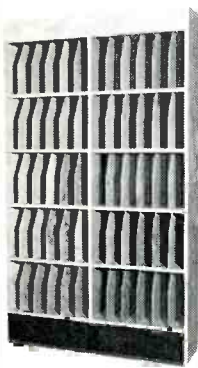


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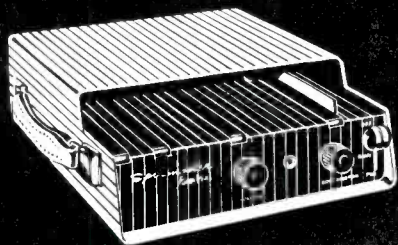
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## SPOTMASTER



### PortaPak I Cartridge Playback Unit



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.

Write or wire for full information.

*Spotmaster*

BROADCAST ELECTRONICS, INC.

8800 Brookville Road  
Silver Spring, Maryland

Circle Item 38 on Tech Data Card

Company and for Radio Stations  
KSUN and KAWT.

He holds an electrical engineering degree from the University of Arizona.

William B. Carr has moved his firm of consulting engineers, William B. Carr & Associates, to the Walker Building, 4028 Daley, Fort Worth, Texas.

### PROPERTY TRANSACTIONS

Natco Communications, Inc. has contracted, subject to FCC approval, to buy Radio Station WTAC, Flint, Michigan, from Whitehall Stations, Inc. for a total consideration of \$980,000. WTAC operates full-time with 1000 watts on 600 kHz.

This is the first station to be brought into Natco Communications, Inc., which was chartered in January of this year. Plans are to diversify the interests of the Pittsburgh company through investments in the communications field. Natco Communications, Inc. is headquartered in Augusta, Georgia. J. B. Fuqua, Natco board chairman and chief executive officer, is also vice-president of the subsidiary. Natco Corp. is the parent company.

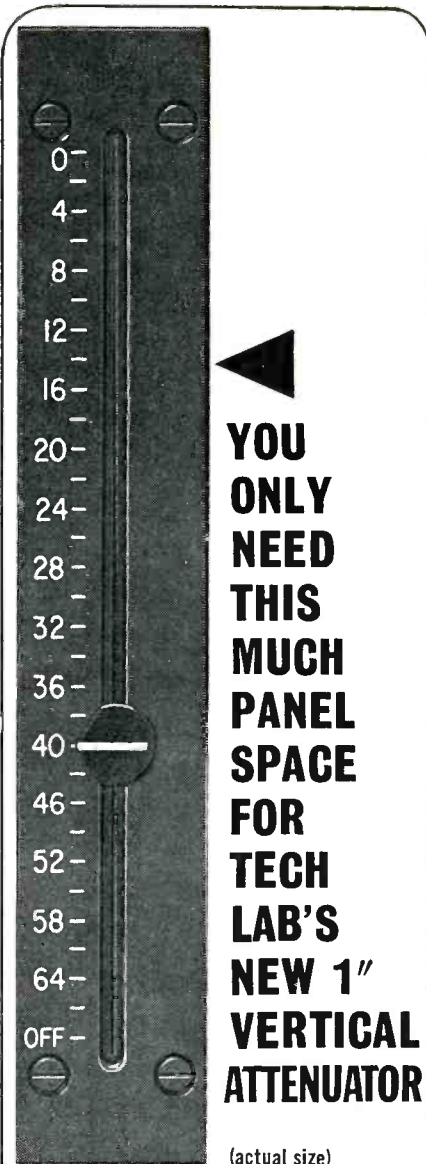
Charles Speights, present Station Manager of WTAC, will be general manager under the new ownership.

As part of a proposed merger with Polaris Corp. of Milwaukee, Wisconsin, Natco would gain two additional broadcasting properties, KXOA (AM-FM), Sacramento, California, and WTVW (TV), Evansville, Indiana. The merger is expected to be submitted to the stockholders of both companies in the near future.

After 39 years of operation as a municipally owned facility, WSUN radio and television in St. Petersburg, Fla., was turned over to a private owner on April 24. Radio broadcasts are on 620 kHz. and television operations are on channel 38.

High bidder for the station was WCAR, Inc., of Detroit, Michigan. The sale price was \$1.3 million. Bids for the sale of the station were opened several months ago, but the final transaction was delayed until approval was granted by the Federal Communications Commission.

The radio arm of the operation went on the air in 1927. The television facility began broadcasts in 1953.



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TECH  
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NEW 1"  
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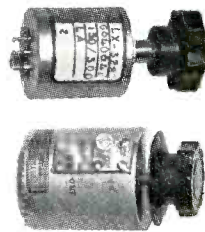
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Here's the smallest vertical attenuator made in the U.S.A. . . . another first from Tech Labs, pioneers in vertical attenuators since 1937.

It uses little panel space . . . only 1" wide x 6" long. It provides quick change of levels on multiple mixers and assures long, noise-free life. Units are available in 20 or 30 steps with balanced or unbalanced ladder or "T", or potentiometer circuits. Standard Db per step is 1.5, others on order. Impedance ranges are 30 to 600 ohms on ladders or "T's" and up to 1 megohm on pots.

Don't wait, send for complete data today!  
Need Video or Audio Rotary Attenuators?

All Tech rotary attenuators are precision made for extended noise-free service. Many standard designs available and specials made to your specs. Send for literature today.



TECH LABORATORIES, INC.

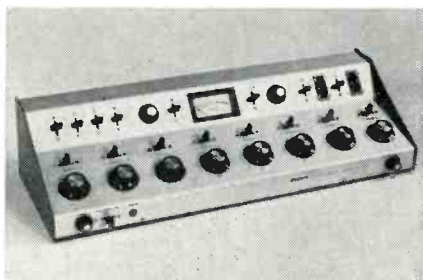
Bergen & Edsall Bldgs., Palisades Park, N.J. 07650  
Tel: 201-944-2221 • TWX: 510-230-9780

Circle Item 40 on Tech Data Card

BROADCAST ENGINEERING

# NEW PRODUCTS

For further information about any item, circle the associated number on the Tech Data Card bound inside the cover for this issue.



## Eight-Channel Console

(60)

The A-20 audio console is designed to provide flexibility and operator convenience in audio mixing applications. This **Sparta** console has eight mixing channels accommodating 22 separate inputs; conventional rotary attenuators and lever selector switches are used. The preamplifiers, line amplifiers, and cue amplifiers are assembled on individual printed circuit

boards. Input balancing transformers and a cue function are provided on all eight channels.

Three channels serve nine low-level inputs. Three other channels serve as high-level inputs; preamplifiers may be installed to convert these channels to low-level service if desired. The remaining two channels, through switch selection, serve five auxiliary sources each. The console includes provisions for two studio talk-back systems, three key-selected line outputs, multi-source selection for the monitor and headphone amplifiers, and a muting-relay system.

The unit measures 28 $\frac{5}{8}$ "  $\times$  6 $\frac{5}{8}$ "  $\times$  10". Typical specifications are: frequency response,  $\pm$  2 db from 30 Hz to 15 kHz; distortion less than 1% at +8 dbm; signal-to-noise ratio, below 60 db with -55 dbm input at +8 dbm output; microphone input impedance, 150/250 ohms; all other inputs, 600 ohms.



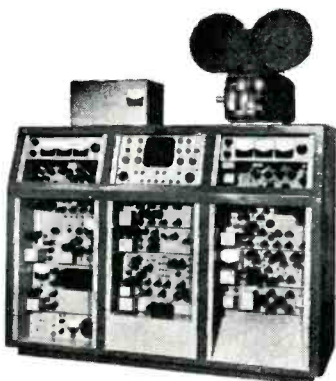
## Automatic Broadcasting System

(61)

The Model 5000 tape-playback system, unveiled at the NAB show, is designed to automate a radio broadcasting facility. A primary feature of this **Tape-Athon Corp.** system is its

## VUE-TRONICS MODEL RK-120 VIDEO FILM RECORDER

- Simple automatic operation
- High resolution— to 20 Mc bandwidth
- Selective standard 525 to 1050 line systems
- Up to one hour recording capacity



Now anyone can easily record from all TV sources—live camera, tape, film, network telecast. Signals appear on flat, high-resolution tube, and are recorded on low-cost TV recording film. Automatic preset exposure parameters ensure high picture quality; automatic corrective circuits give brighter whites, blacker blacks, wide range of grays. Manufactured by VUE-TRONICS, Inc., Los Angeles; distributed by Traid Corporation.

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Round—inches and mm

"D"

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## with Greenlee punches

Here's the simple speedy way to cut smooth, accurate holes in metal, hard rubber, plastics, epoxy, etc.

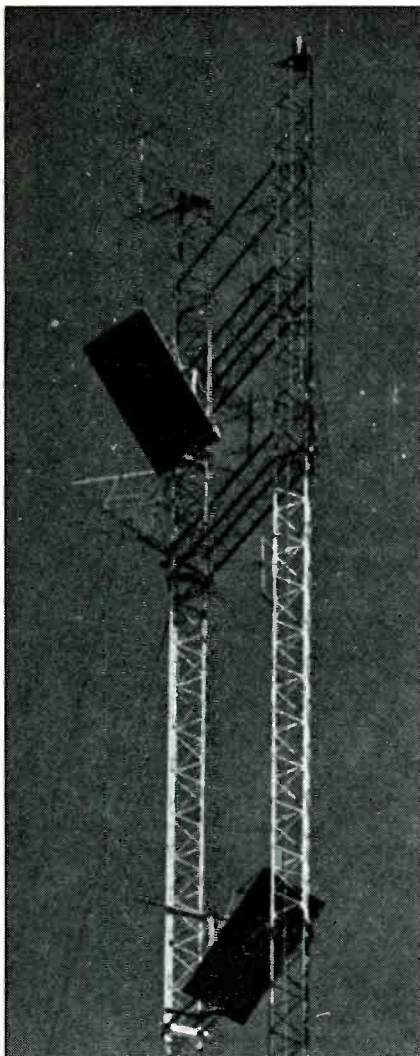
Save hours of hard work . . . punch clean, true holes in seconds for sockets, controls, meters, and other components. Easy to operate. Simply insert punch in a small drilled hole and turn with a wrench. For use in up to 16-gauge metal. Available at leading radio and electronic parts dealers.



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BUILDERS OF COMPLETE  
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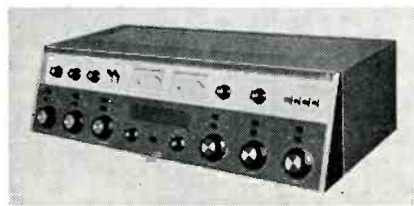
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AREA CODE 202 ST 3-2903

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versatility of programming available. The tape-rack section is an integrated combination of tape transports containing music, and rotary cartridge decks holding prerecorded commercials, time announcements, and station breaks. Modular construction of the system permits incorporation of two to ten tape transports and one to nine rotating cartridge units, in monophonic and stereophonic versions. The basic system holds two music transports and one 24-cartridge message unit.

Control of the tape complex is accomplished by a remote program console that may be located as far as 200' from the tape rack. By setting a number of switches on the console, an operator can preprogram a day, week, or month of automatic broadcasting. Musical selections may be run in singles, or consecutively, with commercials or other messages interspersed on a timed basis. A message will not break into a musical number until the nearest silent period occurs prior to the next number. At the end of a broadcast day, the program may be set to shut off the station automatically and start again the following day.

Prices start at \$5000.



#### **Stereo Speech-Input Console**

(62)

A live demonstration of the 212S-1 stereo speech-input console was featured in the **Collins** exhibit at the NAB convention.

Collins uses a photoconductive cell and a lamp in a sealed container for the purpose of eliminating pops, clicks, and hums in the console. The photoconductive cell has a very low resistance when the lamp is turned on and allows the signal to pass. When the lamp is off, the cell resistance rises, cutting off the signal. The length of time required for the lamp to extinguish permits the signal to be eliminated quickly but smoothly, rather than by sudden chopping as with normal contacts.

A similar device is used for level control of the program material. The photoconductive cell responds to variable voltages from a potentiometer to control attenuation. This control eliminates maintenance normally re-

quired for mixer-control cleaning and lubrication.

Since photoconductive devices can be remotely controlled by DC voltages, the switching and attenuating components can be mounted where they are needed. This allows complete physical and electrical operation of the two program channels from the front panel, which no longer contains program audio wiring and components. Sensitive wiring is concentrated in card cages away from interference.

The 212S has five stereo inputs from local sources plus one of four remote stereo inputs or one network stereo input. Each local stereo input may have two selectable sources. The 212S-1 modules can be used easily in custom studio installations; the plug-in cards may be utilized in many ways to fit particular needs.



#### **Lightweight Color Studio Camera**

(63)

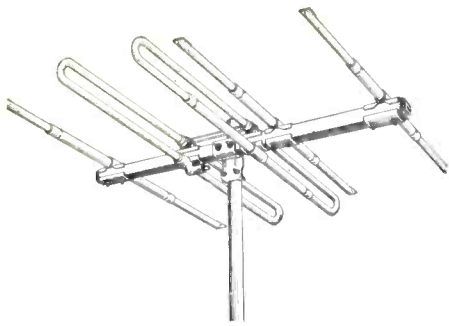
The all-transistorized PE-250 color studio camera fully equipped with zoom lens weighs less than 150 lb. It is one-third smaller than its **General Electric** predecessor. The PE-250, first displayed at the NAB Convention, uses four pickup tubes in a design intended to give the camera improved color fidelity along with light weight and compact size.



#### **Overmodulation Control for FM**

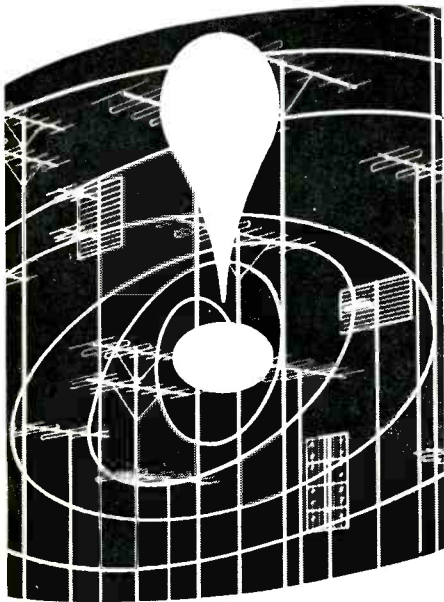
(64)

The FM Volumax, a device intended to prevent FM overmodulation and SCA crosstalk without distortion, was demonstrated by **CBS Laboratories** at the NAB Convention. The Volumax uses time-varying functions to control the low and the high frequencies separately, and instantaneous final limiting to assure no overmodulation occurs. A dynamic frequency compensator is used to adjust high frequencies and process all fre-



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There is simply no compromise when you specify a TACO Yagi antenna or antenna system. As a pioneer manufacturer and prime supplier of Yagi antennas, TACO has developed models for every communications need—point-to-point, rebroadcast TV, Translator, CATV, MATV, ETV, or sophisticated tracking arrays.

TACO Yagi antennas are available in 5, 8, and 10 element designs in single or multiple arrays for vertical or horizontal polarization. These are cut and tuned for specific broad or narrow bands in the frequency range from 30 MHz to 500MHz.

TACO catalogs almost one hundred and fifty different types of Ruggedized Yagis—each suited to do a particular job best. TACO's tremendous backlog of experience in special-function design is matched by no other antenna manufacturer.

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**TACO** antennas and antenna systems

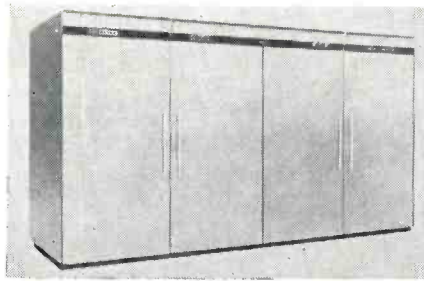
**JERROLD ELECTRONICS CORPORATION**

Government and Industrial Division  
Philadelphia, Pa. 19106

Circle Item 46 on Tech Data Card

June, 1966

quencies at reference level without distortion. The device is priced at \$695 (\$1390 for stereo).



### 50-kw AM Broadcast Transmitter

(65)

Vapor-phase cooling is featured in a new 50,000-watt AM broadcast transmitter from **Gates Radio Co.** Vapor-phase cooling offers improvements in the removal of heat from power-tube anodes and reduction of noise. The new Model VP-50 transmitter, exhibited at the NAB show, has its modulator and power tubes cooled by a liquid-vapor system. Only four tubes are used in the transmitter; the entire audio system, excluding only the power modulators, is transistorized, and all RF circuits up to the driver are solid state.



### Cardioid Microphone

(66)

A new transducer design for sound reproduction is embodied in a **Norelco** cardioid microphone, the D-202ES, produced in Austria by AKG.

The D-202ES incorporates two independent microphone capsules in a single housing, connected by a cross-over network at 500 Hz. One is adjusted for optimum low-frequency, the other for optimum high-frequency response, an arrangement that achieves a specified response flat within  $\pm 2$  db from 30-15,000 Hz. Other specifications include front-to-back discrimination greater than 20 db over the

# CINEMA PRECISION AUDIO EQUIPMENT

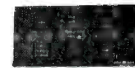
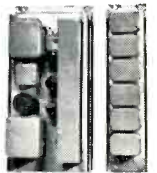


### AUDIO ATTENUATORS

Cinema's new compact rotary slide-wire attenuator is now available for your mixing consoles as single or ganged units. A must where smooth control is desired. Other standard types are also available for applications demanding precision noiseless attenuation, reliability and long term stability.

### GRAPHIC EQUALIZER

The Cinema Graphic Equalizer offers a compact system of extreme flexibility. Each of the six controls permit the operator to equalize or attenuate that portion of the spectrum 8 db. This is an active unit having zero insertion loss and up to 35 db additional gain.



### DIP FILTER

Features a notch depth of 50 db minimum and which is continuously variable from 30 to 9,000 cps. Extremely useful for removing single frequency noise and for harmonic distortion measurements.



### PROGRAM EQUALIZER

Provides for accurate frequency response corrections in audio equipment. Easy operation of the two control knobs allow over 395 curve combinations. Detented action of the controls permits reference dial settings for future duplication of desired characteristics.



### DEGAUSSERS

Cinema bulk degaussers are a favorite with sound men throughout the world. Provides erasure of program material and residual noise from magnetic tapes on reels up to 17 inches in diameter and 2 inches wide. Also, "Pencil" type degaussers are available for erasing small areas thus avoiding splicing.

Hi-Q's Cinema precision audio equipment is backed by an enviable reputation generated by over 25 years of outstanding service in critical sound recording, broadcast and laboratory applications. Many other custom audio products are available. Put the benefit of our experience to work for you. Write for Hi-Q's Cinema precision audio equipment literature today.

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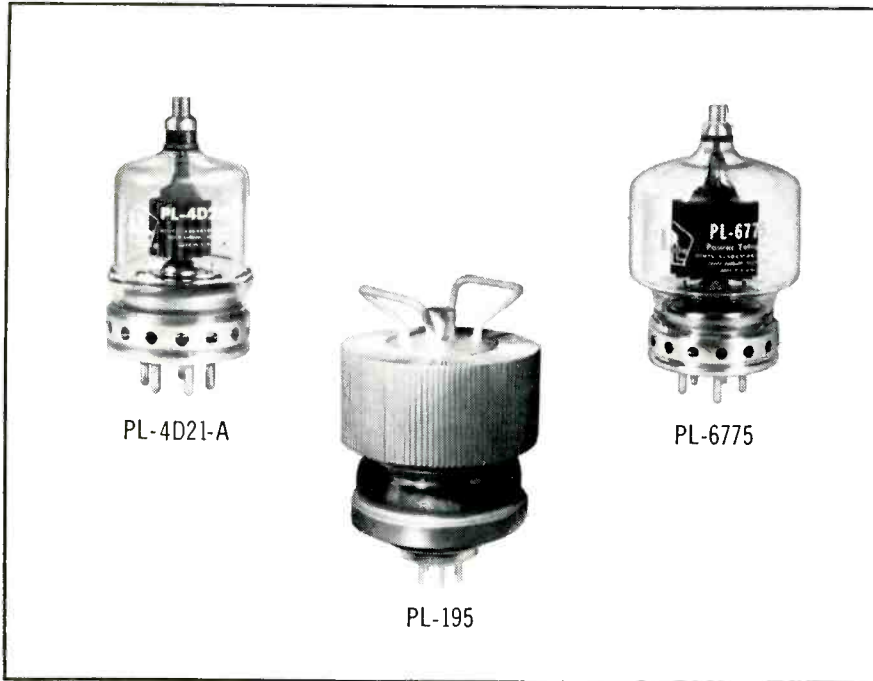
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Circle Item 47 on Tech Data Card



## PENTA Power Tubes for Broadcast Applications



These power tetrodes for broadcast transmitters, available only from Penta, have already run up a service record for ruggedness and reliability.

The **PL-4D21A** is directly interchangeable with the 4D21 (4-125A), but has a plate dissipation of 175 watts. It runs cooler than the 4D21 (4-125A) and generally has longer life.

In the **PL-6775**, you have a more rugged version of the 8438/4-400A. It features the exclusive Penta filament-supporting insulator which minimizes interelectrode shorts.

Both these tubes have a unique, one-piece plate cap and seal which will not come loose or break off easily.

**Penta beam pentodes** are also of interest to designers of broadcast equipment. Highly suited to today's trend toward the use of AM linear amplifiers is the **PL-195**, with a plate dissipation rating of 4000 watts.

To find out about the complete Penta line of tubes for AM, FM and TV applications, send for a free copy of "Penta Broadcast Tubes." The Machlett Laboratories, Inc. — Penta Plant, 312 N. Nopal Street, Santa Barbara, California 93102.

entire frequency range, and off-axis response (90°) completely parallel to the 0° (front) curve. Price of the microphone is \$130.

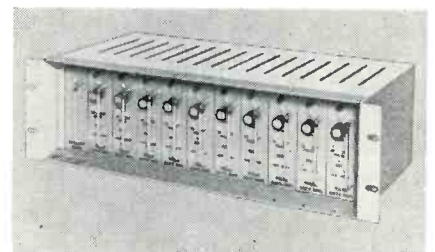


**Professional Recorder**  
(67)

Package and circuitry changes in its recorder for use in professional mastering, duplicating, and broadcasting, have been completed by the **3M Company**. All electronic components have been redesigned to incorporate quick-change plug-in modules. Signal-to-noise ratio is now listed as greater than 80 db. The new unit will accommodate from 1/4" to 1" tape widths, and will record from one to eight tracks. In addition to the dynamic recording range made possible by a special electronic switch, the patented "Isoloop" transport system has been designed to reduce flutter to as low as .04% rms.

Other features include solid-state circuitry, a range of recording speeds from 3 3/4 to 120 ips, and a tape-handling system designed to eliminate tape spillage, stretching, or breakage.

The 3M recorder is available as an unmounted transport, a portable unit with electronics, or a studio console. Prices for the system begin at \$2750 for the tape transport.



**Video-Pulse Distribution Amplifiers**

(68)

The Mark IX video and pulse distribution amplifiers are being produced specifically for use in broadcast television studios by **Ball Brothers Research Corp.**

RAYTHEON

THE MACHLETT LABORATORIES, INC.

A SUBSIDIARY OF RAYTHEON COMPANY  
Circle Item 48 on Tech Data Card

Design features of the fully transistorized equipment include 20-mHz broadband amplification, low differential gain and phase distortion, de-rated components, and individual self-contained electronically regulated power supplies.

Modular construction of the plug-in units permits incorporation of up to 10 individual amplifiers in one electronic housing, providing a total of 40 isolated signal outputs at one central distribution point. The installed equipment, including a stowable module extender for servicing, requires only 5¼" of relay-rack space. Test points on each amplifier facilitate input/output signal monitoring and DC supply-voltage measurements. Each video amplifier has optional provisions for adding either sync or blanking to the output video.



**Bridging Amplifiers**  
(69)

The Novacor CATV bridging am-

## REMOTE CONTROL with a DIFFERENCE

For your UNIQUE STATION we can provide Unique custom modifications to our 615 series Remote Control quickly, cheaply, and efficiently.

Basic Complete Model 615-C for 16 functions including 4 meters. still \$895

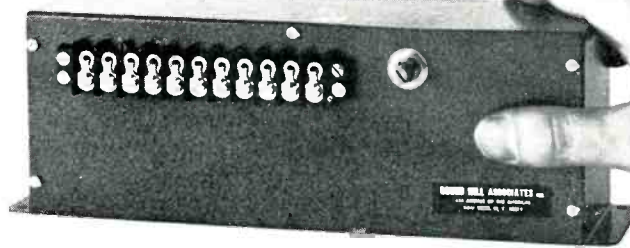
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## Model AA200



## SOLID STATE AUDIO AMPLIFIER

**Frequency Response:**  
±1db, 20 to 20,000 cycles at 100MW  
±2db, 20 to 35,000 cycles at 100MW  
**Harmonic Distortion:**  
Less than 1%, 20 to 20,000 cycles at 100MW  
Less than 2%, 20 to 20,000 cycles at 200MW  
**Input:**  
50 ohms balanced (mu metal shielded, permalloy core transformer)  
2,000 or 100,000 ohms unbalanced  
**Gain:**  
70db, 50 ohm input, 8 ohm load  
65db, 2,000 ohm input, 8 ohm load  
15db, 100,000 ohm input, 8 ohm load

**Output:** 500 and 8 ohms  
(grain oriented transformer)  
**Noise:** Better than -70 db  
**Circuit:** 7 transistors, 1 thermistor  
**Controls:** Locking volume control  
**Connections:** Barrier strip  
**Power Supply:** 9 volts DC, 100 MA  
(accessory power supply available)  
**Construction:** Brown enamelled steel case  
**Size:** 9"L x 2¾"W x 3¼"H  
**Weight:** 28 ounces

Price: **\$34<sup>50</sup>** Including complete Technical Data and Schematic  
**FULL MONEY-BACK GUARANTEE IF NOT SATISFIED!**  
Send check or money order — we pay postage.

## ROUND HILL ASSOCIATES INC.

A MILO ELECTRONICS SUBSIDIARY  
434 Avenue of the Americas, New York, N. Y. 10011

Circle Item 51 on Tech Data Card



## "DUAL RELIABLE" AM BROADCAST TRANSMITTERS



FOR STATIONS REQUIRING THE FOLLOWING FEATURES NOT AVAILABLE IN CCA STANDARD DELUXE TRANSMITTERS:

- BUILT-IN OPERATING STANDBY TRANSMITTER
- ANTICIPATED OFF AIR TIME — 5 SECONDS MAX.
- CONSTANT ELECTRONIC MONITORING SYSTEM
- AUTOMATIC SWITCHOVER TO HALF POWER
- ALL COMPONENTS — INCLUDING TUBES — OPERATE @ 50% RATING
  - 100% SPARE PARTS
- MINIMUM MAINTENANCE — 5 MINUTES PER WEEK
- 10,000 HOUR MINIMUM AVERAGE TUBE LIFE ANTICIPATED AT SUPER CONSERVATIVE OPERATION



Pictured on the left is the monitoring, combining and automatic switching cabinet of the CCA AM-5000DX, 5KW Dual Reliable Transmitter. This cabinet constantly monitors the audio and RF of two independent 2.5KW transmitters and combines their outputs to provide 5KW output. In the unlikely event of a fault, the defective transmitter will be instantly turned off and the second transmitter will automatically feed the antenna. This reduction to half power will have negligible effect on station coverage.

CONTACT CCA FOR DETAILS ON OUR "DUAL RELIABLE" AND DELUXE AM AND FM BROADCAST TRANSMITTERS.



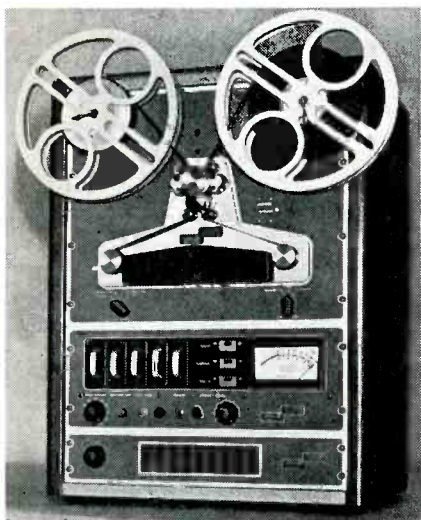
**CCA ELECTRONICS CORPORATION**  
GLOUCESTER CITY, NEW JERSEY  
(609)-456-1716

"TRANSMITTERS ARE OUR BUSINESS"

Circle Item 50 on Tech Data Card

plifiers are modular in design. The bridger case with the connectors and cables attached can become a permanent part of the plant. The electronics chassis unplugs simply for maintenance.

These C-COR amplifiers feature a housing designed to prevent radiation. They are available in 12 different models, all of which have been field tested.



**Displacement Recorder**  
(70)

The Model DR-1 displacement re-

recorder, produced by **Magnasync Corp.** repositions the sound track of a processed 16-mm single-system release print film to "editor's sync" — sound and corresponding picture "in line" — for rapid, accurate editing, then automatically repositions the sound track to printer's sync, or "projection sync." for immediate projection.

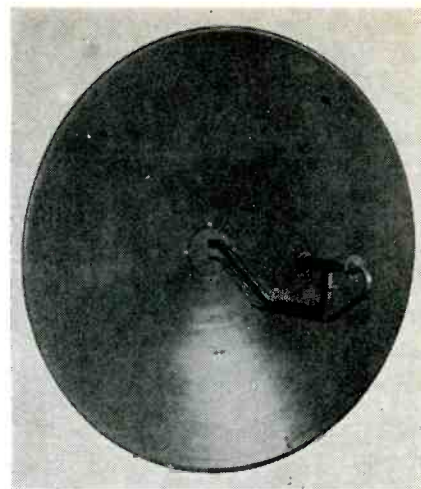
Use of the DR-1 eliminates equipment associated with conventional double-system transfer of 100-mil original magnetic sound track to a second 16-mm magnetic sound track. One displacement recorder and viewer equipped with magnetic head are the only equipment required.

The unit may be interlocked with other magnetic film-recording equipment and projectors, including conventional TV-chain projectors. An audio input is provided to permit addition of sound to unrecorded release print film, and a playback audio output is provided for projection tracks.

The DR-1 circuitry is modular plug-in solid-state. Monitor speaker, headphone output, and automatic switching are provided. Price is \$1785.

**6/12 GHz Antenna**  
(71)

This two-port antenna is for use

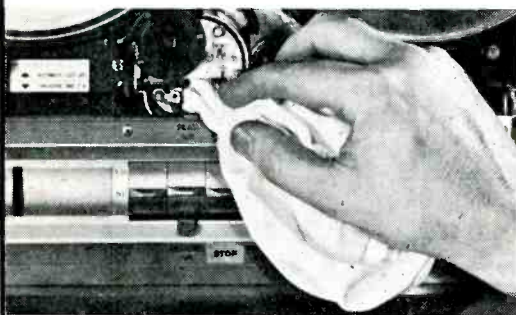


in dual-band operational fixed applications. The **Andrew** antenna operates in the 6.575- to 6.875-gHz and 12.2- to 12.7-gHz bands and is available in 6, 8, and 10' sizes.

A frequency-combiner approach is used to mate the two buttonhook feeds into a common-feed design. The feed has a plane-polarized input for each frequency band, orthogonally arranged. Maximum VSWR is 1.15:1 with polarization discrimination of 20 db, minimum. Typical midband gain of the 6' antenna is 38.8 db over an isotropic radiator (dbi) for the 6-gHz band, and 44 dbi for the 12-gHz band. ▲

## SPRAY/WIPE TEAM REMOVES ALL OXIDE BUILD-UP

mag/tape heads . . . drives . . . capstans . . . guides  
. . . tapes wherever non-contamination is essential



**TEXWIPE** a disposable 100% cellulose LINT-FREE CLOTH designed for cleaning critical areas where non-contamination is essential.

**Non-Contaminating** — pure lint-free and fuzz-free.

**Non-Abrasive** — featuring the Twill Weave, a raised thread pattern.

**Static-Free** — does not require anti-static finishes to neutralize static charges. Non-Raveling — is cut on a bias to prevent raveling.

**High-Absorbency** — no additives to impede instantaneous absorption.

**TEXWIPE** is available from stock in the following sizes: Bias 9" x 9", 12" x 12"; Hemmed 18" x 14". Texwipe is packaged for complete protection from outside contamination.

**"FREON"™ TF** Solvent Cleaner a safe selective solvent for cleaning Computer-Video-Sound Tape Heads and Films.

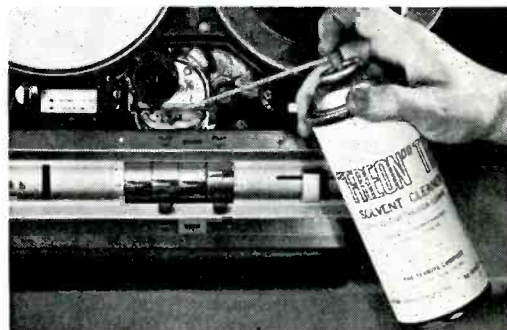
**Selectivity** — removes oxide build-up, grease, oils, dust & grit without damaging materials or equipment.

**Safety** — non-explosive, non-conductive, non-flammable, non-corrosive, odorless and virtually non-toxic. Can be used on operating equipment.

**Low Residue** — "FREON" solvents leave essentially no residue on evaporation. EXCELLENT PENETRATION — Because of low surface tension, "FREON" has superior wetting properties . . . will enter the tiniest openings and pores to replace soils. EXTENSION NOZZLE — Pin-Points spray into hard to reach areas. "FREON" TF is available in the large 16 oz. Aerosol Industrial size.

Write for details.

\* DuPont™.



**THE TEXWIPE COMPANY** • HILLSDALE, NEW JERSEY 07642

Circle Item 52 on Tech Data Card



## ENGINEERS' TECH DATA

### AUDIO & RECORDING EQUIPMENT

80. MEMOREX—Type 77V precision broadband video tape is described in a new eight-page brochure. Magnetic and physical properties are featured.
81. QUAM-NICHOLS—General catalog lists speakers for new installation and replacement in public address, background music, hi-fi, and automotive systems.
82. SWITCHCRAFT — New Product Bulletin 159 covers "Mix Amp" high-power miniature preamplifier Models 503 and 504. Models offer higher signal-to-noise ratio and higher gain. Offer includes New Product Bulletin 158 which describes recently introduced "Multi-Slide" switches.
83. VIKING OF MINNEAPOLIS — Brochure describes new Series 235 tape-duplicating system.

### COMPONENTS & MATERIALS

84. ALFORD — 128-page catalog "N" provides photographs and detailed descriptions of AMCI RF instruments and components. Listed are slotted lines, precision connectors, RF bridges, dipoles, power dividers, and many other products.
85. CORNELL-DUBILIER—New 65-page expanded and revised Replacement Component Selector includes addition of 16 major replacement products marketed through general-line distributors.
86. DAVCO—135 separate items, including unusual coaxial connectors and adapters, are listed in new 24-page catalog.
87. POMONA ELECTRONICS — New General Catalog 11-66 displays variety of molded banana-plug patch plugs, test leads, test probes, shielded "black boxes," and socket adapters for standard tubes and CRT's.

### MOBILE RADIO & COMMUNICATIONS

88. MOSLEY ELECTRONICS—Catalog lists complete line of 1966 Citizens-band equipment.
89. ROUND HILL — Data sheet and schematic features CS-10 wireless cuing system. Receiver is shirt-pocket size.

### POWER DEVICES

90. HEVI-DUTY—Bulletin 7-22 supplies data on line-voltage regulator using saturable-core reactor.

### RADIO & CONTROL ROOM EQUIPMENT

91. AUTOMATIC TAPE CONTROL — Spec sheet gives information about new "customer-designed" automatic programmer.

### REFERENCE MATERIALS & SCHOOLS

92. CLEVELAND INSTITUTE OF ELECTRONICS — New pocket-size plastic "Electronics Data Guide" includes formulas and tables for: frequency vs. wavelength, db, length of antennas, and color code.
93. GATES — Eight-page "Broadcast Studio Planning Guide" emphasizes technical "core area" principle of station layout. Covers small, medium, and large broadcasters with alternate "core area" plans.
94. JERROLD—Basic systems for ETV is subject for a 36-page booklet prepared for educators exploring TV and others interested in specifications. Systems outlined include: ETV broadcasting stations, microwave, MATV, and CCTV.
95. HOWARD W. SAMS — Literature describes popular and informative technical publications; includes latest catalog of technical books.

## For a top job in broadcasting . . . get a FIRST CLASS FCC LICENSE ... or your money back!



**Y**OUR key to future success in electronics is a First-Class FCC License. It will permit you to operate and maintain transmitting equipment used in aviation, broadcasting, marine, microwave, mobile communications, or Citizens-Band. Cleveland Institute home study is the ideal way to get your FCC License. Here's why:

Our electronics course will *quickly* prepare you for a First-Class FCC License. Should you fail to pass the FCC examination after completing your course, you will get a *full refund* of all tuition payments. You get an FCC License . . . or your money back!

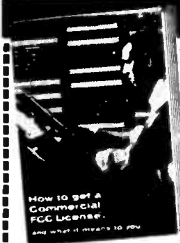
And only CIE offers you new, up-to-the-minute lessons in all these subjects: Logical Troubleshooting, Microminiaturization, Single Sideband Technique, Pulse Theory and Application, Boolean Algebra, and many more.

You owe it to yourself, your family, your future to get the complete details on our "proven effective" Cleveland Institute home study. Just send the coupon below for FREE book or write to Cleveland Institute of Electronics, 1776 E. 17th St., Dept. BE-27, Cleveland, Ohio 44114.

### NEWS FOR VETERANS

New G. I. Bill may entitle you to Government-paid tuition for CIE courses if you had active duty in the Armed Forces after Jan. 31, 1955. Check box in coupon for complete information.

### MAIL COUPON TODAY FOR FREE BOOK



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of Electronics  
1776 East 17th Street, Cleveland, Ohio 44114

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

Name \_\_\_\_\_ (please print)

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Occupation \_\_\_\_\_ Age \_\_\_\_\_

Veterans check here for GI Bill information

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BE-27



## Studio 96

**PROFESSIONAL TAPE TRANSPORT  
AND MATCHING SOLID STATE ELECTRONICS  
QUALITY DESIGNED FOR BROADCASTERS  
AND RECORDING STUDIOS**

### STUDIO 96

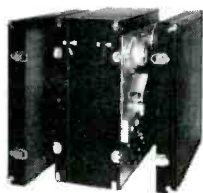
Two speed tape transport with automatic sequence braking, choice of hyperbolic head configurations, hysteresis capstan drive and heavy duty reel drive motors, remote control jacks and 10 1/2" reel capacity. Superbly smooth tape handling - interlocked "fool-proof" switching - fit for every studio.

Rack mount ready from \$585.45

### AMPLIFIERS

Solid state, record and playback amplifiers of modular design with interchangeable plug-in options, mixing controls, A-B monitoring, 600 OHM line output, illuminated VU meters, exceed NAB standards.

Rack Mount Monaural RP110-R2 \$299.00  
Stereo RP120-R2 \$399.00



Portable Case "100"  
with detachable front and back, accepts  
Studio 96 and either RP110-R2 or RP120-  
R2 amplifier.

"100" case only \$59.50

FOR COMPLETE INFORMATION  
PLEASE WRITE FOR CATALOG . .



**Viking** OF MINNEAPOLIS®  
9600 Aldrich Ave. S. Minneapolis, Minnesota, 55420

CANADA: Alex L. Clark, Ltd., 3751 Bloor St. W., Islington, Ontario  
Electro Tec Marketers, Ltd., 1624 W. Third Av., Vancouver, British Columbia  
CENTRAL & SOUTH AMERICA: ManRep Corp., P.O. Box 429 N. Miami Beach, Florida, U.S.A.  
OVERSEAS EXPORT: International Division Viking of Minneapolis, Inc.,  
9600 Aldrich Av. S., Minneapolis, Minn., U.S.A.

Circle Item 54 on Tech Data Card

## STUDIO AND CAMERA EQUIPMENT

96. CLEVELAND ELECTRONICS — A 52-page quick-reference, step-down die-cut catalog covers complete information on Vidicon, Plumbicon®, and image-orthicon deflection components. Included are photographs, specifications, technical data, and dimensional drawings.
97. COHU ELECTRONICS — Available are Bulletin 8-57, "A New Approach to Election Coverage by TV;" Bulletin 8-53, "Portable TV Camera Gives Golfing Complete Coverage;" and Bulletin 8-49, "Miniature Camera Used in Broadcast TV." A four-page technical data sheet, No. 6-415, gives both specifications and details on sync generators, genlock, color standard, dot-bar generators, and automatic change-over switch.
98. DYNASCIENCES CORP.—Dynamens, an image motion compensator which nullifies image distortion with long-lens cameras, is detailed in technical bulletin M060.
99. ROANWELL — Brochure describes new family of light-weight, cushioned headsets with microphones. Features include choice of subassemblies and impedances.
100. TELEVISION ZOOMAR — Literature is offered on low-cost 10 x 40, 10:1 image orthicon zoom lens, and on Autocam programmed remote control for TV cameras.

## TELEVISION EQUIPMENT

101. AMPEX — A six-page brochure, No. A-044, lists audio, video, and tape products useful in broadcast applications. Included are information and pictures on closed-circuit television, low-cost video tape recorders, language-laboratory equipment, professional audio recorder/reproducers, TV cameras, audio and video tape, and audio and video systems.
102. COLORADO VIDEO — "Slow-Scan" television equipment for communications is described in data sheets.
103. INTERNATIONAL NUCLEAR — Booklet gives information on "Reed-Relay" video switches.
104. VITAL — Data sheets give specifications of model VI-500 stabilizing amplifier, Model VI-10A video distribution amplifier, and Model VI-20 pulse-distribution amplifier.

## TEST EQUIPMENT & INSTRUMENTS

105. BIRD—Short-form catalog SF-66 lists nearly all the coaxial load resistors, absorption wattmeters, directional wattmeters, and coaxial switches stocked. Also tells about custom-built accessories.
106. FREQUENCY ELECTRONICS—Four-page brochure includes photographs, specifications, and descriptions of frequency-control and timing instrumentation, components, and systems. Describes frequency standards, phase comparators, distribution amplifiers, digital clocks, etc.
107. HEWLETT-PACKARD—Two new brochures outline portable electronic equipment for maintenance of underground cable plant. Bulletin 66-2 illustrates Delcon 4900A fault locator for pinpointing electrical faults, and Bulletin 66-3 covers the new Delcon 18000A ultrasonic duct-probe for locating pressure leaks.
108. SIMPSON—Stock instruments, panel meters, and the new "Lab-Line" group of precision instruments are headlined in each of three separate catalogs offered.

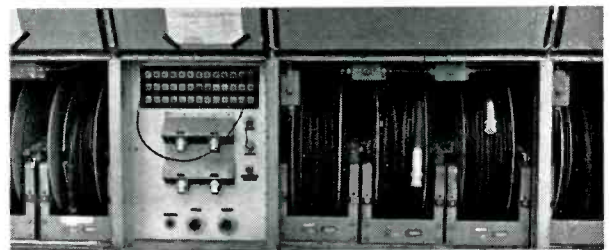
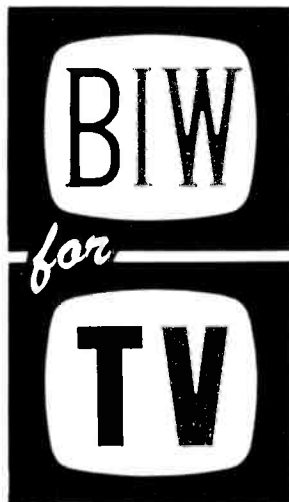
## TRANSMITTER & ANTENNA DEVICES

109. ANDREW CORP. — New catalog No. 24 presents detailed product information, UHF, VHF, and microwave antennas for commercial and military applications. Helix, flexible coaxial cables and elliptical waveguides, antenna positioners, RF switching devices, pressurization equipment, rigid transmission lines, and waveguides for complete and integrated antenna systems are described.
110. BAUER — Brochure illustrates new product line exhibited at 1966 NAB Convention. Products include AM and FM transmitters, and dual-channel and stereo consoles.

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June, 1966



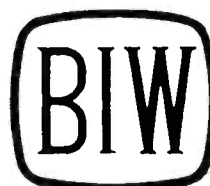
# CABLES

For studio, mobile or remote use, BIW offers rugged, reliable cables for color and black and white cameras. All types are offered in complete factory wired and tested assemblies, cut to any desired length. Or, they can be had in bulk.

BIW TV cables are available for all models of American, British and European cameras. Particularly interesting are the BIW prefabricated custom terminations for studio wiring. These provide instantaneous hook-up and save technicians time in providing trouble free installation. BIW has designed and made TV camera cables since TV's inception. Long experience since this time provides the knowledge to produce quality cables that:

1. Have unusual flexibility that permits easy camera action whether in complex studios, dirty, wet football fields or sub-zero St. Moritz.
2. Have tough, durable neoprene jackets that withstand the rigors of abuse from dollies, trucks and dragging.
3. Have signal and control leads grouped to minimize cross talk.

BIW also makes cables for special application television cameras. Let us know your requirements and we will send complete information, catalog and quotations.



## BOSTON INSULATED WIRE and Cable Company

Boston 25, Massachusetts  
Canada:  
Hamilton, Ontario

El Segundo, California  
International:  
Boston, U.S.A. and Montreal, Canada

Circle Item 55 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

**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. LIPPS, INC., 1630 Euclid Street, Santa Monica, California 90404. (213) EX 3-0449. tf

**VIDEO TAPE RECORDER**  
AUDIO HEAD ASSEMBLY SERVICE  
Precision relapping of all heads and supporting posts, including cleaning and testing. Ampex head assembly with "cue" tracks, \$75.00 complete. RCA units also relapped. One to two day service. LIPPS, INC., 1630 Euclid St., Santa Monica, Calif. 90404. (213) EX 3-0449. tf

**PAUL H. LEE, P.E.**  
27 Years Experience in Radio,  
TV, & Communications Engineering.  
5209 Bangor Drive,  
KENSINGTON, MD.  
(A suburb of Washington, D. C.)  
Phone 301-946-7238  
Senior Member IEEE

## EQUIPMENT FOR SALE

**AMPEX PR-10-2.** 2-track stereo R&P with 4-track playback also. Portable case. Like new, audiophile owned, never used commercially. \$675. Dept. 155. Broadcast Engineering. 6-66-11

"AUDIO EQUIPMENT — Whatever your needs, check us first. New and Used. Ampex, Altec, AKG, EV, Fairchild, Neumann, Langevin, Rek-O-Kut, Uher, Viking. Send for equipment list." 6-66-61

**SPOTMASTERS** — Completely reconditioned and guaranteed including new Hysteresis Synchronous motors and Nortronics metal faced heads. Model 505 playbacks (5) \$250 each. Model 500 Record/Playback (1) \$325 ea. SPECIAL — Wall mount Cartridge Racks \$30 each. Holds 90 cartridges. 30 day Money Back Guarantee on all items. Terms; Check with order or COD. FOB Washington D.C. BROADCAST PRODUCTS CO., Box 324, Kensington, MD (301)942-1224 6-66-11

## 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

**Cartridge Machines** \$50.00. Accept Fidelipac or equivalent to 1200. Good working order. Easily adapted for studio playback or transmitter standby. Supplied 1 7/8. Speed easily converted, w/pre-amp. As-is, working order. \$50.00 per unit, limit 2 per customer. Shipped freight collect. Send Check or Money order to: H & H Productions, 112 East Euclid Ave., Tampa, Florida 33602. Sorry, No C.O.D.'s 6-66-11

**RIDER MANUALS** — 11 volumes in very good condition. Schematics for hundreds of radios. \$35 F.O.B. Richard M. Jacobs, 1015 Glenside Place, University City, Missouri 63130 6-66-11

**CO-AXIAL CABLE** Helix, Styroflex, Spiroline, etc. Also rigid and RG types in stock. New material. Write for list. Sierra-Western Electric Co., Willow and 24th Streets, Oakland, Calif. Phone 415 832-3527 5-66-11

**Tape Cartridge** reconditioning and rewinding. Reloading with 3M 151 tape and minor parts replaced for as little as 90¢ on a 40 second tape. Average savings over new cartridges: 60%. New cartridge warranty. Special pricing for rewinding only. Southwestern Cartridge Service Co., Box 121, San Angelo, Texas. 5-66-31

**Audio Equipment** bought, sold, traded. Ampex, Fairchild, Crown, McIntosh, Viking, F. T. C. Brewer Company, 2400 West Hayes Street, Pensacola, Florida. 3-61-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. Electrofilm Co., 410 Columbus Ave., NYC. 212-EN-25680. 8-64 U

**COMMERCIAL CRYSTALS** and new or replacement crystals for RCA, Gates, W. E. Bliley, and J-K holders; regrounding, 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

**Trimm 504 Audio Patch** cords \$4.00. Audio jack panels for 19" racks, 10 pair \$8.95. Repeat coils 500-500 ohm flat to 20k \$4.00 —Relay racks and equipment cabinets. Write for list. Gulf Electro Sales, Inc., 7031 Burkett, Houston, Texas. 4-66-tf

**NEW CAPSTAN PRESSURE IDLERS FOR AMPEX 300's, 350's, and 354's, \$15.00. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California. 4-66-61**

**AMPEX HEADS** replaced in your 3 head 300, 350, 351 assembly. Our heads are manufactured under controlled laboratory conditions and are guaranteed to meet or better original equipment specifications. Full track and half track \$97.50. We will send free brochure. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California. 4-66-61

**AMPEX HEAD RECONDITIONING SERVICE** for 300's, 350's, 351's and 354's, includes the relapping of worn or grooved heads, and the same complete alignment and quality control testing as new head replacements. Full and half track assemblies \$15.00, two track \$60.00. TABER MANUFACTURING & EQUIPMENT CO., 2619 Lincoln Ave., Alameda, California. 4-66-61

**AMPEX VIDEO TAPE RECORDER AUDIO HEAD ASSEMBLIES REBUILT.** Assemblies with cue track lapped \$100.00, without cue tracks, \$80.00. New heads for assemblies without cue track \$220.00, with cue track \$310.00. Assemblies without cue converted with four new heads \$350.00. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California 4-66-61

## EQUIPMENT WANTED

We need used 250, 500, 5K & 10K Watts AM Transmitters. No Junk. Broadcast Electronics Corp. 1314 Turbide St., Laredo, Texas 78040. 3-66-tf

**WANTED:** Several crystal units or holders of these types: RCA TMV-129B, G.R. 376L and Collins 297. Frequencies unimportant. List what you have, state condition and cash price. Edison Electronic Co., P.O. Box 96, Temple, Texas. 6-66-11

**WANTED**—Sound effects records, new or used, must include all types of sounds and musical bridges as well as fanfairs. If you are in the area call collect Doug Clark 203-527-9017 or write Fiesta, 158 Albany Ave., Hartford, Conn. 6-66-11

We wish to buy ONE REL TRANSMITTER, type 695A-series S-1103, in good condition. Range: 150-174 MC. Address all correspondence to: RADIO POPULAR, P.O. Box 347, MARACAIBO, VENEZUELA. 6-66-11

## Position Wanted

Seeking position as chief engineer or assistant chief engineer in AM FM radio and VHF UHF television. Ten years experience in radio, television, microwave, and antennas. First class license and electronic college graduate. Currently employed for large Eastern electronics firm. Married. Prefer Alaska but all offers considered. 6-66-11

College student desperately needs summer employment. Experience w/NBC owned and operated, and others. Third endorsed ticket. Age 20. Call Henry Navin 271-7116; write 9325 Beacon Avenue, Cleveland, Ohio. 5-66-21

## Employment

"IMMEDIATE OPENINGS for television technicians experienced in all phases of studio operations. Color experience helpful. First class radio telephone license required. Send resume to: R. L. Renaud, Chief Engineer, WWJ-TV, Detroit, Michigan 48226." 6-66-11

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