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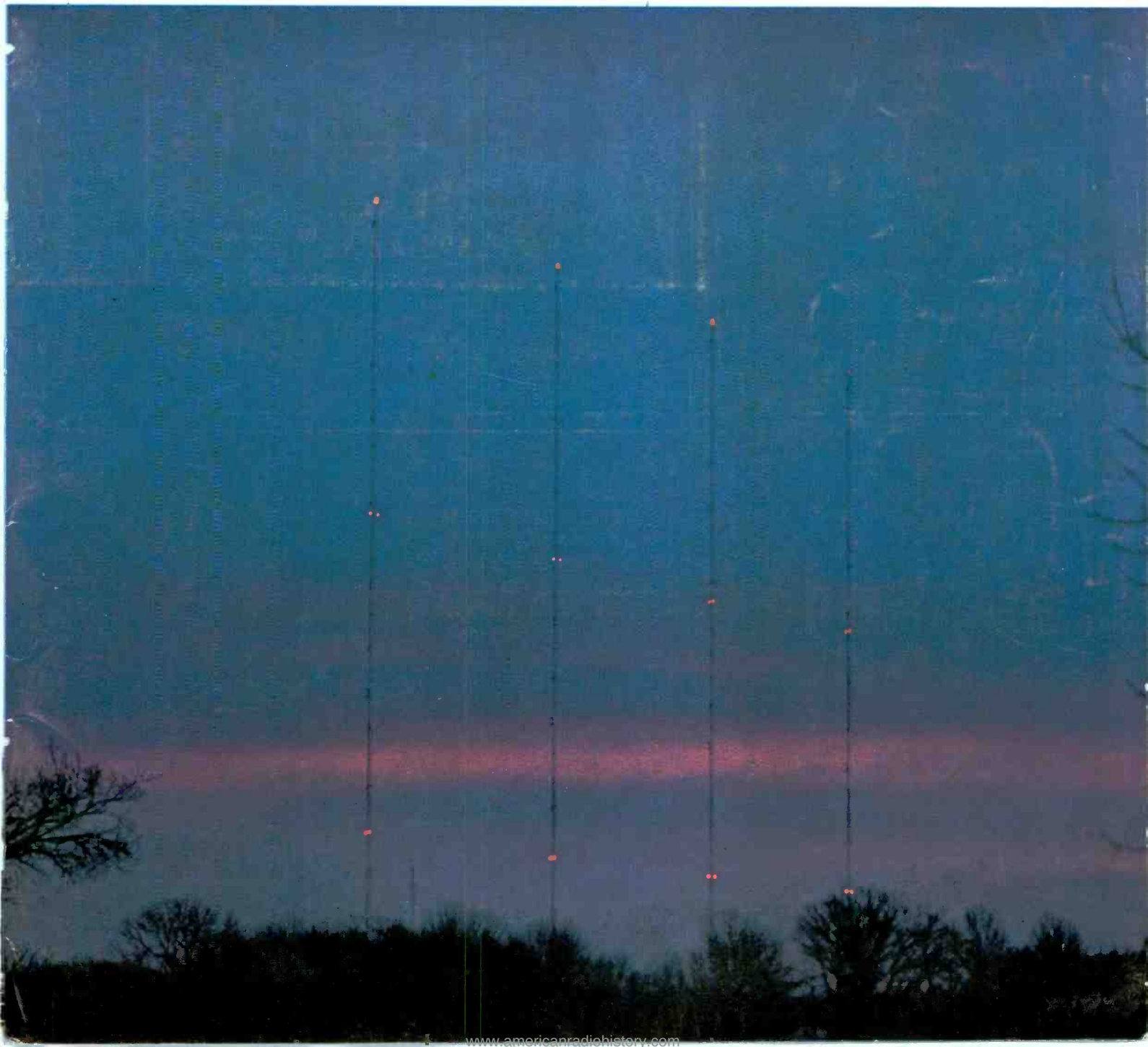
APRIL 1966/75 cents

# Broadcast Engineering

*the technical journal of the broadcast-communications industry*



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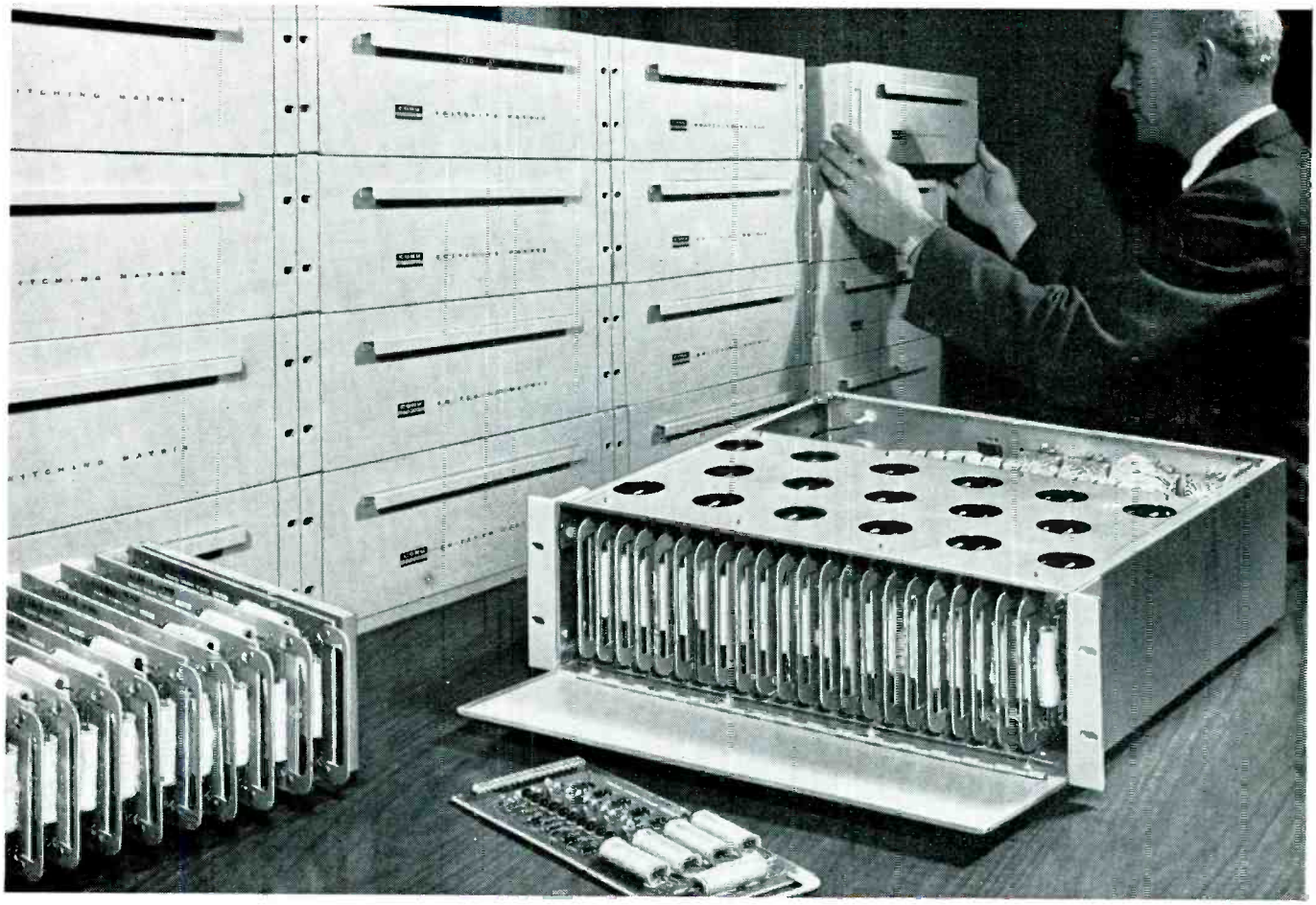

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*the technical journal of the broadcast-communications industry*

Volume 8, No. 4 April, 1966

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## Departments



The scene on our cover (at WCIN, Cincinnati) is repeated every evening at thousands of broadcast stations. To be sure your towers are marked as they should be, you'll want to read the article on page 21.

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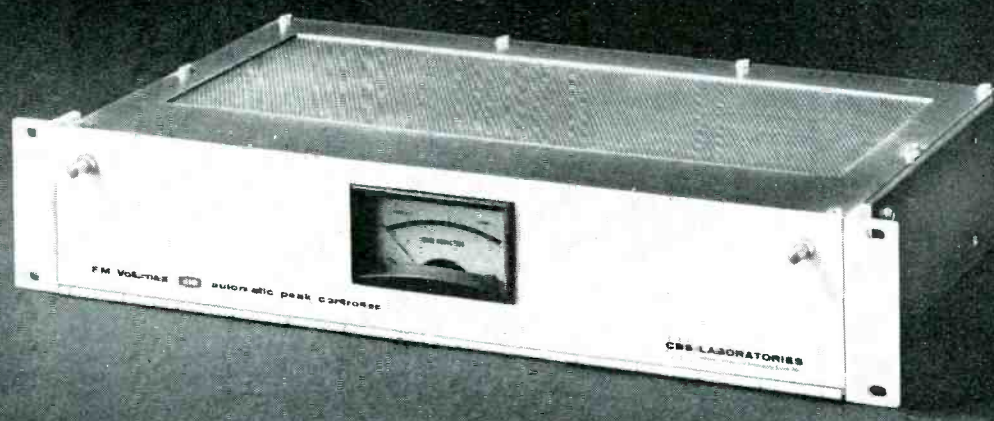


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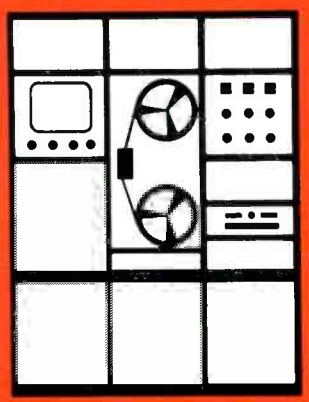
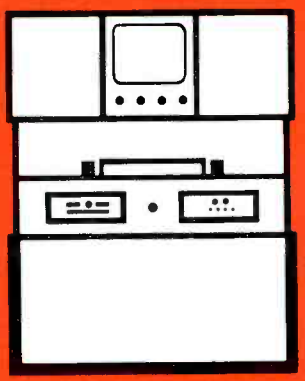


TRT/HB



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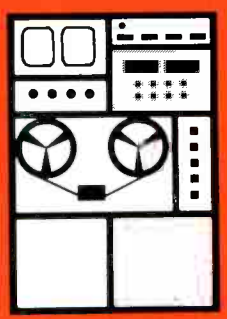

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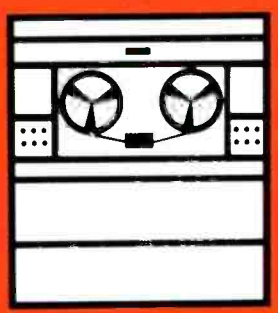

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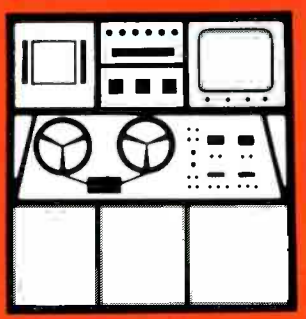

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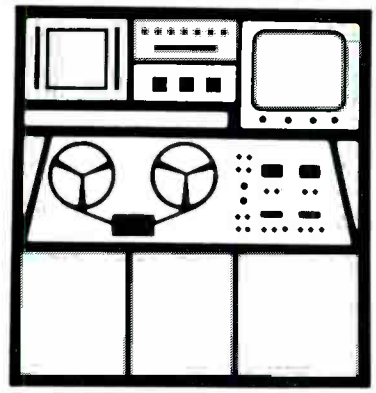

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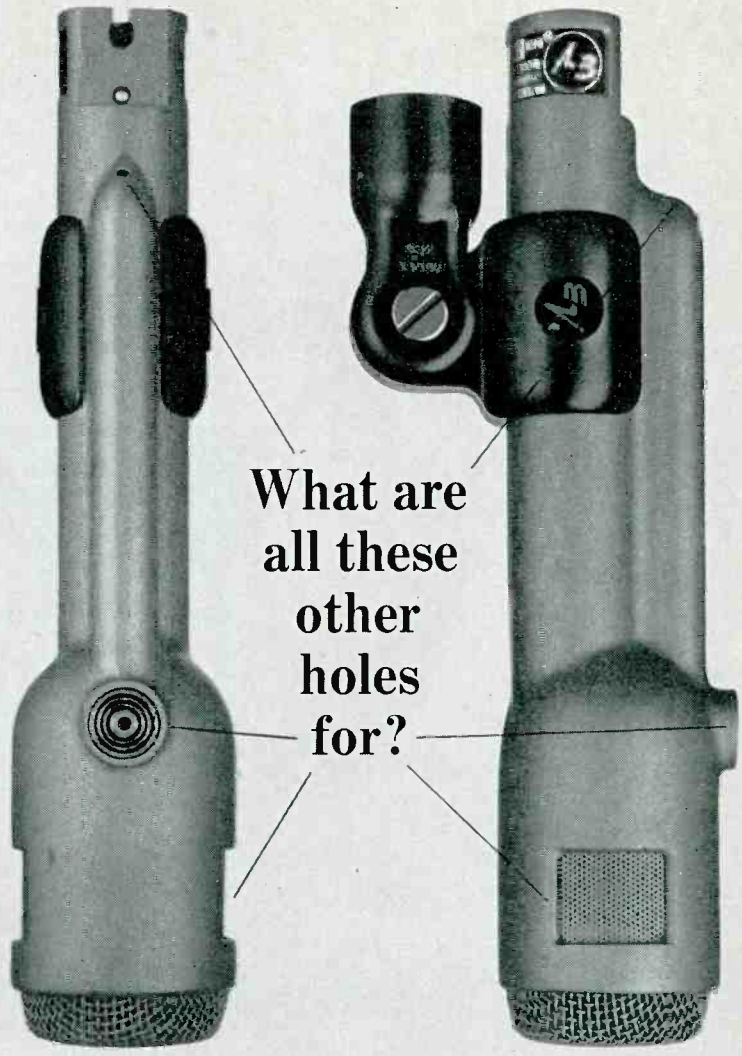
LOOK TO VISUAL FOR NEW CONCEPTS IN BROADCAST EQUIPMENT

# If the Electro-Voice Model 666 picks up sound here...



## What are all these other holes for?

Ev. The holes in the top, sides and rear of the Electro-Voice Model 666 make it the finest dynamic cardioid microphone you can buy. These holes reduce sound pickup at the sides, and practically cancel sound arriving from the rear. Only an Electro-Voice Variable-D® microphone has them.

Behind the slots on each side is a tiny acoustic "window" that leads directly to the back of the 666 Acoustalloy® diaphragm. The route is short, small, and designed to let only highs get through. The path is so arranged that when highs from the back of the 666 arrive, they are cut in loudness by almost 20 db. Highs arriving from the front aren't affected. Why two "windows"? So that sound rejection is uniform and symmetrical regardless of microphone placement.

The hole on top is for the mid-range. It works the same, but with a longer path and added filters to affect only the mid-frequencies. And near the rear is another hole for the lows, with an even longer path and more filtering that delays only the bass sounds, again providing almost 20 db of cancellation of sounds arriving from the rear. This "three-way" system of ports insures that the cancellation of sound from the back is just as uniform as the pickup of sound from the front—without any loss of sensitivity. The result is uniform cardioid effectiveness at every frequency for outstanding noise and feedback control.

Most other cardioid-type microphones have a single cancellation port for all frequencies. At best, this is a compromise, and indeed, many of these "single-hole" cardioids are actually omnidirectional at one frequency or another!

In addition to high sensitivity to shock and wind noises, single-port cardioid microphones also suffer from proximity effect. As you get ultra-close, bass response rises. There's nothing you can do about this varying bass response — except use a Variable-D microphone with multi-port design* that eliminates this problem completely.

Because it works better, the E-V 666 Dynamic Cardioid is one of the most popular directional microphones on the market. Internal taps offer 50, 150, or 250 ohm impedance output. Frequency range is peak-free from 30 to 16,000 Hz (cps). Output is—58db.

To learn more about Variable-D microphones, write for our free booklet, "The Directional Microphone Story." Then see and try the E-V 666 at your nearby Electro-Voice professional microphone headquarters. Just $255.00 in non-reflecting gray, complete with clamp-on stand mount. Or try the similar Model 665. Response from 50 to 14,000 Hz (cps), $150.00 (list prices less normal trade discounts).

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You can buy the system outright. Or finance it. Or lease it.

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And the truly gratifying thing about ATC systems is that you buy only what you need to serve your purpose—and your budget. If you want to expand later, you just add on.

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# LETTERS to the editor

DEAR EDITOR:

I have received the February issue of *Broadcast Engineering* containing the article "Removing the Mystery From Grounding." I was disappointed that problems of grounding TV towers for lightning were not discussed at all. I believe you have overlooked a very important aspect of grounding techniques by leaving this out.

I hope you can add this in the very near future. Otherwise, I enjoy the magazine very much.

E. P. HUHNDORFF

Operations Manager
KPRC
Houston, Texas

*We're planning an article (maybe more than one) on lightning protection for all types of broadcast stations. We expect to be completing our arrangements for this soon, and you should be seeing the article in a few months.—Ed.*

DEAR EDITOR:

Each month I look forward to receiving a new and interesting issue of BROADCAST ENGINEERING. I keep them in loose-leaf binders for future reference.

With all the circuits that pass across your desk, I wonder if you've seen some good ones for transistorized turntable and microphone preamps, program amplifiers, and monitor amplifiers—it would be nice to build a transistorized board.

ED TOMLIN

Chief Engineer
KWIN
Ashland, Oregon

*How about it, readers? Do you have a circuit for a solid-state amplifier or preamplifier you'd like to share? If so, send it in. If we publish it, you'll earn some cash.—Ed.*

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GE-29

# MODERN FM TRANSMITTER DESIGN

*by Thomas R. Haskett,* Central Regional Editor—A survey of current design practices in FM transmitters.

Sales of FM transmitters have increased rapidly in the 1960's. There are several reasons for this fact: Many new FM stations have come on the air; the increasing use of stereo and SCA multiplex has demanded new transmitters capable of handling these signals without degradation; more foreign stations are buying from American manufacturers. FM - transmitter designers have had to keep pace with sales; consequently there are a number of new features to be found in today's FM circuits.

### Exciters

Nine manufacturers were surveyed in preparing this report. Since their transmitters are type-accepted by the FCC for FM broadcasting, they all meet FCC specifications for frequency response, harmonic distortion, FM and AM hum and noise, and carrier stability. Therefore these features need no discussion. The designs were found to have certain other items in common also. All exciters have an output of 50 or 51 ohms, unbalanced. All but one have an RF output power of 10 watts (the Standard Type 936 has a 5-watt output). All but one will accept stereo and SCA modulation from accessory generators (CCA's FM-10D won't accept stereo, but the company is now building an exciter that will). All exciters use vacuum tubes, and two (Moseley's LPE-10 and Collins' A-830-2) also use solid-state components. Rectifiers are solid-state in seven exciters; Standard's 936 uses vacuum-tube rectifiers, while Moseley's LPE-10 uses solid-state in the low-voltage supply and vacuum tubes in the high-voltage supply. All exciters are available as complete transmitters for low-power use; the difference between a 10-watt exciter and a 10-watt transmitter is that the latter comes with a harmonic filter and a few more meters.

Phase modulation (indirect FM) is used by five manufacturers—CCA, Gates, Rust/GEL, Standard, and Visual. Fig. 1 illustrates a representative circuit, employed by CCA and Visual. V1 is a crystal-controlled oscillator, whose frequency is 1/864 of the desired carrier frequency. Since this oscillator is not modulated, the carrier is quite stable. V2 is a buffer and pulse shaper driving V3, a sawtooth generator. The arrangement employs Serrasoid modulation (Latin *serra,* saw) and involves feeding a sawtooth pulse to the grid of modulator V4. V4 functions more as a switch than an amplifier, producing a square wave. The leading edge of this square wave can be advanced or retarded in phase by the cathode voltage fed to V4. This voltage is supplied by V6, the second audio stage, and consists of whatever mono, stereo, and/or SCA signals are fed through the AF input, and the first audio stage.

The result of the audio voltage on the cathode of V4 is to change the phase of the leading edge of the square wave in the V4 output circuit. The square wave is differentiated and the resultant signal is applied to the chain of frequency multipliers V7 through V14. The original frequency (unmodulated) is multiplied by a factor of 864 to produce a carrier frequency in the range of 88 to 108 mc. At the same time, the initial small amount of phase shift, which is also a small frequency shift, is multiplied so that the output of V14 contains frequency deviations of up to ±75 kc.

Note, however, that the frequency deviation produced in this way is proportional to the time rate of change of phase. The maximum rate of change of a sine-wave modulating signal is proportional to the slope of the curve as it crosses the x axis. This slope is porportional to frequency (assuming constant peak amplitude); hence, the maximum frequency deviation is proportional to modulating frequency. This frequency response is not desired, so a

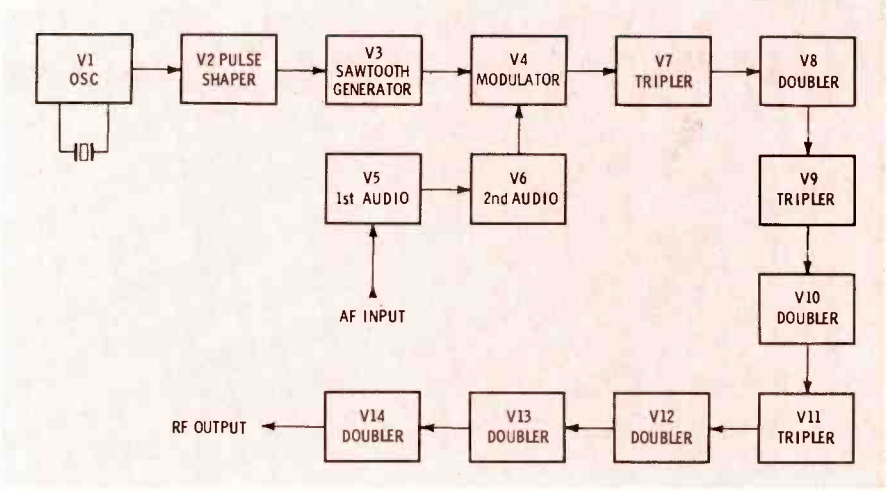



**Fig. 1. A typical exciter circuit employing phase modulation (indirect FM).**

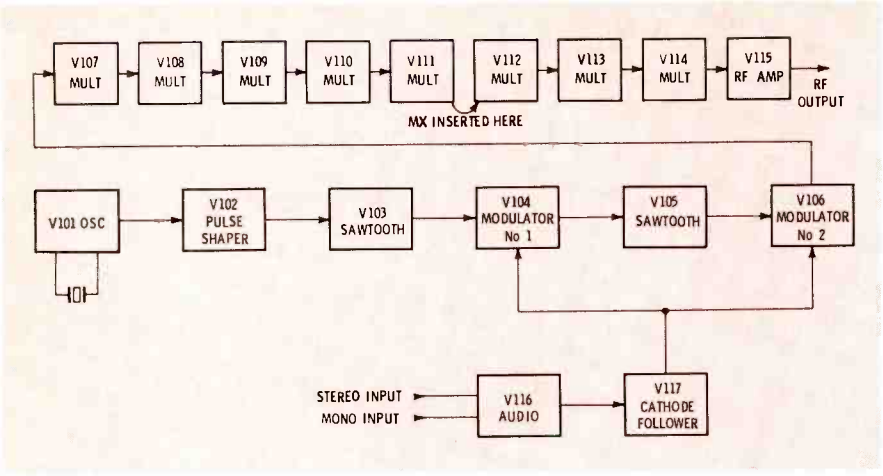



**Fig. 2. Block diagram shows operation of Serrasoid modulation in FM exciter.**

low-pass RC integrating circuit is placed in the audio path to correct it. Of course, a pre-emphasis network is used to produce the desired FCC 75-$\mu$sec curve.

Gates uses a refinement of the Serrasoid techniques in its M-6095 exciter, the diagram of which appears in Fig. 2. There are two separate phase modulators, operated in cascade, with a sawtooth generator driving each. It is claimed that since the frequency swing of the two modulators is additive and the same modulating signal is applied to both stages, the performance capabilities are doubled and limitations are halved. In effect, the modulating ability of the exciter is increased at low frequencies.

Direct FM is used by the other four manufacturers surveyed—AEL, Collins, Moseley, and RCA. The RCA circuit is shown in Fig. 3 and is a straightforward example of the direct FM system. V1A is a series-tuned Colpitts oscillator whose plate voltage is derived from a cathode follower working from the regulated power supply; hence the free-running oscillator is stable. The center frequency of V1A is one-half the desired carrier frequency. Modulation, from the mono, stereo, or SCA inputs, is applied to a capacitive diode across the grid circuit of V1A, thus shifting frequency in accordance with audio amplitude. Buffer V2 isolates the oscillator and couples the signal to doubler V3, which produces carrier-frequency signal for output amplifier V4.

An AFC network, or feedback loop, is used to stabilize the carrier frequency and reduce drift. The reference crystal oscillator, an unmodulated oscillator in a Butler circuit, is mounted in a controlled-temperature oven and produces a reference frequency equal to one-half the carrier frequency plus 130 kc. Output from V5 and a sample from buffer V2 are mixed in V6, where a beat is produced. If the exciter is *on frequency,* the beat is 130 kc. V7, a Schmitt trigger, clips the 130-kc sine wave and produces a square wave, which is amplified by V8. The square wave is then clamped by a pair of clamping diodes and fed to a counter detector whose output is directly proportional to frequency. With 130 kc coming from the mixer tube, the counter detector supplies a constant current to the magnetic amplifier, but an identical bucking current of opposite polarity is supplied from a stable reference source so that there is effectively zero input to the magnetic amplifier. Since the *center-frequency adjustment* controls the bucking current, the zero point may be adjusted over certain limits to vary the transmitter carrier frequency. When the V1A oscillator drifts off frequency and the output from mixer V6 is different from 130 kc, an error signal appears at the input to the magnetic amplifier. This error signal is amplified by 40 db and fed to a capacitive diode across V1A, to correct the center frequency. An AFC defeat switch is provided to leave the FM oscillator free-running.

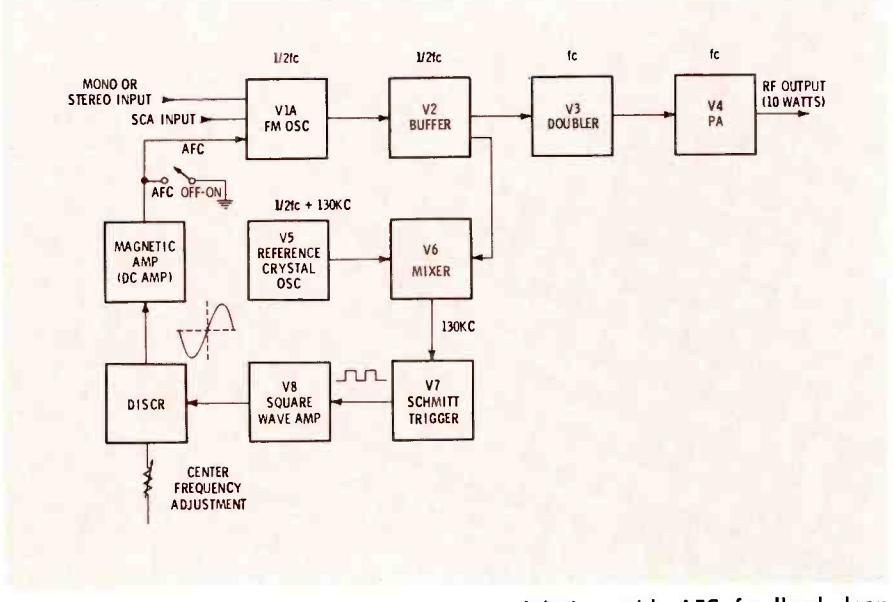



**Fig. 3. RCA exciter uses direct frequency modulation with AFC feedback loop.**

Moseley's Type H6242 exciter utilizes a slightly different circuit (Fig. 4) to achieve direct FM. V107, the basic oscillator, is a modified Hartley oscillator operating around 14 mc (depending on carrier frequency). It is isolated by buffer V108, and its output is mixed with the signal from doubler V109B, driven by high-frequency crystal oscillator V109A. V109A is adjusted so that the mixing process produces an output at the desired carrier frequency in the range 88-108 mc. This signal is amplified by V110 through V203 to an output level of 10 watts.

Meanwhile, some of the buffer output is divided by a factor of 1024 by a series of bistable flip-flops. Divided output is then amplified by V112A, split in phase by V112B, and fed to one input of a phase detector, or comparator. The other input to the phase detector is derived from a temperature-controlled low-frequency crystal oscillator and

amplifier V111A-B. The frequency of this input is 1/1024 of the frequency of the basic oscillator. Under normal on-frequency operation of the exciter, then, the two inputs to the phase comparator are equal in frequency. The comparator has zero output to DC amplifier V106, and no corrective action to the modulator takes place. Should the exciter drift off frequency, an error signal is developed by the comparator and fed through the DC amplifier to the reactance modulator, V105.

Mono or stereo signals are also fed to V105, where they cause frequency modulation of the basic oscillator. SCA multiplex information is fed to the DC amplifier and thence to the modulator.

Collins has taken a different approach in the design of its A830-2 exciter (Fig. 5). Speaking of the *baseband* signal (composite stereo plus SCA), Collins states that the necessary audio response (6 db per octave) to produce FM by the indirect method would require that 50-cps signals be 65.5 db above signals at 75 kc; the wide dynamic range and strict signal-to-noise requirements create difficult amplifier-design problems.

To overcome these problems, Collins utilizes a circuit involving both vacuum tubes and transistors. Referring to the diagram, the baseband signal is fed into and amplified by Q607 and Q608, then applied to a voltage-sensitive capacitor in the base of Q601, the FM oscillator. Thus the baseband input signals cause frequency modulation. The FM signal, at approximately 14 mc, is passed through two limiters to Q604, a driver stage. One output of Q604 goes to a modulator discriminator which converts the FM signal to an AM signal, which is then detected. The resulting audio is fed to the baseband input, closing a feedback loop which suppresses distortion from the FM oscillator, as well as gain and phase variations.

The other output of driver Q604 goes to Q606 and then to balanced mixer V427. V427 also receives a signal from V426A, the VHF oscillator, through buffer V426B. This oscillator is quite stable and is used to heterodyne the 14-mc signal up to carrier frequency. The mixer output is then limited by V428 and amplified by V429 and V430 to an output level of 10 watts.

Meanwhile, the other output of Q606 is fed, through AFC buffer Q605 for isolation, to a diode switch. The center frequency of the exciter is stabilized by comparing it to the output of temperature-controlled reference oscillator Q512. The comparison is made by alternately switching between the reference oscillator and the FM oscillator. Q508 is a keying generator which produces a square wave of about 5 cps that is fed to multivibra-

Table 1. FM-Transmitter Power Ratings

| | 100 to 500 watts* | 1000 watts | 5000 watts | 10kw | 15kw | 20kw | 40kw |
|---|---|---|---|---|---|---|---|
| AEL | X | X | X | X | | | X |
| Bauer** | | X | X | X | X | X | |
| CCA | X | X | X | X | | X | X |
| Collins | X | X | X | X | | X | |
| Gates | X | X | X | X | | X | |
| RCA | | X | X | X | | X | X |
| Rust/GEL | | X | X | | X | | |
| Standard | X | X | X | X | | X | |
| Visual | X | X | X | X | | X | |

*Power rating is within this range.
**Uses Moseley exciter.

Table 2. Manufacturers and Addresses

**American Electronic Laboratories, Inc.**
P.O. Box 552
Lansdale, Pa. 19446

**Bauer Electronics Corporation**
1663 Industrial Road
San Carlos, Calif.

**CCA Electronics Corp.**
716 Jersey Avenue
Gloucester City, New Jersey

**Collins Radio Company**
Cedar Rapids, Iowa

**Gates Radio Company**
Quincy, Illinois 62302

**Moseley Associates, Inc.**
P.O. Box 3192
Santa Barbara, Calif. 93105

**Radio Corporation of America**
Broadcast and Communications Products
Camden, New Jersey

**Rust Corporation of America**
195 Massachusetts Avenue
Cambridge 39, Mass.

**Standard Electronics Corp.**
Rt. 33 Manalapan Twp.
P.O. Box 677
Freehold, New Jersey

**Visual Electronics**
705 Haverford Road
Bryn Mawr, Pa. 19010

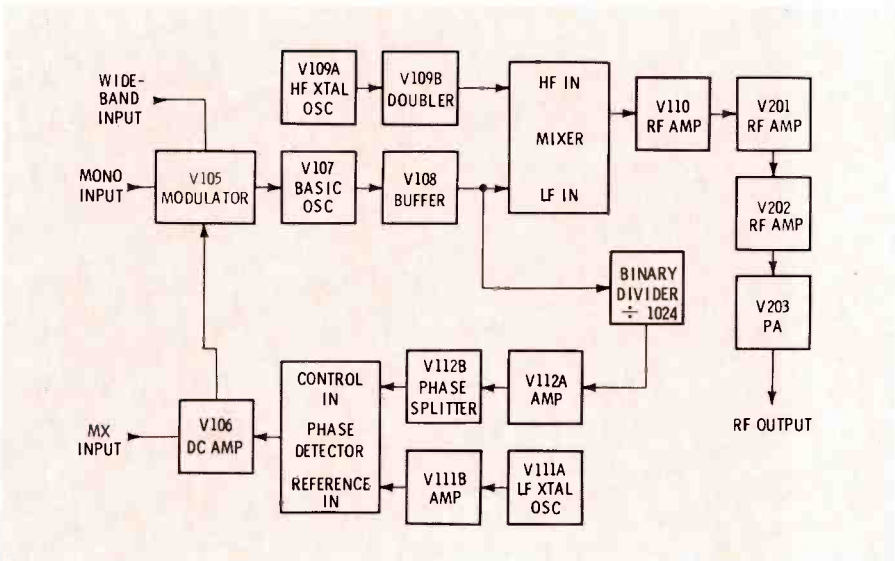



**Fig. 4. Moseley uses this circuit to generate FM signal with stable carrier**

tors Q509-Q510. They feed the diode switch, CR501-CR502. From here, the 5-cps switched signal is limited by Q501 and Q502 and amplified by driver Q503. This error signal is then converted to AM by the AFC discriminator, amplified by error-signal amplifiers Q504-Q507, and then fed to a synchronous detector, where a DC control voltage is produced. This control voltage corrects the FM oscillator for drift. The synchronous detector is synced by keying pulses from the multivibrators.

Application of baseband signal to the FM oscillator causes an amplified error signal to exist through the AFC loop. But Q511, the baseband cancel amplifier, applies an equal amount of baseband signal 180° out of phase through diode switch CR511, keyed by the multivibrators, to the error-signal amplifiers. Hence all trace of baseband modulation is removed from the AFC loop, and only center-frequency errors cause control.

## Complete Transmitters

The power ratings of available transmitters are summarized in Table 1. Exciter-transmitters in the range of 5 to 50 watts have already been covered.

There are more 1-kilowatt transmitters in use in the U.S. today than any other power rating—this applies equally to both AM and FM. Therefore, an extra word or two about such models is in order. Four companies use grounded-grid, zero-bias triodes as their PA stage: AEL and Visual each use a single 3CX1000-A7, Bauer uses a pair of 3-400Z's in push-pull, and CCA uses a single 3-1000Z. A single triode stage has relatively low amplification and thus requires an IPA stage to raise the 10-watt exciter output to the 50 or so watts required to drive the PA input. Of course, the grounded-grid triode requires no neutralization. However, the IPA (usually a 4CX-250A tetrode or similar tube) operates grounded cathode and requires protective bias in case drive from the exciter should fail.

Four manufacturers employ grounded-cathode tetrodes in the PA stage. These require neutralization, but they don't require much grid driving power. Hence there is no IPA stage and the exciter couples directly into the PA. Collins, Gates, and RCA use a single 4CX1000A in very similar circuits. Rust/GEL uses a pair of 4CX300Y's. Standard is the only company using a pentode PA—a single PL-172.

All 1-kw transmitters can be remotely-controlled, all use solid-state rectifiers, and the following have automatic recycling which put the rig back on the air following two or three momentary overloads: AEL, CCA, Gates, and Visual. Bauer is the only company to offer its transmitter in kit form.

Transmitters covered here are: AEL FM-IKA, Bauer 607, CCA FM-1000D, Collins 830D-1A, Gates FM-1G, RCA BTF-1-E, Rust /GEL FMT-1C, Standard Type 940, and Visual FM-1KA. The manufacturers' addresses are listed in Table 2. ▲

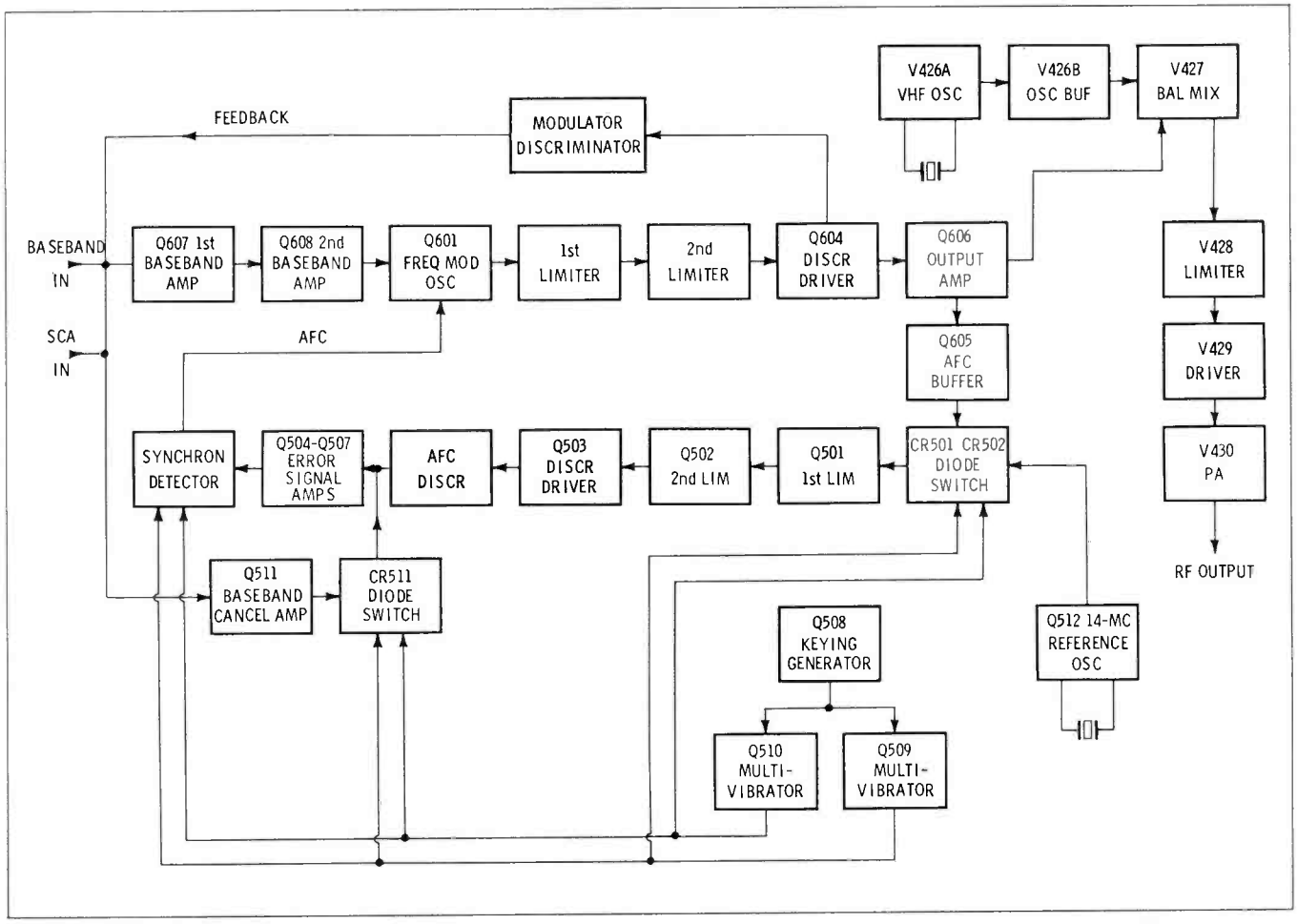
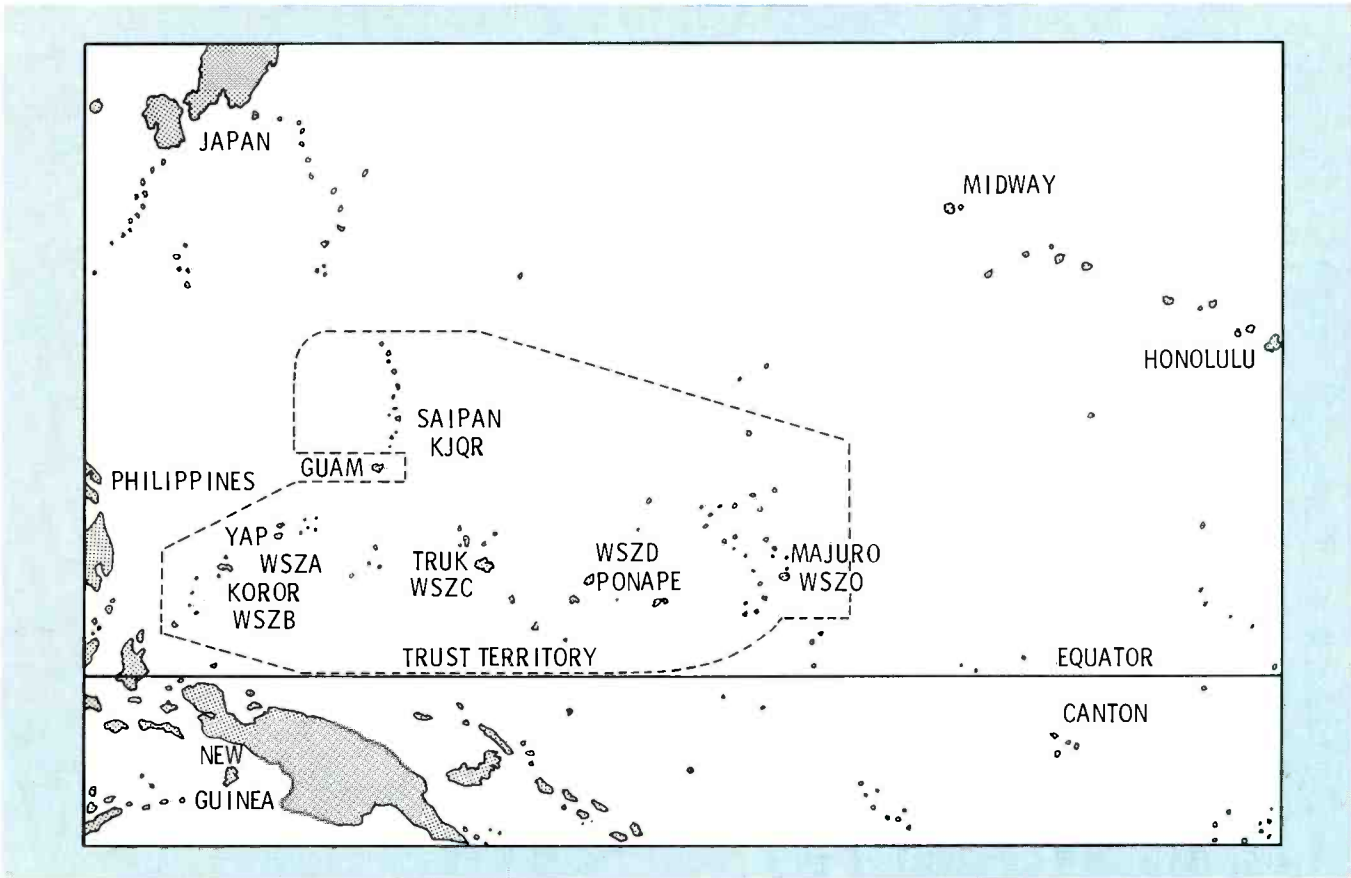



**Fig. 5. Collins exciter combines tube and solid-state circuits to provide wide-band modulation and AFC.**

# RADIO BROADCASTING IN MICRONESIA

***by Janet Grace Go***—A look at radio broadcasting in some of the islands of the Pacific.




Until six years ago, the only waves lapping the shores of Micronesia were Pacific Ocean waves. Today, radio waves fill the air and help reduce the 3,000,000 square miles of the Trust Territory of the Pacific Islands, administered by the United States under the United Nations trusteeship system.

The Trust Territory is divided into six districts sprawling 2700 miles from west to east and 1300 miles north to south, extending to 20° north of the equator. The problems of communication in these 2100 isolated islands and the resulting logistic difficulties (as well as budget restrictions) were gradually overcome by the United States administration.

Communication among the islands and contact with the "outside" world was through a radiotelephone and radiotelegraph system, weekly airplanes, and monthly copra ships. With a short-wave radio, of course, one could tune in to Guam, Japan, or elsewhere. A handful of amateur radio enthusiasts kept in contact with other hams around the world and aided in emergencies such as epidemics, typhoons, or lost fishing craft.

Magellan, in 1519, was the first European to explore this vast Pacific territory of which only 700 square miles are land. About 85,000 Micronesians live on these islands, which have a tropical climate with slight seasonal changes, heavy rainfall, and frequent typhoons. The average daily temperatures range from 70° to 80° F with relative humidity between 77% and 86%.

The Micronesians are people of In-

Table 1. AM Radio Facilities in Micronesia

| Date Operation Commenced | Location | Frequency | Call Letters | Hours of Operation |
|---|---|---|---|---|
| March 1959 | Majuro, Marshall Is. | 1440 | WSZO | 13 hours daily |
| June 1961 | Koror, Palau Islands | 1500 | WSZB | 15 hrs Sun-Fri<br>17 hrs Sat |
| Dec. 1962 | Truk District | 1500 | WSZC | 12 hours daily |
| 1964 | Ponape District | 1450 | WSZD | 6 hrs M-F<br>7- Sat, 8-Sun |
| March 1965 | Saipan, Mariana Is. Dist. | 1350 | KJQR | 12 hours daily |
| June 1965 | Colonia, Yap Dist. | 1480 | WSZA | 10 hrs M-F<br>12½ hrs Sat & Sun |

All stations operate with power of 1000 watts.

donesian-Malayan origin with strains of Mongoloid and Caucasoid. They are of medium stature, brown skin, and straight to wavy hair. Today the Micronesians differ from their ancestors both physically and culturally because of the influence of nations who administered the islands—first Spain, then Germany, Japan and, for the last 20 years, The United States. Excluding Japanese, which is understood by the majority of the older generation today, there are nine major languages in Micronesia, more than one to each district! However, English is now becoming the common language. Radio broadcasting in English is a great step forward in uniting the diverse island people.

At present all six districts have an AM radio broadcasting station, and the biggest selling items at the district trading stores are transistor radios. Micronesians now gather in trading stores, in their thatch or concrete homes, wherever there is a radio, to hear their own district broadcasting station announcing world news, local island news, typhoon warnings, shipping schedules of the copra boats, bargains in the stores of their district centers, social items, educational programs, agricultural advice, English lessons, and music—popular western tunes, Japanese music, and Micronesian songs. Today radio is replacing the monotonous native chants and strum of guitars.

Since these sister stations of Micronesia are non-commercial and government-owned, they are identical in physical and technical features. Located in district centers, the stations are housed in one-story, 24′ × 40′ typhoon-proof buildings with concrete roofs and floors and cement-block side walls. The buildings, air-conditioned to protect the equipment from humidity, heat, and salt spray with resulting rust and mildew, are divided into three sections: control rooms, broadcasting studios, and equipment rooms.

The studios and 1,000-watt transmitters are under the same roof in all locations. All use non-directional towers, and night power is not reduced. Turntables and reel-to-reel tape machines are used to reproduce recorded program material. All equipment is commercially made.

Radio technicians and broadcasting personnel are all Micronesians. They have been trained by the post-war U.S. Navy administration, given on-the-job training with the Trust Territory, or sent to special technical schools.

Brief geographic descriptions of each district and histories of the stations are given below.

The pioneer station, WSZO, is in the Marshall Islands. This district has only 70 square miles of dry land distributed over 29 low-lying coral atolls and five coral islands which support a population of about 17,500. More than 1500 islands are strung out over a strip of Pacific in two parallel chains running some 800 miles northwest from the equator. The Marshall atoll, on which the district center of Majuro is located, is about 25 miles long and less than a mile wide.

Early attempts to operate a broadcasting station by the Marshall Islands Education Department were successful but short-lived. Beginning in 1958 at low power and on 1250 kc, in 1964 WSZO was boosted to 1,000 watts and assigned to a frequency of 1440 kc. The transmitter and other equipment were renovated,

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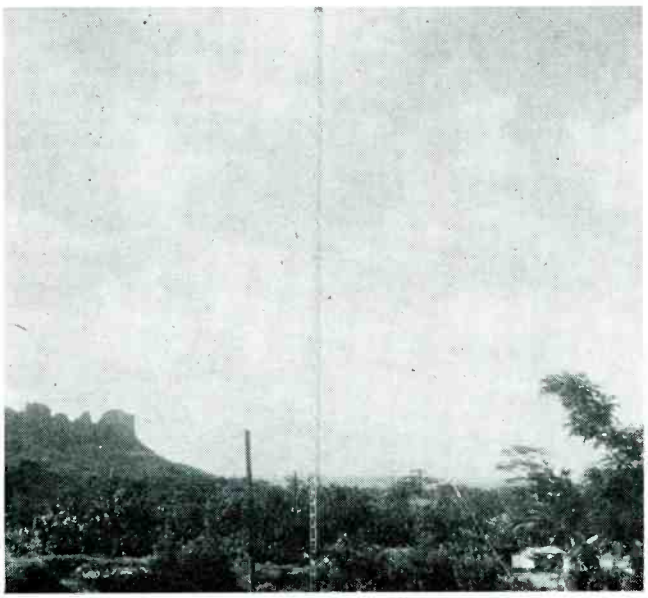
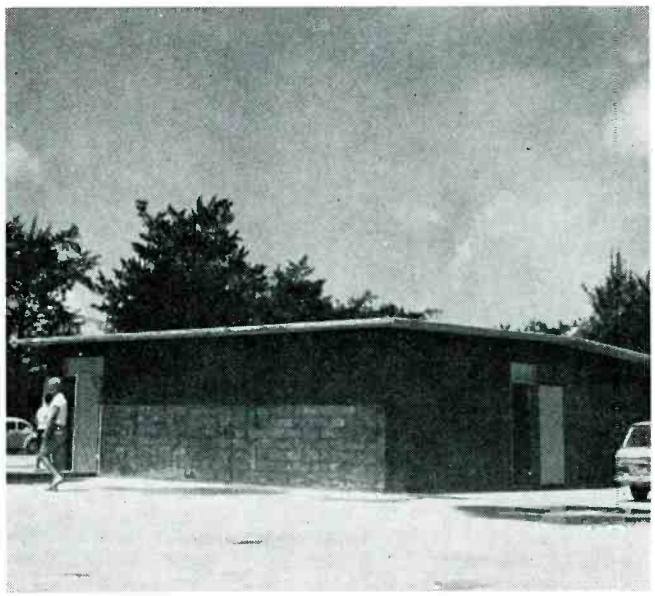


The antenna tower of radio station WSZC on Truk Atoll.



Building at KJQR is typical of Micronesian stations.

# TOWER MARKING AND LIGHTING

*by* ***Elton B. Chick,*** Consulting Author, General Manager, WLOU, Louisville, Ky, and ***Thomas R. Haskett,*** Central Regional Editor

—Part 2. Considerations in planning, constructing, and maintaining broadcast towers.

Last month, the regulations governing the painting and lighting of towers were discussed. This concluding part of the series examines the practical applications of those rules.

Usually the broadcast engineer is concerned with tower lighting and marking only to the extent of meeting and maintaining minimum FCC requirements. Often, the letter of the requirements is not met; more often it is met, but not economically. Money can be saved by careful and proper planning of tower painting and lighting. For example, the cost of tower lamps is only a fraction of the cost of replacing lamps, and long-life lamps can effect a considerable saving.

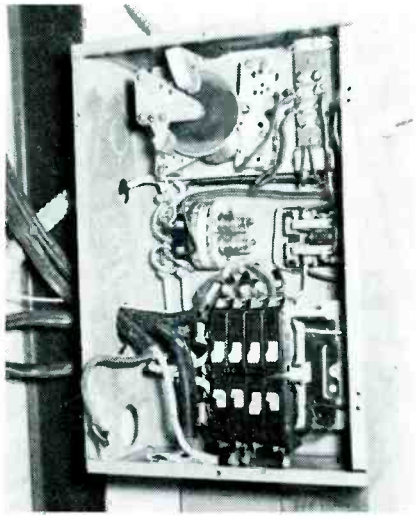


**Fig. 1. Lighting for each tower should have a separate circuit and breaker.**

First, consider the planning necessary to produce a low-maintenance-cost installation. Here, the broadcaster may pay more for a better job, but usually will have the money returned in lower maintenance cost.

In most cases, broadcast station licenses and construction permits have tower-lighting specifications set forth in the authorization by use of FCC Form 715. This form covers almost all lighting conditions; the requirements are stated in the license or CP by reference to certain paragraphs of Form 715. These requirements, based on Part 17 of FCC Rules, were adopted by the Commission, and are based on FAA Rules. This fact recalls the basic needs for tower lighting and painting. The FAA Rules are based on the need to mark structures that are hazards to aircraft in flight. Also, it is advantageous to light such structures at night to serve both as hazard warnings and as navigational aids. Except for these considerations, the only reasons for painting and lighting would be for preservation and appearance.

The new installation offers the best opportunity to effect a reduction in maintenance cost because most factors can be controlled. New towers are often purchased by contract that includes a lighting kit and erection. Often this lighting kit may have no description other than "Lighting Kit, Type A1, A2, A3, etc." These type numbers are based on FAA requirements and give no description of the quality of material to be used. Therefore, the station engineer should require greater detail or specify the manufacturer and type of equipment, as well as the means of installation. Beacons and other lamp holders are standardized; about the only selection to make is quality of workmanship. From here on, the selection of material is more difficult, there being a number of types of wire, lighting chokes, transformers, photoelectric-cell units, and flasher mechanisms on the market. Also, there is a variety of accessory material available. The wise engineer will contact several manufacturers of tower-lighting equipment to request and carefully study their descriptive

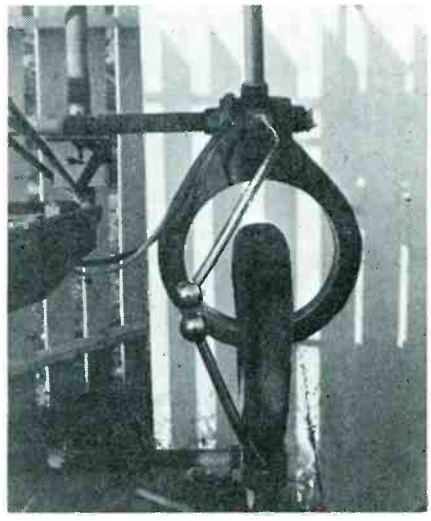


**Fig. 2. Austin transformer transfers AC while maintaining RF isolation.**

literature. In addition to this information, a knowledge of electric wiring codes is necessary. Armed with as much information as possible, the station engineer should then plan his installation and write specifications, remembering that in installing a directional-antenna system, the result of poor judgment is multiplied by the number of towers.

### Tips for Equipment Selection

It is most advantageous to feed the lights for each tower on a separate breaker or disconnect for each (Fig. 1). All lines should terminate at the same point, of course, but with separate feeds, for then a defective tower-lighting system can be isolated to save much needless trouble-shooting.

Whether to use conduit or all-weather wire for tower wiring is a difficult question. There is no doubt that conduit offers maximum protection to conductors, resulting in practically no conductor breakdown; however, it is more expensive than all-weather wire. The protection required is important in determining whether wires are to be buried or supported above ground. Local electrical codes may make buried wiring uneconomical. An ideal arrangement is outside cable buried in watertight pipe. This reduces weather effects and minimizes the possibility of damage, but such an arrangement might be quite expensive.

AM towers which are series-fed (insulated from ground) require that the lighting circuit be broken for RF. The usual method is to use an

**Fig. 3. Alternate isolation method uses series choke, shunt capacitors.**

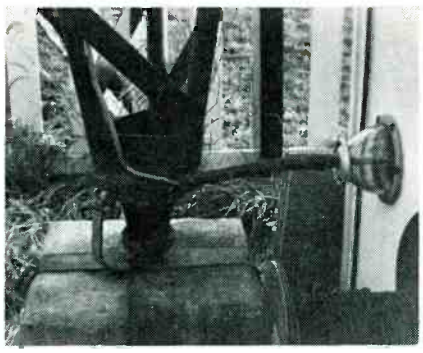


**Fig. 4. Isolated AC line is inside RF conductor extending to tower base.**

Austin transformer (Fig. 2) which will pass the 60-cps lighting current, but present a high impedance to RF. Another method involves a double pi network, with series RF chokes and parallel RF bypass capacitors (Fig. 3). Once the lighting circuit reaches the tower (Fig. 4), the neutral or grounded side of the line must be tied physically to the tower frame for safety.

Vertical lighting-conductor runs up the side of the tower, if made in conduit, will be supported by bolting the conduit to the tower at junction boxes and by metal straps. However, if all-weather wire, service-entrance cable, or nonmetallic-sheathed cable is used, the usual arrangement is to bind the conductors to the tower with straps designed for the purpose. Standard electrical junction boxes should be used at the beacon, the obstruction lights, the flasher, and at the tower base.

Where a code beacon is required atop a tower, it must flash. There are several mechanisms which interrupt the current fed to the beacon (Fig. 5). A motor-driven switch is most common, but rotating contacts may become pitted and arc, usually becoming defective shortly thereafter. A better device is a mercury switch which is relatively immune to this kind of trouble.

Unless the broadcaster chooses to run his lighting continuously 24 hours a day, a photoelectric cell is usually necessary to energize the system when the north-sky light intensity falls below 35-foot-candles, as required by both FAA and FCC. These devices are available in both vacuum-tube and solid-state versions; they come as a complete kit which is simply mounted on the side of the tower or transmitter building, with the PE window facing north.

The particular lighting fixtures used are specified in FAA and FCC regulations—that is, certain lamps must be employed. The housing used is optional. Some points: Wiring should be enclosed in watertight boxes, but a *breather* should be included at each lamp to prevent moisture accumulation and condensation within the system. This breather prevents rain from entering while allowing air to escape. Some lamp housings are vented near the top, allowing good air circulation, lowering lamp bulb temperature, and thereby prolonging lamp life. The usual beacon construction consists of a glass cylinder split in the middle and opening in two halves. Two bulbs are used, one in each half of the cylinder. Since the beacon is at the very top of the tower, it could be awkward to replace lamps were it not for this construction. Obstruction lights are side mounted and are easier to replace. They can also be hinged, and are available with conduit entrance on either the side or the bottom.

To protect the beacon from lightning, it is recommended that a lightning-rod assembly be installed atop the tower. The rod extends several feet above the glass beacon housing, and in most cases lightning discharges will follow the rod and not damage the beacon.

The actual types of lamps chosen will depend on user preference, within the limits of FAA-FCC rules. It is best to purchase long-life lamps. Ap-

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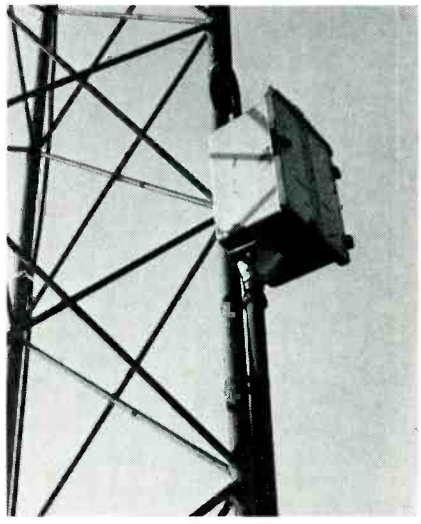

**Fig. 5. The flasher is usually mounted a few feet above the tower base.**

# COLOR IT FAITHFUL

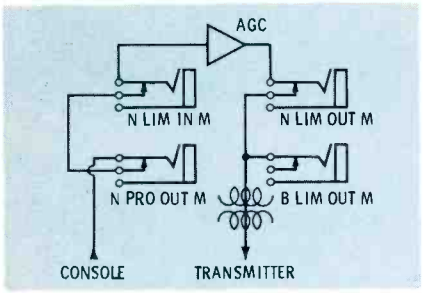


**Fig. 4. Several connections to AGC amplifier are possible through jacks.**

ing diagram of the remote-lines input circuitry of the patch panel. With this wiring, should a remote broadcast be on the air via remote line No. 1, it is still possible to check out a second remote on line No. 2 by several methods. The most obvious is to insert a patch cord into the line-No. 2 jack in the jack field, interrupting the circuit to the No. 2 input of the console and bringing the No. 2 remote line out on the patch cord. Then insert the other end of the patch cord into the jack of any console remote-line input numbered 9 through 12. The second remote can now be cued and auditioned on the new input key.

### Labeling

We made no definite attempt to follow a standard method of labeling but tried to make our labels understandable to the nontechnical persons who use the patch panel. Because of limited space on a jack strip, key letters and abbreviations were used, as follows:

A jack connected to a circuit normally continuing through the field but which is interrupted and and brought out on the patch cord when it is inserted is labeled N for "normalling."

The jack of any circuit that either continues through the field or is dead-ended on the jack and will not be interrupted by the insertion of a patch cord is labeled B for "bridging," although there may or may not be a bridging pad included. Every jack in use in our patch panel has a label including either a B or an N.

Also on the label is an indication, sometimes abbreviated, of the circuit to which the jack is connected; — KEY 8 — and — LIN 5 — are examples.

Should a jack be connected to an input or an output, an entry is made indicating to which the jack is connected; IN indicates input; OUT indicates output. Should the jack be connected to a circuit that can operate either way, this entry is simply omitted.

Finally, the label shows the impedance of the circuit to which the jack is connected. M is for 500-600 ohms (medium) and "8," for 8-ohm loudspeakers and amplifier outputs. There are no high-impedance jacks.

For example, B LIN 5 M means remote line No. 5 is connected to this particular jack; the circuit will not be interrupted by inserting a patch cord; the line is near 600-ohms impedance; and it can either be fed with a signal or transmit one.

N MGR IN 8 is a jack through which the speaker in the manager's office is normalled to the on-the-air monitor amplifier-receiver. When a patch cord is inserted into the jack, the speaker is lifted from the monitor-amplifier feed. The other end of the patch cord must then be inserted into a feed from another amplifier of near 8-ohms impedance to reactivate the speaker.

### Console Outputs

Our console program-amplifier output is normalled through the jack field (Fig. 4). This makes it possible to reroute console program if necessary. The output is wired first to a normalling jack, N PRO OUT M, then through another jack, N LIM IN M, to the input of our AGC amplifier.

Insertion of a patch cord into the N PRO OUT M jack lifts the console program feed from the AGC amplifier and reroutes it to where the other end of the patch cord is inserted. Inserting a patch cord into N LIM IN M lifts the console program feed from the AGC amplifier, but the input of the AGC amplifier is brought out on the patch cord. Anything fed into this patch cord will go through the amplifier to the transmitter. This feature is utilized when there is need to perform maintenance on the console during regular broadcast hours. Our remote turntables can be fed into this jack; or, should a remote broadcast be in progress, it can be routed around the console during maintenance or when performance measurements are made. A patch cord can be inserted into N PRO OUT M and loaded with an appropriate resistor, then connected to the desired test instrument. An audio oscillator can be connected to the AGC amplifier through N LIM IN M and its characteristics checked.

There are two jacks following the limiting amplifier. One of these, N LIM OUT M, lifts the amplifier output from the program loop to the transmitter. The other, B LIM OUT M, simply bridges the AGC amplifier output. Distortion measurements, for example, can be made from the first of these jacks. The second (bridging) jack is used almost daily

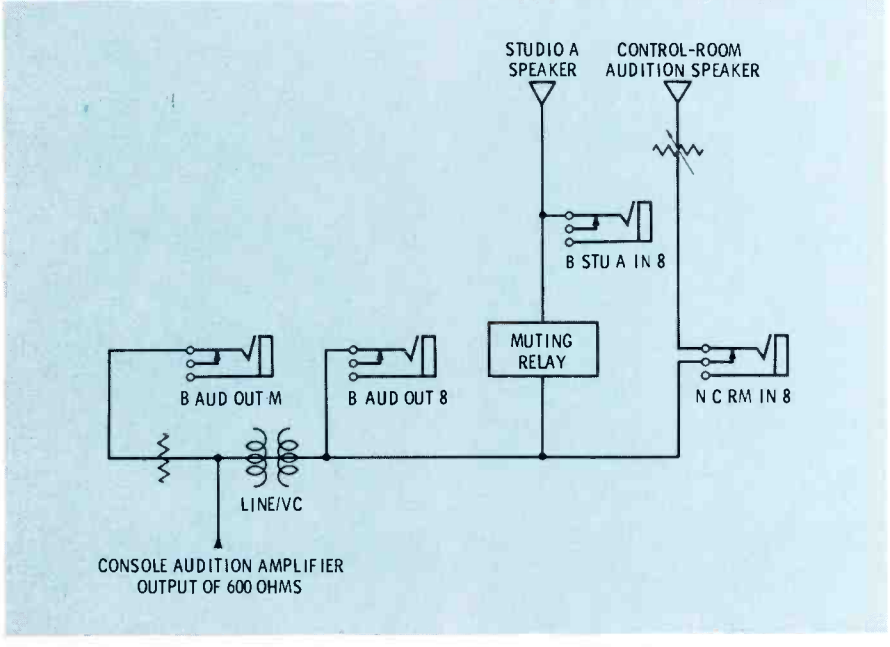


**Fig. 5. Simplified circuit of console audition amplifier jacks in patch panel.**

to record a program or an announcement as it is being aired.

Our console has a built-in 8-watt monitoring (audition) amplifier, and we brought two leads from its output to bridging-type jacks (Fig. 5). One jack, B AUD OUT M, is a padded-down access to the amplifier's 600-ohm output used for many purposes such as making recorded commercials, playing spots into the telephone line for a sponsor, making response and distortion measurements, and feeding the program chain should the program amplifier fail. The other jack, B AUD OUT 8, is an 8-ohm power feed which can be patched into any of the 8-ohm loudspeakers in the station.

### Recorder and Tuner Terminations

Our two recorders used primarily for playing on the air are normalled through the patch panel to two console inputs for remote lines No. 8 and No. 10 (Fig. 6). Thus the system operates without patching in any cords. These two switch positions (No. 8 and No. 10) are symmetrically located on the console and are associated with two separate channels in the console, allowing playing of the machines in sequence without the necessity of throwing switches. Two access jacks, one for each recorder output (N 101 OUT and N 102 OUT M) allow the recorder feeds to be lifted from the console inputs and routed elsewhere if desired.

The output for the recorder used for transferring spots is terminated in a bridging-type jack, B PT6 OUT M, and must be patched into the input it feeds.

All recorder inputs are brought out to simple bridging-type jacks and must be patched to record. With our Magnecord PT-6 recorder, we included a repeat coil between its input and the input jack, then rewired its line input to feed into the microphone input via a pad to avoid loading its playback circuitry by a patch cord left in the input jack.

The AM-FM tuner output is brought out to a bridging-type termination and must be patched into a console input in order to audition or rebroadcast. It may, of course, be patched into many other jacks for specific purposes such as feeding another station via remote line or recording another station.

### Loudspeakers

The patch panel was designed to supply certain loudspeakers in the building with a feed other than from the on-the-air monitor amplifier-receiver. To accomplish this, we brought all loudspeaker leads to the patch panel and normalled all office speakers to the on-the-air amplifier output (Fig. 7). Each speaker has an access jack, and any amplifier output of near 8-ohms impedance can be patched to any particular speaker in lieu of the aired signal. We used 8-ohm impedance instead of 500 ohms to avoid confusion among nontechnical persons operating the panel.

Studio A speaker (Fig. 5) is fed continuously from the audition amplifier of the console and has a bridging jack by which another audio signal can be added via patch cord, although the speaker remains connected to the audition amplifier. Sufficient isolation is provided so that both feeds can be had with acceptable fidelity. We make use of this arrangement whenever someone "on mic" in the studio is fed with an off-the-air program and receives cues from the announcer as well.

The control-room audition speaker is normalled through the patch panel to the audition amplifier and can be lifted from the amplifier and supplied with another feed via its jack (Fig. 5).

The newsroom speaker is normalled to the air-monitor amplifier and can be fed with any other signal in lieu of the air signal via jack N NEWS IN 8. This assists the news editor in receiving an important story on the wire and listening to developments via another station.

There are four 8-ohm sources of audio power available at jacks in the patch panel. These are one tape recorder, the console audition ampli-

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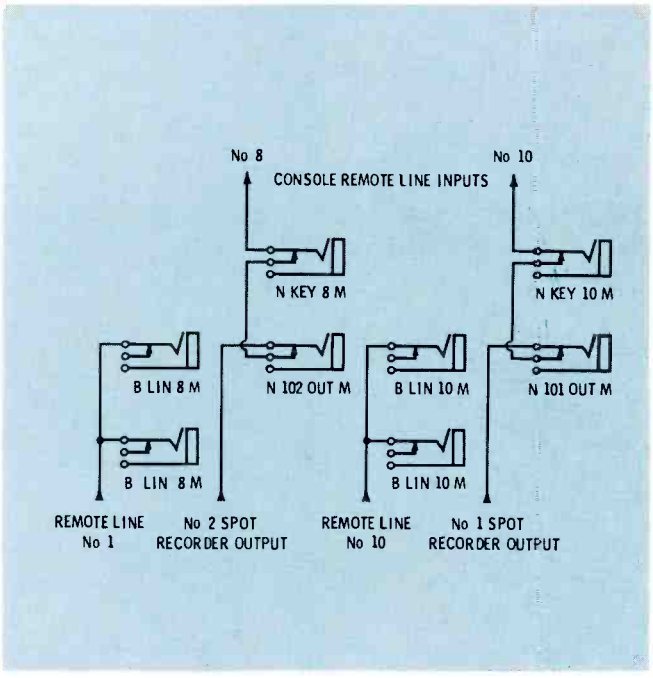



Fig. 6. Circuits for spot recorders, lines No. 8 and 10.

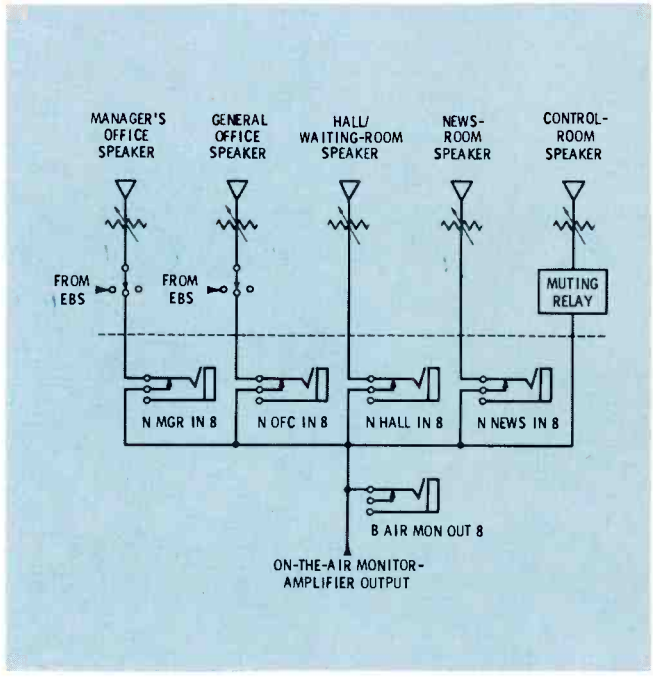



Fig. 7. Panel circuits for on-the-air amplifier, speakers.

# EQUIPPING THE IDEAL MAINTENANCE SHOP

***by Paul Norman***—These hints can help you make your shop more nearly ideal.

To keep a broadcast station in operation, maintenance of operating equipment is necessary. At a small radio station, there may be only a single engineer who performs maintenance, while at a large TV station there may be an entire department. In each case, however, proper facilities are a must before the work can be done well.

### Facilities

Much of the equipment used at broadcast stations can be, and usually is, taken to a maintenance shop for work. The shop must have a bench consisting of a work table with shelves behind it. The work table must be high enough that a technician can work on a piece of gear while standing without having to bend over uncomfortably. A high stool is often used to relieve the fatigue of constant standing. There should be sufficient shelves to hold test equipment and spare parts. The bench and shop area must be well lighted to avoid eyestrain, and there should be enough room on the bench to service the largest piece of equipment you expect to troubleshoot. The shop should be roomy enough to prevent congestion and work inefficiency.

AC service and breaker boxes to the bench and other facilities in the shop should be provided, and there should be a master switch to kill the entire bench in case of accident, and at the end of the work day. Depending on your particular application, it is advisable to run in antenna lines, RF feeds, audio and/or video lines, etc., to obtain test signals easily.

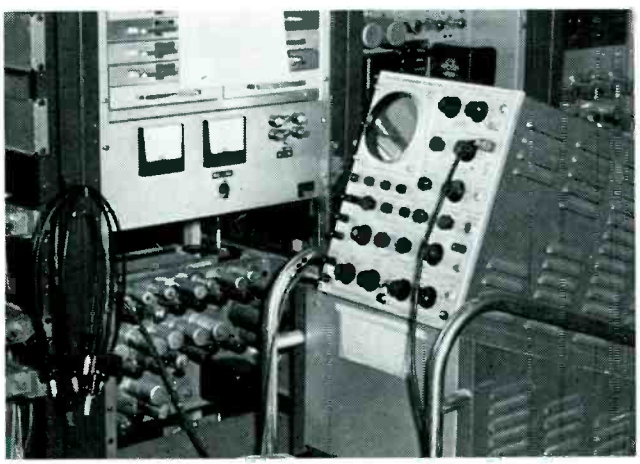
The maintenance shop can be, and often is, a part of the transmitter room. This is all right, but sometimes the high ambient RF field makes it difficult to troubleshoot sensitive amplifiers. Of course, the shop should never be located next to a studio or control room where live microphones are in use, for the maintenance engineer must be able to make a lot of noise without disturbing anyone.

### Tools

It is difficult to recommend basic tools, for each man has his preferences. Perhaps this list, a compromise, will do for a start. It's possible to get by with much less, and if your budget is limited, perhaps you must. But we are speaking of the *ideal* maintenance shop.

#### *Pliers*

Long-nose, needle-nose, gas, lineman's, duckbill, *Channellock, Vise-grip,* and hemostats (seizers). Each has a specific application; one can usually not be used as a substitute for another. For example, nothing



**An oscilloscope is useful in an AM, FM, or TV station.**

**A well stocked tool kit can be taken where it is needed.**


*Our TDA26 High Gain Video Amplifier is designed for use in any application where up to 28 DB gain is required.*

It's completely transistorized and is generally used at the output of camera branching pads. Three outputs are provided for distribution service. The amplifier circuit is designed to take one input signal of as little as 50 millivolts peak to peak and deliver three isolated output signals of 1 volt or more. A sync mixing feature is included which permits addition of sync from a standard 4 volt source to a non-composite signal within the amplifier.

*We specifically designed our TDA26 High Gain Video Amplifier for use in any application where up to 28 DB gain is required.*

It rack mounts in only 1¾ inches of vertical panel space and will operate reliably for many years without need for replacement of any parts. The unit is completely shielded to prevent radio-frequency interference and all signal connectors are the standard 83 type. The power supply is self-contained and employs full-wave rectification, degenerative feedback and stabilization by the use of a Zener diode.

*If you've got any application where up to 28 DB gain is required, then you need our TDA26 High Gain Video Amplifier. No fooling!*

**$400.00 EACH F.O.B. NASHVILLE**

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Circle Item 11 on Tech Data Card

takes the place of hemostats as heat-sinks for diodes and transistors while soldering them in circuits.

### *Cutters*

Two or three sizes of diagonals, to cut both fine and large wire; end nippers for working on printed circuit boards; tin shears; and a medium-sized, good-quality pair of dressmaker's scissors. An electrician's knife is desirable, and a razor-blade type cutter is very useful for repairing printed circuits.

### *Screwdrivers*

At least four blade and shank sizes of ordinary flat-blade drivers—one for set-screws, one stubby, one medium sized, and one large sized. At least two sizes of blade for cross-slotted screws. Possibly one each clutch-head and right-angle drive. A set of jeweler's screwdrivers is a must if you have much transistor gear on which to work.

### *Wrenches*

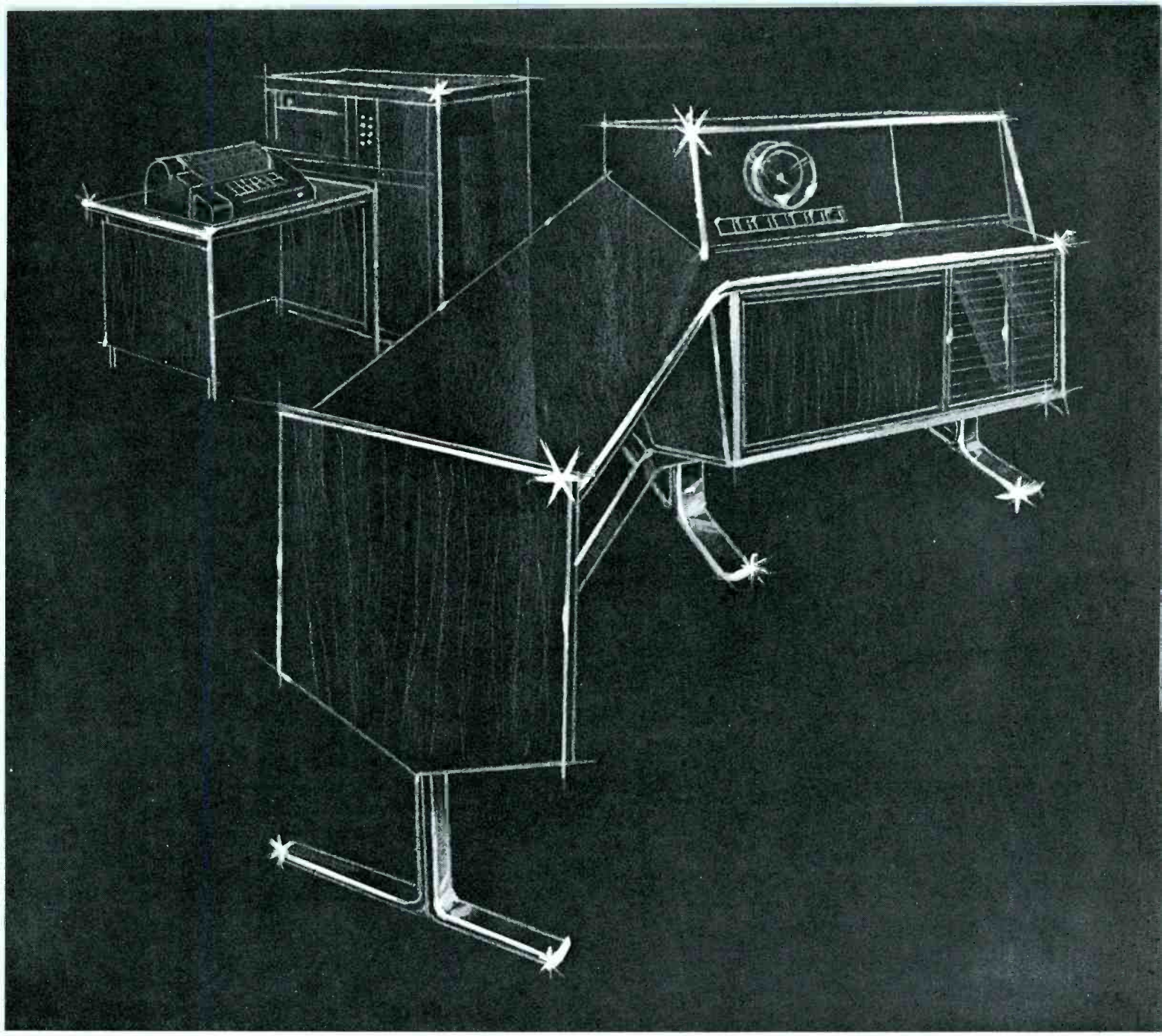
At least a set of nutdrivers from No. 6 to No. 14, although you can buy them from No. 2 to No. 20. The standard six-inch size is good for most work, but you can also buy miniatures (pocket size), stubbies, hollow-shaft, long-shaft, and removable-socket types. It's best to duplicate these small sockets with right-angle box or open-end wrenches, because you will often have to turn a nut from a right angle. Larger work requires right-angle wrenches of the open-end, box, ratchet, or swivel type. An adjustable end wrench will handle several sizes of nuts. A special socket wrench is available for panel nuts that are serrated like a dime. You should have a set of hex and spline wrenches.

### *Other Metal-Working Hand Tools*

Wire strippers, scratch awl or pick, taper reamer, tweezers, relay-burn-

Table 1. Test Equipment for Broadcast Stations

| | |
|---|---|
| **Basic** | |
| VOM | Used by AM, FM, and TV stations |
| VTVM | |
| Oscilloscope | |
| Tube Tester | |
| Transistor Tester | |
| Capacitance Bridge | |
| Test Disc Recording | |
| Test Tape Recording | |
| **Audio** | |
| AC VTVM | Usable at AM, FM, and TV stations |
| AF Oscillator or Generator | |
| Harmonic Distortion and Noise Meter | |
| Intermodulation Distortion Meter | |
| Gainset | |
| Detector Box | |
| Flutter Meter | |
| **Video** | |
| Video Sweep Generator (with crystal or variable markers) | TV stations only |
| Stairstep Generator | |
| Square-wave Generator | |
| Sideband Response Analyzer | |
| **RF** | |
| RF Generator | Usable at AM, FM, and TV stations |
| RF Bridge | |
| Communications Receiver | |
| Grid-Dip Meter | |
| Frequency Meter or Counter | |
| Field-Intensity Meter | |
| **Miscellaneous** | |
| Variable Regulated Power Supply | AM, FM, TV |
| Impedance Bridge | |
| Resistor and Capacitor Substitution Boxes | |
| Clamp-on Ammeter | |
| Stereo FM Modulation Monitor | FM only |
| Color Vector Scope | Color TV only |



# we call it TASCOM

Television station managers call it a lifesaver. ■ It's a Traffic-Availabilities-Scheduling Computer. ■ TASCOM ends the costly confusion surrounding traffic, availabilities, and scheduling. ■ With unbelievable speed and accuracy, TASCOM determines your long and short term avails . . . at once. ■ TASCOM verifies time sales . . . schedules all elements of your broadcast day . . . provides library data on location of tapes, slides or films. ■ TASCOM prints your program log. ■ TASCOM saves money . . . ends confusion. ■ TASCOM pays for itself, probably in 18-24 months, maybe 12 or less in a major market.

**TASCOM is a product of Sarkes Tarzian, Inc., Bloomington, Ind.**

*Symbol of Excellence in Electronics*

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ishing tool, manicurist's sandpaper boards.

### *Soldering Equipment*

For transistor work, a pencil iron. For general-purpose work, a gun from 100 to 200 watts. For larger work, an iron. For really large work, a gas torch. Don't forget solder and possibly solder flux, a soldering aid, and a small wire brush for cleaning lugs.

### *Cleaning Equipment*

A small, horsehair artist's brush is handy for cleaning small assemblies. You can also buy a round paint brush and a foxtail brush to make it easy to clean up wood chips, dust, etc., when working in a control room, office, or the like. Most cleaning is done with a combination vacuum and blower, and the large shop kind—with a good, long AC cord on it—is the best. This is absolutely essential to every broadcast installation, for you must remove the dust from the equipment often. You should also have an assortment of chemicals: contact cleaner, alcohol (not carbon tetrachloride; it's poisonous), Freon TF, light machine oil, and a couple of sizes of oil cans, as well as a hypodermic-syringe type of oiler for small equipment. Small cotton swabs and pipe cleaners are useful for applying cleaning solutions in cramped quarters.

### *Heavy Equipment*

Since most stations do some construction of chassis and some modification of studios, the following items are useful for such purposes: Electric drill, ½" for large jobs, ⅜" or ¼" for chassis work. Drill bits should be high-speed type, with the carbide-tipped variety for concrete and masonry drilling. Useful accessories for the drill are rubber, sandpaper, and lambswool buffing wheels, grinding wheel, and wire-brush attachments. You should also have a countersink bit and a center punch for locating starting holes.

A saber saw is very handy for minor construction work. Preferably get high-speed hollow-ground blades for wood and veneer, and hacksaw blades for metal. A hand hacksaw is also useful. You will need a 25 or 50' AC extension for the drill and the saber saw; it should be a three-wire (grounding-conductor) type for safety.

### *Miscellaneous Items*

A knob puller, a nut starter, an assortment of alignment tools and wrenches, several tube pullers of both the bulb and forceps type, a pin straightener for miniature tubes, a dental mirror for looking into inaccessible places, hookup wire, plastic tape, masking tape, several flashlights, a tape-recorder head demagnetizer, some extra AC cube taps, a first-aid kit, lots of jumpers or clip leads with insulated hoods over the clips, extension cables of all kinds to match your particular connectors, and an assortment of cements — epoxy, plastic, corona dope, etc.

You will probably want assortments of the following: wood and metal files, C-clamps, chassis punches, a carpenter's saw, a claw hammer, a ball-peen hammer, a T-square or carpenter's square, a level, and a 12' steel tape. If you can afford it and have use for it, you may want a bench vise, a grinder, or a drill press.

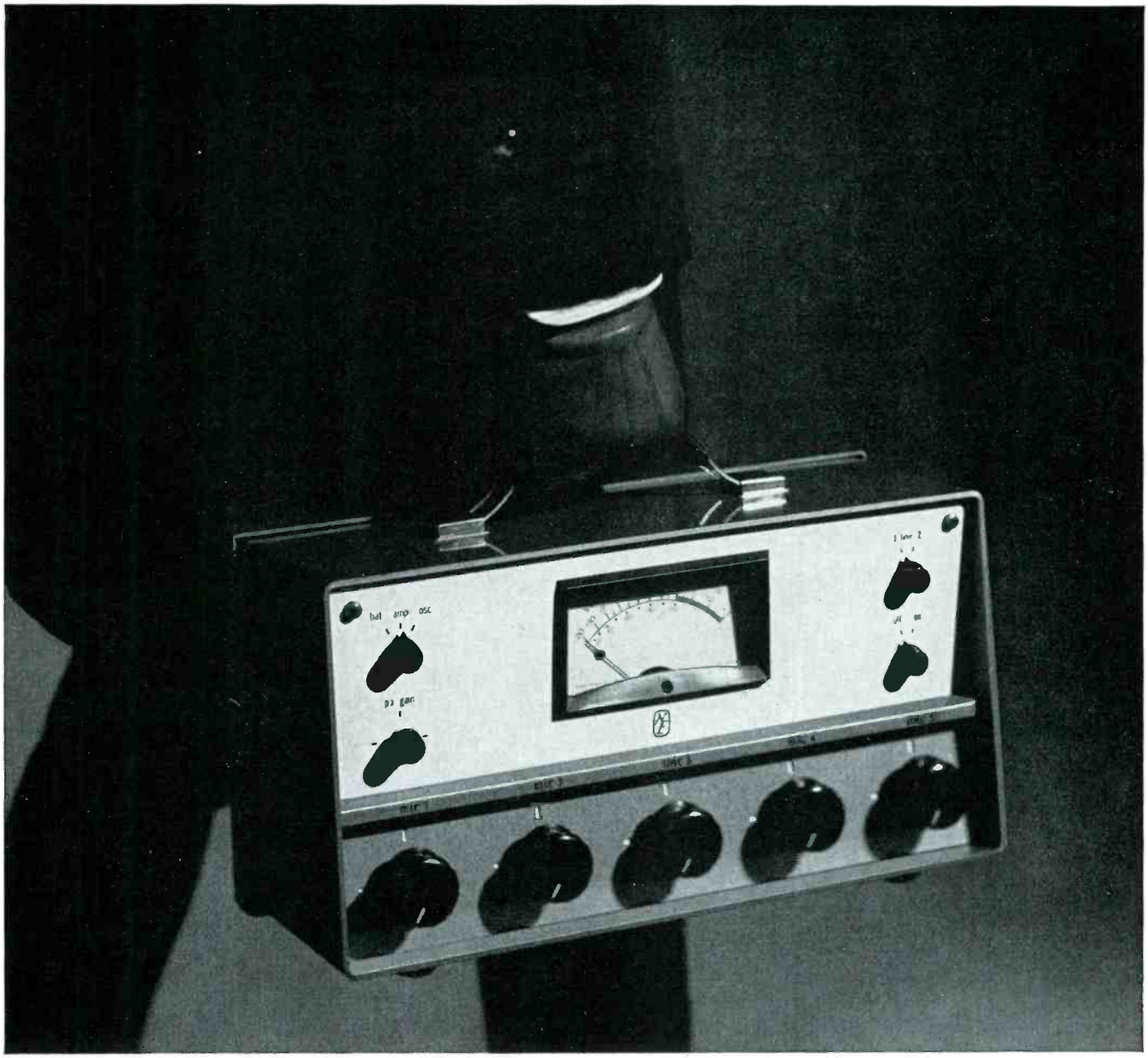
If you do much chassis construction, you may want a metal-bending brake and shear to custom build your own panels. A label-maker is almost a must for tagging nearly everything.

## Equipment

Table 1 is broken down into categories by use. "Basic" items are those you must have, whether your station is AM, FM, or TV. The type of scope obtained depends on your use—a relatively inexpensive one will do for audio and AM, while TV requires a wide-bandwidth scope. The tube tester should be of the transconductance type, but the transistor tester may be quite simple.

The "audio" category contains items that are useful and desirable but not absolutely necessary. You can forget about the AC VTVM if you have either an H.D. or I.M. Meter, for these instruments contain an AC VTVM. If you intend to use the AF generator to calibrate FM or TV-aural modulation monitors by using Bessel functions, get a generator with continuously variable frequency, rather than one with switch-selected frequency. The detector box

• *Please turn to page 64*



# Take me out to the ball game

And if you want to know the name of the game, it's called PROFIT. This solid state portable audio broadcast console lets you handle *any* remote with complete equanimity. (You can even run two or more in tandem for complicated multi-mike jobs.) And this is a truly *failsafe* unit: optional rechargeable NiCad batteries float across the AC supply as insurance against local power failure; you have two-line alternative outputs at +18 dbm. Now take off the snap-on front and back covers. You'll find four microphone inputs with XLR connectors; a line level input +18 dbm; built-in 1000 cps test oscillator; PA output with separate gain control; headset monitoring jack; even provision for order wire and telephone handset. With all these solid state features going for you, the price is almost ridiculous. *A mere $680, US funds, FOB Toronto, duty and brokerage included.*

**Northern Electric**
**COMPANY LIMITED**

For specifications, write Dept 9950, Belleville, Ontario, Canada.

1065-3

**Circle Item 15 on Tech Data Card**

## Radio Broadcasting

*(Continued from page 20)*

Control room at KJQR, Saipan, during inaugural broadcast, March 27, 1965.

a building was constructed, and the permanent station commenced broadcasting 13 hours a day. News and music as well as public-health, education, and agricultural programs are broadcast to the distant atolls.

The second operational station was WSZB in the Palau District, which lies in the southwestern corner of the Trust Territory. With the exception of four isolated coral islands and an atoll, the entire land area of the district is contained within the high island archipelago known as Palau Islands, made up of Babelthuap, the largest land mass of the territory, Palau Island, and others. The Palau group includes 200 islands of volcanic and coral limestone composition of which eight are permanently inhabited. The island chain is about 125 miles long and 25 miles wide with a total land area of 185 square miles inhabited by about 10,500 people.

The district center of Koror and WSZB are located on Palau Island. WSZB, like WSZO in Majuro, initially broadcast on 1250 kc in 1961, but the frequency was changed in 1963 to 1500 kc. The station now operates 15 hours a day Sunday through Friday and 17 hours on Saturday. Programs include Palauan folk songs, Japanese music, country and western music, news, and health and educational programs.

The Truk District, located in the geographic center of the Trust Territory, is 5000 miles southwest of San Francisco and 2000 miles east of the Philippines. The district is 300 miles wide and 600 miles long covering a water area of 180,000 square miles. Here are scattered about 100 islands, 40 of which are inhabited by a population of about 24,000. The total land area is only 46 square miles. Truk is a complex atoll surrounded by coral reefs.

Located on Truk Atoll, station WSZC, after two unsuccessful starts, commenced permanent broadcasting in December 1962 as the third link in Radio Micronesia. Operating on an assigned frequency of 1500 kc, WSZC broadcasts 12 hours daily.

In 1964, the fourth addition to the network, WSZD in Ponape District, began operation. Ponape consists of two large volcanic islands of Ponape, the second largest island in the territory, Kusaie, and 8 coral atolls. Kusaie ranks fourth in land area. Kapingamarangi and Nukuoro atolls, far to the south, are included in the Trust Territory, but are classified as Polynesian rather than Micronesian. Ponape has a population of approximately 18,000.

WSZD operates at 1450 kc for six hours daily Monday through Friday, seven hours Saturday, and eight hours Sunday.

The Mariana Islands District in-

# The soundest sound in AM is the new Gates Vanguard II Transmitter

Every listener applauds the superb sound quality produced by Gates Vanguard II because it truly rivals FM transmitters in audio performance.

Typical response is ± 1 db. from 20-16,000 cycles with typical distortion in the range of 1% or less.

Only one power amplifier tube. All other circuitry completely solid state. Fewer components to go wrong. More reliability. And less expensive to maintain. Write for complete information.

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**Vanguard II:**
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cludes 13 single islands and one group of three small islands. The total land surface is approximately 183 square miles with a population of about 11,000. Two-thirds of the area is made up of the principal islands of Saipan, Tinian, and Rota. The Mariana Islands extend in a chain 300 miles long from Farallon de Pajaros in the north to Guam in the south and consist of volcanic peaks and coral limestone terraces.

The fifth AM radio station, KJQR, located on Saipan, opened with a formal ribbon-cutting ceremony March 27, 1965. The studio facilities and antenna are located at Micro Beach, Saipan, where an open-house and a tour of facilities were held. A live interview program was conducted on the opening morning and taped for rebroadcast later that day. High Commissioner of the Trust Territory, M. W. Goding; former Mariana Islands District Administrator, Roy T. Gallemore; and Alan MacQuarrie, former Assistant District Administrator of the Mariana Islands District, participated in the ceremony. Mr. Robert Mangam, Chairman of the Economic Survey Group, Interior Department, Washington, D. C., cut the ribbon to begin operation of the station. Interviewer was John D. Livsey, Jr., former Information Officer of the Trust Territory.

Station KJQR of Saipan broadcasts 12 hours daily on an assigned frequency of 1350 kc.

Last to joint its Micronesian sisters, the toddler WSZA at Yap commenced operations in June 1965. This station operates on a frequency of 1430 kc with 10 hours of broadcasting Monday through Friday and 12½ hours on both Saturday and Sunday.

Yap District includes Yap Island, 9 inhabited atolls, two single island formations, and thousands of miles of water. From Yap proper, where the district center of Colonia and WSZA are located, the inhabited outer islands spread to the east for a distance of about 700 miles to Satawal with a north-south width of 160 miles. Major atoll groups, inhabited by about 6,500 people, are Yap, four islands; Ulithi, 5 islands; and Woleai, 7 islands. Today in Yap one can see men clothed in red and blue *thus* (loincloths) and women wearing grass skirts — with transistor radios in their hands or in bamboo baskets which many Yapese men carry.

With new developments in transoceanic television, perhaps television may soon come to Micronesia. The big problem, as it was in establishing radio broadcasting stations, is how much money the U.S. Congress will appropriate for Micronesia in the future. Or, perhaps a commercial company will investigate trans-Micronesian television.

However, the United States administration, under the Department of the Interior, can well be proud of this great advancement in communication in the Trust Territory. For Micronesia, radio is both a link to the constantly shrinking modern world and a bridge across the miles of Pacific Ocean to island neighbors. ▲

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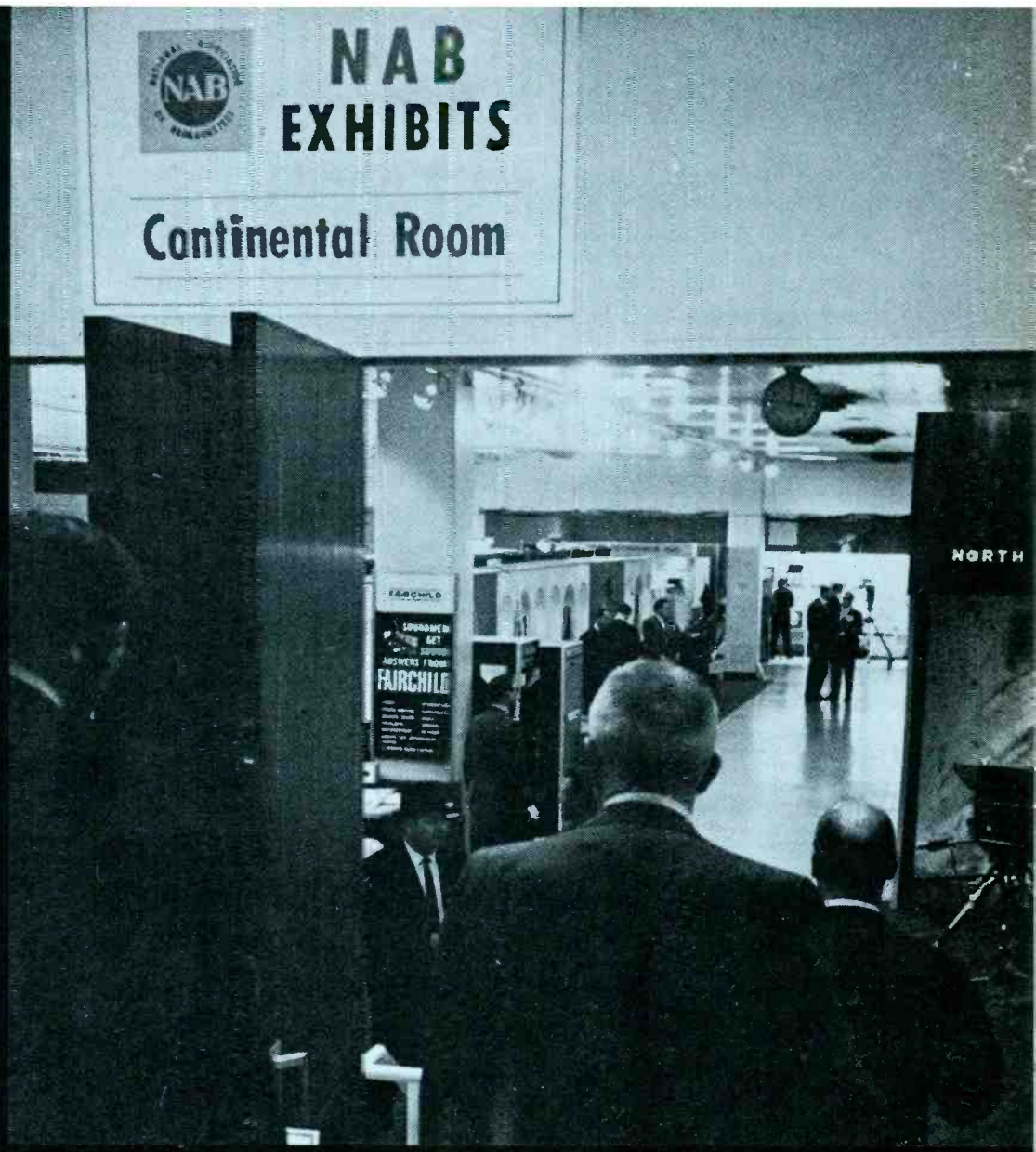
APRIL 1966/75 cents

# Broadcast Engineering

*the technical journal of the broadcast-communications industry*

# 1966 NAB CONVENTION REPORT



# EXHIBIT HIGHLIGHTS

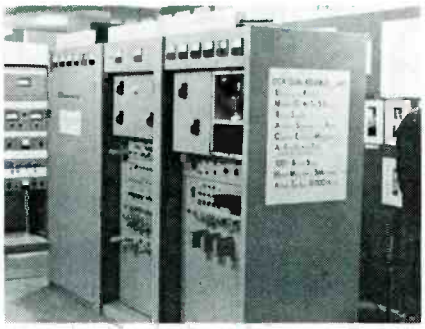
More than 100 equipment manufacturers displayed their products in a record 50,000 square feet of exhibit space in four halls at the Conrad Hilton. This year more than ever, there was something to interest everyone. Although there did not appear to be any new trends of a revolutionary nature, there were refinements in areas that had their beginning at previous NAB Conventions: automation, color TV, video tape recording, use of solid-state devices in equipment, and others. The following paragraphs will take you on a quick tour of the exhibits.

For the first time in many years, new AM field-intensity meters were on display at the Convention. Both Vitro and Wilkinson had completely solid-state models with self-contained monitor amplifiers and speakers, and monitor volume controls which do not affect the accuracy of the reading.

Vitro's FIM-135 is a little smaller and weighs about the same as its predecessor, the 120-E. The designers have used a mirror-scale meter for greater accuracy and dial locks on receiver and oscillator tuning so you don't have to recalibrate either at each measuring location. They've combined the two gain controls into a single ten-turn pot. Because most engineers hold a field meter by the bottom on an upraised hand, the FIM-135 strap is on the *bottom* of the case — a good example of human engineering — so you can hold it in the conventional position with greater security. The receiver local oscillator may be crystal-controlled by plugging in an accessory crystal, and this doesn't destroy the tunable capability of the new meter. The power pack is two mercury cells with an average life of 175 hours. Operation of the new meter is very similar to the operation of the previous one.

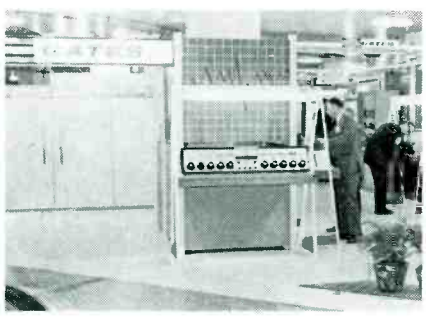
Wilkinson's Type 4N1 uses nickel-cadmium batteries, and the case includes a recharge facility with a power cord which plugs into a 117-volt AC receptacle or a 12-volt DC cigarette-lighter socket. Normally, batteries will function for 12 hours without recharging. An innovation is that the loop antenna is out of the circuit when the calibration oscillator is adjusted, so you don't have to null the signal being measured. This makes it very easy to take close-in readings in high ambient fields.

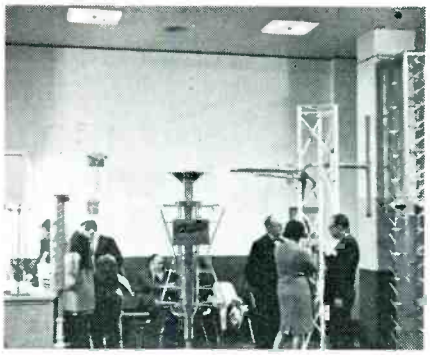
Many companies showed new radio transmitters this year, and it



seems that everyone is now using silicon rectifiers in one form or another. Solid-state exciters and supporting circuits are also appearing in several lines. Gates Radio's one-tube Vanguard (now updated as the Vanguard II) has generated both 5-kw and 50-kw AM transmitters, each of which is solid-state except for four tubes—the two modulators, the RF driver, and the PA. The VP-50 (50 kw) utilizes vapor cooling, which is said to be more efficient than either forced air or water. Collins Radio's Type 820E/F-1, a 10 kw/5 kw transmitter, is also solid-state except for the four modulator, driver, and output tubes.

CCA Electronics has brought out a new design philosophy in AM transmitters. If a station operates with a single transmitter and it fails, the station is off the air. An auxiliary stands idle 98% of the time, representing wasted capital. CCA's *Dual Reliable* line, available from 1 kw to 50 kw, provides standby protection with no idle equipment. In the 1-kw version, for example, there






are two separate exciters and two separate power amplifiers. Each PA is capable of supplying one-half of the rated power, and when properly combined by the integral combining network, the total equals the licensed power. An automatic monitoring circuit watches for distortion or degradation of the transmitter output. If this occurs, or if either exciter or PA should fail, the monitoring circuit shuts down the degraded module and switches to the alternate. The dead PA is switched out of the output circuit, and an alarm is used to alert the operator. He may then couple the dead PA into a dummy load and work on it while the station remains on the air at one-half power. Since all components are used in duplicate, virtually no failure can do worse than reduce the station to half power.

AEL's new 1-kw AM transmitter, the AM-1KA, has a built-in constant-voltage transformer which regulates all supply voltages except the high voltage. It should make for more stable operation. There is a running-time meter (usually found only on high-power rigs), and the PA output is tuned by a vacuum capacitor. Remote control is standard, and no modification of the transmitter is necessary. There's a single push button to initiate all start and stop functions.

A disadvantage of the standard VU meter is that it has a range of only 23 db, and it is necessary to set up a noise meter and switch down-range to measure noise in a circuit or line. The new CBS Laboratories Model 600 wide-range program monitor has a meter whose dial has a 60-db scale (as well as a range switch) which enables program noise and crosstalk measurements to be made faster and more easily. The unit is completely solid-state and has an output for remote monitoring or driving a chart recorder. CBS also showed a new FM Volumax, or automatic peak controller for FM systems where 75-$\mu$sec pre-emphasis is employed. This unit has a frequency-shaping network which permits higher average modulation levels without overmodulation by high-frequency program material.

In the realm of television, this was the year of color sophistication; the engineer who last year wandered from booth to booth to examine the basic differences between color cameras spent this convention determining the finer points of difference. Picture quality (both in black-and-white and in color), ease of set-up, stability, and weight were items of interest. The following is a sample of the items of interest in the exhibit booths.

Sarkes Tarzian showed a color film camera employing 1″ vidicons plus a 1½″ vidicon in the luminance channel. This company also showed a live studio camera (without optics, as they weren't ready at show time), available either with four Plumbicons® or with three 1″ vidicons plus a 3″ image orthicon in the luminance channel. They are promising delivery in the fall of this year.

General Electric showed some four-Plumbicon studio cameras, the new Model PE-250.

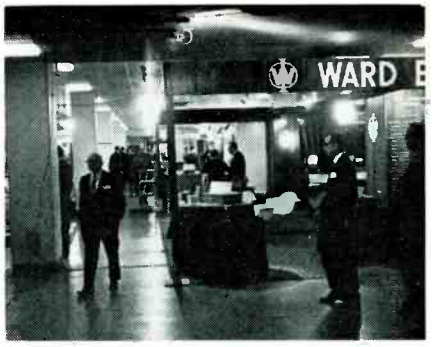
Cohu Electronics displayed the lowest-priced color camera at the show. This three-vidicon camera was offered for fall purchase in either a live version with viewfinder for about $29,000 or a film-head version for $28,500, both prices including encoder.

RCA showed its new color camera featuring one 4½″ image orthicon and three 1″ vidicons.

Marconi showed a new version of its four-Plumbicon camera, promising delivery in about 18 months.

Norelco has added a new feature to its three-Plumbicon camera, an aperture-boost circuit referenced to the green-channel video. This increased the apparent resolution of the system for ranges greater than 6′, increased the edging noise at closer range, and stirred up a controversy between those who want flat-bandwidth pictures and those who say they and their viewers like a picture better if it has a slight edge effect.

Most unique of the color cameras shown was the Japanese-made Shibaden, using two 4½″ image orthicons. One tube is used in the luminance channel; the other, used with a filter vertically striped with narrow bands of red, blue, and green




(80 triplets of stripes), is operated in conjuntcion with a gated switcher as the chrominance pickup. The camera would sell for $50,000 if marketed in the U.S.

In the video tape recorder line, RCA exhibited its new TR-70 high-band master video tape recorder priced at $82,500.

Ampex showed a new upgraded version of its VR 1000 series, the new VR 1200. Priced at about $35,000, the unit features many redesigned electronic assemblies and fills the gap between the VR 1100 and the VR 2000.

Westel, a new company at the show, exhibited a nonoperating model of its Coniscan VTR. The unit features a modification of the helical scan principle to allow use of a single record-playback head. Sync is generated by a built-in EIA sync generator, and thus is not lost when the head crosses a tape edge (which occurs in the vertical interval). The tape transport features five servo-driven motors and careful handling of the tape.

MVR Corporation showed an explained its stop-action video disc recorder. The unit, which records 20-second segments, allows freeze-frame shots of indefinite length. Priced at $10,200, the unit weighs 40 lbs and meets FCC standards.

A new maker of video tape also exhibited. Memorex Corporation showed a complete line of video tape, 1″ and 2″ types for both quadrature and helical-scan equipment.

In the electronics and processing-gear field, Riker Industries showed a "Colorizer" unit. Priced at $1400, the unit is principled on a shift of phase of the 3.58-mc chrominance information relative to the grey-scale values in the input video. Thus each step of a stair-step signal reproduces a different color. The unit was an outgrowth of development on Riker's new encoded color-bar generator, Model 5618. This unit, priced at $1500, creates a full color-bar signal including I and Q signals without the use of an encoder, and should be useful for those people concerned with color adjustment of video tape recorders.

The Grass Valley Group, Inc., showed their Synac (SYNc ACquisition) color sync lock, Model 762. Priced at $1200, the 762 will accept either sync or composite video and deliver adjustable drive, blanking and sync, a phase-adjusted 3.58-mc crystal source phase-locked to the incoming burst, and an adjustable burst flag output.

Telemet exhibited its Model 3209 processor amplifier, which contains a complete EIA sync generator and a sync lock. The unit completely replaces the incoming sync, will replace as many as 100 missing sync pulses per field, offers set-up control, chroma and burst boost, adjustable pulse widths, and white clip for an even $4000.

Dynair Electronics, Inc., offered its new TS-100A sideband analyzer. Priced at $950, the unit features an internally generated sweep signal with built-in markers, and a tuner for channels 2-13.

Finally, two exhibitors at the show may be a sign of some future expansion of exhibitors in the motion-picture industry. Eastman Kodak Company and Arriflex Corp. both had booths, Eastman promoting its new Ektachrome EF Type B 7242 reversal color film for news work, and Arriflex its new model 16-BL self-blimped 16-mm camera with either double or single system, designed for TV news work.

A number of companies exhibited audio and video switching and control systems, automatic programmers, and logic and memory systems varying from single preset systems to memory systems controlled by a master computer which handles everything from orders to billing.

In addition to the exhibits already mentioned, there were displays of antennas, emergency power equipment, CATV equipment, printing and reproducing machines, towers, tubes—even the armed services were represented. Quite literally, one could have spent the entire four days of the Convention in the exhibit halls. And yet, if this year's show is any indication, an even greater array of broadcast hardware can be expected next year—further evidence, if any is needed, of the dynamic nature of the broadcast industry.



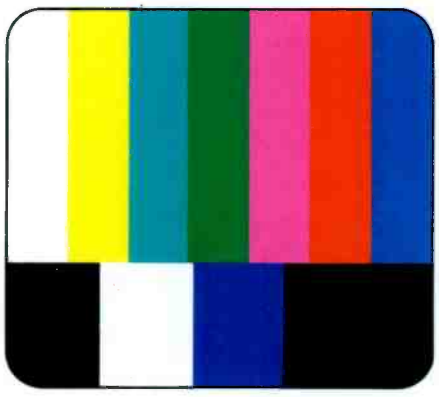
**3M show you new way to get rid of paleface!**

**How?**

# color tape plus!

## New "Scotch" Video Tape No. 399 opens a new dimension in video quality

3M COMPANY



**Livelier, truer colors:** Colors appear brighter, clearer, life-like. Up to 5db better signal-to-noise ratio for multiple generation copies. New oxide, new binder, new coating technique make this possible.

**Stronger black and whites:** Compatible high fidelity resolution with startling presence. Minimal background interference or blur. It's a picture that's truly *alive!*


**Longer life:** Capable of 2,000 passes with no oxide rub-off or increase in dropouts; no visible indication of head to tape contact. Almost impossible to wear out. Virtually unlimited shelf life.

**Cleaner running:** Will not shed, block or rub-off. Leaves no oxide deposit on heads or guides. Assures better results—averages less than 15 dropouts per minute.

**Perfect copies:** Create up to 4th generation duplicates that only the most experienced eye can distinguish from the master tape.

**Improved sound:** Dynamic range is substantially improved across the sound spectrum. Tape background noise is significantly reduced. New No. 399 gives you living sound to match the picture!

**Total versatility:** Can be used for both high-band and low-band recording. Recorders need no special adjustments or set-ups.

**Field proven:** Thoroughly tested and proven in actual broadcasting use by networks, local television stations and production studios.


**"Scotch" Video Tape No. 399**

**color tape plus! adds a new dimension to your programming.**

PRINTED IN U.S.A.


# color tape plus! can put you years ahead in television programming

Find out HOW!!

**Magnetic Products Division** 3M COMPANY

THE TERM "SCOTCH" IS A REGISTERED TRADEMARK OF THE 3M COMPANY

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Please send me more information on new "Scotch" Brand Video Tape No. 399

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# Highlights of the Engineering Sessions

One of the focal points of attention for technical people attending the Convention was, of course, the twentieth annual NAB Engineering Conference. Combined radio-television sessions were held Monday afternoon and Wednesday morning, and separate sessions were held Tuesday morning. The papers were diverse in subject matter and included both product papers and engineering presentations of more general application.

### Monday Radio-TV Session

At the opening session, following introductory remarks by NAB President Vincent T. Wasilewski, Benjamin B. Bauer of CBS Laboratories presented excerpts from a paper titled "Researches in Loudness Measurement." Two points made in the presentation were: 1. There is not now a loudness meter, but research indicates that one is possible. 2. A VU meter does not indicate loudness; it can be as much as 20 to 30 db in error.

The speaker defined two kinds of loudness. The first, sensory loudness, is a physiological phenomenon, the result of the action of the inner ear. The second kind, perceptual loudness, involves psychological effects and depends on the individual listener. (For example, a shouting voice may seem louder because of the sound of "urgency.") The research described in the paper deals with the first kind of loudness.

Requirements for the kinds of test sounds to be measured were listed; a random sound as opposed to a tone is needed. The presentation included a block diagram of a hypothetical noise meter. The remaining key problem is the development of a meter movement having the proper ballistic characteristics.

A practical solution to the problem of measuring loudness is not yet at hand, but the speaker was confident that research will find such a solution, and that an ultimate possibility is automatic control of loudness.

Clyde M. Hunt, Chairman of the NAB Engineering Advisory Committee, gave a report on the Committee's activities for the year. On the subject of the FCC's commercial-loudness policy statement, he said that an NAB Loudness Subcommittee is developing guidelines for licensees. The Subcommittee has also investigated measuring and controlling loudness. Mr. Hunt stated that the problem will require an intensive engineering effort and cooperation on the part of everyone concerned. He said he hoped for a solution before the next Engineering Conference.

Mr. Hunt next listed NAB's efforts in seeking FCC authority for remote control of VHF television transmitters. He said the record in this proceeding would close April 1, and the Committee hopes for a favorable decision.

On other subjects, Mr. Hunt reported that NAB's position on sharing of TV frequencies with other services is that such sharing is not feasible and would result in destructive interference. He said that NAB supports the concept of antenna farms, but it opposes FAA veto power over the location of such farms. He reported that the engineering-management seminar held at Purdue University last fall was booked to capacity far in advance. The seminar, a solely nontechnical meeting intended to teach engineers about management, will be repeated in November, 1966.

Following the EAC report, the EBS and its importance to the nation were the subject of a panel discussion. Members of the panel, moderated by Clure H. Owen, of ABC, New York, were: Arthur F. Barriault, National Industry Advisory Committee, Washington, D.C.; Joseph F. Keating, MBS, New York; Thomas O'Brien, ABC, New York; Thomas H. Phelan, NBC, New York; and David M. Vorhes, CBS Radio, New York. The members of the panel described the organization and operation of the EBS at all levels. Mr. Barriault described the monthly system test in which a crew goes on location to a different originating point each month. He also described the preparation of an EBS digest, which is to be distributed to all licensees.

A few of the facts brought out about the EBS are: The President must be able to address the nation from anywhere on five minutes' notice; only the President can activate the EBS; the EBS is not classified information; participation in the EBS does not constitute a violation of the antitrust laws. The EBS panel was attended by a standing-room-only audience.

The Monday session concluded with the presentation of two papers describing products for television. Mr. William H. Butler, general manager of Westel Co., described his company's back-pack video tape recorder and portable camera. The recorder and its companion studio record-playback unit employ the "Coniscan" single-head recording system in which the 1″ tape wraps around a conical mandrel for more than 360° and overlaps itself at the edge. The portable recorder and camera weigh 30 lbs combined. The unit employs silicon solid-state and integrated circuits, and a color module is available.

Final speaker of the day was Dr. Herbert Mangold from Rohde & Schwarz, Munich, Germany. Dr. Mangold described his company's line of test equipment for television systems. Included were a complete TV transmitter test assembly, a video noise meter, a group-delay measuring system, and the Videoskop swept-frequency display unit.

### Tuesday Radio Session

Among the papers given at this session was "Units of Measurement in Equipment Performance," delivered by W. J. Kabrick of Gates Radio Co. In his paper, Mr. Kabrick defined the quantities to be measured in the audio chain of a broadcast station. The units of measurement for these quantities were defined, and methods of measurement were described briefly. The paper was described as a summary of many publications. The presentation was concluded with an announcement that the NAB may establish standards for terms and measurements if there is sufficient interest on the part of engineers.

FCC Commissioner Robert T.

Bartley delivered a few remarks about FM broadcasting. Commissioner Bartley, who has been a supporter of FM broadcasting for more than 30 years, suggested that an important area for future utilization of FM facilities is the transmission of newspapers by facsimile.

An automation panel was moderated by Wilson Raney, Cowles Broadcasting Co., Memphis. Panelists were Ross H. Beville, Broadcast Electronics; James H. Butts, Mullins Broadcasting Co., Denver; Don W. Clark, Continental Electronics Manufacturing Co.; Lee Facto, International Good Music; Eldon Kanago, KICD, Spencer, Iowa; and Allan T. Powley, WMAL AM-FM-TV, Washington, D.C. The panelists were in general agreement that a station must plan for automation in the light of what it intends to accomplish from automating. There must be cooperation between those responsible for programming and engineering before the system is built. Some of the speakers pointed out that immediate sharp cuts in personnel are inadvisable; somebody has to prepare material to put into the automation system. Careful maintenance is required, and a greater-than-average degree of technical skill is required to keep these complex systems functioning.

Mr. Butts, Mr. Kanago, Mr. Facto, and Mr. Powley described the approaches of their stations to automation. Mr. Powley's installation uses a battery of automatic turntables, since it is not economically desirable to dub classical music onto tape. Mr. Facto expressed the conclusion that automation permits greater efficiency of personnel; by relieving them of routine mechanical operations, the machine permits them to channel their efforts more creatively. Mr. Powley summed up the need for qualified technical personnel at an automated station: "Nothing is simple in automation. You'd better have a good maintenance man."

### Tuesday Television Session

Interest of station engineers in the differences between cameras was typified by the television technicial session on Tuesday morning. The first talk was by N. L. Hobson of RCA, who spoke on the "Design Philosophy of Operational and Setup Facilities in TV Cameras." He told of the new color setup procedures developed by RCA for its color cameras because of the demands by broadcasters to eliminate as many qualitative judgements as possible. Mr. Hobson showed slides of several new test signals which are inserted in the camera to speed setup. RCA's general philosophy of setup procedures tends toward adjustments that nullify the differences between two signals.

The CBS Television Network, with a year of experience behind it, sent Richard Streeter and Robert Cobler to recount their experiences with Plumbicon® color cameras. From the CBS evaluation of the color cameras to the present CTN operating policy, they outlined a very realistic attack on the problems of adding color cameras. The camera being considered, a three-Plumbicon version by Norelco, was tested alongside a color camera employing three 3″ image orthicons and a black-and-white camera using a 4½″ image orthicon. They reported that for pictures judged to be qualitatively equal, the three-Plumbicon camera had an approximate one-stop advantage over the three-image-orthicon camera, and an approximate one-stop disadvantage compared to the 4½″ black-and-white camera. Judgments were made using depth-of-field and signal-to-noise ratios as criteria.

Items affecting the decision to buy three-Plumbicon cameras, other than the above picture-quality test, included advertised stability, size, weight, and simplicity of operation.

CBS spent some time experimenting with the cameras in its Television City (Hollywood) studios before bringing them into the New York headquarters. By the time the company was ready to install the New York cameras, it had determined which controls should be remoted to the video operator and which should remain at the camera control position. By remoting only gain and setup to the video operator, and by having this one operator judge and match all cameras using a single color monitor, CBS has obtained what it feels is more than satisfactory between-camera balance.

Streeter and Cobler also mentioned several operational procedures now used with the cameras, including an average studio illumination of 200 to 250 foot-candles, maximum contrast ratios of 30 to 1, policies of warming up the cameras one hour before use, and an average line-up time of one-half hour.

Hugh H. Martin, General Electric Co., detailed the various methods of automatic video-level control in film cameras, from target-voltage correction, to projector-lamp voltage correction, to introduction of various optical attenuators in the light path. He explained the advantages and disadvantages of each method and discussed the method used by General Electric: a neutral-density filter on each projector, servo-controlled by the video signal from the chain.

John R. Whittaker of CBS explained why the quality of color film prints for television may appear to vary. He covered the various printing and reduction methods, showing examples of footage printed by each method.

Frank J. Haney, ABC, New York, gave the color-equipment makers, and broadcasters using four-tube color cameras, something to consider. His organization discovered that the spectral response of the luminance channel may not always match NTSC standards for color (.59 green, .39 red, .11 blue), thus causing the viewed brightness value of all colors to vary from normal. Mr. Haney explained the ABC method of balancing the film chains with white light and filters to meet NTSC standards.

Mr. John M. Waner, Society of Motion Picture and Television Engineers, showed a new SMPTE subjective reference film for color television. Mr. Waner explained the various uses of the film.

Probably the most lively technical panel concerned color cameras. Panelists Dale Buzan, Sarkes Tarzian, Inc.; R. T. Cavanagh, North American Philips Co.; Dr. H. N. Kozanowski, Radio Corporation of America; Norman N. Parker-Smith, Marconi Co., Ltd.; and R. E. Putman, General Electric Co., first expounded the color-design philosophies of their respective companies. Then the session was opened to questions from the floor. The re-

marks of each speaker are summarized as follows:

Mr. Buzan stated that his company can supply a three vidicon plus 3″ image orthicon camera, or a four-Plumbicon camera, weighing 118 lbs. Basically he expressed a position that the company is ready to go in any direction the broadcaster wants.

Mr. Cavanagh said his company sees no reason for a fourth channel and feels its three-Plumbicon camera can exceed the picture quality and operating simplicity of any four-tube model. He mentioned the new aperture boost circuit referenced to the green channel.

Mr. Putman said his company feels that a separate luminance channel improves both the black-and-white and color image, and gives an operational advantage; but he emphasized this is not an excuse for color misregistration and tracking error.

Mr. Parker-Smith stated that his company feels that a four-Plumbicon color camera combines the advantages of matched gamma characteristics of a single tube type with those of a camera offering the added resolution of a single luminance tube.

Dr. Kozanowski said his company feels that the three-IO camera is currently the most reliable color camera available with respect to parts and tube reliability.

Some questions aimed at the panel were:

When will manufacturers standardize camera cable? No agreement could be reached. As with cameras, each had reasons for use of his particular cable.

What is Plumbicon availability? Mr. Cavanagh said current policy is to keep a sufficient replacement stock for units sold before new units are issued. He added that two new plants are under construction, including one in Rhode Island, to supply the demand for Plumbicons.

What is the recommended warm-up time for color cameras? Answers varied from 20 min to 1 hour.

How important are matched tubes? Originally they were very important, but operations experience is currently showing that matching is principally concerned with image-orthicon tubes.

**Wednesday Radio-TV Session**

Radio broadcasters were spectators at a solid block of technical papers on television.

Robert D. Post, NBC, New York, described the operating principles of the KNBC-TV automated switching center, illustrating the paper with slides.

Charles H. Coleman, Ampex Corp., explained the use and operating principles of the Ampex model 1090 automatic velocity compensation, then demonstrated high-band color dubs to the tenth generation.

L. S. Lappin and D. R. Musson of RCA described a TV remote-control system installed at WKBS-TV, channel 48, Philadelphia. The system utilizes two pairs of DC control lines plus an off-air tuner for monitoring.

The final feature of Wednesday's technical session was the now famous FCC Technical Panel, where a number of members of the FCC staff answered questions put to them by the audience. The panel was moderated by Mr. Leslie S. Learned, MBS, New York. The panelists were: Hart S. Cowperthwait, Rules and Standards Division; Otis T. Hansen, Chief, Existing Aural Facilities Branch; Wallace E. Johnson, Assistant Chief, Broadcast Bureau; Harold L. Kassens, Assistant Chief, Broadcast Facilities Division; Harold G. Kelley, Supervisory Engineer, TV Applications Branch; and Curtis B. Plummer, Chief, Field Engineering Bureau.

The questions put to the panel included:

*Question:* With the recent reduction in aural transmitter power, we find our aural power amplifier unnecessary. Is it possible to license this as an auxiliary main transmitter?

*Answer by Mr. Kelly:* This is possible; in fact a number of stations have already applied for such permission.

*Question:* Does this also apply as an alternate main transmitter?

*Answer again by Mr. Kelly:* The major difference between an auxiliary transmitter and an alternate transmitter is that an auxiliary transmitter is intended for use when the main transmitter is inoperative, whereas an alternate transmitter is intended as a regular substitute or alternate for the main transmitter for whatever reason the licensee may wish to use it. The Commission currently requires that an alternate transmitter be submitted to and pass a regular proof of perfomance, whereas an auxiliary transmitter need not pass a proof of performance. Therefore, if your aural amplifier is capable of passing the performance tests required of an alternate transmitter, it could be licensed.

*Question:* What is it necessary to do to a television modulation monitor to avoid a citation for overmodulation?

*Answer by Mr. Kassens:* Read the instruction books; set the flasher as instructed. When the Commission type-approves a monitor, it does so with the understanding that it will be adjusted according to the instructions enclosed.

*Question;* Has the war in Viet Nam, or other demands, increased the shortage of licensed engineers?

*Answer by Mr. Plummer:* Judging by the requests for temporary operation without a licensed engineer, no. The Commission has received fewer such requests this year than in past years.

*Question:* In a recent power failure in the Northeast, a number of daytime stations were requested by local Civil Defense authorities to operate beyond their scheduled sign-off time. Who is to make such decisions, and how?

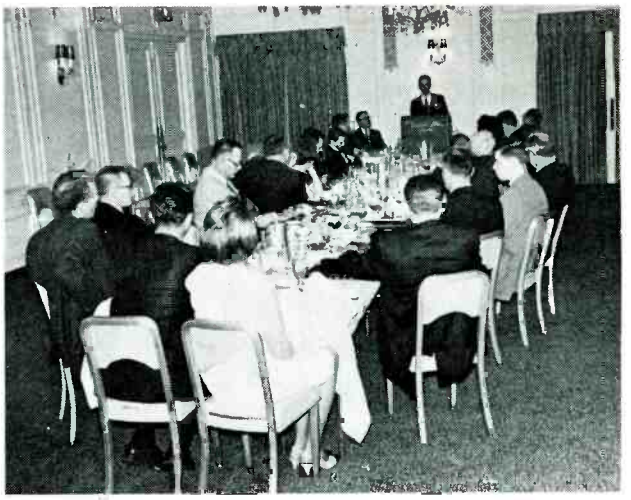
*Answer by Mr. Johnson:* The Commission feels that probably the best judge on the scene is the station's operator. He should judge, taking into consideration whether other local stations are operable. Thus far, the Commission has accepted such operators' judgment as sufficient, and will probably continue to do so. This should be differentiated, though, from an EBS emergency, when only the predesignated stations should be operating.

*Question:* With the current shortage of copper, will the Commission accept grounding of AM towers using aluminum wire?

*Answer:* No. There is presently a station temporarily operating on an aluminum ground system, but it has not been licensed. The Commission does not feel the copper shortage has reached a stage so critical that such measures are needed.

# C-A Dinner

On March 28 the third Annual Consulting Author dinner was held. Attending the dinner, hosted by the Magazine Division of the Howard W. Sams & Co., Inc. were Donald W. Bradley (General Manager), William E. Burke (Editor of BROADCAST ENGINEERING), James M. Moore (Managing Editor of BROADCAST ENGINEERING), Martin Taylor (Editor-in-Chief of RADIO y TELEVISION), and Gene Randolph, George M. Frese, Mr. & Mrs. Robert A. Jones, Mr. & Mrs. Len Spencer, Steven A. Cisler, George C. Sitts, Edward Tong, Philip Whitney, Thomas R. Haskett, Patrick S. Finnegan, Melvon G. Hart, Mr. & Mrs. Howard T. Head, and John J. Walsh. Special guests were Hugh Wallace (Advertising Sales Manager) and Mrs. Wallace, Paul Houston (Central Sales Representative), and Dale Irvin (Representative of Sams Technical Institute).



Short talks outlining the mechanical preparation and scheduling of BROADCAST ENGINEERING were presented by Mr. Burke and Mr. Moore. Mr. Taylor's talk covered the readers and national coverage of RADIO y TELEVISION, a recent acquisition of the Howard W. Sams & Co. The attending authors and their wives were presented with gifts in appreciation of their service to BROADCAST ENGINEERING, and an informative question-and-answer period ended the evening.

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# AWARDS

The 1966 Engineering Achievement Award was presented to Carl J. Meyers, senior vice-president and director of engineering, WGN, Inc., Chicago. The presentation was made at the Wednesday Engineering Conference Luncheon. The full text of the award read: "National Association of Broadcasters Engineering Achievement Award, presented to Carl J. Meyers in recognition of his distinguished professional career, for his outstanding leadership and untiring efforts to the lasting benefit of the industry, for his many contributions to our nation's knowledge in the fields of radio and television, and for his pioneering spirit which has so richly enhanced the forward progress of broadcast engineering. 20th Annual Broadcast Engineering Conference, March 30, 1966, Chicago, Illinois."

At the opening General Assembly on Monday, NAB President Wasilewski presented the Association's 1966 Distinguished Service Award to Sol Taishoff, editor and publisher of *Broadcasting* and *Television* magazines. In his acceptance speech, Mr. Taishoff said if broadcasters are to take advantage of the many opportunities offered through technological advances ". . . the dead hand of government must be lifted from the controls of our communication system." He said broadcasters have allowed government officials to decide that the First Amendment " . . . afforded less protection to broadcasting than to other information media." He also criticized the concept that the airwaves belong to the public. Private venturers, he pointed out, have created the equipment and know-how to move pictures and sound through the air. Broadcasters, Mr. Taishoff said, should mount a "meaningful resistance movement" to turn back neutralizing federal controls.

The NAB Radio Code Award of Merit went to the Oklahoma Broadcasters Association: "For taking the initiative in building support for the Radio Code by conducting a concentrated campaign during which time the Oklahoma Association achieved a substantial majority of its members as Radio Code subscribers. Special recognition is given to Association President Lee Allan Smith for his dedication to the cause of self-regulation and for his personal efforts which assured the success of the campaign." In accepting the award, Mr. Smith said: "The members of OBA believe in the free-enterprise system, and accept the responsibilities that such a system demands in a free and unencumbered society. We believe that only through self-regulation can the principles of a free-enterprise system be maintained and be left free of complete federal control . . . .

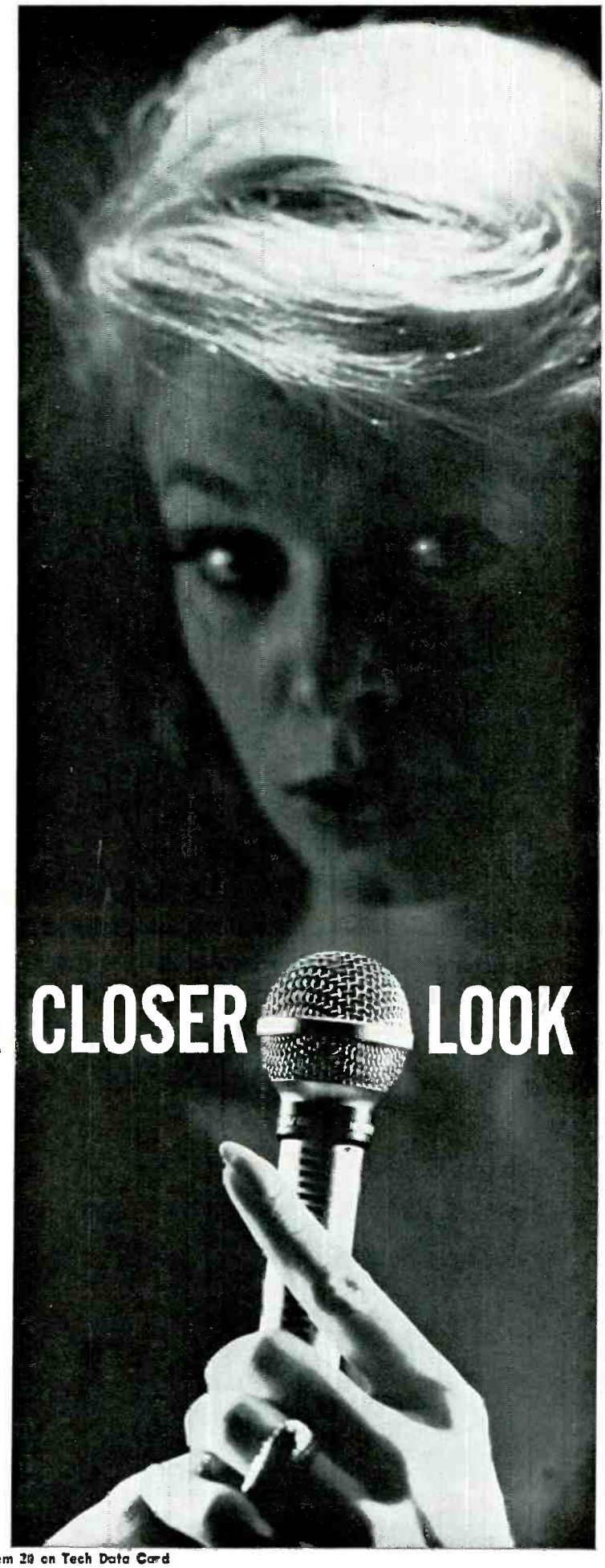
"We further believe that our membership in and our adherence to the principles set forth in the Radio Code of the National Association of Broadcasters is our strongest safeguard against deeper encroachment by governmental agencies.

"We, therefore, pledge to the industry and to those at home whom we serve, our determination to place 'the public interest' first through continued adherence to this self-regulating instrument. And we encourage all broadcasters to support the NAB Code."

Take a real close look. We are proud of this original microphone used by so many top recording artists. Now, like any successful product, *it is being copied in appearance.* However, there are any number of top performance characteristics, *which we doubt can be duplicated,* which will continue to make the **D-24E** first choice of foremost entertainers as well as recording and broadcast engineers.

The **D-24E** boasts a wide and smooth frequency response (an individually plotted frequency curve is supplied with each unit); no popping nor harshness, plus above average cardioid characteristics to guard against feedback.

Write for details or see your local dealer today. He will show you many more advantages.



# COME ON, TAKE A CLOSER LOOK

One step removed, the **D-119ES** provides similar characteristics such as good cardioid and freedom from popping. It may be connected directly to any amplifier — *high or low impedance.* With on-off switch.

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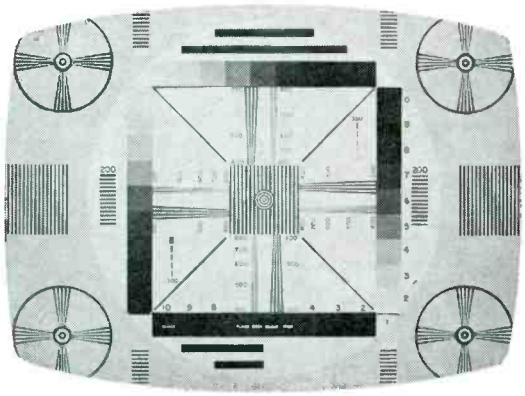

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PRECISION MAGNETIC TAPE

Two important points of superiority you'll find in Memorex video tapes—both of which result in visibly better pictures—are their super-smoothness and their high-conductivity coating. These features result in absence of dropouts, picture clarity, and freedom from static build-up. You'll also get significantly reduced head-wear and a greater number of re-plays—a direct benefit from Memorex's experience in producing premium error-free tapes for computer use.

If you'll write Memorex Corporation at 711 Memorex Park, Santa Clara, California 95052, we will send you video tape specification data and a bibliography of technical information available from the Memorex library of reprints. Also let us know, by letter, if you'd like a free sample reel of Memorex video tape.

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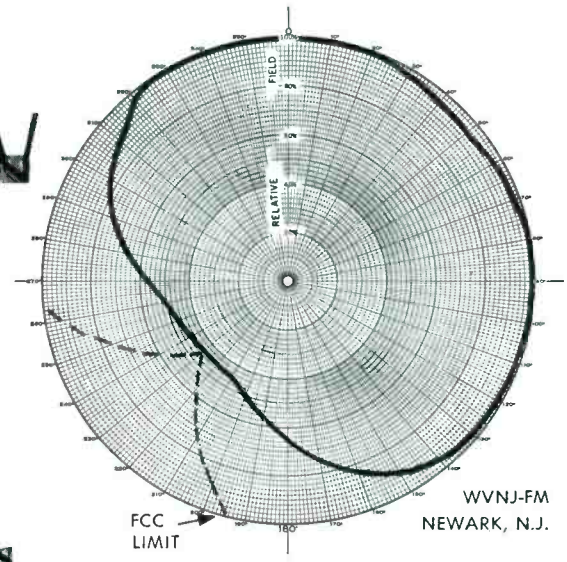
# Directionalized Dual Polarized FM Antennas are PATTERN TESTED prior to shipment

The new Jampro testing range allows our design engineers to erect, test and adjust every antenna to conform to your specific vertical and horizontal pattern requirements before shipment is made.

Since the mounting pole and tower affect the radiated pattern, our engineers can actually duplicate your mounting specifications when adjusting your new directional antenna. We'll even adjust for phasing and spacing of the dual bays, which is often required in tight or multiple null patterns.

**Contact Jampro for newly developed technical information regarding Dual Polarized FM Directional Antenna measurements and performance.**




**ADVANTAGES OF JAMPRO'S NEW DIRECTIONALIZED DUAL POLARIZED FM ANTENNA**

Effective radiated power can be increased and still protect neighboring short spaced stations. The VSWR Bandwidth is not affected and the antenna peak gain is nearly always increased.

# JAMPRO ANTENNA COMPANY

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Circle Item 22 on Tech Data Card

April 1966

We interrupt this magazine to bring you...

# Late Bulletin from Washington

by Howard T. Head

## Commission Assumes Jurisdiction Over All CATV

The Federal Communications Commission has announced its decision to assume jurisdiction over all CATV systems. Previously, its control was limited to those systems employing microwave relays for program feeds, relying on the Commission's unquestioned authority to regulate the issuance of microwave licenses.

Under the new requirements, CATV systems must carry the signals of all stations providing Grade B service to the city served by the system. The CATV system is required to refrain from carrying distant stations when programs duplicate those of a local station, although this requirement is limited to programs appearing on the same day rather than 15 days before and after as previously proposed. Furthermore, nonduplication protection is not required in the case of prime-time network programs carried outside of prime time, or in the case of color programs carried locally only in black-and-white. Private agreements between stations and CATV systems for different degrees of protection will be recognized by the Commission.

CATV applicants in the top 100 markets, as established according to ARB ranking, will not be permitted to bring in outside signals beyond the Grade B contour unless approved through an FCC hearing. Importation of distant signals will be permitted in markets below the top 100, although objections to such carriage will be entertained on a case-to-case basis.

No regulations regarding the origination of programs by CATV systems have been established. The Commission has asked Congress to consider legislation dealing with this point, as well as all other aspects of the relationship between the Commission and CATV regulation.

## Broadcast Licensees Warned on Promotions

Numerous complaints have been received by the Commission concerning contests and promotions by broadcast licensees. As a result, all licensees have been cautioned against conducting promotions and contests which may damage private property, block traffic, or otherwise create disorder. Some of the promotions complained about have included "treasure hunts" resulting in damage to both public and private property, and the broadcasting of "scare" announcements or headlines in such a way as to mislead or frighten the public.

Formal regulations governing contests and promotions of this nature have not been adopted, but Rules on the subject are likely if the complaints continue. Similar regulations are also under consideration as a result of complaints concerning "open-mike" programs, particularly those which are conducted in such a way that the moderator has inadequate control over spontaneous remarks of participants.

## Broadcast Bureau to Levy Fines

Authority has been delegated to the Broadcast Bureau to levy fines up to $250 for violations of the Technical Rules, which are increasing in number. The Commission suspects that some licensees have been deliberately ignoring many of the Technical Regulations in the belief that the violation either was not sufficiently serious to draw a fine, or that the Commission's procedures were so cumbersome that fines were unlikely. Under the new simplified procedures, minor violations may now draw not only a citation, but also a notice of forfeiture (fine) in the same mail.

## Plans for New Radio Treaty with Mexico

At a meeting in the State Department in Washington on March 15, Government officials heard expressions of industry views regarding possible revisions in the treaty between the United States and Mexico governing AM radio broadcasting. The present treaty expires in June of this year, and plans are being made for conferences between the two countries to discuss a new treaty.

Some of the restrictions on U.S. broadcasters considered to be the most onerous are those establishing a 5-kw power limitation on stations on the Mexican clear channels, the prohibition against nighttime operation on these channels with any power, and the restriction of power to 250 watts both day and night for Class IV stations in the U.S. near the Mexican border.

No date has been set for the initial discussions with the Mexican Government. Based on previous experience, however, it appears likely that no new agreement will be reached for some time to come.

## Short Circuits

A West Coast station operating a directional antenna by remote control has been denied permission to read meters at the transmitter within four hours of switching to directional operation rather than within the two-hour period now required by the Rules; however, the Commission left the door open for a petition for change in the Rules...The Instructional Television Fixed Service (ITVFS) Rules governing operation in the 2500-2690 mc band have been changed to reduce from 5 to 4 the number of stations which may be licensed to a single licensee in a given community...The revised table of UHF channel assignments (November 1965 Bulletin) has been issued...The Commission has proposed to permit the use of television microwave STL and intercity relays for other purposes during idle hours; the uses would include relaying audio material, or the telemetering of data related to station operation...New Commission Rules prohibit the use of radio to eavesdrop on private conversations...Part 17 of the Commissions Rules is proposed to be amended to conform with FAA regulations, and to require a certificate from a licensed engineer or surveyor as to the accuracy of geographical coordinates...The Commission has refused to reconsider the recently adopted Rules outlawing "double billing" (December 1965 Bulletin).

Howard T. Head...in Washington

## Tower Marking

*(Continued from page 22)*

proved lamps are available in 100- and 500-watt ratings, as well as 111- and 620-watt ratings. The higher-wattage bulbs produce the same light output as the lower-wattage versions, but last much longer. The additional power used by the higher-wattage bulbs and the slight differences in cost are more than offset by their long life. Some stations use twice the number of lamps required at each level. A current-operated relay is then used to turn on No. 2 if No 1 fails. It is also possible to run both lamps continuously, since it seldom happens that both will fail concurrently.

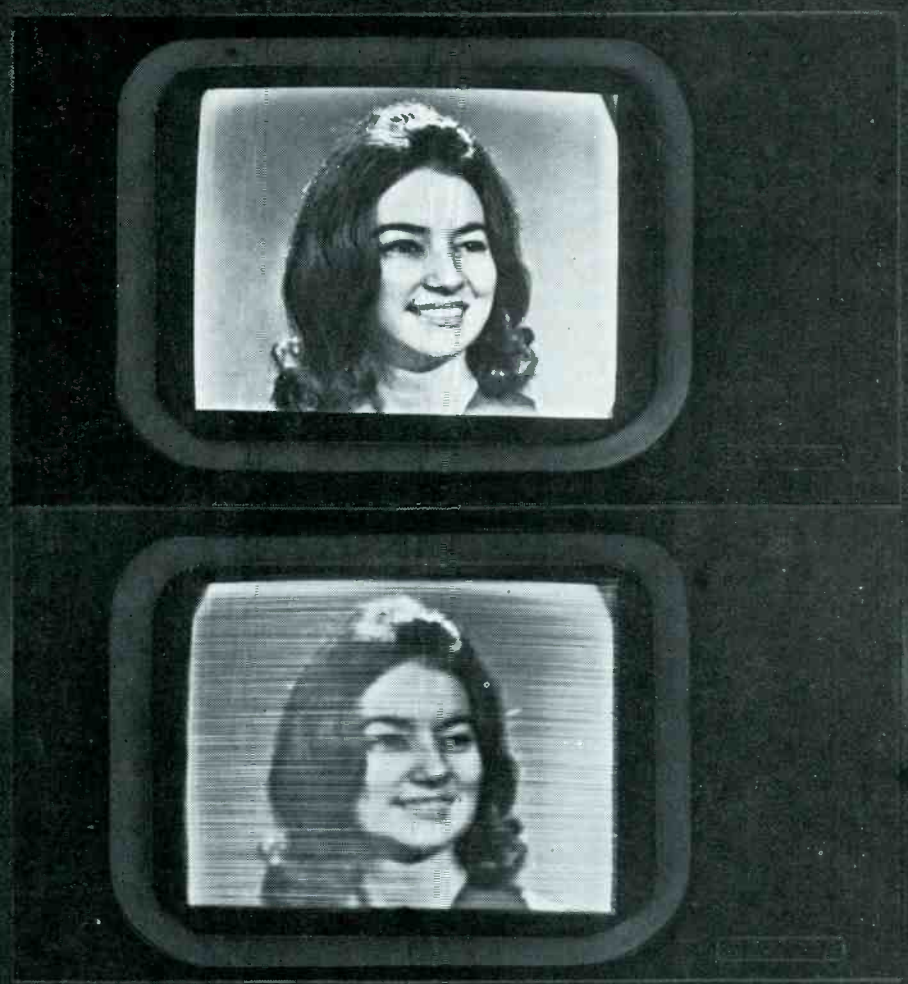
On a short tower (say, under 300′) it is fairly easy to comply with the 3% socket-voltage rule by simply using large conductors. However, on tall towers, conductor size becomes excessive and prohibitively expensive. The problem is solved by using one or more autotransformers to step up the voltage as the distance from the source increases. Another thing to remember about tall towers is that they require more than one flashing beacon; thus, the current switched becomes large, affecting voltage regulation of the tower circuits, and perhaps even of other station circuits. Where this problem occurs, the use of more than a single flasher is recommended, thereby reducing peak load requirements and enhancing voltage regulation.

### Galvanizing and Painting

If a tower is exempt from painting and/or marking requirements, it should be galvanized for protection from the weather. Guy wires are always galvanized before being woven. The small diameters of the strands render them particularly susceptible to attack by acids in the air. When tubular tower members are used, they must be galvanized inside and out, unless precautions are taken to prevent moisture from entering and causing rust to develop on the inner surfaces.

Even the apparently simple job of painting a tower presents problems. Paint will not adhere to newly galvanized surfaces; it is therefore necessary to rough up the smooth metal. A suitable method is to brush on the following solution: 2 oz copper chloride, 2 oz copper nitrate, 2 oz sal ammoniac, 2 oz muriatic acid, and 1 gal water. The solution is applied and allowed to dry. In about ten hours the surface is ready to paint and will not need a primer coat. If an older surface is grayish or black, a primer will probably not be needed, because weathering has done the etching. Rusted galvanized surfaces should be scraped and wire-brushed to remove all dust, dirt, loose rust, and rust scale. In any event, be sure that the surface is free from grease, oil, or any other dirt; and use good paint, with a primer if necessary. One coat of primer should be used, the exact type depending on whether the surface is new or rusted. Usually two coats of finish are then applied. A drying time of 24 hours is usually observed between successive finish coats.

Contractors prefer a fast-drying primer so that paint spatters dry before they reach the ground, not causing damage to cars and buildings. They feel the same way about finish



# Which twin has the heterodyne?

IF you want to carry color programming for any distance at all you need clean color tones like those of our heterodyne "twin" in the top set above. (It *is* in color, in case your magazine's monochrome.)

Lenkurt's 75A microwave relay system will deliver color or black and white TV clear and sharp because its heterodyne repeaters are especially designed for heavy-duty long-haul routes.

Since there's *no* baseband demodulation enroute, there's less chance for degradation of signals on a long-distance hook-up. Yet you have the capability to drop TV channels for CATV or ETV operations along the way, which greatly extends the 75A's flexibility. It exceeds CCIR specs for noise performance, and meets both CCIR and NTSC requirements for monochrome and color television transmission. Frequency stability is held to within ±0.002%. And one-for-three path protection is available.

If top performance is what you're looking for, ask us about our true blue (not to mention red and green) 75A Microwave Radio. Lenkurt Electric Co., Inc., San Carlos, California. Offices in Atlanta, Chicago, Dallas, and New York City.

**LENKURT ELECTRIC**

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coats. The fast-drying feature is good, but it has disadvantages. It is essential that primers of this type be applied to *exceptionally* clean surfaces, since because of their fast-drying properties their oil content is reduced; hence, they do not have the surface - wetting properties which characterize primers of longer oil length. Structural steel is rarely cleaned of corrosion products unless sandblasted.

A good primer to use is Federal Specification TTP-641, Type II Zinc Dust, Zinc Oxide Primer. Although it is not fast drying, it has excellent adhesion and presents an ideal surface for the finish coat. Eight ounces of linseed oil added to each gallon helps in areas which are not sufficiently clean. The oil helps the primer penetrate into voids of the surface, rather than bridging over the top, which later results in film failure.

Sufficient paint should be applied in all cases. The minimum dry-film thickness should be 1 mil (0.001") per coat, and dry-film thickness of 1.25-1.5 mils per coat is normally preferred. No portion of the films should be less than these thicknesses. Dry-film thickness should not exceed 2 mils per coat.

Surfaces of all parts of the tower, including any exposed steel of the anchors, turnbuckles, and cable clamps, should be painted. The guy wires and accessories, such as antennas, lights, and cables should be galvanized. All bolts and nuts not painted during assembly should be painted after erection.

The paint is applied either by brush or spraying, depending on conditions or the subcontractor's option. All surfaces should be uniformly covered, with no streaks or incompletely covered surfaces. For best results, all painting should be done in dry weather. Paint should *not* be applied on wet surfaces, when the relative humidity exceeds 80%, nor when the surrounding air or the surface to be painted has a temperature of 40° F or below. Steel should not be handled until the paint is thoroughly dry; after erection the tower paint should be carefully touched up, assuring proper coverage of the areas to be protected.

### Maintenance Procedures

Broadcast-tower maintenance is often limited to periodic painting and lamp replacement. When considered from a long-range view, this may be false economy. The broadcaster interested in real economy will take precautions to see that his towers receive thorough maintenance.

#### *Repainting*

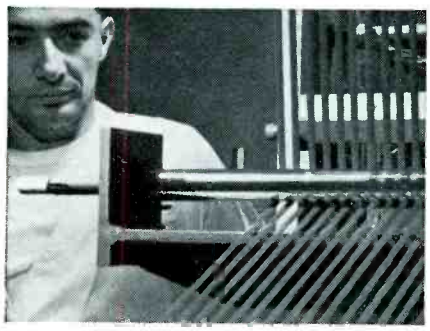
As has been stated, repainting of towers is required by FAA and FCC regulations; it is also good engineering practice, because the paint protects steel tower members against rust and corrosion.

Most of the remarks mentioned earlier concerning initial painting of towers also apply to repainting. Before a tower can be repainted, it must be cleaned of contamination so that the new paint may adhere satisfactorily to the surface. Two chief deposits are found on towers: *Mill scale,* often blue-gray in color, develops during the manufacture of

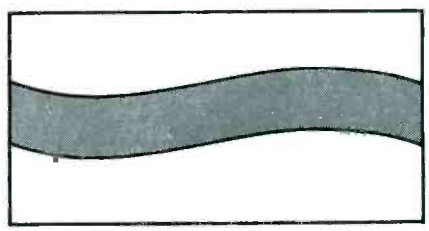
Some plain talk from Kodak about tape:

# Sobering thoughts about slitting... and making the best basically better

A wise man once said, "Baloney's basic worth is unaffected by the manner in which you slice it." Maybe so for baloney...but certainly not for sound recording tape. Slicing, or to be technically correct, slitting quarter-inch ribbons of tape from the 42-inch-wide master web in manufacture takes a pretty sharp eye. This slitting operation is important to your pleasure since the closer the tape comes to being dimensionally perfect, the better is the azimuth relationship between the recorded signal and the reproduce head. Like it in plainer English? Then consider some examples of poor slitting...and what they sound like.



**"Drunken" slitting and others.** Variations from the ideal occur if tape is too wide, too narrow, or if its width varies. If the tape is too wide, it may actually override the guides on your tape deck. If the tape is too narrow, it may see-saw as it passes by the head. Either way, you're in trouble. Variations also occur if the edges are not straight. One such variation goes by the name of "drunken" slitting. Sound bad? You bet. The edges snake even though the width is constant (see drawing). As a result, on playback the output varies as the tape weaves past the reproduce head...causes a warbling of the signal. This is a type of distortion the human ear is most sensitive to. You wouldn't like it.



Drunken slitting, a dramatization

**Quality-control makes the difference.** Standard industry specification calls for a tolerance on width of ± .002 inches. To start, we hold ours to ± .001 inches. And to make things more interesting we make our test over a twelve inch span to equal or exceed guide spacing on most tape recording equipment. Next, not relying on eyeball tests as others do, we test for drunken slitting or fluted edges by actually running the tape with a recorded short wavelength signal through a tape recorder. This "drunkometer" test helps us spot any tape that's had even one beer. The slightest whiff, and out it goes. Lastly, Kodak Sound Tapes have to go under the microscope where we watch for rough or dirty edges. When you buy Kodak Tapes, you know they're clean.

**Best base better?** Strength and toughness sound like they mean the same thing...but they don't quite when it comes to a tape base. Take a piece of spaghetti. It's stronger when it's dry...but tougher when it's wet—harder to break, that is, and not just because it's slippery. Designing a tape base, you're always up against the problem of making it strong so it doesn't stretch...and tough so it doesn't break. Today's DUROL base, the best there is, is now more resistant to shock abuse and carelessness. It's even tougher than before while it still retains the strength that made it famous.


Kodak tapes—on Durol and Polyester bases—are available at most 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 8, Eastman Kodak Company, Rochester, N.Y. 14650.

EASTMAN KODAK COMPANY, Rochester, N.Y.

Circle Item 26 on Tech Data Card

steel, when in the forming or cooling period iron molecules combine directly with oxygen from the air to form iron oxide (oxide on steel). *Rust scale* is a rust deposit that is not anchored securely to the surface, and in time will invariably "pop" off. When the rust scale comes off, it will take the paint coating with it if this coating has been applied over the rust scale.

Because the service life, and therefore the usefulness, of any organic coating is greatly dependent on the manner in which the surface is prepared prior to coating, the attention given to this part of the program should be extremely thorough. Proper surface preparation requires that all foreign substances, such as dirt, oil, grease, loose rust, peeling or deteriorated previous coatings, mill scale, and rust scale, be removed from the surface.

There are a number of methods used to clean tower surfaces prior to repainting. Solvent cleaning is the use of rags or brushes wetted with a suitable solvent to remove oil or grease. Stratified rust or rust scale is removed by hand cleaning, using hammers or impact tools to chip, and by hand-operated wirebrushes, sanders, and scrapers. All loose or nonadherent paint is removed, and thick edges of remaining old paint are feathered so that the repainted surface can have a smooth appearance. The remaining old paint should have sufficient adhesion so that it cannot be lifted as a layer by inserting the blade of a dull putty knife under it. Power tools are often used where considerable surface area must be cleaned, since power wire brushes, impact tools, grinders, and sanders speed up the work. Blast cleaning, also a rapid method of cleaning towers, employs abrasive material propelled at high velocity through nozzles or by centrifugal wheels.

Painting contractors should be required to post a performance bond to guarantee completion of the job, and they *must* have liability insurance to cover possible paint damage to neighboring property owners and bystanders. Depending upon the drying qualities of the paint used, the care with which it is applied, and the population density within a few hundred feet of the tower, some paint spatter is likely to occur. The broadcaster cannot permit himself to be liable for this damage. There is also the possibility of a worker dropping a tool and injuring someone.

#### *Lamps and Flashers*

Lamp replacement offers a real opportunity for saving. The difference in cost between long-life and regular tower lamps is incidental when compared with the cost of lamp replacement. A good practice is to purchase only long-life lamps. They should be purchased in a quantity that will allow for accidental breakage or other damage while on the shelf or during installation.

Note that FCC rules require that a licensee must have on hand enough lamps to replace completely all tower lamps at any time. Another good practice, while not required, is to have on hand replacement lamp sockets, lamp globes, and aviation-red shields for beacons. Beacon flashers, while reliable, can fail; therefore, it is advisable to have a spare motor and switch on hand,

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especially since the switch contacts arc and become pitted periodically. The photoelectric-cell assembly is sometimes vulnerable to lightning, as it is mounted in an exposed position. If a spare assembly is not kept on hand, upon failure of the PE the licensee must then turn on the lights by hand each night, or else run them continuously.

#### *Tower Inspections*

Sec. 17.38 of the FCC Rules, as well as related FAA Rules, require that the licensee make a daily inspection of the tower-lighting system to insure that it is operating properly — *unless* an automatic tower-lighting failure-alarm circuit is used. An entry stating that this inspection has been made must appear in one of the station logs—program, operating, or maintenance. The rule does not specify which is preferred, but it seems more convenient to make the entry in the maintenance log. Sec. 17.38 also requires a similar entry of the time the tower lights are turned on and off each day if manually controlled; the nature, date, and time of any observed failure of the lighting system; the date, time, and nature of the adjustments, repairs, or replacements made; identification of the FAA Flight Service Station which was notified of the failure of any code or rotating beacon light or top light not corrected within 30 minutes; the date and time such notice was given; and the date and time notice was given to the Flight Service Station that the required illumination was resumed.

Sec. 17.38 states that once every three months a complete inspection shall be made of all tower lights and associated tower-lighting control devices, indicators, and alarm systems. An entry must then be made—again the log used is not specified, but probably the most desirable is the maintenance log—which must show the date of the inspection and the condition of all the equipment. Details must be noted of any adjustments, replacements, or repairs made to insure compliance with the lighting requirements, and the date such adjustments, replacements, or repairs were made.

#### *Summary of Hints for Maintenance*

1. Repaint towers every two years.
2. Buy only long-life lamps.
3. Keep more than a minimum of spare lamps on hand.
4. Keep spare globes, sockets, and color shields on hand.
5. Use three lamps for sidelights.

▲

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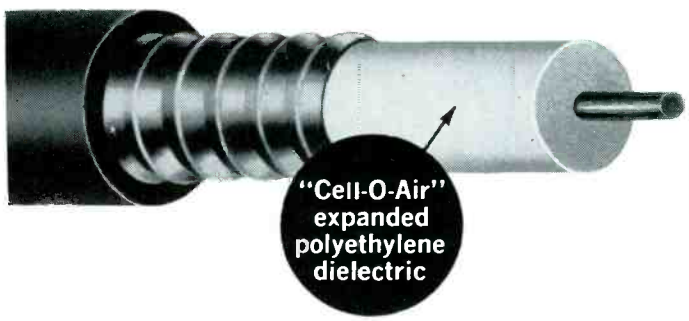
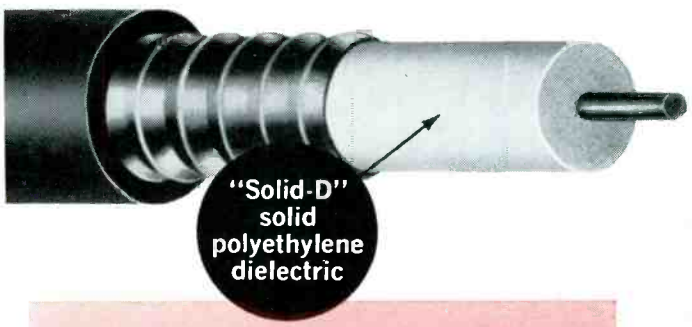
# The CATV Cable that GUARANTEES FULL-SPECTRUM CAPABILITY

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Circle Item 32 on Tech Data Card

## Patch Panel

*(Continued from page 27)*

fier, the EBS receiver, and the off-the-air monitor. In addition, any external audio power source of near 8-ohms impedance can be used to feed any speaker in the building through the jack field.

### Equalizers and Filters

WBEJ does extensive broadcasting of sports events via remote lines. It was found that the sound quality on many of the remotes could be greatly improved by rolling off the low audio frequencies and equalizing the highs, thus attenuating the low-frequency noise in gymnasiums and bowling alleys and overcoming the treble roll-off characteristic of telephone lines. We found that a simple high-pass filter consisting of two 0.5-mfd. capacitors wired between two jacks in the patch panel virtually eliminates low-frequency noises and clarifies the announcer's words. The announcer at the console can easily patch through the filter into a console remote line input when the need arises (B FILTER IN M and B FILTER OUT M). The filter is also useful when a remote line has excessive 60-cps hum.

We did not wire our equalizer to jacks in the patch panel for three reasons: First, it requires too many jacks; second, announcers would not be using this feature widely; third, it could possibly be accidentally patched into a circuit adversely affected by equalization. Therefore, we use a test lead with alligator clips and clip the required amount of equalization onto any two terminals of either of the two terminal boards. All these terminals have access jacks in the patch panel and may be routed, within limits, by patch cords.

### Conclusion

With this patch panel, we have been able to route signals in a variety of ways, check remote setups prior to air time, substitute equipment when needed, and insert filtering and equalization as desired.

It is extremely unlikely that the same conditions and needs existing at WBEJ exist at any other station. But perhaps somewhere in the description of our patch panel will be found the solution to a problem you may have. ▲


# *New from Wilkinson!*

**Model 4N-1**

## 4 in 1 *Portable Solid-State*

## FIELD INTENSITY METER + NULL DETECTOR + STANDARD SIGNAL GENERATOR + AM MONITOR RECEIVER!

At last a practical, extremely versatile instrument for broadcast stations and consultants. The new Wilkinson Model 4N-1 all solid state Field Meter combines all the features broadcast engineers have long been awaiting in a completely portable 12-pound unit.

As a Field Intensity meter, the Wilkinson 4N-1 measures field strength with 3% accuracy and reduces measurement time because no nulling is required. Long-term reliability is assured because all critical circuitry is passive.

As a Null Detector for use with a RF bridge to measure impedances, the Wilkinson 4N-1 eliminates the complexity of a multi-instrument AC test set-up. Visual null detection eliminates earphones and broken ear drums.

As a Standard Signal Generator, the Wilkinson 4N-1 is invaluable since its output accuracy of 3% from one microvolt to one volt is essential to many broadcast applications.

As a Monitor Receiver, the Wilkinson 4N-1 has sensitivity of 5 microvolts nominal, permitting excellent off-air monitoring in extreme fringe areas.

The frequency range of the complete Wilkinson 4N-1 is 535-1605 kc.

The Wilkinson 4N-1 is powered by dependable nickel cadmium batteries, rechargeable from AC or an automobile source. Ease of operation is assured by simplicity of procedure, oversized controls and meter, built-in speaker and illuminated panel. The Wilkinson 4N-1 is packaged in a sturdy and attractive genuine cowhide case. When the case is closed, the power is interlocked off.

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Circle Item 34 on Tech Data Card

## Maintenance Shop

*(Continued from page 32)*

can be built—it's a simple passive AM detector—or you can buy one. A very similar item is the noise-meter adaptor for reading AM noise in an FM transmitter. The flutter meter is a luxury item, used by few stations. Alignment tapes and test records will usually suffice for setting up turntables and tape recorders.

The "video" category is almost mandatory for running a video proof of performance.

The "RF" items are useful and desirable, but often not absolutely necessary. The RF generator should have output up to 5 or 10 volts across 50 ohms; the communications receiver should be well shielded and cover the broadcast band. You can buy grid-dip meters, transistor meters, and even a tunnel-diode dip meter; the last two items are completely portable and make transmitter tune-ups easy. The frequency meter or counter is definitely a luxury item unless you are responsible for a lot of transmitters. The field-intensity meter is required at all new directional AM stations, useful at others. FM and TV field-intensity meters are almost never found at stations; they are seldom used except by consulting engineers.

The "miscellaneous" items are not mandatory, although the last two can be of considerable help.

### Spare-Parts Inventory

There are two ways of keeping spare tubes. Nearly everybody keeps at least one of each tube type in use. Some keep 50% spares, while others keep most-in-one-chassis. Many stations keep 100% transmitting spares to permit tube rotating and resultant longer tube life. The same rules apply to transistors and diodes, but silicon rectifier stacks are best kept on a 100% spare basis.

Some engineers feel that if they have much duplication of studio equipment (several consoles, tape recorders, preamps, etc.) they need little or no stock of resistors, capacitors, and similar items. If something fails, it may take a few days to get the components to fix it, but at least the station isn't off the air. This rule does not apply to the transmitter (unless you have an alternate main or an auxiliary). Many engineers feel safer if they keep in stock any component they cannot readily obtain at a local parts house. If you do much construction, you will need an ample supply of hardware—nuts, bolts, screws, washers, etc.

If certain items—such as blower and turntable motors—are critical and could knock out the station if they failed, then you probably should have spares available.

A maintenance shop isn't complete without a library. No one can remember everything. Your station should subscribe to at least Volume III of the FCC Rules and Regulations, and perhaps to Volume I. Other good books include the *NAB Engineering Handbook*, the ARRL *Radio Amateur's Handbook*, RCA's *Radiotron Designer's Handbook*, Ennes' *Broadcast Engineering Notebooks* (four volumes), the current *Broadcasting* yearbook (it gives addresses and phone numbers of all broadcast equipment manufacturers), and either Terman's *Radio Engineers' Handbook* or Henney's *Radio Engineering Handbook*. You should have at least two tube and/or transistor handbooks, several good distributor catalogs—and finally, a manual and print on every piece of gear in your plant. If you have old equipment, don't throw away out-of-date parts catalogs, for you may want to refer to them about parts replacement for your old gear.

### Equipment Allocation

If your studio and transmitter are under one roof, you have no problem. If you have two or more plants, equipment allocation becomes a problem. The general rule is this: Relatively cheap equipment (VOM's, VTVM's, hand tools, etc.) is generally kept in duplicate at both locations, while the more expensive items (HD meters, AF generators, etc.) are carried back and forth as needed. Some stations that send engineers along on remotes also have a small tool kit for him to carry for emergency field repairs. ▲

# ENGINEERS' EXCHANGE

## Neutralizing With a Scope

by Robert Dail
Chief Engineer
WCDJ, Edenton, N. C.

Here is a suggestion to make neutralizing a transmitter easier. I have a scope connected continuously to my final tank by means of a pick-up loop. With this arrangement, I can check my carrier and modulation at any time without wasting time connecting wires. I also use this system to neutralize the transmitter. The method is very simple: 1. Disconnect the high voltage from the plates of the final tubes. 2. Set the scope gain fairly high, with the vertical gain about midway, and the other controls the same as for monitoring. 3. Turn on the transmitter (final high voltage removed), and observe the scope. There should be a carrier wave on the CRT. Adjust the scope vertical gain until an amplitude of about 1" is produced on the screen. As you turn the neutralizing control on the transmitter, you should see the carrier increase or decrease. Adjust the control until the carrier has minimum width on the screen. This adjustment should bring about neutralization of the transmitter. Reset the scope to normal before reconnecting the final voltage.

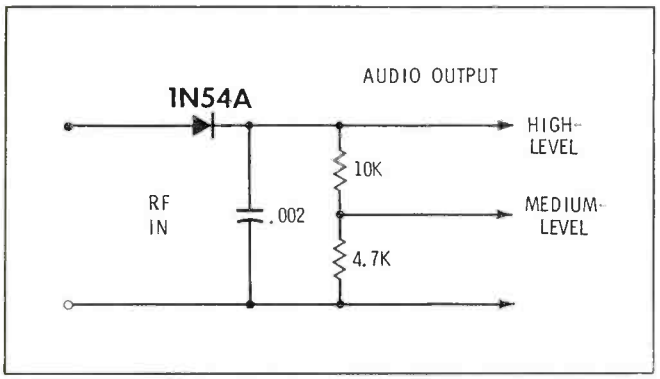
**This suggestion is our contest winner for April. If you've solved a technical problem lately, why not share your idea with other engineers via Engineers' Exchange?**

## Audio Monitor

by John H. All, Jr.
WDIX, Orangeburg, S. C.

This circuit should be of interest to engineers who are unable to get a good off-the-air sound from older modulation monitors.

The instruction book for our monitor very plainly states that above 7500 cps a small amount of peak clipping occurs in the diode detector; this clipping reaches 5% at 15,000 cps and 100% modulation. The circuit shown here has been in use over six months at this station and provides a good improvement in sound. The input is paralleled across the modulation-monitor input; a change in RF takeoff-loop coupling may be required since the detector produces enough loading to decrease the input to the monitor. ▲



# NEWS OF THE INDUSTRY

## INTERNATIONAL

### ETV Mobile Unit to Scotland

The University of Glasgow has taken delivery of a television outside broadcast unit believed to be the first designed for an educational institution in the United Kingdom. The four-camera unit, supplied by the **Marconi Company,** contains facilities normally found in an ETV studio control room. room.

The unit will be used to record lectures on video tape for subsequent use by the University and associated educational institutions. It will also be used to link lecture theatres within the University so that more students can "attend" lectures.

Three studio cameras with electronic viewfinders are provided. Two have four-lens turrets, and the other is fitted with a zoom lens. The cameras can be operated at distances of up to 500′ from the vehicle by means of cables provided. The camera complement is completed with a caption camera. This is normally housed in the vehicle, but it can be used externally with a boom for such purposes as recording surgical operations.

Mixing facilities are provided for the four cameras, and sound mixing provides for up to eight microphones and four high-level sources. In addition to the normal communication facilities between the producer and the camera and sound crews, facilities are provided for students in the linked lecture theatres to communicate with the lecturer. None of the controls in the unit requires the presence of an engineer during a broadcast.

The caption camera is placed to one side of the control panel. Its copy table can be lighted from either above or below; therefore, ordinary artwork or transparent material such as used to illustrate lectures can be shown. This camera has a zoom lens.

Distribution amplifiers contained in the vehicle each provide five output signals. These can be used to feed lecture theatres or video tape recorders.



### AM Transmitters to South Africa

Fifteen Dual-Reliable AM broadcast systems are being shipped to the **South African Broadcasting Corp.** by **CCA Electronics.** Each system consists essentially of two independent transmitters with a combining system. It incorporates an operating standby transmitter which can be automatically fed directly to the antenna in the event of a fault in the system.

### London Electronics and Automation Show

Approximately 850 companies will exhibit more than $84 million worth of equipment at the International Instruments, Electronics and Automation Exhibition to be held in London, May 23-28. One-third of the participants will be from outside Britain. The United States, France, and Czechoslovakia will have official exhibits. The United States will occupy the largest space at the show. Some 240 individual firms from 12 other countries will have equipment on display.

Some 10,000 visitors from outside Great Britain are expected to attend the exhibition.

## National

### Elected to Radio Board

The **National Association of Broadcasters** has announced the election of 12 prominent broadcasters to its Radio Board of Directors. All were elected to two-year terms starting on Wednesday, March 30, final day of the NAB's 44th Annual Convention in Chicago.

Those elected:

District 2 (New York and New Jersey):
Simon Goldman, WJTN, Jamestown, N. Y.

District 4 (North Carolina, South Carolina, and Virginia):
Jack Younts, WEEB, Southern Pines, N. C.

District 6 (Arkansas, Louisiana, Mississippi, and Tennessee):
F. C. Sowell, WLAC, Nashville, Tenn.

District 8 (Indiana and Michigan):
Raymond A. Plank, WKLA, Ludington, Mich.

District 10 (Iowa, Missouri, and Nebraska):
George W. Armstrong, WHB, Kansas City, Mo.

District 12 (Kansas and Oklahoma):
Grover C. Cobb, KVGB, Great Bend, Kan.

District 14 (Colorado, Idaho, Utah, Wyoming, Montana, and New Mexico):
Al Ross, KGEK, Sterling, Colo.

District 16 (Arizona and Southern California):
Kenneth Harwood, KUSC-FM, Los Angeles, Calif.

AM Stations (Class "A" market):
Charles E. Gates, WGN, Chicago, Ill.

AM Stations (Class "B" market):
Daniel W. Kops, Kops Communications, Inc., New Haven, Conn.

AM Stations (Class "C" market):
J. R. Livesay, WLBH, Mattoon, Ill.

FM Stations:
Everett L. Dillard, WASH, Washington, D. C.

Results of the mail balloting were certified by a three-member Election Committee appointed by NAB President Vincent T. Wasilewski. Irv Lichtenstein, program director, WWDC, Washington, served as Chairman. Members are William L. Hedgpeth, program director, WTOP, Washington, and Harry A. Karr, Jr., station manager, WRC, Washington.

## CATV for Atlanta

**Georgia Cablevision Corp.,** 80% owned by **Cox Cablevision Corp.,** and 20% owned by an affiliate of **Georgia Theatre Company** has been granted a permit by the city to wire Atlanta for cable television.

J. Leonard Reinsch, president of Cox Broadcasting Corp., stated that since the grant to wire Atlanta was made prior to the FCC's action on CATV, it is anticipated that the Commission will look with favor on development of CATV in a city like Atlanta; the company does not anticipate any delay in plans.

Signal surveys are under way now to determine how many channels will be carried on the system. It is hoped that as many as eight channels can be provided, including educational television and a time, weather, and news channel.

Cox Cablevision is wholly owned by Cox Broadcasting, which is also the parent company of WSB TV-AM-FM in Atlanta. WSB has a history in radio dating back to 1922. Cox owns 20 CATV systems in five states and 50% of Kaiser-Cox Corp., a CATV equipment manufacturing company in Phoenix, Ariz.

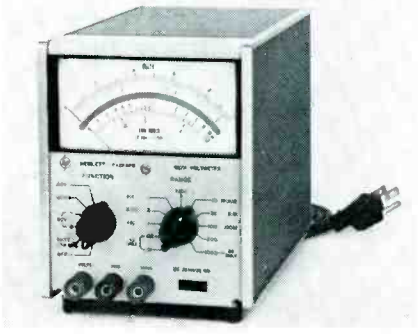
Georgia Theatre Company owns an interest in the Waycross Cable Co., now operating a CATV system in Waycross, Ga.

## Moves to New Location

The building shown is the new home of **Sparta Electronic Corp.** The firm has more than doubled its office, plant, and warehouse space with this move. Facilities include dust-free filtered air


system, a new design laboratory, and special lighting system. The move is the company's third to larger facilities in less than five years. The new building is located at 5851 Florin-Perkins Road, Sacramento, Calif. 95828. ▲

# NEW PRODUCTS



## AC/DC Volt-Ohmmeter

A multifunction meter, of all-solid-state circuitry, battery-operated, with a mirror-backed, individually-calibrated, taut-band meter is offered by **Hewlett-Packard.** The price is under $200.

HP Model 427A is a DC voltmeter and an AC voltmeter for the frequencies from 10 cps to 1 mc, with ±2% full-scale accuracy. DC full-scale ranges are ±100 millivolts to ±1000 volts; AC ranges are 10 millivolts to 300 volts rms. Ohms ranges, ±5% accurate, are 10 ohms center-scale to 10 megohms center-scale.

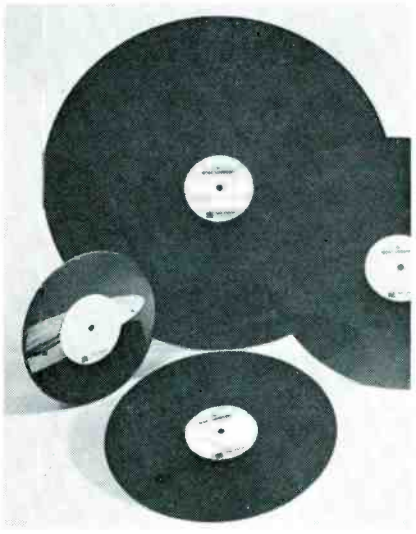
Heart of the Model 427A is a DC amplifier, using a field-effect transistor both for high input-impedance conversion and, through a balancing circuit, for temperature compensation. Input resistance is above 10 megohms. DC drift with temperature is typically under 0.5 millivolts per degree centigrade.

Battery power makes possible complete isolation from power-line ground. The common signal ground is floated and may be operated as much as 500 volts DC from ground potential. A single 22.5-volt internal dry battery is the normal power source and has a continuous-operating life of about 300 hours. AC power-line operation is an option.

Both AC and DC volts are measured from the same terminals. Since the DC mode strongly rejects AC, separate measurements of AC and DC voltages at a common point may be made by changing the setting of the function knob. Overloads are well tolerated.

Model 427A is priced at $195. Option 01, adding AC-line to battery operation is $25 extra.

Circle Item 59 on Tech Data Card



## Recording Discs

The gold-label Micro-Lac recording-disc line consists of single- and double-face masters in 10, 12, and 14" sizes, and instantaneous acetates in single and double playback grades of 7, 10, 12, and 14". The **Reeves Soundcraft** masters are intended for standard or microgroove, mono or stereo. The playback grade is for volume production in broadcasting and studio applications.

Circle Item 60 on Tech Data Card

## Dual Microwave Links

"Outage insurance" for television broadcasters is offered by **Raytheon Company** in the form of the KTR-II automatic parallel microwave television STL equipment.

The "fail-safe" parallel link arrangement provides automatic transmitter switching and duplicated receiver protection to prevent off-the-air periods. Completely solid-state except for the klystron, the Dual Link II transmits monochrome or color TV with program audio at a minimum output power of 1.0 watt (+30 dbm) over a 6875-7125 mc frequency range.

Circle Item 61 on Tech Data Card

## Solid-State Sideband Analyzer

The Model TS-100A television sideband analyzer is intended for use in alignment of broadcast television transmitters or CATV modulators. It is tunable through all 12 VHF channels and provides facilities for video modulation of the unit under test plus analysis of the RF output.

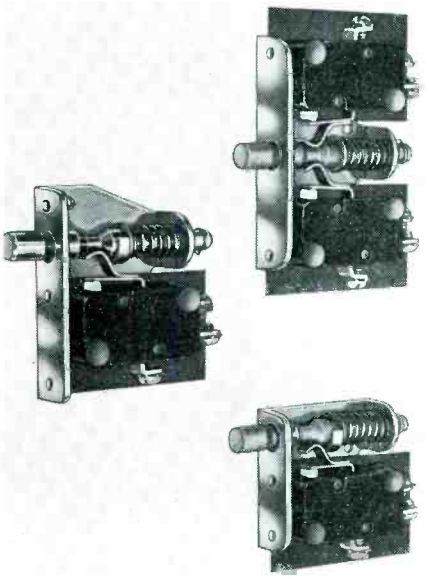
The TS-100A provides a video sweep signal which modulates the video transmitter. The resulting sidebands are analyzed, and a detected response is presented on an oscilloscope, showing upper and lower sidebands in correct relationship to the carrier.

As a spectrum analyzer, this **Dynair Electronics, Inc.** unit may be used to observe the RF output of a transmitter

being fed with standard test signals or live programming. In addition, the video sweep output is available for test or alignment at video frequencies.

The TS-100A is compatible with most commercial oscilloscopes having vertical and horizontal input deflection of at least 10 cps through 1000 cps. It is designed to be installed either in a 19" equipment rack or carried from station to station.

Circle Item 62 on Tech Data Card



**Safety-Interlock Switches**

Available in both single-pole and double-pole, double-throw contact arrangements, the **Unimax Switch** TL Series of safety-interlock switches affords choice of installation and control possibilities.

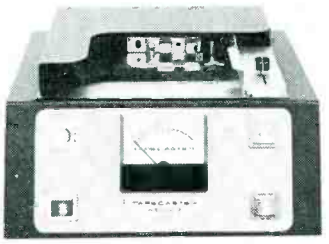
When mounted on a door frame and wired in series with the power supply line, a Type TL interlock shuts off the apparatus when the door is opened, yet provides for manual reclosing to allow live-circuit testing. The switch can be opened manually for dead-circuit testing and servicing. Whenever the enclosure door is closed to put the apparatus back in service, the interlock automatically assumes its safety position so that re-opening the door shuts off the power.

The metal bracket, on which are assembled the basic TM-type switches, operating plunger, latch-out mechanism, and positive overtravel stop, has tapped holes for attachment of the switch to a surface that is either parallel to or at right angles to the operating plunger. This plunger is furnished in stainless steel or plastic; when specified, a tapped hole, concentric with the plunger, permits attachment of an extension.

Electrical rating of the basic switches in the TL series is 15 amps 125/250

volts AC, ½ hp 125/150 volts AC, ½ amp 125 volts DC, ¼ amp 250 volts DC.

Circle Item 63 on Tech Data Card

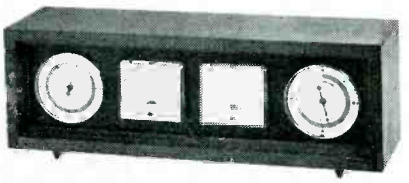


### Tape Cartridge Machines

A new 700 Series of tape cartridge machines is being marketed by **Tapecaster Electronics.** Features include plug-in relay, regulated power supplies with electronic filtering, all silicon transistors, remote control of all functions, large illuminated control buttons, and a design for automation with secondary tone output on all units.

Model 700-P playback unit is priced at $300, and Model 700-RP combination record-playback unit (pictured) is priced at $450. Model 700-P Stereo playback unit sells for $450, and the 700-RP Stereo combination for $700.

Circle Item 64 on Tech Data Card



### Weather Forecasting Instruments

The Mark IV Weatherminder was designed by **Texas Electronics, Inc.** to combine accuracy and ruggedness of construction. The Weatherminder provides a continuous indication of wind velocity, wind direction, barometric pressure, and outside temperature in the immediate area. Its instruments are enclosed in a compact, handrubbed-walnut console for desk or wall.

Circle Item 65 on Tech Data Card

### Cardioid With Adjustable Bass Response

This cardioid microphone, the Model 505, combines the **Turner Microphone Company** Model 500 with the acoustical characteristics of an adjustable-bass-response dynamic microphone. Adjustable bass response is achieved by use of a rotary switch marked "NORMAL" and "LESS BASS." It switches in a ferrite-core inductor to modify the low-frequency response. Frequency response is specified as 40-15,000 cps when the switch is in "NORMAL" position and 100-15,000 cps in the "LESS BASS" position.

This bass roll-off feature is provided for use whenever the microphone must be used close to the sound source. When longer-distance pickup is required, the switch can be returned to the "normal" position.

Model 505 also has a line-shorting on-off switch and is furnished with

20′ of cable. The impedance is HI or 150 ohms, adjustable at the free end of the cable. The 505 is designed for auditorium work, rostrums, broadcast booths, and recording work of all types. List price is $110.

Circle Item 66 on Tech Data Card

### Coaxial Test Termination Plugs

These coaxial termination plugs provide a means of terminating a line in its characteristic impedance and, in addition, having access to the center conductor for examination of the signal under terminated conditions.

The plugs, available from **Holland Electronics, Inc.,** contain a ½-watt, 1%-tolerance, low-noise resistor. Standard values are 50, 75, and 93 ohms; terminating resistors can be supplied in any value required at additional cost. All contact surfaces are gold plated. Solder-lug or pin-tip jack test terminals may be chosen. Plugs are compatible with RCA or W.E. patching systems, as specified. ▲

Circle Item 67 on Tech Data Card

# POSITIONS IN COLOR TV ENGINEERING

The sudden industry wide acceptance of PLUMBICON Color Cameras has created many entirely new engineering positions in the areas of systems planning, field engineering, equipment packaging, circuit design. Engineers with live camera TV station experience and who are looking for personal advancement will receive training in this new equipment which is already playing a major role in the present shift to color.

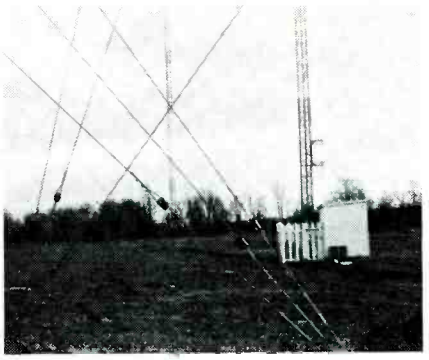
Salary is commensurate with experience and ability. Locale: New York and Los Angeles. Relocation assistance provided. Interviews possible in major cities or interview travel expenses paid.

Send complete resume or call Mr. C. E. Spicer or Mr G. H. Wagner, Visual Electronics Corporation, 356 West 40th Street, New York, N. Y. 10018, telephone (212) 736-5840.

**VISUAL ELECTRONICS CORPORATION**

**NEW CONCEPTS**

**IN BROADCAST EQUIPMENT**



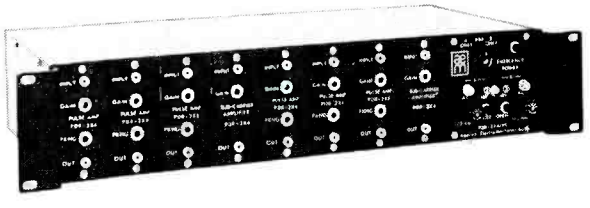
**How well do you know** your directional-antenna feed system? Next month George Frese will show you how to get better acquainted. Don't miss this and the other articles on antennas in the May issue of

**Broadcast Engineering**

You'll find a handy subscription form inside the cover of this issue. Fill it out, send it in, and you'll receive the *Broadcast Engineers' Maintenance Guide* free.

**NOW FROM** ae **THE PULSE GROUP AMPLIFIER**

**NEW PACKAGING CONCEPT BREAKS THE CHAIN-FAILURE SEQUENCE IN PULSE DISTRIBUTION SYSTEMS**



Currently, pulse distribution systems follow video distribution patterns, producing a fan-out that puts heavy reliance on each distribution unit. The new Pulse Group equipment allows each camera to get its full pulse complement from one amplifier and, conversely, one amplifier to serve only one camera. In this system, a failure affects only one video source and a major program disruption is avoided.

Pulse Group Amplifiers are completely flexible, providing one output up to eight outputs per input. They are ideal components for custom pulse-switching systems. Available with six channels for standard color cameras (5 pulses + 1 sub-carrier) and in double-four units for the new RCA TK-27 and TK-42 color cameras. The double-four can also be obtained for standard b&w and later modified for color.

FOR MORE INFORMATION CALL OR WRITE:

**APPLIED ELECTRO MECHANICS, INC.**
**2350 DUKE STREET, ALEX., VA. 22314**
**703-548-2166**

Circle Item 51 on Tech Data Card

## ENGINEERS' TECH DATA

### AUDIO & RECORDING EQUIPMENT

80. ATLAS SOUND—Catalog 565 illustrates and describes many new models of public address speakers, microphone stands, and accessories for commercial sound applications.
81. BAUER ELECTRONICS — A brochure describes audio consoles Model 910D and 910S (eight-channel dual and stereo) and Models 912 and 912S (five-channel mono and stereo).
82. CROWN — Technical-specifications sheet supplies data on two-channel solid-state monitor amplifier with 20 watts per channel sine-wave power rating.
83. KRS INSTRUMENTS — Technical Bulletin S-1 provides descriptive information on STACTape® stackable, continuous-loop, magnetic-tape cartridges, offering editing reversibility, 1200′ tape capacity, and maximum tape protection.
84. MAGNECORD — Six-page brochure gives features and specifications of the Models 1021 and 1022 transistorized tape recorder/reproducers.
85. MEMOREX — A detailed eight-page brochure on precision magnetic tape for broadcast video applications is offered.
86. QUAM-NICHOLS — Sound system catalog lists public-address speakers, background-music speakers, intercom speakers, outdoor speakers, and line-matching transformers.
87. TELEPRO INDUSTRIES — Data sheet describes Fidelipac® automatic, continuous single-reel tape magazine.
88. VIKING OF MINNEAPOLIS — Literature describes an industrial tape transport, Model 230.

### CATV EQUIPMENT

89. AMECO — Two new brochures describe solid-state CATV amplifiers, the 65 series and 70 series. Also available is a brochure on related services offered by Ameco.
90. JERROLD — Eight-page brochure features "Starline" solid-state unitized CATV systems.

### COMPONENTS & MATERIALS

91. AMPEREX — A new condensed semiconductor catalog is available.
92. DENSON ELECTRONICS — Flyer 964 D1 lists new and used radio and TV broadcasting equipment, including Foto-Video inventory. Flyer 965 A1 lists new and used radio and TV equipment and includes book news of technical information.
93. INTERNATIONAL ELECTRONICS—New color folder describes the 10M-series tubes designed to feature tube-to-tube uniformity, section-to-section uniformity, and long life for broadcast application.
94. OAK — Forms SP-214, SP-216, and SP-187 provide specifications, prices, and cross-reference for push-button, lever, rotary and slide switches.
95. SWITCHCRAFT — New-Product Bulletin No. 158 features the "Multi-Slide" Switch, Series 39000, a multiple-station slide-function switch, available one to 18 stations (3PDT circuitry per station), with interlock, all-lock, and non-lock functions.
96. TEXWIPE — Product sheet describes "Freon" TF aerosol solvent cleaner for use on video and sound tape heads and film.

### MICROWAVE DEVICES

97. MICROWAVE ASSOCIATES — Bulletin 9021 gives specifications and photos detailing solid-state TV-relay equipment.

### MOBILE RADIO & COMMUNICATIONS

98. MOSLEY ELECTRONICS — Catalog lists complete line of 1966 Citizens-band equipment.

### POWER DEVICES

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

100. TOPAZ — Catalog No. 12166 provides information on power supplies with 115-volt 60±.03-cps output for operating video tape recorders and other frequency-sensitive equipment from 12- or 24-volt batteries.

## REFERENCE MATERIALS & SCHOOLS

101. CLEVELAND INSTITUTE OF ELECTRONICS — New pocket-sized plastic "Electronics Data Guide" includes formulas and tables for: frequency vs. wavelength, db, length of antennas, and color code.
102. HOWARD W. SAMS — Literature describing popular and informative technical publications; includes latest catalog of technical books.

## STUDIO AND CAMERA EQUIPMENT

103. CLEVELAND ELECTRONICS — Data concerns modifications using new yoke assembly to update 3" image-orthicon cameras.
104. 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 changeover switch.
105. QUICK-SET — Literature gives data on Sampson, Hercules, and Gibraltar lines of instrument-positioning equipment tripods, dollies, panheads, wall and ceiling brackets, close-up stands, and other products.
106. TELEVISION ZOOMAR — Literature is presented on Angenieux Zoomar Model 10x40 C for I.O. comeras; Autocam servo remote control of TV cameras for I.O., vidicon, and Plumbicon.®

## TELEVISION EQUIPMENT

107. 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/reproducers, TV cameras, audio and video tape, and audio and video systems.
108. BALL BROTHERS RESEARCH — A four-page pictorial brochure describes the AGC-V111 Automatic-Gain-Control Video Amplifier. Specifications on the amplifier are included.
109. Colorado Video — A data sheet features the Model 401 Video X-Y Plotter, which provides X-Y display on standard TV monitors.
110. MICRO-LINK SYSTEMS — A 2500-mc ITV Planning Guide is offered.
111. 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

112. HICKOK — Brochure features Model DMS-3200 digital measuring system and Model 580 tube tester.

## TRANSMITTER & ANTENNA DEVICES

113. ANDREW CORP — New catalog No. 24 presents detailed product information on UHF, VHF, and microwave antennas for commercial and military applications. Heliax, 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.
114. GATES RADIO — A brochure describes the new Vanguard II, a one-tube, 1-kw AM transmitter.

▲

## Advertisers' Index

## 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
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**CARL E. SMITH**
Consulting Radio Engineers
AM, FM, TV and CATV
8200 Snowville Road
Cleveland, Ohio 44141
Phone: 216-526-4386
Member AFCCE

**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

**MALARKEY, TAYLOR & ASSOCIATES**
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WASHINGTON, D.C.
1101 17th Street, N. W.
Area Code 202 • 223-2345

## 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

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

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

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

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

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

**Parabolic Antennas**, 6' aluminum solid surface complete with dipole and mounting bracket. Now tuned for 1750 MC for $125 set. Tuned to 950 MC for $175 set. Sierra Western Electric Cable Co., 24th and Willow Streets, Oakland, California. Phone 415 832-3527. 12-65 tf

**Transmitting tube** sale — All new, fully warranted 5736 @ $115.00 ea. —4CX1000A @ $135.00 ea. —5894 @ $17.00 ea —4CX250B @ $18.00 ea. —6146B/8298A @ $3.75 ea. —891R @ $210.00 ea. Send for complete list. Your one source for electronic tubes and semiconductors at realistic prices. Thor Electronics Corporation, 741 Livingston St., Elizabeth, N.J. 07207. 2-66-2t

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

**AMPEX 600 SERIES USERS**, gain up to 20 db S/N ratio using VIFKIT 1001 6F5 replacement adaptor containing selected (for low noise) 7025. For postpaid delivery send check for $10.00 each to VIF INTERNATIONAL, PO BOX 1555, MOUNTAIN VIEW, CALIF. 94040. 4-66-4ta

**NEW CAPSTAN PRESSURE IDLERS FOR AMPEX** 300's, 350's, and 354's, $15.00. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California. 4-66-6t

**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. 4-66-6t

**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 $45.00, two track $60.00. TABER MANUFACTURING & EQUIPMENT CO., 2619 Lincoln Ave., Alameda, California. 4-66-6t

BC375E new all TU $75; Two BC645A new $40; BC1255A $17; BC221A $75; ESTERLINE-ANGUS 1 ma Recorder $150. Dept. 152, Broadcast Engineering. 4-66-1t

**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 4-66-6t

**NAGRA RECORDER** w/ pilotone sync, ATN power supply, Nagra mixer, headset, complete with RCA BK-6B, AKG D-25, EV 644 microphones, windscreen, fishpole boom, etc. All in like new condition. Will sell separately or as complete package $1900. Dept. 151, Broadcast Engineering. 4-66-1t

**Collins 26W Limiter Amplifier**, excellent condition, complete with instruction book and FCC set spare tubes. $150 FOB WKIK, Leonardtown, Md. 4-66-1t

### EQUIPMENT WANTED

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

## Position Wanted

**YOUNG MAN** seeks responsible position as recording engineer and technician. Have 12 years experience with emphasis towards motion picture production. Presently employed in N. Y. area. Details on request. Dept. 151, Broadcast Engineering. 4-66-1t

## Employment

**WANTED**—Technicians for closed circuit systems planning — closed circuit — color television — video tape maintenance or supervision of installations of RCA equipment. 630 Fifth Avenue, Rockefeller Center, 757-0677 or 297-3336. G. Whiteford. 2-66-tf

**America's largest** Radio and Television Employment Agency has immediate openings with stations in all parts of the country for experienced Engineers. Send resume today to: Nationwide Broadcast Services, 645 North Michigan Avenue, Chicago, Illinois. 1-66-tf

**Job Headquarters** for all Radio and Television Engineers. Immediate openings exist in 9 western states and elsewhere for qualified engineer and technical personnel. All categories from trainees to experienced transmitter maintenance, chief, assistant chief, live color video maintenance and technical operations. Send us your complete resume now. The AMPS Agency, 3974 Wilshire Blvd., Los Angeles, California 90005. Telephone DU 8-3116.
By Broadcasters — For Broadcasters

**Chief Engineer For Alaska.** Excellent wage. Practical experience in color TV necessary. Assume responsiblity to layout, install, maintain new TV-FM. Studios-Xmtr on existing AM site. Airmail application, references to Bill Harpel — KHAR, Anchorage. 4-66-2t

## Business Opportunities

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No competition. To service and set up new accounts in exclusive territory. Investment secured by fast moving inventory of amazing plastic coating used on all types of surfaces interior or exterior. Eliminates waxing when applied to any type of floor. Eliminates all painting when applied to wood, metal or concrete surfaces.

**Minimum Investment — $ 500**
**Maximum Investment — $12,000**

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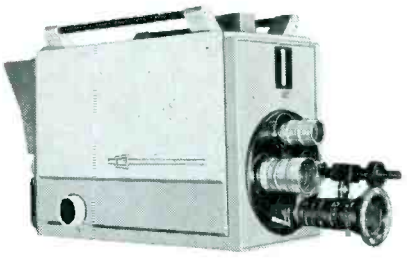
Merchandising Division
**P. O. Box 66**
**St. Ann, Missouri 63074**

DAGE

# The Best Value In Broadcast Equipment!

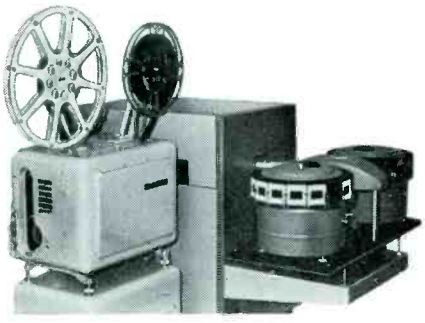
## Broadcast Camera



**Dage 520 System**

Available with PLUMBICON • VIDICON • SEPARATE FIELD MESH Best dependable solid state camera for all commercial and educational applications.

## Dage FC-11



**Film Chain**

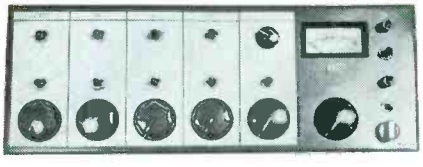
Dage Prism type multiplexer accepts up to 4 film or slide sources to compliment studio broadcast. New FC-11 film camera provides 800 lines of resolution.

## Broadcast VTR

**Dage DV300**

Portable Helical scan VTR measures up to any standard of comparison. More operational features with low tape usage and 2000 hour head life warranty.

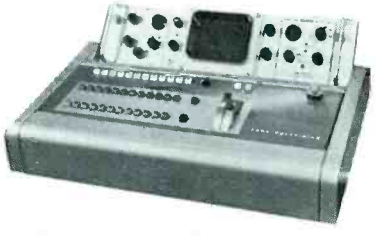
## Broadcast Program Control



**Audio Panel**

5 mixer channels with provisions to handle up to 8 mikes and 5 program sources-program and audition bus.

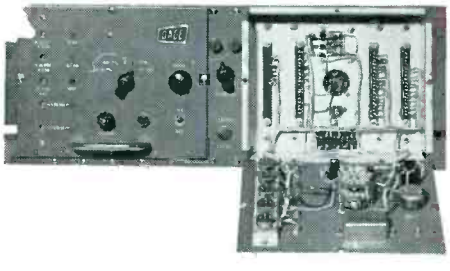
## Switcher Fader



**Broadcast Equipment**

Select either 8 or 12 camera input program lines composite or non composite, with additive or non-additive video mixing, all solid state, separate preview channel for program flexibility.

## Sync Generator



**Solid State Reliability**

Reliable Transistorized circuitry meets all EIA and FCC specs for broadcast use. Small compact space for all commercial and educational requirements.

RAYTHEON

# Dage-Bell Corporation

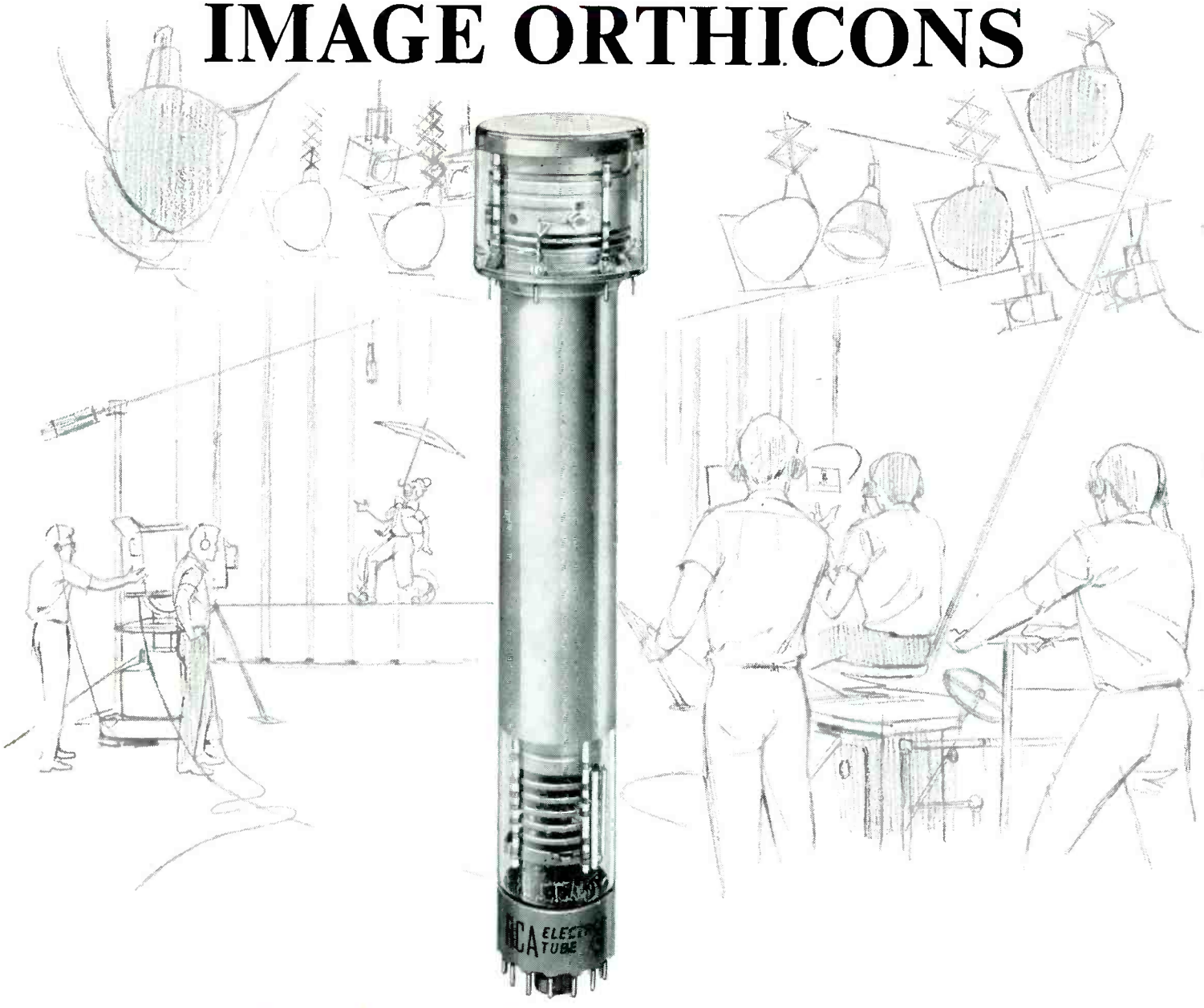
A SUBSIDIARY OF RAYTHEON COMPANY

DAGE TELEVISION PRODUCTS

455 Sheridan Avenue • Michigan City, Indiana 46360 • Dept. 30-10

Circle Item 58 on Tech Data Card

# RCA color capability
# IMAGE ORTHICONS




## 7513/S-4513/S For Superior Quality Studio Color

## 4415/S-4416/S For Uniform Color at Black-and-White Lighting Levels

## 8092A/S For Unequalled Remote Color Pickup

**AVAILABLE FROM YOUR RCA BROADCAST TUBE DISTRIBUTOR**

For complete technical information, ask for RCA's new Camera Tube catalog, CAM-600B. RCA Electronic Components and Devices, Harrison, N.J.

**The Most Trusted Name in Electronics**