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NOVEMBER 1965/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry

COLOR RIKER
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New

ENCODED

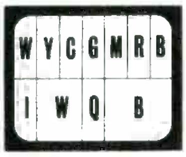
COLOR-BAR GENERATOR

SPECIFICATIONS

INPUTS—Sync, Blanking, Burst Flag, 3.58 MC/S

OUTPUTS—two—either Comp or Non-Comp—White, Yellow, Cyan, Green, Magenta, Red, Blue—I, Q, B, W

CONTROLS—Split Screen, Full Raster, 75% amplitude, 100% amplitude.



Now it is no longer necessary to tie up an encoder in order to produce color test signals.

The new RIKER MODEL 5618 provides standard ENCODED COLOR BAR SIGNALS. With a front panel switch you may select full raster or split screen presentations. A second switch selects color bars at 100% or 75% amplitude. All-transistor circuitry assures ultimate accuracy and stability.

This new precision color test signal generator is designed for use in checking studio facilities, setting up video tape recorders, and mobile vans. Color testing at transmitters can now be performed without requiring a video source from the studios, thus freeing facilities and personnel. The RIKER MODEL 5618 ENCODED COLOR BAR GENERATOR releases your studio encoders for program use.

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Circle Item 1 on Tech Data Card

now read this

A well informed individual usually makes the wiser decision

INFORMATION:

Shown below is the rear of the rack mounting frame used with our video and pulse distribution amplifiers and other plug-in units. You will appreciate the easy accessibility afforded by the connector configuration. Note that no connector is closely surrounded by several other connectors, as is the case with many other frames. As a result, cables may be plugged or unplugged with greater ease and speed.

The pulse distribution amplifier, model VI-20, pictured above, offers superior performance with many desirable features. A few of these features are:

- **Self-contained, regulated power supply in each amplifier.**
- **Four plug-in amplifiers mount in a 1¾" rack frame providing a total of 16 outputs.**
- **High isolation between outputs during <u>and</u> <u>between</u> pulses.**
- **Maintains constant output levels.**
- **Indicator lamp shows presence or absence of output pulses.**

Clean and precisely controlled pulses assure stability of camera sweeps and improved tapes. Pulse defects such as ringing, overshoots, rounding, poor rise time, tilt and line reflections are overcome by the pulse reforming action of this unit. The VI-20 pulse D.A. is wired to operate in the same standard rack frame as the VI-10A video D.A.

Price: One complete frame with 4 pulse amplifiers..$1100.00

Write for complete information and specifications

VITAL INDUSTRIES 3614 SOUTHWEST ARCHER ROAD GAINESVILLE, FLORIDA—PHONE 372-7254

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the technical journal of the broadcast-communications industry

®Broadcast Engineering

Volume 7, No. 11 **November, 1965**

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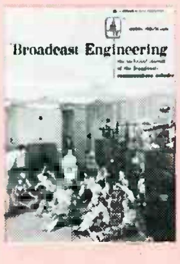
Departments

This class at University Schools, Bloomington, Indiana is serving two groups—the students in the classroom and, by closed-circuit television, student teachers at the Indiana University School of Education. Technical highlights of the system are described beginning on page 14.



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Just send this page to CBS Laboratories. We will send Audimax and Volumax to your station. If you want to send them home after 30 days, we will pay the freight. But if you want to make your station their permanent home, all you do is pay $665 each.

At the end of that period, chances are you will be so sold on Audimax and Volumax you will want to buy them.

And you should. After all, they can increase your program power 8 times.

Solid state Audimax is an automatic level control years ahead of the ordinary AGC. By automatically controlling audio levels, it frees engineers, cuts costs and boosts your signal.

Volumax, also solid state, outmodes conventional peak limiters by controlling peaks automatically without side effects. By expanding effective range and improving reception, it brings in extra advertising revenue.

We can afford to give Audimax and Volumax away free. Because we know they're so good, most people can't afford to give them back.

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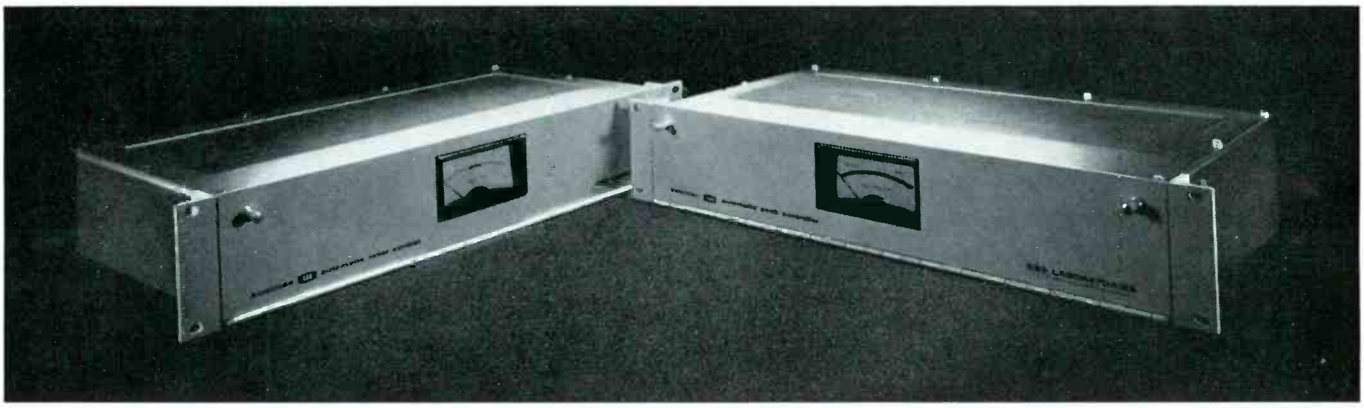


Circle Item 3 on Tech Data Card

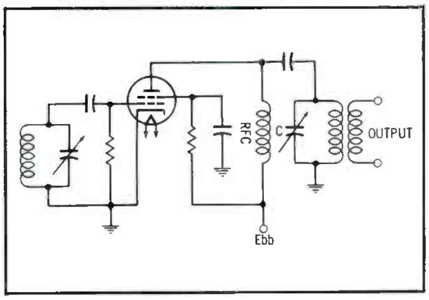
LETTERS
to the editor

DEAR EDITOR:

We enjoyed your article on class-C amplifiers (August 1965 BE, page 18), but please let's put a capacitor between the hot ends of the RF choke and the tank coil.

R. M. CHAMBERLIN

Chamberlin, Castle
and Associates
Vero Beach, Florida



The circuit (lower part of Fig. 1) will work much better this way!—Ed.

DEAR EDITOR:

I have just read the article "Surveying Central-American Radio and TV Activity" in your August issue. This is an immensely interesting article. An engineer who wants a warmer climate might well find a position at one of these stations where he could be a big help; but the Communist uprisings might dampen such enthusiasm.

The point was mentioned about equipment sales without instructions in Spanish or follow-up. This point cannot be stated too strongly. I have been an engineer at three stations, and there was only one sales representative of an equipment manufacturer who ever called on me. This one man, who has since left to work in a broadcasting station, took it upon himself to call on every station every trip. He helped me whenever problems arose, and would stop in even if there were no problems. The station engineer certainly appreciates such service, and the manufacturer will surely benefit from providing it.

PAUL SCHUETT

Blythe, Calif.

We're glad you liked the article, Paul. Broadcasting is a worldwide industry, and by publishing such reports we try to keep our readers up-to-date on what our neighbors all over the globe are doing.—Ed.

Most straight-forward design yet! The Gates FM-1G is the newest addition to the complete line of Gates FM transmitters. Only one power tube beyond the exciter provides a full 1000 watts output. Featuring a high degree of stability, the new FM-1G is quality all the way with reliable silicon power supply and built-in second harmonic filter. Supplied with the popular Gates "Cascade" exciter for extended frequency response, the FM-1G reflects a brand-new roundup of reasons why the soundest sound in FM is the new sound of Gates.

Send for complete description and specifications. Ask for brochure 164.

HARRIS INTERTYPE CORPORATION

GATES

GATES RADIO COMPANY
A Subsidiary of
Harris-Intertype Corporation
QUINCY, ILLINOIS 62302

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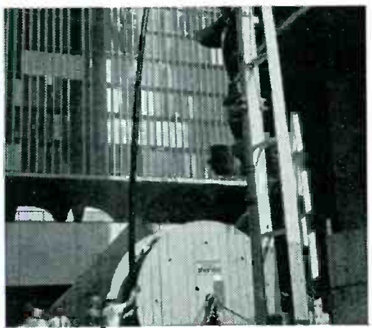
Export: Rocke International Corporation, New York City

Circle Item 6 on Tech Data Card

...Factory attached fittings

...Long lengths

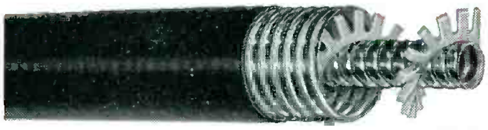


...No splices

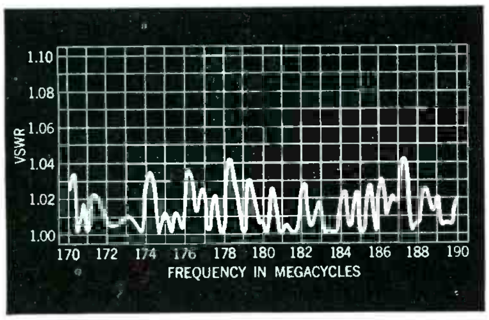
HELIAX 5" air dielectric coaxial cable hoisted from street to Marina Tower rooftop in one continuous length for ABC-TV, Chicago

HELIAX® FLEXIBLE COAXIAL CABLE

guaranteed reliability for high power RF transmission



Actual measured VSWR for installed 742 foot length of 5" HELIAX



Long continuous lengths, and flexibility of Andrew HELIAX cable made this critical transmission line system possible. Installation required less than six hours. Cost was dramatically reduced.

Type H9-50 HELIAX cable insures long term reliability in high power RF transmission*. Corrugated copper inner and outer conductors absorb stress and cable retains superior electrical qualities after repeated flexing. Andrew end connectors firmly anchor inner to outer conductor and eliminate any RF noise from vibration or temperature changes.

Contact your Andrew sales engineer, or write for information on this superior transmission line.

**Handles average power of 250 kw @ 10 Mc or over 50 kw @ 200 Mc*

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4-65

Circle Item 7 on Tech Data Card

Andrew CORPORATION

P. O. BOX 807 • CHICAGO, ILLINOIS U.S.A. • 60642

Some plain talk from Kodak about tape:

Kodak
TRADEMARK

The meat of the matter... and some boxing news

Undistorted output from a tape—as from any other link in the chain of audio components—is at the very heart of high fidelity enjoyment. Distortion (or the lack of it) is in theory simple enough to evaluate. You start out with something measurable, or worth listening to, and you reproduce it. Everything added, subtracted or modified by the reproduction, that can be measured or heard, is distortion. Since most kinds of distortion increase as you push any component of your system closer to its maximum power capability, you have to label your distortion value to tell whether you did this while coasting or at a hard pant.

Cry "uncle"

To make the distortions contributed by the tape itself big enough to measure and control, we simply drive the tape until it hollers "uncle" and use that power reference as our benchmark. Here's the procedure. Record a 400-cycle signal (37.5-mil wavelength at 15 ips) and increase its level until in a playback, which is itself pristine, you can measure enough 1200-cycle signal (third harmonic) to represent 2% of the 400-cycle signal level. This spells "uncle!" We use 400 cycles for convenience, but insist upon a reasonably long wavelength because we want to affect the entire oxide depth.

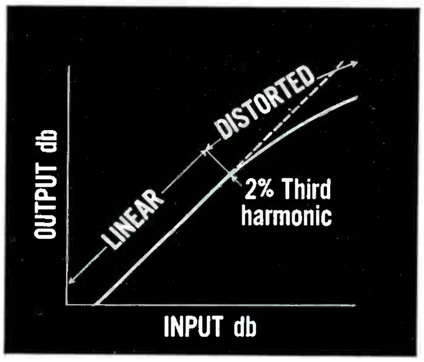
The more output level we can get (holding the reproduce gain constant, of course) before reaching "uncle," the higher the undistorted output potential of the tape.

Simple, what?

"Wadayamean—undistorted output at two percent?"

That's what makes a Miss America Contest. Two percent third harmonic is a reference point that we like to contemplate for a picture of oxide performance. Since distortion changes the original sound, it becomes a matter of acumen and definition how little a change is recognizable. If you're listening, two percent is a compromise between a trained and an untrained ear. If you're measuring, it comes at a convenient point on the meter. It's like a manufacturer testing all sports cars at 150 mph, even though some cars are driven by connoisseurs and some by cowboys. Same goes for tape. Two percent tells us a lot about a tape even if, on the average, you never exceed the 0.5% level.

Because undistorted output helps to define the upper limit of the dynamic range, it has a further effect on the realism of the recording. The higher the undistorted output, the easier it is to reproduce the massed timpani and the solo triangle each at its own concert hall level. And this is just another area where Kodak tapes excel . . . our general-purpose/low-print tape (Type 31A) gives you up to 3 decibels more crisp, clean output range than conventional tapes.



2% third harmonic distortion represents the practical limit to linear recording.

The great unveiling—Kodak's new library box with removable sleeve!

Kodak tapes—in the five- and seven-inch sizes—now *look* as good as they sound. We've put package identification on a removable sleeve and designed a tape library box with a smart new look. This box features durable one-piece construction, full index space, plus detailed tape use instructions on the inside. *Kodak* Sound Recording Tapes are available at most electronic, camera, and department stores.

New 24-page, comprehensive "Plain Talk" booklet covers all the important aspects of tape performance, and is free on request. Write: Department 8, Eastman Kodak Company, Rochester, N. Y. 14650.

EASTMAN KODAK COMPANY, Rochester, N. Y.

Circle Item 8 on Tech Data Card

UNDERSTANDING AND USING THE FIELD-INTENSITY METER

by ***Thomas R. Haskett,*** Central Regional Editor, Cincinnati, Ohio—Part 1. You should understand how this instrument works before you try to use it.

The field-intensity meter, as its name implies, is an instrument that enables the engineer to measure the strength, or intensity, of the field radiated by a broadcast station. Fig. 1 shows the appearance of such a meter (often denoted as an FIM) used for standard-broadcast work. It can be used to measure the field from any station within the range of 540 to 1600 kc, and will cover signal intensities from 10 microvolts per meter to 10 volts per meter. It is self-contained, battery-operated, portable, and direct-reading, and it will drive a strip-chart recorder where a permanent record of continuous measurement is needed.

Circuit Operation

Fig. 2 is a block diagram of the field-intensity meter. Only two tube types are used. Both are filamentary quick-heat types, making it unnecessary to leave the FIM turned on between measurements. The circuit contains an RF amplifier, a converter stage, three IF amplifiers, a crystal-diode detector, and a calibration oscillator. A shielded, unbalanced loop antenna is used to minimize stray electrostatic noise pickup. The receiver circuit is fairly conventional, except that the RF amplifier and three IF stages make the field meter extremely selective —it has a bandwidth of 7 kc at 1000 kc and both image rejection and IF rejection exceed 80 db. The circuit is also quite sensitive, and for measurement of high signal intensities this sensitivity is reduced by attenuators in the RF- and IF-amplifier input circuits.

Much shielding is used in the FIM to prevent stray pickup which would destroy accuracy. The second detector is a crystal rectifier which drives the meter movement and a headphone jack, the latter for aural monitoring. The meter movement is calibrated to read field intensity directly on a logarithmic scale which is graduated 1 to 10 and has no zero position. The pointer rests to the left of the first mark when the instrument is turned off. S1, the FULL SCALE RANGE, or attenuator, switch, inserts precise amounts of attenuation into the receiver circuits and provides for full-scale deflection of the meter as follows: 100 uv/m, 1 mv/m, 10 mv/m, 100 mv/m, 1 v/m, and 10 v/m.

The attenuator is arranged so that attenuation takes place first in the input to the IF amplifier. On the 100 uv/m position, the 1 mv/m position, and the 10 mv/m position of the FULL SCALE RANGE switch, the RF attenuator is out of the circuit, and the RF stage is running wide open for maximum signal-to-noise ratio. On the 100 mv/m position, the 1 v/m position, and the 10 v/m position, the IF attenuator is maintained at full attenuation, and loss is introduced progressively in the RF attenuator. The attenuator cannot detune the RF amplifier, for this stage operates with fixed bias.

The calibrating oscillator, V6, is the heart of the FIM, for it permits on-location calibration for any

Fig. 1. FI-meter, loop in operating position.

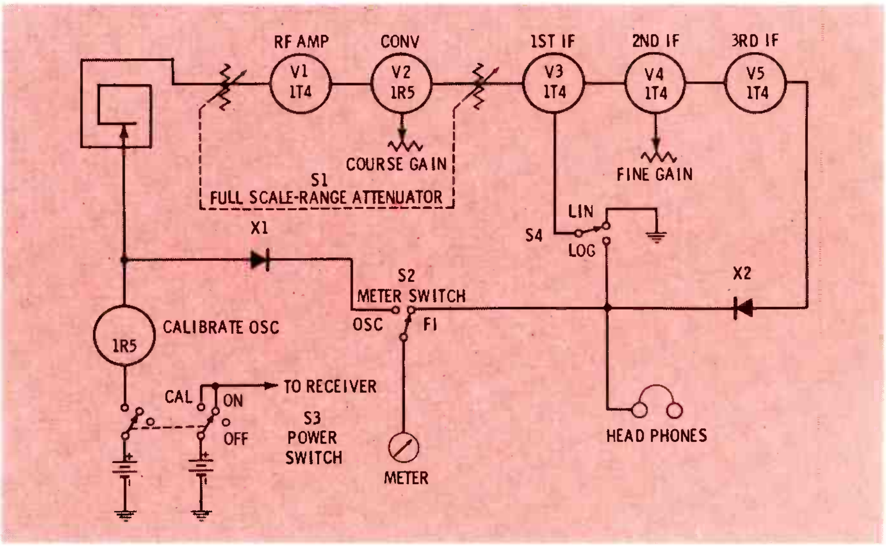


Fig. 2. Block diagram of field-intensity meter shows how to calibrate instrument.

desired signal. With METER switch S2 in the FI position so that the meter reads signal intensity, the desired station is tuned in and the loop rotated for maximum signal. The loop is then rotated 90°, reducing the desired signal nearly to zero. The calibrating oscillator is then switched on by putting POWER switch S3 in the CAL position. (Note that the receiver is still on.) The METER switch is put in the OSC position, and the strength of the signal injected into the loop is measured on the meter. The METER switch is then returned to the FI position, with the calibration oscillator still on, and by means of the coarse and fine gain controls the receiver gain is set so that a reading equal to the one for the OSC position is obtained. In this manner the receiver output is calibrated against a known input at the frequency on which it is to be used. Field intensity is then read by switching off the calibrating oscillator and orienting the loop for maximum meter deflection.

Accuracy and Calibration

Primary calibration of the field meter is accomplished by placing the instrument in an RF field of known intensity and adjusting certain components until the meter reads the exact amount of the field. This is performed at various frequencies across the broadcast band, unless the customer orders spot calibration at one frequency only. For reasons of frequency tracking, slight errors (less than 1%) may be found at a few specific frequencies. This calibration requires laboratory instruments of extremely high sophistication and can be done only by the manufacturer or the National Bureau of Standards.

A new meter (or a recalibrated one) bears a calibration certificate listing the exact amount of error at various frequencies and accompanied by an affidavit signed by the calibrating engineer. The date of this calibration certificate is very important, as the FCC may not accept measurements made with a meter calibrated more than a year prior to the date of the measurements.

If your meter was last calibrated more than a year ago, you can assure yourself of its accuracy by comparing it with a recently calibrated meter. This is done by placing each meter in turn in a stable ground-wave field. It is best to take several measurements with each meter, and run graphical comparison curves on them. For instance, if you plan to measure on 1380 kc, it is desirable to take comparison measurements at 1370, 1380, and 1390 kc at field intensities of .5, 5, and 50 mv/m on each frequency. Since it may be inconvenient to find signals at such levels and frequencies, a simple method is to radiate a signal from an RF generator feeding an antenna composed of 20 or 30′ of hookup wire strung around a room. Chalk a square on a table in the center of the room, and place each field meter in precisely the same position within the square when taking the readings.

The accuracy of the FIM is stated two ways by the manufacturer—attenuators are rated at 2%, and the meter-scale accuracy is within 3% of indicated readings, provided proper battery voltages are present. Batteries are checked by using the meter movement itself; the METER switch has four positions (not shown in the diagram) that allow readings to be made of receiver and oscillator A and B batteries. So long as the meter indicates within the green band, the batteries are usable.

Operation of the Field Meter

Before opening the meter case, clean the loop-antenna contacts (located atop the case beside the handle) with a soft rubber pencil eraser (Fig. 3). This should be done once or twice each day the instrument is used, and any time the meter gives erratic readings. Dust accumulates easily on these unprotected contacts. Next raise the cover into operating position (as in Fig. 1), turn the FULL SCALE RANGE switch to the 1V CAL position, and turn the POWER switch to the CAL position. The METER switch should then be rotated to the AR, BR, AC, and BC battery-check positions. If any position gives a pointer deflection below the green band on the meter scale, the corresponding battery must be

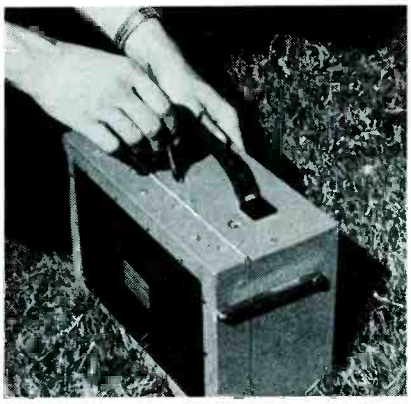


Fig. 3. Pencil eraser is used to clean contacts to avoid erratic operation.

replaced before the instrument can be used.

Assuming that the batteries are good, turn the POWER switch ON and the METER switch to FI; place the LOG-LIN switch on LIN. (Except for those rare occasions when a strip-chart recorder is used with the FIM, this switch should **always** be in the LIN position. Check it when starting a day's measurements.) Plug a pair of headphones (25,000 to 50,000 ohms impedance) into the PHONES jack to allow aural monitoring of the desired signal. Turn the FULL SCALE RANGE switch downrange to the approximate range of signal expected. Turn the COARSE GAIN control about three-quarters on and the FINE GAIN control about one-half on. Note that the COARSE GAIN control may affect tuning, whereas the FINE GAIN usually does not. Hence, it is desirable to obtain a satisfactory setting of COARSE GAIN before calibration, and subsequent adjustments should be made with FINE GAIN only.

Adjust RECEIVER tuning (by means of a large knob to the right of the meter) to the frequency of the desired signal, as read on the right-hand tuning dial. Use the meter itself as a tuning indicator and peak the tuning. Rotate the instrument and loop for maximum signal (the loop is, of course, bidirectional, with two peaks and two nulls); then retune for peak signal. Note that slightly different peaks may be reached when tuning for resonance from left or right; this is a mechanical matter which is peculiar to each instrument. Once the tuning has been peaked, do not readjust RECEIVER tuning during

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TV TRANSMITTER PROOF OF PERFORMANCE

by Patrick S. Finnegan, BE Consulting Author, Chief Engineer WLBC AM-TV, WMUN FM, Muncie, Indiana—A description of how these vital measurements are made.

Every TV station should make a proof-of-performance at least once a year and partial proofs at shorter intervals. Since a proof helps the station operator to assess the performance of the system, it is actually a preventive-maintenance measure. The partial proofs help in maintaining the equipment in top operating condition throughout the year.

There is no specific form required for the proof, but one acceptable method is to follow as a guide the engineering-data section of the license-application form and Sections 73.682 and 73.687 of the FCC Rules. There are actually two individual proofs to be made—one for the aural transmitter and one for the visual transmitter.

Aural

Measurements made on the aural transmitter are much the same as those made on a standard FM transmitter. There are a few differences in tolerances, and the carrier frequencies are different. Since no tolerances have been established concerning the amount of interaction between transmitters, the visual is turned off when making the aural tests and vice versa.

The aural measurements are made for the entire system from microphone-preamplifier input to transmitter output, just as with any FM station. Any AGC or compression amplifiers must have these functions disabled; otherwise the readings taken will be meaningless.

Before beginning to make measurements, it is a good practice to make a few spot checks. Measure response, distortion, and FM noise at 100 cps, 400 cps, 1 kc, and 10 kc at 100% modulation. These spot checks should indicate if there are going to be any problems; if there are, they can be corrected before wasting time and setups on the regular measurements.

The impedances of the audio generator and the preamplifier input must be matched so that the measured high-frequency response will be correct. Also, be careful about mixing balanced with unbalanced circuits; this can result in excessive hum. Proper grounding procedures between the measuring equipment, generator, and building ground are vital.

A block diagram (such as the one in Fig. 1) showing the amplifiers in the system and the level indicated at each input serves as a record of the setup used and as a reference for future use when there is trouble in the system.

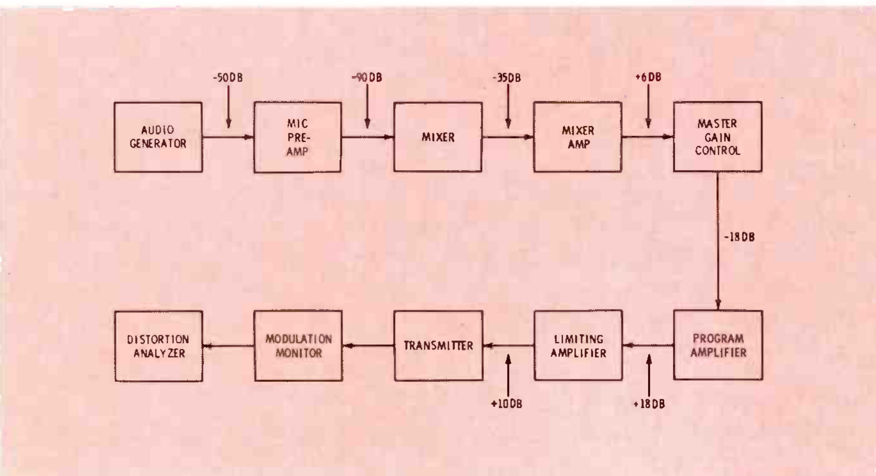

Fig. 1. Block diagram for measurements of the audio system shows volume levels.

In making the response measurements, the input level is adjusted to maintain the required modulation percentages; the modulation monitor is used as the indicator. This instrument does not use de-emphasis, and appropriate allowance must be made for this fact. Also keep in mind that the input signal changes in a direction exactly opposite to the system response. That is, when the system gain is increasing, the input level will be decreasing. This can be somewhat confusing to a groggy-eyed technician in the small hours of the morning. The safest procedure at such times is to use a pencil and paper to compute the values correctly rather than to depend upon mental calculations. The measured response curves must fall within the limits of the Standard pre-emphasis curve (Fig. 12 of Section 73.699, FCC Rules).

It is best to measure distortion each time a response measurement is made. This will save both time and setups. It will quickly point out overload conditions, especially in the preamplifier. Should the distortion figures seem too high, try lowering the input level one or two db. If an overload condition exists, the distortion will drop immediately.

Distortion measurements are required up to 15 kc at 100% modulation. For the 50% and 25% modulation tests, they are required only to 5 kc. This is permitted in TV service because the monitors have too much inherent noise at the lower levels. Distortion measurements are made using de-emphasis; the distortion output terminals on monitors have the de-emphasis incorporated internally. Tolerances for distortion are found in 73.687 (b) 3 of the Rules.

There are two separate noise

measurements to be made. The first is FM noise, with a maximum permissible value of —35 db. Generally, it is necessary to measure noise at only 400 cps. An oscilloscope helps the operator determine what components make up the noise. If it is predominantly hum, he can adjust the hum-balancing controls for minimum; if it is fine-grain noise, a tube may need to be changed or a control cleaned.

The AM noise measurement indicates how much the FM carrier (which should be of uniform amplitude) is amplitude modulated by hum, etc. The diode detector may be borrowed from the visual side and used to rectify the aural carrier, and a meter is used to read the resulting DC voltage, which is proportional to carrier level. If the carrier were 100% amplitude modulated by a sine-wave signal, the output of the detector would be a sine-wave voltage having a peak amplitude equal to the DC value obtained for the carrier alone, or an rms value numerically equal to .707 of the DC value. This output can be simulated by operating an AF signal source at the proper level as determined using the same meter used to measure the DC detector output. The AF signal is then used to make the full-scale calibration of the noise meter. After the calibration is performed, the rectified aural carrier is fed to the noise meter, and the AM noise is measured. Permissible value here is—50 db relative to 100% modulation.

Visual

Unlike the aural proof, the visual proof is done for the most part only

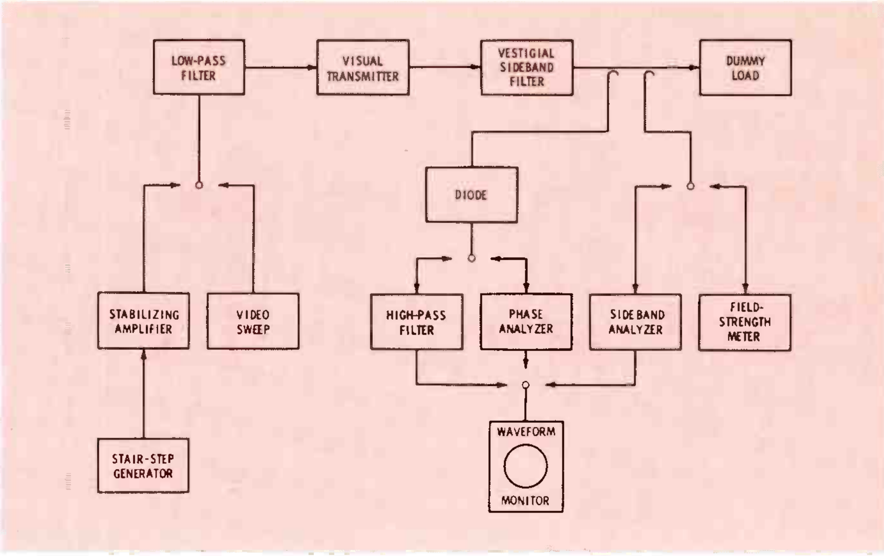

Fig. 2. Diagram similar to this can be used to show setups for tests on video transmitter.

on the transmitter working into a dummy load. However, most operators prefer to make some overall system measurements, particularly of response, linearity, and phase. The basic requirement for an overall measurement is that sync must be supplied along with the test signal so that the clamp circuits may operate properly. As with the audio proof, it is a good idea to draw a block diagram of the test setup (as in Fig. 2).

Measurements showing overall attenuation vs frequency must be made. A video sweep signal is fed to the transmitter through the low-pass filter, and levels are adjusted carefully to prevent overloading. The transmitter is operated "AC Coupled"; that is, the clamp bias is switched to a fixed bias and adjusted for mid-characteristic operation. This results in approximately 30% power on the reflectometer. A diode detector is connected after the sideband filter, and an oscilloscope serves as a measurement indicator. The display should be the familiar "boot" pattern, with limits as set out in 73.687 (a) 1 or 2 and Fig. 11 of Section 73.699. A tracing of the oscilloscope pattern should be made and plotted on a graph scaled in db (Fig. 3).

The upper and lower sidebands must be measured. There are two ways this may be done: with a sideband analyzer or with a field-strength meter.

In the sideband-analyzer method, a video sweep modulates the transmitter, operated mid-characteristic, AC coupled. A sample of RF is picked up after the sideband filter and fed to the analyzer, the output of which is displayed on an oscilloscope. Care must be taken to avoid overloading and compression, both with the modulating signal and the RF input to the analyzer. A tracing from the scope display should be made. Without making any other

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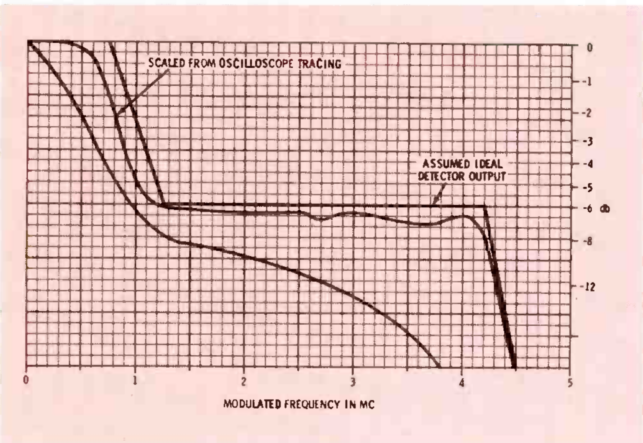

Fig. 3. Video response is shown by tracing of scope display.

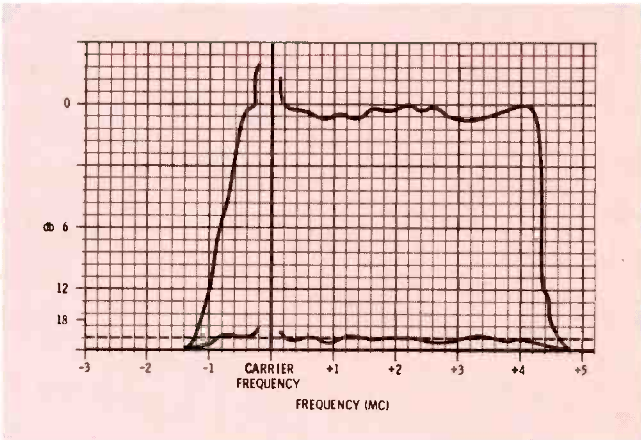

Fig. 4. Attenuation vs frequency is shown by display tracings.

CCTV TEACHES TOMORROW'S TEACHERS

*by **Richard Mann**, Technical Coordinator-CCTV, School of Education, Indiana University, Bloomington, Indiana*—TV brings new and improved techniques to the classroom.

The School of Education at Indiana University has put into service a CCTV system that provides tomorrow's teachers with unobtrusive observation of elementary and high-school classes. The system also connects into the campus-wide CCTV network and utilizes off-the-air signals. It makes use of extensive patching and custom features achieved with the use of standard components.

Inauguration of the system culminated more than a year's design and engineering work that saw extensive revision of the original design concept. A number of special-use features put limitations on the system: It must be simple to operate, be of broadcast quality throughout, be under the constant control of the demonstration teacher and the methods teacher (the future teachers' teacher), afford high resolution, be unobtrusive in classroom use, and be extremely reliable.

Cost loomed large, since the School of Education wanted to be able to view an extensive cross-section of the University Schools classes ranging from first grade to senior high school. With 86 classrooms plus individual study booths and other areas where viewing would be desirable, permanent camera installations in all rooms were out of the question.

System Sources

The problem was solved by the use of mobile television-camera cabinets (Fig. 1) built around fully transistorized cameras. The camera units operate in conjunction with redundant coaxial cables and intercom wires that were run to 34 University Schools classrooms. The cameras provide 800-line resolution and stability through a temperature range of —4° to 130° F — important for outside pickups (play areas, etc.).

Six of these mobile cabinets were built. In normal usage, two cameras are mounted in the demonstration classroom, one at the rear to cover the teacher and to sweep the room from the rear, the other at the front to permit viewing of student reactions. Consequently, three classrooms can be viewed via CCTV at one time with the normal complement of cameras. Six rooms can be viewed by using one camera in each

Fig. 1. A mobile vidicon camera unit.

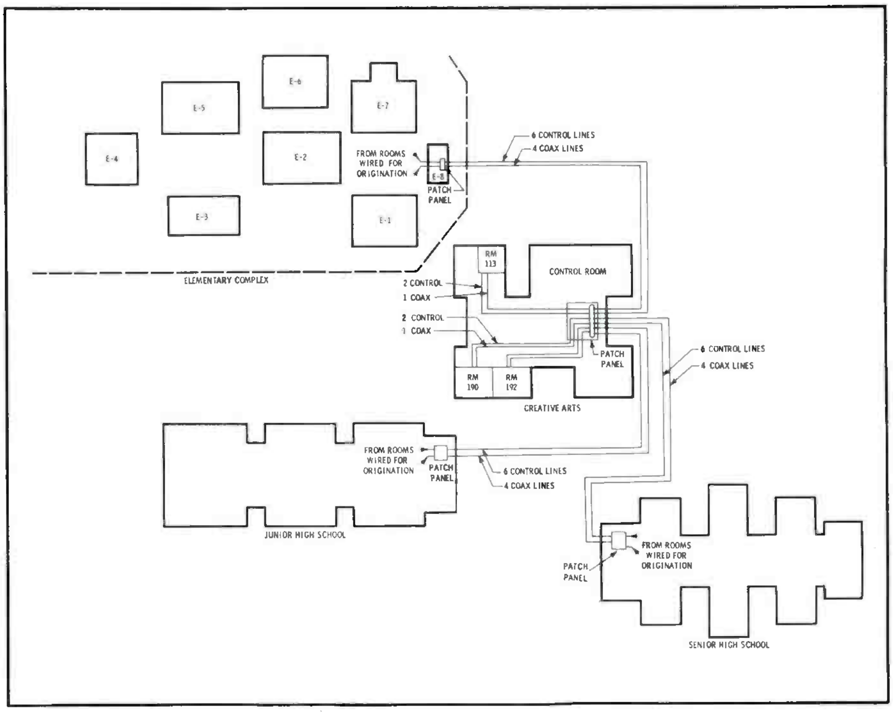

Fig. 2. Camera signals are modulated on RF, sent to control room via coax lines.

room. Of course, more units can be added as the need arises.

A permanently mounted camera (this will be fitted later with pan, tilt, and zoom capability) in an individual study room and another that shoots directly into a pedestal-mounted 16-mm projector for film presentations complete the camera facilities. Two VTR's and an off-the-air system add to the overall signal-source capability of the system.

The Mobile Cabinets

Each mobile unit contains a transistorized vidicon camera with zoom lens and pan-and-tilt head, an EIA solid-state sync generator, an RF modulator, a directional microphone, microphone preamplifiers, AGC/line amplifiers, intercom facilities, a power supply, power distribution with circuit-breaker panel, and an audio-gating device. Nondirectional microphones are available for auxiliary pickup and can either be hung from any of the five existing hangers or used as neck microphones. Audo gating, with variable threshold setting, eliminates background noise when no one is talking; these noises are "masked" by normal speech.

The original design of the audio system had called for a hybrid audio system with a line-amplifier compressor, but it was decided to change to an all solid-state audio system (amplifier module and compressor module) using audio attenuators. The complete audio system requires a panel only 5¼" x 19". The change to all solid state enhanced the reliability of the unit, reduced heat build-up problems, and cut the weight of the mobile cabinet by an estimated 30%. This left room for a storage drawer (not in the original design) that holds auxiliary microphones, zoom lens, test equipment, and even the camera. Moreover, two men can now lift or handle the unit; this would not have been possible with the original design.

Another change in the design of the "'television studio on wheels" was in the location of the power supply. Originally this was to have been located at the control center, but since University Schools is a multibuilding complex rather than a single structure, this would have involved extensive cable installation. Instead, the units are powered by ordinary wall-outlet 120-volt AC, with 24-volt DC relay control from the control center. This also renders a benefit during setup; if the unit produces a signal not received at the control center, then clearly there is cable trouble. Under the original design, failure to receive a signal could mean either cable trouble or unit failure.

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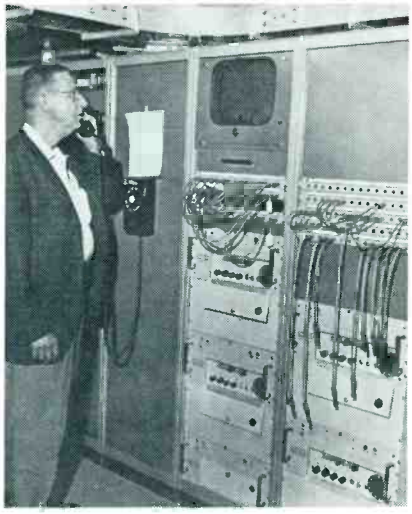

Fig. 3. Operator uses intercom to classroom. Note also 14" monitor, patch panels.

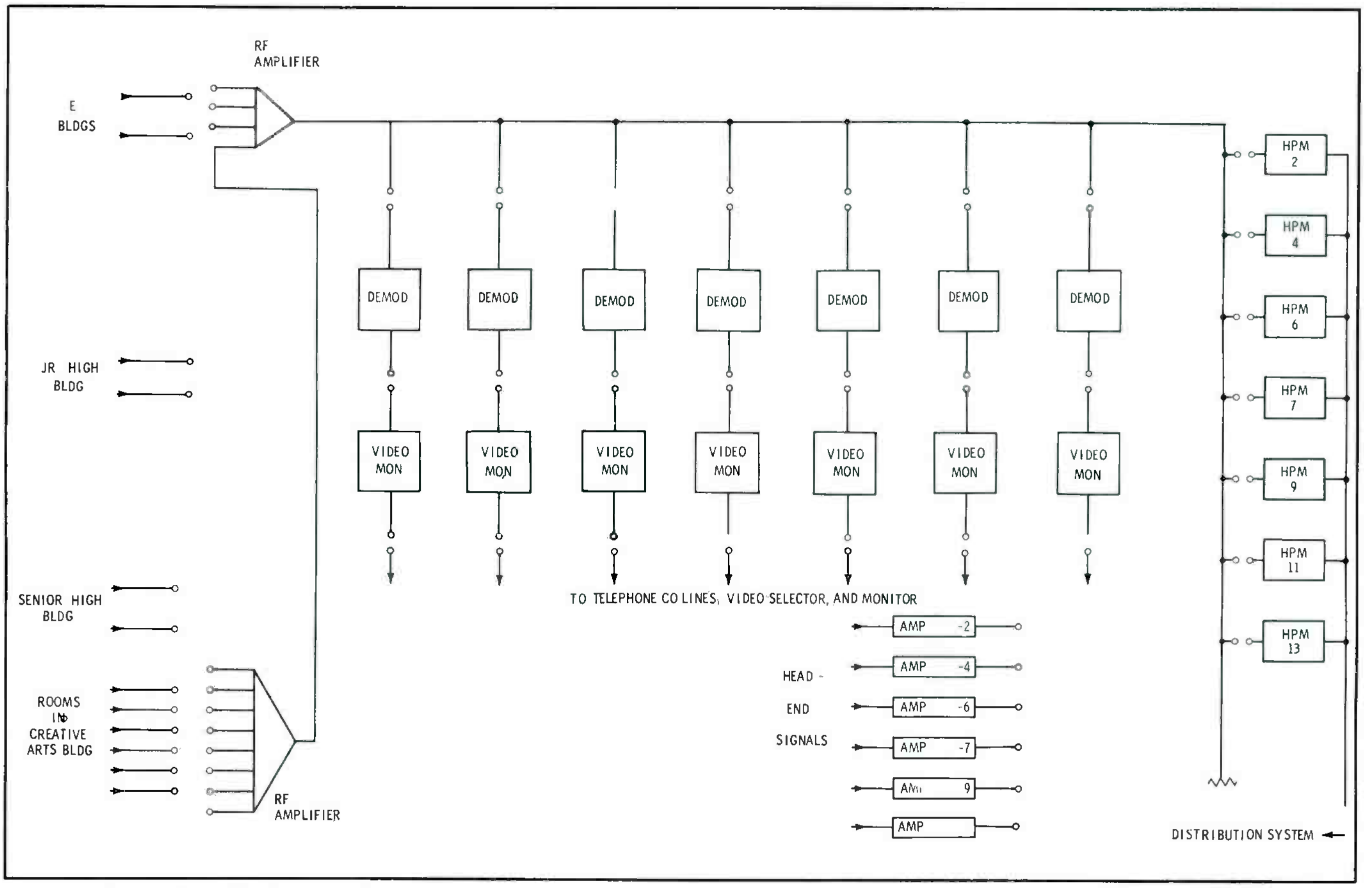

Fig. 4. Simplified block diagram of University Schools CCTV system shows basic RF routing through control room.

HOW TO CONDUCT A SITE TEST

by ***Robert A. Jones,*** Midwest Regional Editor, and Howard L. Enstrom—Today's allocation problems often make these tests necessary when planning a new station.

Section 73.36 of the FCC Rules permits special site-test authorizations if the applicant can show that a need for the measurements exists. Probably the most important and most common use of site tests is for measuring soil conductivity. The FCC's Soil Conductivity Map (designated Figure M3) lists conductivity values existing in 1954 for all parts of the United States. It was based, in part, upon all measured data then on file. Even today, many areas have not been measured, and others may exhibit values varying widely from those shown on the map. Since Section 73.183(c) requires the use of FCC Figure M3 in areas where accurate and dependable soil measurements have not been made, actual station contours sometimes differ greatly from predicted intensities. A site test is useful in selecting a proper transmitter location. From the results of the test, the engineer can predict with certainty whether the 25 mv/m contour will cover the business district and the 5 mv/m contour will cover the residential areas as required. He can also predict whether the proposed station will overlap other stations, whether a station at the proposed site will cover desired nearby communities, and whether one site is better than another. As an example, a site test would be called for if calculations based on FCC Figure M3 indicated a minor overlap with another station would exist. If a site test were conducted and lower values of soil conductivity were found, the overlap would be nonexistent, and the new station could be approved. The site-test results also indicate whether a directional or nondirectional antenna system is needed.

Site tests don't always give favorable results, of course. However, if reasonable precautions are taken and if results obtained by measuring other stations in the area show the true soil conductivity to differ from that indicated by Figure M3, helpful results can be expected.

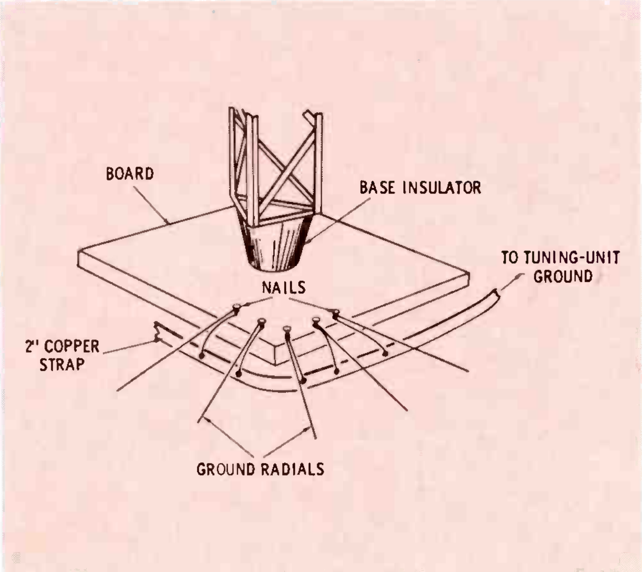

Fig. 1. Ground wires must be firmly connected to copper strap.

Fig. 2. Tower base and tuning unit at site-test installation.

The Authorization

The first step is to obtain FCC authorization to conduct the site test. If you are not already a station licensee or an applicant, it is necessary to submit Section II of FCC Form 301 along with your request. There is no special form for making the request; however, it should be in writing and signed under oath. The request must include the following information:

1. Purpose, duration, and need for test,
2. The frequency to be used, the plate power of the transmitter, and the time of operation,
3. A brief description of the test-antenna system, including height, the number and length of ground wires, and the expected effective field (in mv/m at one mile),
4. If the site test includes a request for a directional antenna (normally nondirectional tests are conducted), an estimate of the maximum expected field intensities in the directions of pertinent stations,
5. A description of the test-site location. If possible, give both a street address and the geographic coordinates.

The FCC staff is most efficient in handling these requests, and approval (by collect telegram) can be expected within a few days. Since this telegram is the only authorization you will receive, it should be saved and posted at the test site as proof of authority.

The Equipment

The next step is to construct the test installation. Since test sites are used only temporarily, the ground wires normally are not buried, but are laid on the surface of the ground. It is generally satisfactory to use about 33 wires, each 100′ long and made of No. 10 soft bare copper wire. The more wires and the longer the wires used, the better the system efficiency will be. A large board with nails around the edge may be used to hold the ends of the wires until they are soldered to a copper strap which connects to the tuning-unit ground (Fig. 1 and Fig. 2). Since the system is used only for a few days at most, soft solder can be used to connect the wires.

In erecting a temporary antenna, it is best to remember that upon completion of the test the system will be dismantled. A lightweight aluminum tower or mast (Fig. 3) normally can be used. If additional height is needed, a few sections of aluminum tubing can be extended above the tower. For the base insulator, some ingenuity is often required. The one shown in Fig. 2 consists of a large power-line insulator inverted in an old Christmas-tree stand. Large glass jars, glazed bricks, or other insulating material can be used as well.

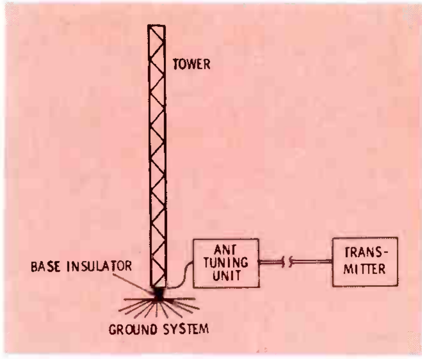

Fig. 5. A simple equipment arrangement like this is sufficient for a site test.

Keep in mind that the guy wires also must be insulated. Plastic clothes line is satisfactory, and it is inexpensive. If you use this material, make certain that you don't install the type with a core of steel wire. For the 60′ tower shown here, it was necessary to attach guys at just one level.

A transmitter such as the one in Fig. 4, while designed for amateur radio service, can easily be padded down to cover the high end of the broadcast band. Shown in the photograph above the transmitter are the line-voltage meter, the VSWR meter, and the antenna ammeter. The equipment must be operated under the direct supervision of a licensed radiotelephone operator (first- or second- class) at all times.

The antenna tuning unit, the transmission line, and the transmitter must now be connected. Fig. 5

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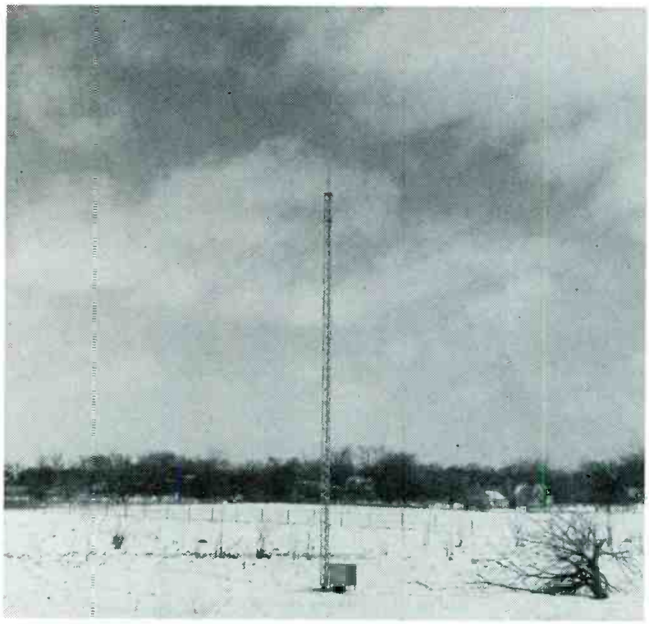


Fig. 3. 60' site-test tower guyed at top with plastic clothes line.

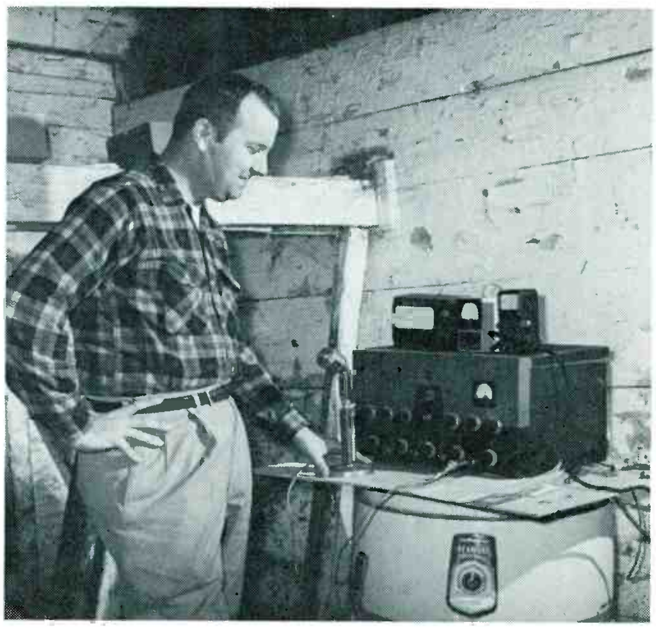


Fig. 4. Transmitter should be sheltered. This barn was nearby.

MAINTENANCE OF THE UHF TRANSMITTER

by George C. Sitts, Eastern Regional Editor—A good preventive-maintenance program can save money for the broadcaster.

Maintenance of the UHF television transmitter has assumed new importance with the rise of a new breed of UHF station. In the past, a VHF or modest-budget UHF station maintained an auxiliary or alternate main transmitter, permitting some laxity in transmitter maintenance. UHF stations that had only one transmitter usually operated on a limited schedule, allowing ample time for maintenance between sign-off and sign-on. Now, however, new full-schedule, single-transmitter, low-budget UHF operations have changed the picture. Engineers must depend almost entirely on preventive maintenance to keep their stations on the air and their operating costs low. To determine what makes up an effective transmitter preventive-maintenance program for low-budget UHF stations, we asked transmitter manufacturers and numerous transmitter supervisors with past experience in the low-budget field for their recommendations.

The aim of a good preventive-maintenance schedule is to reduce down-time and prevent damage to expensive equipment. Down-time in the single-transmitter station means lost revenue and lost community respect—an intangible but important factor. Equipment, particularly in the final stage, is expensive; avoiding a burned-up final amplifier or associated part is well worth the hours spent in giving the equipment routine care.

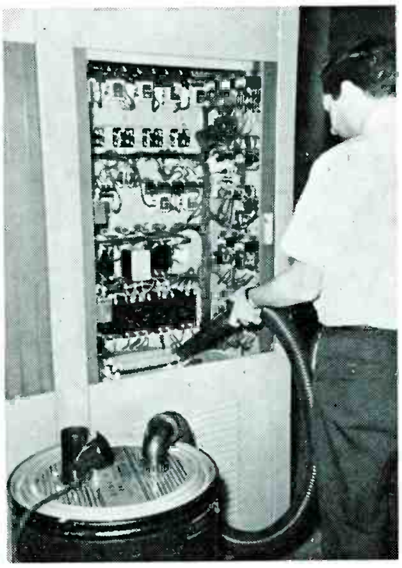
Transmitter maintenance falls into two general categories: physical, or mechanical, maintenance and electronic maintenance.

Physical Maintenance

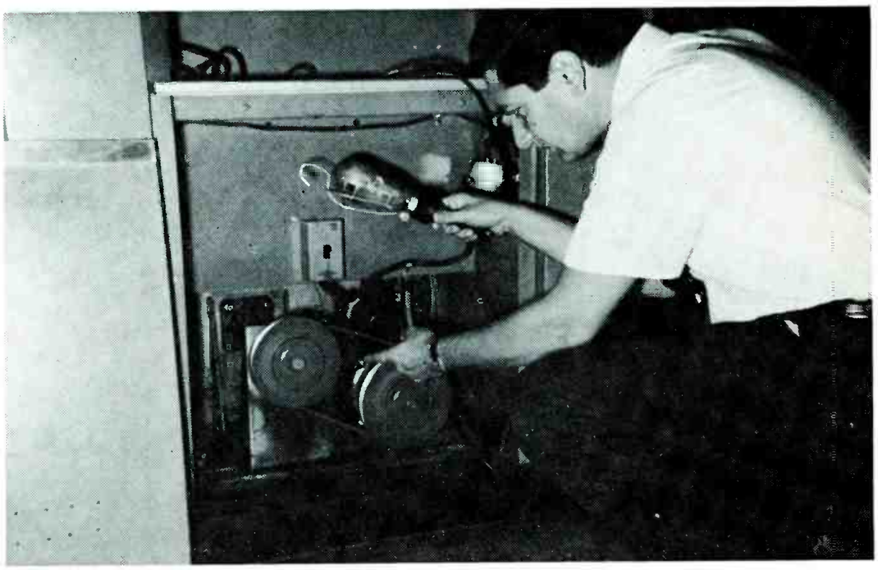
Physical maintenance, the more time consuming of the two, is less understood by new transmitter operators. This is perhaps to be expected, since most transmitter operators are principally electronically inclined by nature of their occupation. As one operator put it, "If I'd wanted to use a dust rag, I'd have gone to janitor school." Nevertheless, if you as maintenance engineer tend to overlook physical maintenance, you will inevitably pay for it in more down-time.

To begin physical maintenance, dust the whole unit thoroughly, and wipe over outside surfaces with a soft cloth. Dampen the cloth with mild soap and water when it is used on meter faces and plastic windows. Of course, avoid use of solvents or abrasives. Admittedly, this does little to increase transmitter reliability, but psychologically, clean equipment indicates to station management that you are maintaining it, which is to your advantage when trouble does occur.

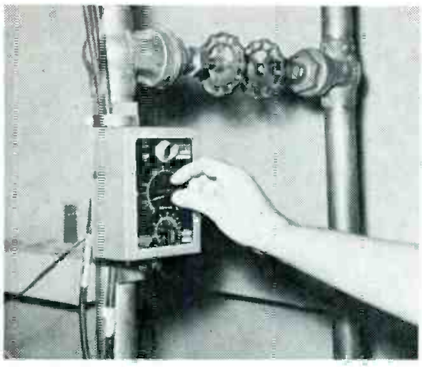
Next, get down to serious cleaning. Dust and vacuum the entire inside of the transmitter. Be sure to wipe off such known trouble spots as plate mica capacitors. Due to the exposed high voltage, these tend to collect dust and thus arc over frequently, particularly in the IPA and doubler stages. Several



Clean inside the transmitter regularly.



Inspect blower belts frequently, and replace when they show signs of wear.



This device permits operator to measure resistivity of cooling water in the system.

engineers mentioned this problem, and the only solution seems to be frequent cleaning. (Needless to say, you must stay away from any high-voltage point when the voltage is present.)

Air systems also require frequent attention, particularly in the southwestern United States. Pull out all air filters; clean permanent types, and replace disposable types when necessary. Check on air flow; remember even water-cooled finals require good air flow to cool their associated equipment. While you are checking the air system, clean and oil blower motors, and examine belts for wear. Belts are inexpensive, so if one looks bad, replace it —a two-dollar belt could save you a driver stage.

If your system is of the water- or vapor-cooled type, some additional maintenance checks are necessary. Examine the entire cooling system carefully for signs of leaks. A small leak may not result in lowered coolant level until after some of the liquid has dripped

A "feel test" may be used to locate trouble in transmitter RF plumbing.

on a B+ connection or a hot tube. While you look for leaks, examine hoses for deterioration. These are not worth saving when they begin to age. Changing a hose almost inevitably involves complete shutdown of the transmitter—it's worth the price of a new hose to do this job at your convenience.

When you are satisfied no leaks are imminent, check the water-flow and return-temperature meters. Water is a regular problem, for even distilled water seems to pick up particles from one place in the system and deposit them elsewhere. Also, many systems don't use distilled water, but depend on the filtering of tap water. In either case, the quality of the system you use will determine the rate of build-up.

Check mineral build-up occasionally — frequently when the rig is new, less often as you become familiar with the build-up pattern. When you look for build-up, make a water-resistance check by removing the final plate lead, or high-voltage lead, and checking the resistance to ground. If the resistance drops below two or three megohms, replace the water filters and associated parts.

Immediately after sign-off is a good time to make a quick check of the high-level RF connectors. Look at them for signs of heating; then "feel test" each elbow and connection for heating. Include all connections from the doubler stage through the filter-diplexer unit.

A regular program of tightening the coaxial connections should prevent any problems in this area. Use a screwdriver to tighten all terminal-board connections. Connection tightening is another of those maintenance operations needed frequently when equipment is newly installed and only occasionally as it ages. And while you are on that first tightening spree, be sure all nuts and bolts that hold the rig together are secure.

Obtain a good contact-burnishing tool and start on the relays next. Clean all exposed relays and examine each contact for pitting. Replace any contacts that appear deteriorated. This is one operation many engineers overlook until it is too late — with predictable results.

Some transmitters have a tendency to develop noise from their

A regular program of tightening high current and RF connectors is wise.

cavities, particularly in the exciter stages. Often this can be cured temporarily by dismantling the cavity and running a clean, soft cloth through it. If the noise continues and is bothersome, it is time for a regular clean-up. Replace the cavity with the spare; then thoroughly clean both the inside and the contact springs. Remember that an oxidized silver surface is a good conductor. Your aim is only to clean foreign matter from the surface without scratching the silver. Examine all contact springs and replace any that appear corroded. When you have reassembled the cavity, store it in a clean, dust-tight enclosure until you need it.

Physical maintenance is principally the keeping of foreign matter from the system. Your particular transmitter or its location may require special precautions.

Electronic Maintenance

As a starting point for electronic

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Keeping the cavities clean helps maintain cavity noise at a minimum level.

FORTY-FIVE YEARS OF BROADCASTING

by ***Joseph E. McCormack,*** Transmitter Supervisor, WCIN, Cincinnati, Ohio —
A veteran broadcaster reminisces about the early days of broadcasting.

It's hard to pinpoint the date when broadcasting began—after all, it was nearly a half-century ago. November 1920 is often considered to be the time when broadcasting actually started, so it's appropriate to pause this month and look over our shoulders to see how far our industry has come since those days not really so long ago.—Ed.

In the year 1920, ham operators were slowly salting away their spark-coil transmitters. The four-foot-high loading coil, the coherer detector, and the rotary spark gap soon would be things of the past. The Electro Importing Company and William B. Duck catalogs were being filed away as memories of days gone by. Just a few years before, a young engineer named Lee DeForest, while experimenting at San Jose college, had added a third element, a "grid," to the diode valve. The name of wireless was gone; it now carried the new name "radio." Music was beginning to fill the air and was free for all who wanted to put together a few turns of wire on an oatmeal box, a hunk of mineral called galena, a cat whisker made out of a sewing needle, a telephone receiver borrowed from the house phone, and a wire strung between two trees for an "aerial."

Just who was the first to broadcast is a matter of much controversy. Experimental licenses were issued by the Bureau of Navigation; WWJ and KDKA were both claiming the honor of being the first station. Charles David Herrold was said to have conducted experiments as early as 1909. He had installed crystal sets in his neighbor's home to receive the signals. A daily broadcast may have begun as early as 1910. Several years before KDKA, which went on the air in 1920, Dr. Frank Conrad of Westinghouse was broadcasting from his home under the call letters 8KK. Dr. W. D. Reynolds, founder of KLZ in Denver, had a 100-watt station on the air as early as 1919. So the story goes with the pioneers. A few others are WSB, Atlanta, Georgia; KCLN, Blytheville, Arkansas; KTAR, Phoenix, Arizona; WAPI (started in Auburn, Alabama, later moved to Birmingham); KHJ and KNX, Los Angeles; KGB, San Diego; KNBC and KSAN, San Francisco; KWG, Stockton, Calif.; WDEL, Wilmington, Delaware, WDRC, Hartford, Conn.; KFKA, Greeley, Colorado; WAAF and WGN, Chicago, Ill.; WOI, Ames, Iowa; WWL, New Orleans; and WCAO, Baltimore. All of them — and others—helped pioneer broadcasting.

In the beginning, a power of 10 to 20 watts was considered normal; a station with 500 watts was a giant. However, don't be fooled; some of those little ten watters reached out a long way! I remember very well how a little ten-watt station in Coldwater, Mississippi put a good signal into my home town in north Alabama. This little station was fathered by an amateur, Hoyt B. Wooten. Later this station was moved to Memphis, and WREC was born. KELL in Shreveport, KFBK in Sacramento, and many more were using only ten watts of power.

In the beginning, there was no minimum schedule. You could come on the air and go off whenever you desired. Some stations were only on the air a couple of hours in the morning and one or two at night.

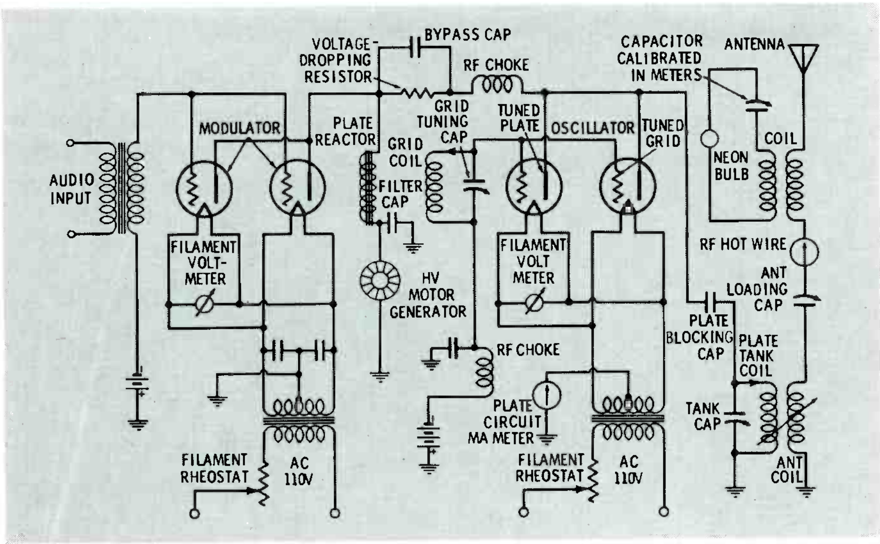
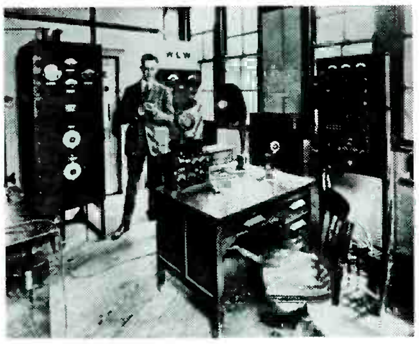
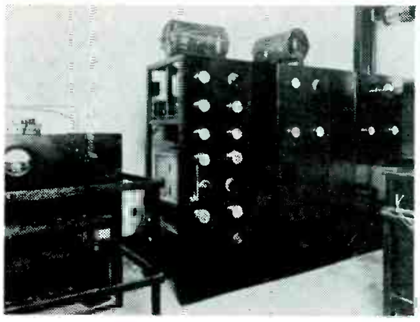


Fig. 1. Circuit designs of early transmitters were simple, but they lacked most of the refinements that are indispensable in modern broadcasting with its strict standards.



Powell Crosley is shown at WLW in 1922. The transmitter put out 500 watts.



This 5-kw composite transmitter was built for operation at WWL in 1921.

Transmitting Facilities

All the early transmitters were home-brewed. It wasn't until around 1921 that commercial manufacture of transmitters began. Even then many stood by their belief that the home-built rig was good enough. Equipment was hard to come by in those days; KFH in Wichita had to search the country to find enough equipment to build a 50-watt station.

Most of the transmitters in the early days consisted of two tubes as oscillators and two similar tubes as modulators (left, Fig. 1). Crystal control was unknown. An audio amplifier of one or two tubes drove the modulators, and the sound was picked up by a carbon microphone. Percentage of modulation? Who knew?

Plate voltage for the transmitter was obtained either from a motor-generator (Fig. 2), or a cheaper method known as a chemical rectifier. The chemical rectifier consisted of fruit jars filled with a solution of borax mixed with equal parts of distilled water. (When the chemical boiled over the edges of the jars, it made a pretty good mess of things.) Electrodes of copper and zinc were placed at opposite sides of the jars. A bank of 24 cells were connected in a series-parallel circuit. The high-voltage AC was fed into one end of the bank; the opposite end delivered an unfiltered DC voltage. The loss in rectification was great; you had to feed 2000 volts of AC into this type of rectifier to get 1200 volts—or less—of DC out. However, by adding a few home-made filter capacitors made of glass photographic plates and tin foil, the builder could make a usable plate supply. Of course, where finances permitted, the better motor-generator was used.

Most of the transmitters in those days were breadboard mounted, or the equipment was secured to a table (Fig. 3). The tank coil was usually mounted on the wall behind the table. Of course, some of the more professionally built transmitters were mounted on wooden or plastic panels. Metering was scarce: a hot-wire RF ammeter, a filament voltmeter, and a plate voltmeter if one could be found. The hot-wire RF meter in the antenna circuit was not for power measurements; it was to show the transmitter was radiating and for tuning the oscillator tank coil for maximum antenna current. Getting all you could out of that ten watts was the idea. Sometimes a ten-watt light bulb answered the same purpose, if you wanted to avoid buying an RF ammeter. The hot-wire ammeter was very slow in reaching equilibrium, but after a half hour or so of operation, you could pretty well tell what amount of RF you were putting out. Poor line-voltage regulation to the motor that was driving the plate generator made that RF

This control-room equipment at WWL in 1922 has almost a modern look.

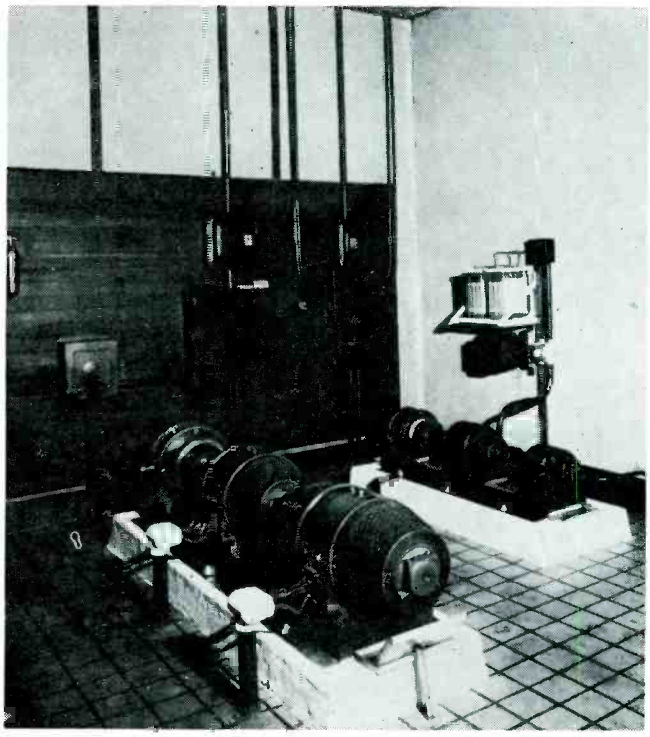


Fig. 2. Generator room at an early station. The large motor-generator supplied plate power, the other powered the filaments.

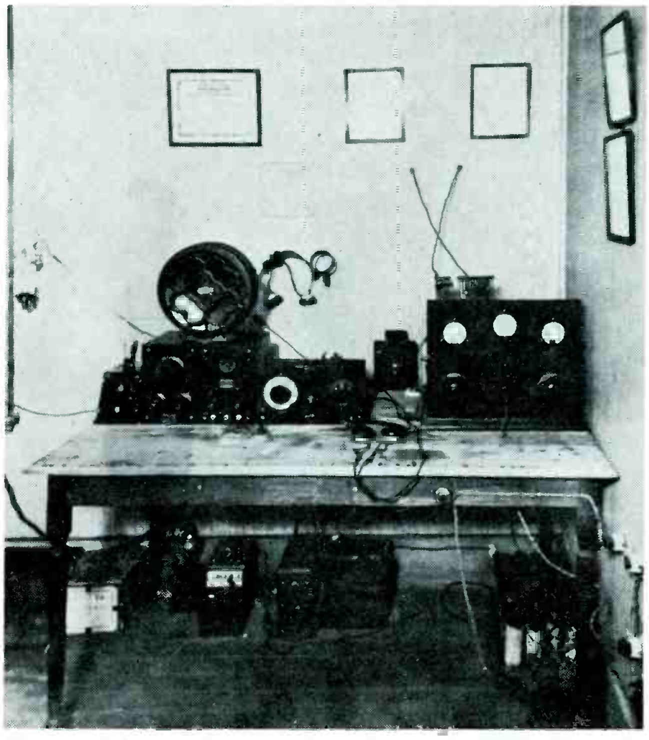


Fig. 3. A composite transmitter in use in 1919. Note the chemical rectifier on the floor at the right end of the table.

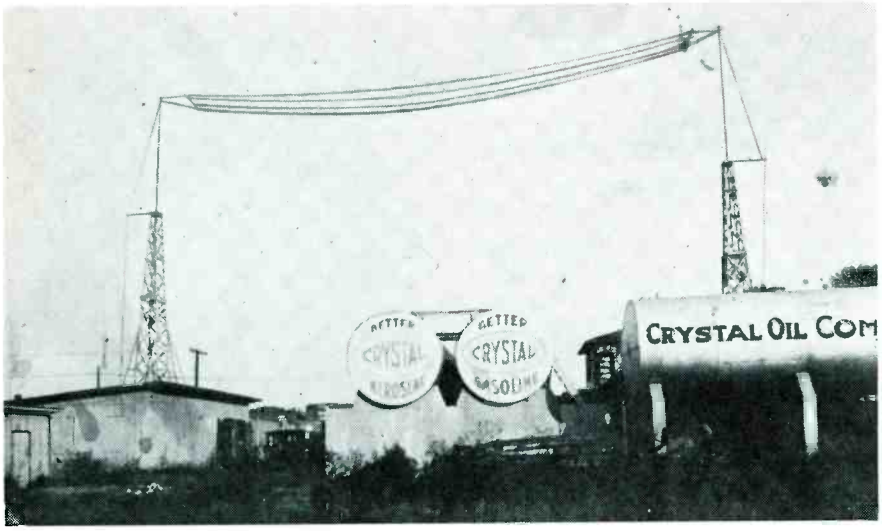


Fig. 4. The use of metal towers as radiating elements was unheard of in the early days of radio. These wooden structures support a flat-top antenna typical of the period.

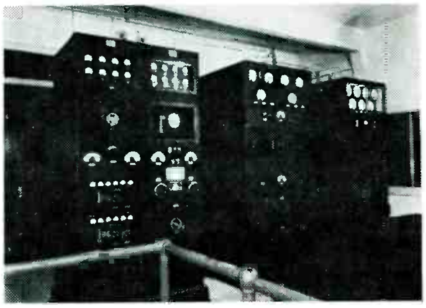
meter look like the rise and fall of the Roman Empire.

One station—WTAM in Cleveland—used a bank of storage batteries for its voltage supply. Pretty expensive you say? Well, the station was then owned by the Willard Storage Battery Company. They really had DC, and they saved on filter capacitors and chokes.

One of the early 500-watt commercially built transmitters used a water-cooled tube. The design was such that if the water pressure got low, the transmitter would lose its plate voltage to protect the tube. The station would stay off the air until the pump could bring the pressure up again. On one occasion a radio inspector was visiting a station using one of these transmitters. At one point during the visit, he asked to use the bathroom; the normal course of events led to a sudden drop in water pressure, and the transmitter went off the air. The engineer had to wait five minutes until the tank refilled before he could get the transmitter back on the air. His face may still be red.

The early transmitters were not crystal controlled. The frequency was determined by the oscillator tank circuit. A calibrated dial on a wavemeter was set to the assigned frequency, and the tank capacitor was tuned until the indicating lamp on the wavemeter was brightest. The coil of the wavemeter was placed in the field of the tank coil. It was a common thing for the transmitter to drift 500 cps above or below the assigned frequency. Frequent adjustment of the tank-circuit capacitor was required, and transmitters had to be guarded very carefully. Since those transmitters were modulated oscillators, we had FM in its early stages.

Two types of antennas were used in the early days, the flat-top (Fig. 4) and the cage. The flat-top consisted of four or more wires insulated at both ends and spread about 1½′ apart on wooden rods, called spreaders, about 6′ long and 2″ in diameter. (It was learned after a few years that a single wire gave the same results as six or eight.) The wires were then brought down to a common point known as the lead-in. The same type of antenna had been in use for many years on ships. The cage antenna was built practically the same way, except hoops of metal were used as spreaders. Water tanks, telephone poles, and any other objects high enough and far enough apart supported the antenna. The idea was to get the radiators as high as possible for the best results.


In 1932, WWL, New Orleans, was broadcasting with this 10,000-watt equipment.

Some of the more prosperous stations used two steel towers on the ground or atop buildings to support the antenna—no one ever thought of using the tower itself for the antenna. Some of those same towers are still standing as reminders of a past era.

License Requirements

1922 was the year radio zoomed—from 30 stations on January 1 to over 500 by the end of the year. The Bureau of Navigation was kept busy handing out licenses. These were easy to come by; you just went to Washington and asked for one. The Federal Radio Commis-

Fig. 5. Operator's license of the 1920's.

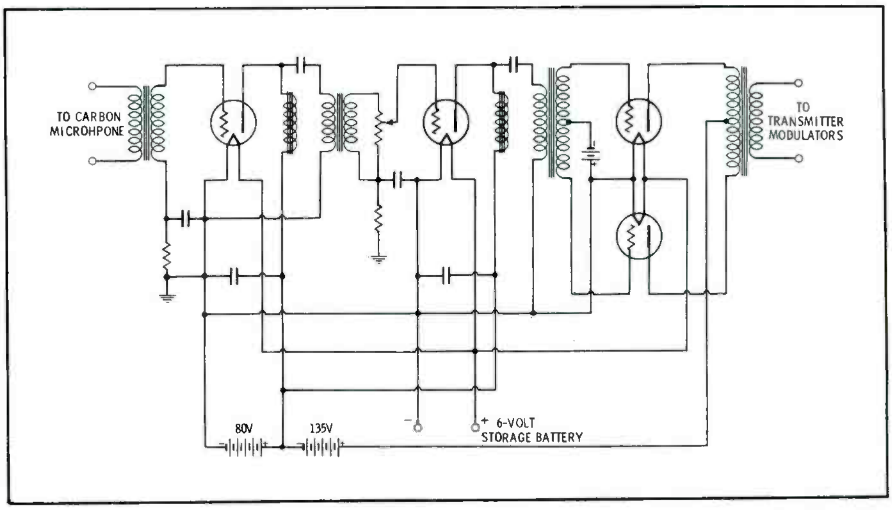


Fig. 6. Around 1920, the entire audio section of a broadcast station was made like this.

A composite transmitter. Note the wavemeter at the right of the loudspeaker.

sion, as it was first called, had not yet been formed.

Licenses for engineers were issued under the Department of Commerce and titled "Radio Operators Class" (Fig. 5). There were no multiple-choice questions on the examination; each and every question had to be answered fully. The passing mark was 85. A 20-word-per-minute code test was required because some of the stations operating on the lower bands had to maintain a listening watch on the marine distress frequency—so the station could be shut down in case a distress call was heard. Renewal was necessary every two years, and the code test had to be passed each time for renewal.

There were no teletype machines for news in many of the stations. The engineer had to copy the news transmitted in code from WCX and give it to the announcer to read on the air. With one ear on the receiver at all times, while the other was monitoring the station, there was just no time for diversions.

Studios and Audio Equipment

Audio equipment was rudimentary. Two or three transformer-coupled stages having fixed gain were used with the microphone (Fig. 6). There were no pickups for the records. Music was reproduced by placing the carbon microphone in front of a hand-cranked phonograph—the microphone remained open during the entire period of broadcasting.

Fig. 7. Notice how this carbon microphone is suspended with coil springs.

The carbon microphone was excited by dry-cell batteries supplying three or four volts. A loud hissing sound was always present in the background. Sometimes the carbon granules would pack, and the voltage had to be removed and the unit tapped to loosen them again. Any time this type of microphone was moved while on, it made a roaring sound like a clap of thunder. It was found that suspending the element with small springs in the mounting (Fig. 7) reduced this noise considerably.

Following the carbon microphone came the condenser microphone (Fig. 8). This type offered somewhat better quality and less noise. Preamplification was required due to the low output level. The preamp was housed in a box with the microphone on top. This entire assembly was mounted on the stand. External voltage from A and B batteries had to be used; the batteries were usually located in a box on the studio floor. The current drain was heavy, so the batteries had to be replaced often. Sometimes they would fail in the middle of a broadcast; and, if the station had only one of these costly microphones, the program had to wait while the batteries were replaced.

Doing a remote was quite a task. The first remote amplifiers were mounted in a large box, with a handle on each end. The weight was around 40 lb., and it usually took the engineer and the announcer to carry it to the remote point. Since the remote amplifier

Fig. 8. The condenser microphone gave improved performance, but was bulky.

Commercially made audio equipment, 1922. Note cone speaker atop rack.

was powered by a 6-volt A battery and four heavy 45-volt B batteries, these also had to be lugged along. No remote ever seemed to be close to where you could unload; it was either on top of a ten-story building with no elevator or in the middle of a half-mile no-parking zone. It took ten minutes to get your breath before you had the energy to hook up the amplifier. It was a funny thing how many announcers took off to get a cup of coffee when you arrived at that remote destination.

Building a studio ran into quite a sum of money. The walls and ceiling were hung with velvet drapes, and the floor was covered with heavy carpets (Fig. 9). A piano and some chairs were the furnishings. Since most such studios had no windows, the temperature could rise to 115° in the summer. In the winter they were a little cooler—only 90°. The smaller transmitters usually sat on a table in one corner of the studio, combining the whole operation in one space. In some stations the engineer also was the announcer;

• Please turn to page 48

Fig. 9. A carbon microphone stands in this 1922 radio studio at station WLW.

RCA NEW LOOK

A COMPLETELY NEW CONCEPT IN COLOR TV CAMERAS

the best of color

starts with black!

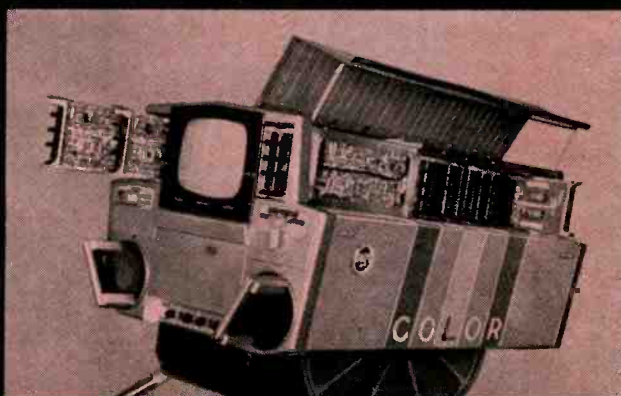
Like the black plate in four-color printing, this radically new camera uses a "black tube" to produce perfect color pictures

Ask any printer and he'll tell you that four-color printing needs a black plate to supply "snap" to the color picture. For the same reason, the TK-42 color camera has a separate luminance (black) tube added to the red, green and blue (color) tubes. Result: Finest detail and superior color pictures.

Everything about this great new camera contributes to the finest, most reliable color reproduction ever provided. Stabilized circuitry permits it to operate for long periods without adjustment. Completely transistorized, plug-in modules provide highest performance and reliability. Big 4½-inch image orthicon tube in luminance channel provides high quality monochrome pictures, as well as highest quality color pictures.

The separate luminance principle has been proved by more than 5 years of intensive engineering, product research and field testing. Several models have been demonstrated at three NAB Conventions. In 1962, broadcasters registered their choices regarding the separate luminance principle, as well as other features. The result is the TK-42...a new standard of color picture quality!

This 4½-inch image orthicon (black tube) is used in the separate luminance channel to sharpen the color picture and to assure a high-quality monochrome picture.



Transistorized modules afford easy servicing, are more reliable, and provide highest performance.

Call your RCA Representative for the complete story. Or write RCA Broadcast and Television Equipment, Building 15-5, Camden, N. J.

RCA **The Most Trusted Name in Television**

Field Intensity

(Continued from page 11)

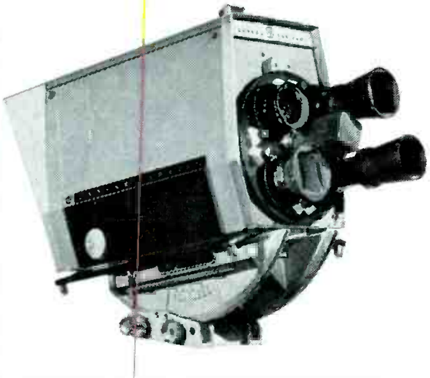
subsequent calibration and field measurement.

After the instrument is tuned, rotate it for minimum meter indication of the desired signal—usually at 90° to the maximum-signal position—switching FULL SCALE RANGE downrange to observe the signal null. (You've got to null out the desired signal without detuning the receiver so that the calibrating oscillator won't heterodyne with it and produce spurious signals.) Now move the FULL SCALE RANGE switch to CAL, and place the POWER switch in CAL position. Tune the CALIBRATING OSCILLATOR tuning control to the same frequency as the receiver, as read on the left-hand tuning dial. When resonance is reached, the meter will deflect; peak this indication with the CALIBRATING OSCILLATOR tuning control, but **do not rotate the instrument.** Move the METER switch to the OSC position and note the meter deflection. Return the METER switch to FI position, and adjust the COARSE GAIN control to obtain about the same meter indication as for the OSC position.

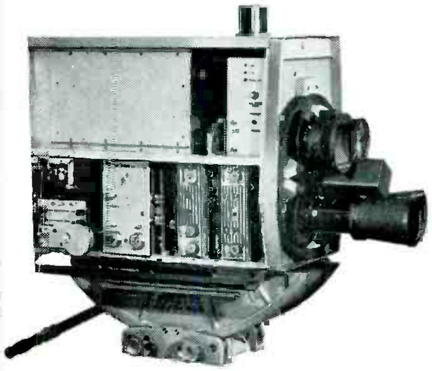
Since changing the COARSE GAIN setting may affect receiver tuning, it now may be necessary to repeat the receiver tuning procedure previously described. Once you have retuned the receiver, rotated the instrument to null out the signal, and retuned the oscillator, you can again put the METER switch in the OSC position and note deflection. Then put the METER switch in the FI position and adjust the FINE GAIN control to obtain the same deflection. Check this comparison by switching back and forth between the FI and OSC positions.

Place the METER switch in the FI position and move the POWER switch to the ON position. (This shuts off the oscillator.) The meter is now calibrated for the frequency to which it is tuned. To read field

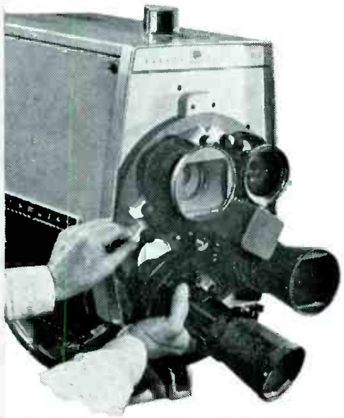
A FEW REASONS WHY YOU CAN'T BUY A FINER TELEVISION CAMERA ...AT ANY PRICE



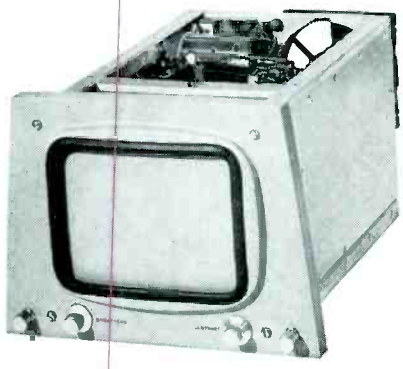
Impressive, designer-styled exterior. Clean lines, ultra-compact package houses field-proven Tarzian 3" Image Orthicon camera system. Highly portable. Easy to handle. Uses conventional camera cable.



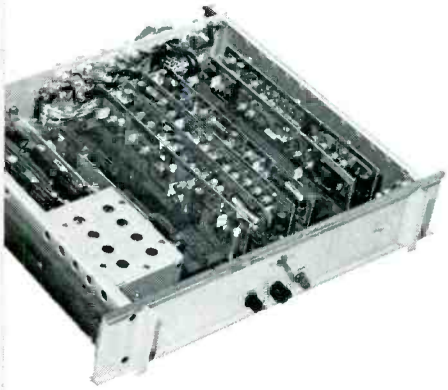
100% transistorized plug-in electronics for reliability and fast, convenient troubleshooting. Hinge out yoke assembly allows rapid change of IO tube.



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



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



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

SPECIFICATIONS

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

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

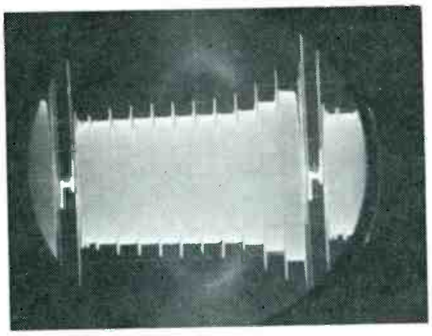
SARKES TARZIAN

BROADCAST EQUIPMENT DIVISION BLOOMINGTON, INDIANA

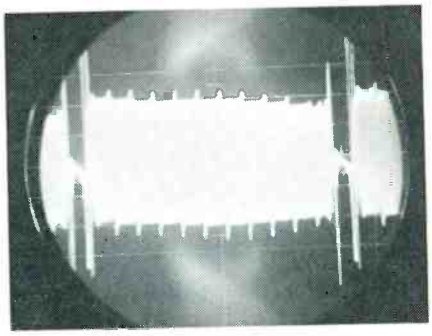
Circle Item 12 on Tech Data Card

TV Proof

(Continued from page 13)



(A) Predistorted input



(B) Transmitter corrected

Fig. 5. Photos of the oscilloscope display show transmitter transfer characteristic.

adjustments, insert a 20-db pad into the RF line to the analyzer. A tracing should be made of the reduced output display, which should be set so that the base line exactly coincides with the base line of the unattenuated display. Both tracings are then drawn on a graph in an overlay (Fig. 4). The 20-db pad gives a reference value from which the tracings can be scaled in db.

The sideband spectrum can also be determined by a second method, which is very similar to the point-by-point determination of audio response. The transmitter is operated as in the previous measurement, and a signal generator feeds single-frequency sine waves into the transmitter through the low-pass filter. The input level is observed with an oscilloscope and is maintained constant throughout the test. Both the upper and lower sidebands are then measured with a field-strength meter. The individual readings are plotted on graph paper scaled in db.

Needless to say, it takes a very good field-strength meter to measure close to the carrier frequency and still select a single desired sideband frequency. Ordinarily, it is only possible to measure to within about 200 kc of the carrier. When properly carried out, the method is accurate, but it is a little slower than the sweep method. By either method, the results must be within the tolerances found in Section 73.687, Paragraph (a) of the Rules.

Another important quantity that must be measured is the transfer characteristic, or linearity from black to white. A stairstep generator is required to modulate the transmitter in the normal program manner to 100% modulation. A 3.58-mc burst is superimposed on each step. This test signal must be fed through a stabilizing amplifier or some correcting device so that the input signal may be predistorted the amount necessary to overcome any nonlinearity of the transmitter.

The ouput signal is detected after the sideband filter and fed through a high-pass filter before being displayed on an oscilloscope. Linearity must then be carefully adjusted so that the display is as even in amplitude as possible. During these adjustments, care must be taken not to overmodulate the transmitter (which is easily done). Therefore, modulation percentage should be checked constantly during the adjustments. No tolerances have been set on this measurement as yet. Photographs (Fig. 5) or tracings of the predistorted input and the corrected transmitter output should be recorded.

Phase measurements are required for color stations. There are two different measurements: differential phase and envelope delay.

The envelope-delay measurements are not ordinarily made at proof time. The transmitter manufacturer makes these as part of his type-acceptance measurements, and so long as approved phase equalizers are used, this measurement is not required. However, if a station has the equipment to make the measurement, it may do so.

• Please turn to page 36

TEST CARTRIDGES FOR ADJUSTMENTS

by James L. Tonne, **Santa Barbara, Calif.—You can make these aids to speed routine adjustment of cartridge playback decks.**

It is interesting to note the increasing number of articles pointing out recommendations for routine adjustment of cartridge machines. Most point out the areas which are critical: speed, head alignment (both azimuth and zenith), and equalization.

One station has prepared a set of test cartridges for checking out cartridge machines which has paid for itself many times over in time saved. These cartridges are used for routine tests of playback capability and to assist in correctly reassembling the decks after any major operation. This is not, however, a "how-to-do-it" article, but rather one intended to be thought-provoking. No two stations or their equipment are alike. An all-inclusive recipe would occupy the entire magazine.

Initially, the machines must be correctly reassembled mechanically. This in itself is quite a mouthful. Deck gauges and the like may be required. Allen wrenches can be used for some gauging operations.

Once things are visibly in order, an electrical verification of correct speed is needed. Several schemes are available. One method is to use a timed tape. Another is to use a strobe. These methods and others along the same lines are quite usable, although most take either quite a bit of time or expensive equipment.

One method of speed checking which is apparently unique is to use a tape recorded with an easily duplicated standard frequency: 60 cps from the power line. A machine known to work properly is used to record the cartridge, and an oscilloscope is used to compare the reproduced signal, and hence the playback speed, with the power-line frequency. A little thought will show that even if the power frequency if "off," a correct result will be obtained. This cartridge is used for pinch-roller or similar speed adjustment.

Now we have a deck with mechanical adjustments in order, and running on speed. Heads must be aligned next. If separate heads are used for program and cue, both must be aligned. For head alignment, use a cartridge whose tape has been recorded full-track on a reel-to-reel machine. (This machine itself must have its azimuth adjustment made correctly.) Then, using Scotch 151 or equivalent tape, record a 15-kc tone at the maximum level possible consistent with freedom from noise and beats with the bias oscillator. This tape will then have the tone printed across the entire tape and, when wound into a cartridge, can be used for azimuth adjustment. It is of course useless for zenith (spacing off the deck) adjustment, which requires some form of gauge or cut-and-try. Be sure the cue head on the cartridge machine used for recording is not recording on the program track; after a batch of cartridges has been recorded with cue tones on the program, management will become a little upset!

Now the machine is ready for playback equalization adjustment or verification that the frequency response is satisfactory. The frequency response run is a bit tricky. It is best to use an actual cartridge machine to make this tape. The machine must have its playback and record responses adjusted as per the instruction manual. Be sure the program head is aligned, clean, and demagnetized. Check the recording amplifier VU-meter calibration, or else use an external meter. The recording level should be held to about 10 db below normal in order that the high-frequency pre-emphasis will not cause saturation of tape or electronics. Bias level must be correct for the recording head used. Proceed to record those tones considered of importance. It's common to use tones from 20 cps to 16 kc. Start off with 1 kc, then follow with 400, 200, 100, 50 and 20 cps. Then again record 1 kc followed by 2, 4, 6, 8, 10, 12, 14, and 16-kc tones. Each tone is about 5 seconds long and is preceded by a voice announcement of the frequency.

Next in line is a 400-cps standard-level tone. This is recorded at the standard level as indicated on the recorder VU meter. Upon playback of this tape, a group of decks (as in an automation system) can then be set for identical playback level. To be most meaningful, the VU meter on the recorder should have its sensitivity set according to the instruction manual. This cartridge can also be used to check for audible wow and flutter.

A cartridge should be cut with a series of cue bursts on it. This will help to verify cue-system operation. This test can be combined with the 60-cps speed test, both on one cartridge. A recommendation here: Record the cue bursts coded, say in groups of three at 2-second intervals.

Auxiliary cue-tone operation can be checked the same way. Insert the auxiliary cue tones in coded groups, perhaps in groups of four at 2-second intervals.

Other possible test cartridges will no doubt come to mind, but the point is record them, and do it now while the equipment is working. Playing back these cartridges will point out a number of typical problems speedily. And hide the finished cartridges from the production department! ▲

November 1965

We interrupt this magazine to bring you...

Late Bulletin from Washington

by Howard T. Head

Filings Heavy in CATV Proposal

In response to the Commission's proposals to regulate all CATV systems (June 1965 Bulletin), voluminous filings have been received from both broadcast and CATV interests. Broadcasters generally favor close regulation of all CATV systems, with prohibitions against "leapfrogging," local originations by CATV, and simultaneous duplication of programs carried by local broadcast stations. Technical standards governing CATV systems are also proposed.

CATV interests are urging the Commission to keep regulation to a minimum, although they recognize the need for CATV to carry local stations and for protection against simultaneous duplication. They urge that technical regulation be held to a minimum, with the burden of establishing signal degradation placed on complaining broadcasters.

The Commission must now sift through the many filings and adopt rules and policies for CATV. In the meantime, the only existing regulations are those on the use of CATV microwave relay systems.

ABC Proposes Private Relay Satellite

The American Broadcasting Company (ABC) has proposed to the Commission that it be permitted to own and operate its own synchronous-altitude space satellite for domestic transmission of network television programs to affiliated stations. Under the ABC proposal, 4 channels would be provided -- sufficient to accommodate the 3 national networks as well as a nationwide educational channel.

The ABC technical proposal, prepared by Hughes Aircraft Company, relies on present satellite technology. Ground receiving stations would employ ordinary microwave receivers and 30' diameter parabolic antennas.

The ABC proposal is expected to encounter substantial opposition. A final Commission ruling, either pro or con, will be well in the future.

Further Revision For Propagation Curves

As a result of engineering conferences held at the request of the Association of Federal Communications Consulting Engineers (AFCCE), it now appears that further revisions will be needed in the new television field-strength-vs-distance curves proposed for adoption by the Commission (October 1965 Bulletin). Discussions at the initial meeting brought out questions with respect to both the new VHF and UHF curves. Although those for UHF are generally an improvement over the present curves (originally intended for use only at 63 mc), considerable evidence indicates that they are still too optimistic in estimating UHF coverage. In a revision now under study, an effort is being made to take into account the influence of varying terrain roughness on UHF propagation.

UHF Allocations To Be Corrected

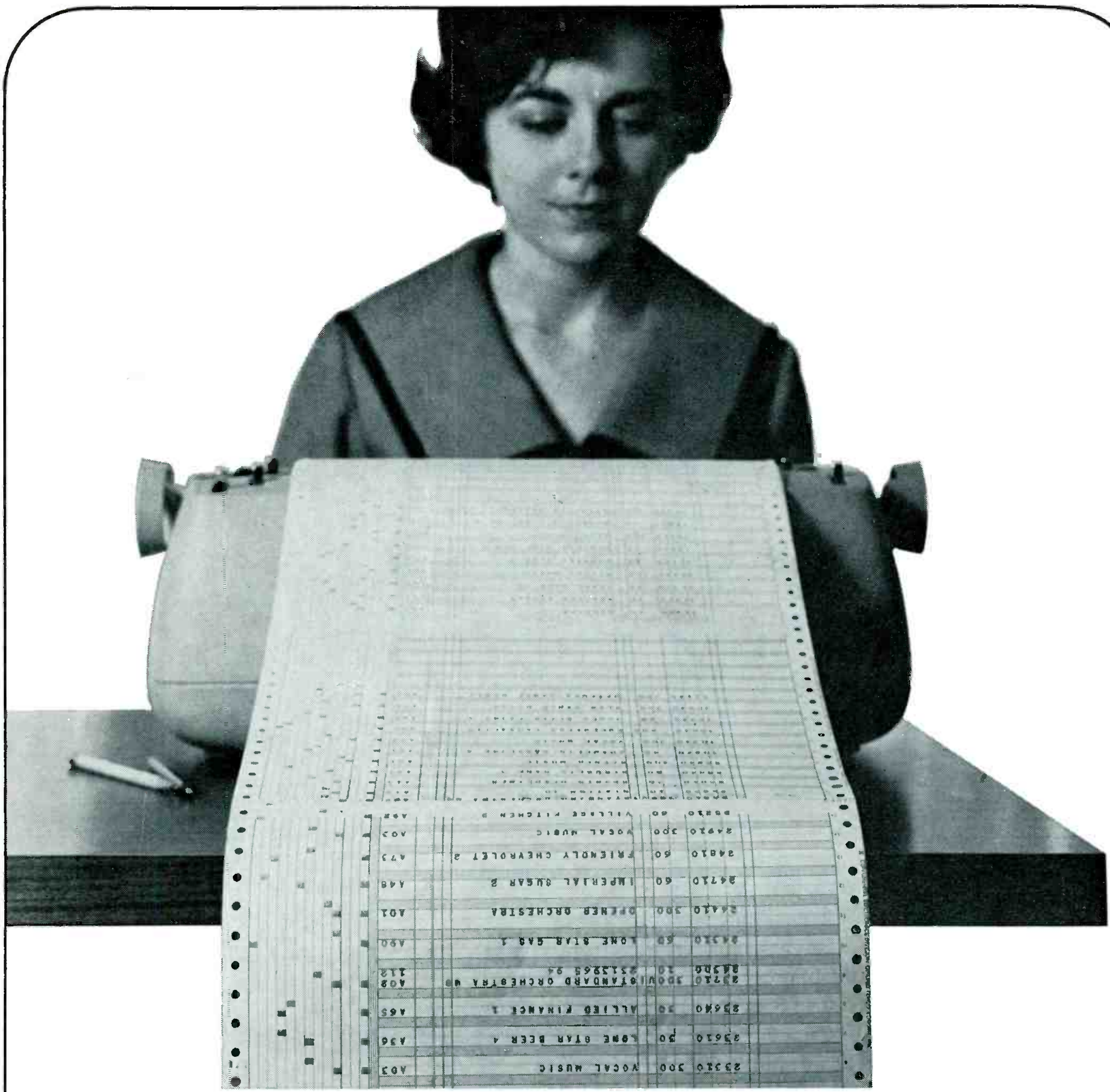
The Commission has discovered an error in programing its computer for preparation of the new table of UHF television channel assignments (July 1965 *Bulletin*). As a consequence, the Commission has reprogramed the computer and is now developing a completely new table of allocations, which is expected to include a substantially higher proportion of assignments on the lower UHF channels.

The Commission hopes to issue the revised table shortly. No changes are to be made in the channel assignments of operating or authorized UHF stations. In the case of applications on file before September 15, 1965, channel assignments in the present table will be retained.

SHORT CIRCUITS

The Commission has proposed to permit VHF TV transmitter operation by remote control, in response to NAB's petition (September 1965 *Bulletin*) . . . The effective date of the new program section for AM and FM license renewal forms has been moved up to January 1, 1966; original date was November 1, 1966 (October 1965 *Bulletin*) . . . The Commission continues to levy fines on broadcasters -- the most prevalent violation is failure to have operators of proper grade on transmitter duty. Two suburban stations may be fined heavily for identifying themselves as metropolitan stations in violation of the Commission's rules -- this is the second such fine in two years for one licensee . . . The instructional fixed television service in the 2500-2690 mc band is booming; applications are so numerous that the Commission is considering a separate office to review such filings . . . The first high-power VHF translator (August 1965 *Bulletin*) has been granted, at Kalispell, Montana . . . Several State Professional Boards have informed the Commission of objections to the use of the title "engineer," except by professionally qualified registrants; the Commission is considering the adoption of regulations on the subject.

Howard T. Head...in Washington



add 3 ■'s to your Log

and get automatic programming, logging and authenticating (only PROLOG can do it)

PROLOG uses your station log to give you any degree or combination of unattended, automatic, or manual-live operation you desire. PROLOG simply adds 3 squares (■) to the information you normally enter on the log. The entire log can be prepared on any standard typewriter, or you can use any of the auto-typing, Traffaccounting, IBM punch-card, and similar equipment in use today. PROLOG uses your established programming format; nothing changes unless you want to change it. That's PROLOG: simple and flexible!

For a 12-page brochure on PROLOG Systems, write to Commercial Sales Dept./Continental Electronics Mfg. Co./box 17040/Dallas, Texas 75217.

LTV *Continental Electronics*
A DIVISION OF LING-TEMCO-VOUGHT, INC.

Circle Item 18 on Tech Data Card

TV Proof

(Continued from page 30)

Differential phase is normally measured as part of the proof. It is defined as the difference in phase shift of a low-amplitude sine-wave signal for two given levels of a low-frequency signal on which the sine wave is superimposed. The test set-up is the same as for the linearity measurements, except the detected transmitter output is fed to a phase analyzer (a different instrument than the one used for envelope delay); the analyzer output is displayed on a scope. The 3.58-mc burst at back-porch level is taken as the reference, and the phase analyzer is used to compare the phases of the bursts at other levels of the stairstep signal with this reference. The reading for the burst having the largest phase difference is taken as the system phase shift. No tolerances have been set, but a phase shift of 5° is easily attainable.

Out-of-channel radiation must be measured. The transmitter is modulated with a standard test pattern, and a field-strength meter is used to explore the areas 3 to 6 mc above and below the channel limits. Radiation in those regions must be no less than 60 db below carrier radiation level.

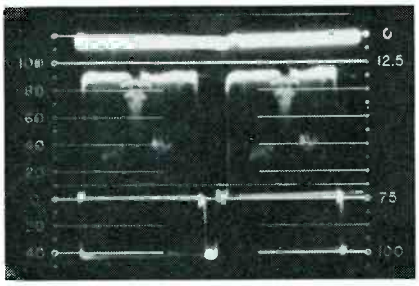


Fig. 6. Waveform for test pattern when the modulation percentage is correct.

It is also necessary to demonstrate that the transmitted signal is within tolerances. No method is specified, but a photograph of the waveform monitor displaying the detected signal after the sideband filter will be suitable (Fig. 6). Modulate the transmitter with a test pattern. Display at least two horizontal-sync pulses on the waveform monitor, and operate the chopper to set proper modulation levels while photographing the display.

The hum, noise, and low-frequency disturbances are to be measured, but again no specific method is required. One acceptable method is a photo of the waveform monitor with the vertical-sync pulse displayed. Tilt, hum, and other nonuniformities of the sync pulse or blanking pulse should not exceed 5%.

As an overall check, a photo of a test pattern, taken from a receiver or a monitor connected to the transmitter output, is required. If a monitor is used, the signal should be detected after the sideband filter.

General

The reflectometers of both transmitters should be calibrated. Plate voltage and current of the visual and aural output stages should be recorded as well as the efficiency of the aural PA stage. (See "RF Power Measurements," BE, April 1965, page 20.)

There may be other checks one wishes to make at this time. One such check would be on the transmission line and antenna system. By the use of a slotted line or a sweep, the VSWR of the line and antenna can be determined. The DC resistance of the line and antenna can also be measured. These measurements will be a very good reference to use in checking for deterioration that may occur in the line and antenna.

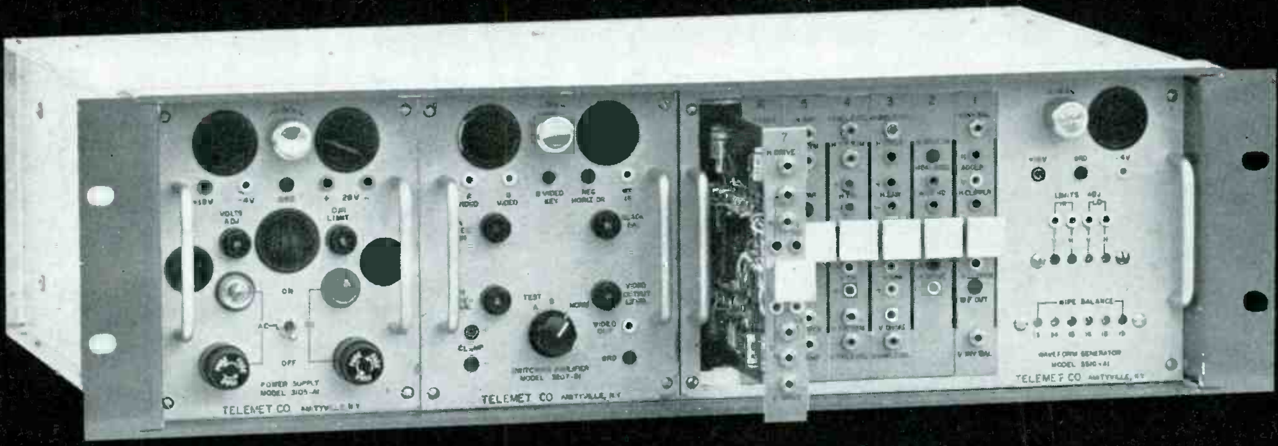
A list of the test equipment used is a good feature of the finished proof. When test equipment of known quality is used, there will be less chance of anyone questioning the measurements and the results obtained.

A proof means just that—proving that the equipment is performing according to specifications. The test equipment used should be of the highest quality and accuracy. Whenever some set of measurements does not come up to specs, measurements should cease, and corrective measures should be taken immediately.

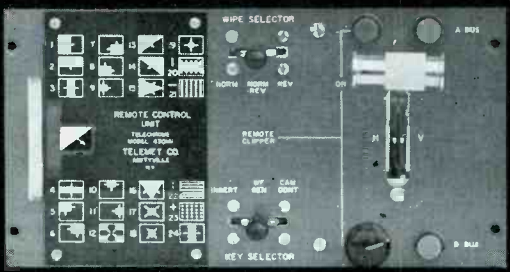
A final hint: One may purchase an inexpensive binder in which to assemble the finished report. This will dress up the final package and at the same time keep all the pertinent information sheets in some logical order. ▲

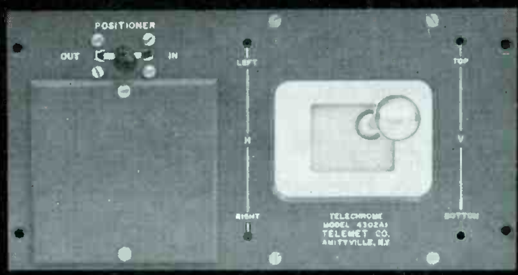
Telechrome*

SOLID STATE TV SPECIAL EFFECTS



MODEL 3801A1 TV SPECIAL EFFECTS PICTURED WITH MODEL 13802A1 POSITIONER





*Brand Name

Designed for studio or mobile applications, the new TELECHROME Solid State Special Effects Generator, Model 3801A1, produces a multitude of visual effects to enhance scene changes, insert keying for commercials and bulletins, etc. The system comprises a power supply, switching amplifier and waveform generator in a 5¼" high rack mounting frame and remote control units. The waveform generator contains 7 plug-in cards, 6 for the effects and one for the accessory joy stick positioner. A newly designed effects remote control unit provides an illuminated pictorial of the selected effects - plus Thumb-Wheel control for rapid and positive wipe selection.

FEATURES

- Occupies only 5¼" of rack space.
- Fully transistorized for reliable service free operation.
- Color or monochrome operation.
- Plug-in waveform generating cards.
- Inserts camera control and chroma keying.
- Up to 72 effects; including both horizontal and vertical wipes, diagonals, rectangle, diamond, circle, etc.
- Individual plug-in switching amplifier, waveform generator, and power supply.
- New compact remote control units occupy less console space.
- Thumb-wheel wipe selector eliminates parallax.
- Plug-in oscillators in positioner remote control unit for modulation of effects.

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Circle Item 21 on Tech Data Card

(Continued from page 15)

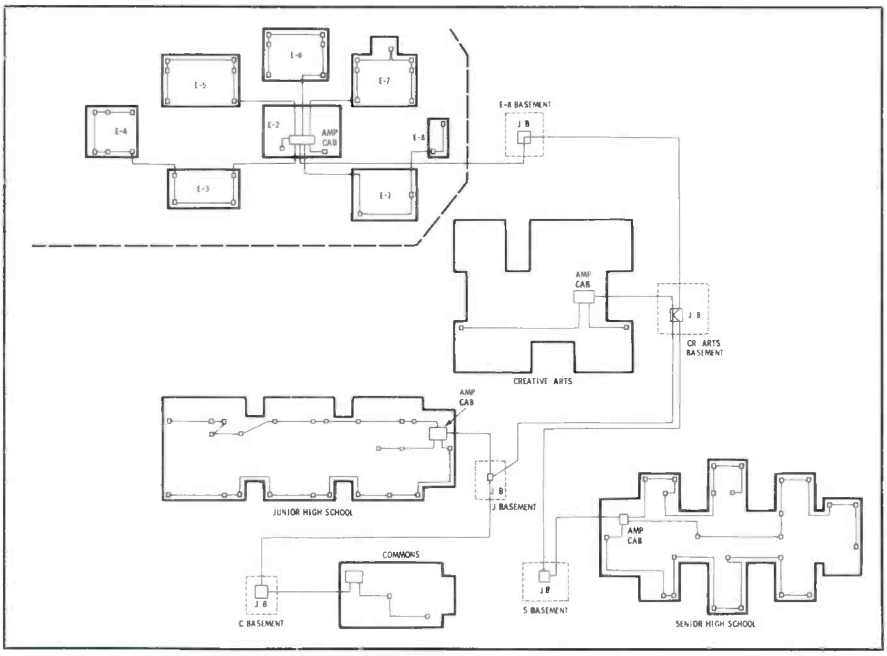


Fig. 5. System for distributing signals among buildings of University Schools.

The TV modulators in the pick-up units are designed to put mixed audio/video signals on VHF channels without cross-modulation, even though the use of nine channels to viewing rooms means that some signals are on adjacent channels. (Seven channels originate in the University Schools and two at the Radio and Television Center [campus distribution which includes signals from Purdue University at Lafayette, Ind., and the video tape recorders].)

The mobile unit does not have a monitor; setup and testing are accomplished by use of a portable TV set. Rough setup or troubleshooting can be accomplished without tying up an operator at the control center. Rapid, accurate final setup is achieved in conjunction with the operator who "talks" the video and audio signals into fine adjustment via the intercom, as is being done in Fig. 1. Stability of the units is such that they can be left in a classroom for successive days' viewing without attention from technical personnel.

Patching for Reliability

Patching, of course, is not new, but the extensive use of patching in the School of Education's installation perhaps makes the system unique. From 13 rooms in the elementary-school complex, 26 control lines and 26 coaxial cables go to a patch panel located in the basement of building E-8 (Fig. 2). In the junior high school, 18 control lines and 18 coaxial cables from 9 classrooms go to a patch panel, and the same is true for the 9 classrooms covered in the senior high school.

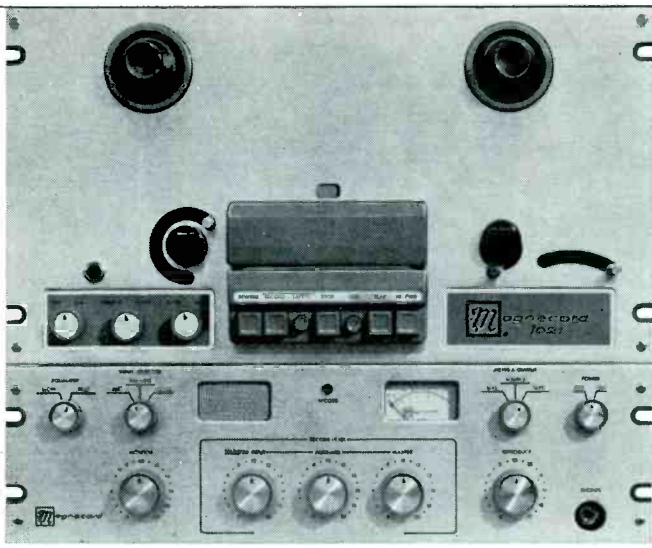
From each of these patch panels, six control lines and four coaxial cables go to the control room (Fig. 3) in the creative arts building. (Three classrooms in this building are connected directly to the control room.) This cable arrangement was one of the considerations in the decision to go to RF rather than direct video, which would have required one cable per picture.

In normal use, the system has one coaxial cable in use and three back-up cables from each area, and since fewer than the six available units normally will be used in any of the three complexes, the six control lines permit control backup.

The operating positions at control center all connect to a patch panel in the control room; thus, cross-patching of any control unit to any control line is possible. Each position has an 8″ monitor, which is also tied to a patch panel; monitors can be switched independently of control positions.

Any incoming RF signal can be patched to any of seven demodulators. The output of each demodulator can be patched to any of the 8″ monitors. Video from each monitor can be patched to any of 12 telephone-company lines to the University's Radio and TV Center. A video selector permits observing any of these outputs on a 14″ monitor that serves as a line or "air" monitor when switching is involved. This extra monitor also can be used to compare the picture signals from the demodulators. All incoming RF signals are fed through line amplifiers which in turn feed the demodulators and the amplifiers of the distribution system for the 86 viewing rooms in the University Schools (Fig. 5).

The RF distribution system allows use of locally originated signals as well as signals from the six-channel off-the-air reception system — four commercial, two Midwest Program for Airborne Television Instruction (MPATI) signals. This arrangement permits use of the system as a teaching device within the University Schools, even while the system is being used by the School of Education for observation of classroom teaching.



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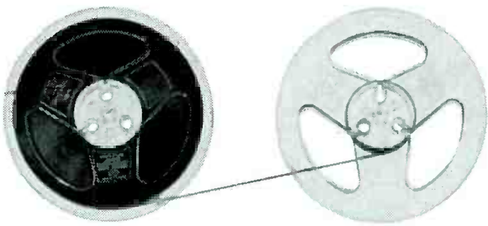

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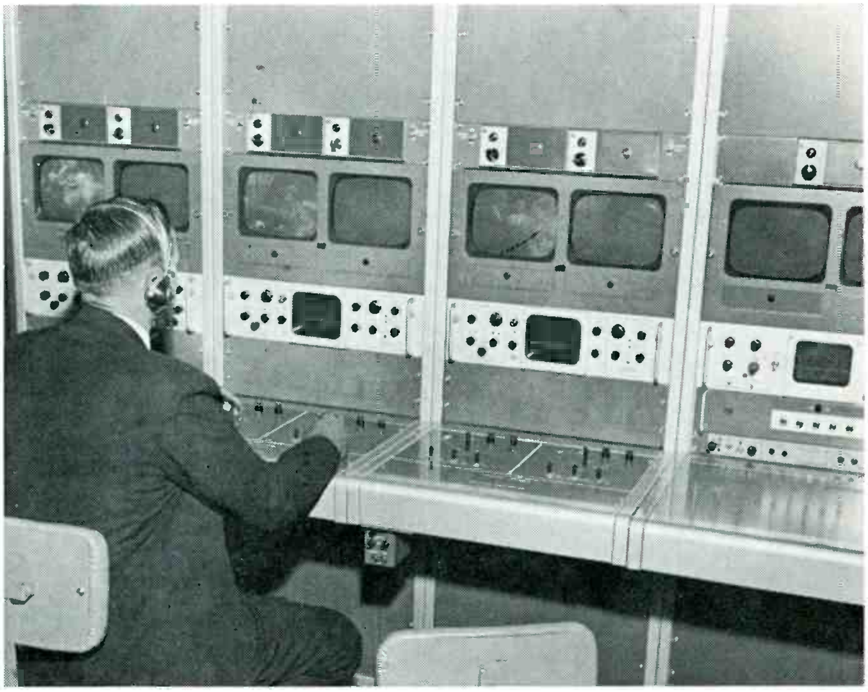

Fig. 6. Technician using one of six control units to operate classroom camera.

The distribution system has one in-use coaxial cable to each building. Additionally, two unused coaxials to each building allow for direct video input and for future system expansion. The distribution-system inputs appear on the same patch panel as do the monitor inputs and all incoming lines; thus, the distribution lines can be cross-patched into incoming signals.

Switching requirements at present are minimal, so the master control is simple — a fader or special-effects switcher is not needed. No switching is required for the viewing rooms, since each of the two cameras (if both are used) in a demonstration classroom appears on a separate monitor at the control room and on a separate ETV receiver in the viewing classroom; both always are on. The only switching involved is to video tape or the film chain. The present switching system, however, is viewed as only temporary, and if multiunit pickup and more extensive use of tape and film materializes, more sophisticated switching will be developed.

Audio Distribution

The audio signals, combined with the video signals until they reach the demodulators, are controlled by a multiposition audio selector which permits monitoring each individual demodulator. From this point, the audio signal is fed to the telephone company, where the signal is remodulated, sent to the Radio and TV Center, demodulated, remodulated, and sent to the viewing rooms at the School of Education. The audio switcher is paralleled by the video selector mentioned previously.

At each control position (Fig. 6) the operator has the program sound in one earphone and the intercom signal in the other for two-way communication with the viewing rooms. These sources are also applied to a monitor amplifier with a ten-position selector switch for choosing any of the seven demodulator audio outputs and three intercom lines.

Each control cable contains a pair of intercom lines that connect the mobile units to the control room. A three-line intercom between the control room and the School of Education 1½ miles away permits the methods teacher to talk directly to the operator controlling a given set of cameras without disturbing any other operator. (If more than three classrooms are covered at once, it is necessary to double up on the intercom.)

In the 15 viewing rooms in the School of Education, the methods teacher in each room sits at a special chair at the side of the classroom where he can view the two

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As long as the distance between your amplifiers— even up to one-half mile continuous lengths.

When Times Wire and Cable decided to build a CATV cable to outdistance any other in length and performance, we really went all the way: We built a cable that can span the entire distance between your amplifiers.

However, it's not just that Times JT-1000 CATV cable is longer that makes it better. It's also continuous. It's seamless for the entire length. And it's aluminum. Put them all together and you have *continuous seamless aluminum tube sheath CATV cable* in lengths up to ½ mile long—a feat nobody else has yet been able to match!

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■ Basily saves you 10% installation and shipping costs. Longer lengths mean fewer splices—8% saved. Another example: Only 1 reel needed for 2,500 feet of cable instead of 1 reel for each 1,000 feet—another 2% saved.

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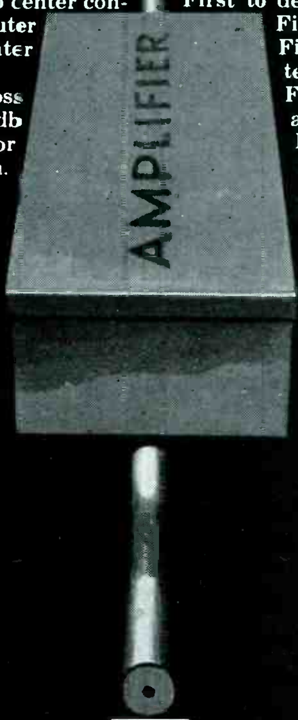
■ Times cable gives you minimum return loss guarantee. Your choice of guaranteed 26 db or 30 db minimum return loss—a must for minimum ghosting, true color reproduction.



■ Increases profit by decreasing splices and scrap. Fewer splices mean less material wasted (fewer tailings), less maintenance needed, too. Less maintenance means less labor cost and more profit.

And don't forget: long after so-called economy cable has been replaced (it starts deteriorating the day you install it), Times continuous seamless aluminum tube sheath CATV cable will still be a top performer, keeping pace with your system's planned potential.

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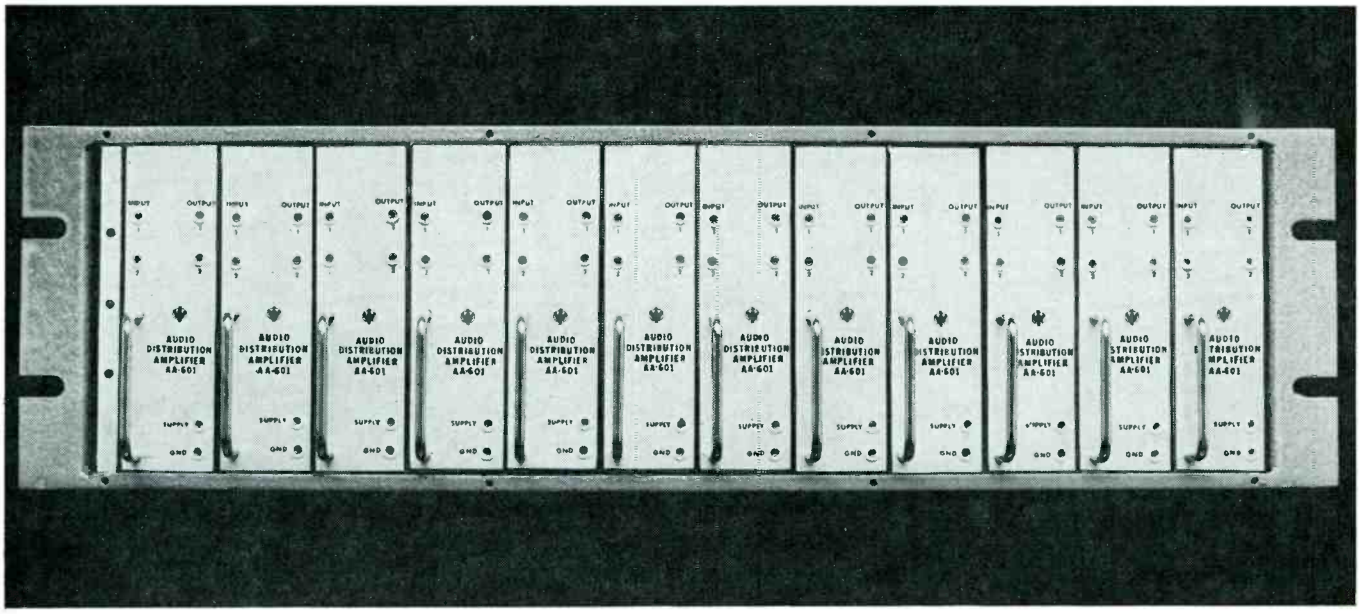
AUDIO

distribution amplifier

(The Audio equivalent of a Video Distribution Amplifier)



Should the distribution of audio signals be treated differently than video? No! *Why not improve output isolation and eliminate expensive, cumbersome output transformers?* Now you can, with the new Ward Audio Distribution Amplifier! . . . the first of a series of solid-state audio equipments designed specifically for television — with many advantages for radio broadcasters, too.

The Ward AA-601 Audio Distribution Amplifier is conceptually identical to that of a video distribution amplifier . . . one input and a number of identical high level outputs, *highly isolated, balanced or unbalanced.* This new unit facilitates distribution of audio at standardized levels throughout AM, FM or TV systems. Twelve AA-601 Audio DAs, furnishing 48 outputs of 24 dbm, are contained in a single 5¼″ rack frame.

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- Balanced or unbalanced transformer input, matching or bridging.
- Four identical transformerless +24 dbm 600 ohm balanced (or unbalanced) outputs. Wide variety of other output configurations can be used.
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- Response ±0.25 db 30-15,000 cycles, with less than 0.5% harmonic distortion.
- Fixed Gain ±0.25 db. . unity in bridging, 40 db in matching condition.
- Constant input and output impedance across audio band.
- No external DC supply, operates from AC.
- Self contained, plug-in solid-state module, with input/output connections on rear of rack frame.

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receivers and use the intercom to request close-ups and other camera changes. The intercom system also features extensive patching so that any line can be connected to any of the control-room stations.

The Future

Projected plans call for expanded use of the system both at the University and at University Schools. The schools of music, speech, and theater have expressed interest in using the system in conjunction with student performances — plays, presentations, music, shows, and so forth. A one-act play performed to meet thesis requirements, for example, could be taped and run at the instructor's convenience for critique and grading.

At the University Schools, plans call for expanded use of the system, not only for classroom teaching but for televising such special student activities as elections or the Christmas play.

Dr. Philip Peak, associate dean of the School of Education and chairman of its CCTV committee, terms the system a vast improvement over the earlier in-class viewing and the experimental studio television system (only one class could be viewed at a time, and students never got over the "I'm on the air" effect). He feels the new system has already opened new dimensions in the instruction of future teachers.

Dr. Peak also states that the camera in the individual viewing room will be particularly useful in training teachers to work with mentally retarded children and in the teaching of courses dealing with the instruction of "culturally deprived" children. Previously, this kind of individual counseling and work had to be viewed through two-way glass, which kept the size of the viewing group small and made concurrent critique and comment—simple with CCTV—all but impossible. ▲

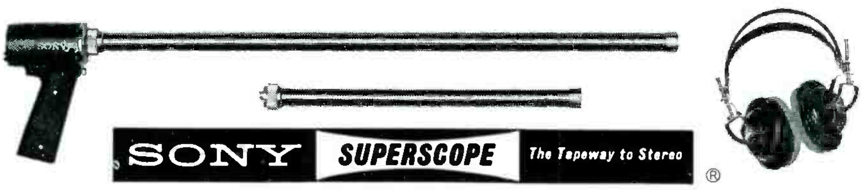
Telemike Exclusive: Built-in Monitor Facility*

Now, with *three* readily interchangeable sound tele-probes, similar in principle to changeable telephoto lenses, you can 'zoom' in from varying distances for the precise sound you're after. The 18-inch probe may be used for 'close-ups,' as far back as 75 feet from the sound source; the 34-inch probe from 150 feet. A 7-foot probe is optional for distances beyond 150 feet.

*The most unique feature, a Sony exclusive, is the built-in, battery powered, solid state monitoring amplifier in the pistol grip handle, which assures the operator that he is transmitting the source with pin-point accuracy.

OTHER FEATURES, OTHER USES: The new Sony F-75 Dynamic Tele-Microphone is highly directional at the point of probe, with exceptional rejection of side and back noises (35 to 40 db sensitivity differential). Recessed switching allows quick selection of impedances (150, 250 and 10K). The uniform frequency response, controlled polar pattern, and unprecedented rejection of background noise eliminates feedback interference in P. A. systems.

The complete Sony F-75 Tele-Microphone includes two sound probes, 18 and 34 inch lengths, monitoring pistol grip handle and the Sony dynamic headset, all in a velvet-lined compartmentalized carrying case, for *less than* **$395.** For specifications and a catalog of the complete line of Sony microphones, visit your nearest Sony/Superscope franchised dealer, or write: Superscope, Inc. Dept. 52, Sun Valley, Calif. *The best sound is Sony.*



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UHF Transmitter

(Continued from page 19)

preventive maintenance, record all meter readings. This does not mean just the readings required by the FCC or those listed on the log, but every meter reading you can readily make. Record all multimeter settings, if any. Record any plug-in current readings. The more readings you take and record, the sooner you will spot troubles as they begin to occur.

Be sure to duplicate conditions as closely as possible each time you make these readings. For example, if you take readings the first time with sync plus blanking and 1000-cps audio at 90% modulation, take all future readings at the same levels.

If there were as much agreement among engineers on tube checks as there is on sufficient meter readings, it would be easy to describe the best method of vacuum-tube maintenance. Some engineers feel that if a tube is operating satisfactorily in a circuit, it should not be removed from its socket. Other engineers feel that all small tubes should be tested on a tube checker at regular intervals and discarded after a predetermined number of operating hours.

Both views have their good points. Removal and replacement of tubes does cause socket wear and increased chance of socket damage, and testing the tube on a checker does not evaluate its performance under actual operating conditions. In fact, this testing may shorten the life of a tube due to the physical shock of removal from the socket and the stress of being tested under more strenuous conditions than those under which the tube usually operates. On the other hand, if the tube is to be left in the socket and checked on a thorough preventive maintenance schedule, the socket voltages and waveforms should be recorded regularly, and a log kept of tube life in each socket.

Small tubes that have been operated beyond their life expectancy should be replaced regardless of their condition. Though you may find some tubes that operate well beyond their expected life span, the odds for regular operation in these cases are against you.

Final-amplifier tubes can be a difficult problem. It takes a pretty ruthless engineer to discard a many-thousand-dollar tube just because it has exceeded its life expectancy, and surprisingly enough, experienced engineers generally agree this is a poor practice. Average life for a final tetrode or klystron is just that — the average life of a large number of tubes. Individual tubes seldom come close to the average; they either far exceed it or fail after a few hundred hours of operation. Adding to this unpredictability is the fact that these tubes, particularly tetrodes, don't fade slowly, but tend to short suddenly and die.

Klystrons, depending on the type, tend to show some signs of failure, and the nervous engineer would be wise to make a change at the first sign. Most engineers keep their fingers crossed the first two hundred hours or so and then stand "funeral watch" once the tubes have exceeded their life expectancy. It's a problem with no easy solution, although manufacturers are working on it. There is at least one maker that allows patching of reduced output through the remaining (visual or aural) final while the dead tube in the other final is changed.

Regardless of what kind of transmitter you use, keep a good spare final tube on hand, and check it occasionally by rotation with an operating tube for a day or so.

Mercury-vapor rectifiers, if your unit uses them, need extra attention. Check power-supply regulation and ripple voltage frequently. When replacing these rectifiers, use tubes that have been "seasoned" with filament voltage only for at least 30 minutes. Keep a small stock of preseasoned or aged rectifiers on hand, being careful, of course, to keep them upright once they are seasoned.

Mercury-vapor tubes may give an indication of deterioration: a darkening of tube walls due to destruction and evaporation of filament material and its ultimate deposit on the relatively cool glass. Because rectifiers are so important and relatively inexpensive, it is a good idea to change them at the first sign of failure. You might consider replacement with new solid-state plug-in substitutes. Many engineers feel that though these units have faults of their own — such as susceptibility to surges and static charges — their shortcomings are overshadowed by exceptionally long life and uniform output.

If your station is a network affiliate, or is fortunate enough to own a vertical-interval test-signal keyer, you can make frequent checks on the transmitter bandpass. However, the transmitter should be broadbanded as part of your preventive maintenance schedule. This will not only insure good response but will also give you an idea of visual tube and component aging. This aging may be revealed by a control nearing the end of its range or perhaps as a new null in the sweep-generator waveform. Make a similar check on the aural transmitter with an audio generator.

Other important checkpoints are control and protective circuits and calibration of filament meters. Filament voltage can be quite critical to tube life, particularly of rectifiers and output tubes, and every effort should be made to operate exactly on recommended voltage — in no event less than 5% below recommended voltage.

Operating Tips

Engineers interviewed gave some additional operating hints to reinforce preventive maintenance measures and extend equipment life. The use of a variable voltage control to raise filament voltage slowly at sign-on and lower it slowly at sign-off was recommended to extend tube life. Added tube life can also be obtained in stations operating in excess of 18 hours a day if all power, including B+ (except that to finals), is kept on during non-operating hours.

Another hint was use of a minimum amount of tune-up at sign-on and refraining from continually touching up tuning. Most transmitters will return to their previous sign-off parameters within an hour after sign-on.

Typical Schedule

The exact scheduling of preventive maintenance depends much on type of equipment used and on environment. However, an excellent example of scheduling a typical operation is used by WHNB-TV, Hartford, Connecticut.

Daily checks:

1. Presign-on cleaning of mica capacitors, other trouble spots.
2. Broadband transmitter, checking response and chroma pass.
3. Sign-off inspection for signs of excessive heating, including output junction points, RF connectors, and transmitter interior.

Weekly/Monthly checks:

1. Air-filter cleaning, air-flow check.
2. Nut-and-bolt tightness check.
3. Read all stage meters.
4. Filament-reading calibration check.
5. Water-system inspection; check for water leaks, hose deterioration.
6. Test standby final-tube operation.
7. Test all small tubes with tubes hot.

Semiannual checks:

1. Lubricate blowers, motors, etc.
2. Inspect relays for pitting and wear.
3. Test protective circuits.
4. Check all control circuits.

Conclusion

A good schedule of preventive maintenance can be very valuable to a low-budget station of any kind. When it comes to UHF transmitters and their high-priced components, preventive maintenance can make the difference between success and failure of the entire station. ▲

45 Years

(Continued from page 23)

Henry Ford at WSB, Atlanta, in 1919. The transmitter is 50-watt composite.

he could keep his eye on the rig while announcing (in addition to sweeping the floors, writing commercials, and even selling a little time in between).

Receivers

Crystal sets were predominant at the start, but as more and more stations went on the air, listeners wanted something better able to receive distant stations. So they began building one- and two-tube receivers (Fig. 10). No manufacturer was building receivers for public consumption; they still had to be home-made. The dime stores were stocking parts and selling them like mad. The most common tubes used were the UV 200 and the UV 201-A, the 200 for the detector and the 201-A for the audio amplifier. The UV 200 sold for around $8, and the UV 201-A was slightly higher.

There were no AC power supplies for the tube receivers. A 6-volt storage battery powered the filaments, and B batteries supplied plate current. B batteries were hard to come by, so some experimenters made their own by seriesing a bank of 1½-volt flashlight batteries to get the required 45 volts. These were assembled in a cigar box, and paraffin was poured around them for support. The drain on the storage battery was high, so a trickle charge was kept on the battery at all times. Several "B eliminators" were manufactured later, but not until the advent of a tube that would run from AC for the filament and a tube rectifier for the plate supply were radio sets able to perform satisfactorily from the AC power lines.

Most early receiver tuning circuits had a primary and secondary coil wound on a tubular form, with a rotary coil turning within the tubing to control regeneration. Variable capacitors were made, but it seemed that no one tried to build a receiver with one at that time.

Regenerative receivers were like small transmitters and would radiate a loud whistle that could be heard a half mile away. You could always tell when your neighbor was tuning in on the station to which you were listening. Not until he had fully tuned his receiver did the whistle disappear.

While a one-tube detector was suitable for headphone operation, a couple of stages of audio were needed to get sufficient volume to operate a loudspeaker. One of the first speakers to come on the market was based on the dynamic principle, and the field had to be

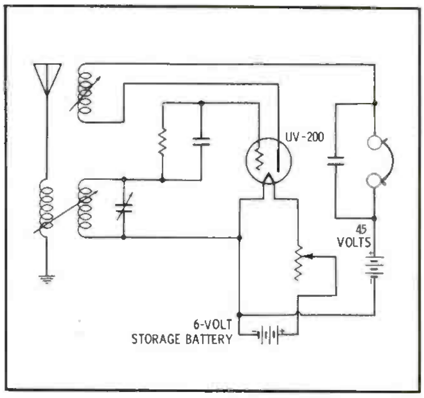


Fig. 10. In the 1920's, programs were heard on regenerative sets like this.

excited with a 6-volt storage battery. There was a goose-neck horn attached above a diaphragm that vibrated against the coil when a signal from the receiver was injected. Another type of speaker was the cone type. It was nothing more than an ordinary headphone with a thin needle soldered to the center of the receiver diaphragm and fastened in turn to the center of the cone.

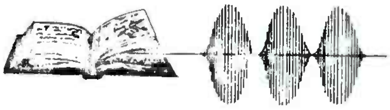
Not until TRF receivers and the superheterodyne, using more modern speakers, appeared were receivers really good. The price of receivers came within reach of more people, and the old home-made jobs became a thing of the past.

Of course, the broadcaster had not stood still. Improvements were being made daily: Better crystal-controlled transmitters, ribbon and dynamic microphones, better audio equipment in the studio—all contributed to good radio reception and the growth of the medium. Today it is hard to find any city that does not have its own radio station. Where not so many years ago stations were widely scattered across the broadcast band, today you can find all you want to hear from California to New York, and from Maine to Florida.

Conclusion

And so we offer a salute to those pioneers—men like Prof. Jacob Jordan, Walt Tyson, Dr. W. D. Reynolds, Prof. Gordon B. Greb, Louis Wasmer, Powell Crosley, Prof. Earl M. Terry, Harold W. Arlin, Fred Christian, Joe Martineau, Paul O'Hara—who brought the radio industry through its formative years. ▲

BOOK REVIEW



Microwave Test and Measurement Techniques: Allan Lytel; Howard W. Sams & Co., Inc., Indianapolis, Ind., 1964; 224 pages, 5½" x 8½", hard cover, $6.95.

This book is intended for the technician, microwave-equipment operator, design engineer, or for any other person desiring familiarity with the wide range of measurement techniques available for use at microwave frequencies. Knowledge of algebra and trigonometry is essential to fully understand several of the techniques (such as the use of the Smith chart). Although theory is included, this book is oriented toward practical techniques.

Following a brief introduction to microwave applications in the first chapter, the second chapter covers characteristics of antennas and transmission lines used at microwave frequencies. Transmission lines—parallel-wire, two-conductor, printed-circuit, coaxial cable, the G-line—and waveguides are detailed extensively.

The next five chapters are devoted to measurement techniques. Measurement methods for determining power, impedance, VSWR, frequency, attenuation, and noise figure are all explained. Different methods for measuring each parameter are listed, and the advantages and limitations of each method are fully discussed. Block diagrams for the test setups are given; also, a block diagram of the test equipment is usually included. (At times, a full or partial schematic diagram of the test equipment is included to implement the written explanation.)

In the eighth chapter, microwave systems are described, and alignment procedures for a typical television translator are given. Radar equipment and its applications are treated in the ninth chapter; a section showing step-by-step troubleshooting procedures for shipboard radar systems is also incorporated. Applications and theory of operation for the klystron, magnetron, pencil tube, TWT, and the backward-wave tube are given in the last chapter. ▲

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Site Test

(Continued from page 17)

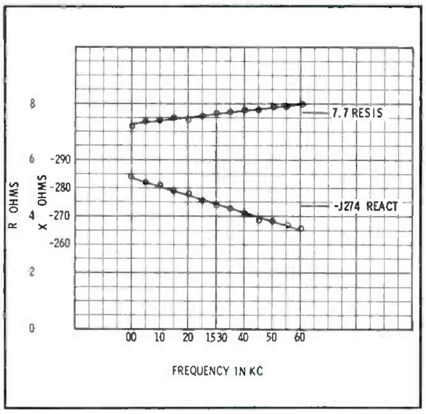


Fig. 6. The short towers used in site tests exhibit extremely low resistances.

is a simple block diagram of the typical setup. In order to determine the actual power delivered to the antenna, and to adjust the antenna tuning unit, it is advisable to use a radio-frequency bridge to measure antenna resistance and reactance.[1] Fig. 6 shows a typical plot of values obtained during a site test. With the short towers normally used for such tests, a very low resistance and a very high capacitive reactance are obtained. Thus a large-capacity antenna ammeter is needed, even with low powers.

Either a T or an L network can be used to match the antenna load impedance to the transmitter or line. In some cases, the antenna tuning unit is matched directly to the transmitter without a transmission line. If the site test is conducted in cold weather, however, it is advisable to place the equipment in a sheltered location, and a transmission line is necessary.

The Test

While performing the actual test, the following additional requirements must be kept in mind:

1. No objectionable interference must result to any other authorized station.
2. The power used shall not exceed that necessary for the purpose of the test.
3. The test signal should be unmodulated except for station identifications each half hour.
4. The plate power should not exceed the authorized limits. The power must be kept constant to get acceptable field-intensity readings.
5. A transmitter log must be kept. These readings must be recorded every half hour: plate current, plate voltage, antenna current, time, and station identification.

With the transmitter operating, field-intensity data is taken along the desired number of radials for the distances required.[2] Data should be taken as prescribed by the Rules. For each point, record location number, field-intensity magnitude, distance from the transmitter, time, and a general description of the test point.

The last step is filing the required report with the FCC. This must be done within 60 days after the test authorization is terminated. There is no required form, but the report should include copies of the transmitter logs, the antenna-resistance measurement, the field-intensity data for each bearing measured, the measuring location maps, and the graphs of field-intensity data vs distance. In addition, the Commission requires that the engineer who supervised the site test set forth his experience and qualifications. It is helpful to include some general information as to the type, make, and model of any equipment used, its calibration accuracy, etc. Of course, the results obtained from the data must be included. The report must comply in all respects with the requirements of Section 73.36.

Conclusion

Accurate prediction of radio-station contours is of prime importance in planning a new standard-broadcast transmitting facility. Frequently, actual ground-conductivity measurements must be made upon which to base the predictions. It is the obligation of the engineer responsible for making the site test to be sure it is made correctly. ▲

[1] "Bridging the Antenna," Robert A. Jones, June 1965 BROADCAST ENGINEERING, page 23.

[2] "Running the Radial," Elton B. Chick, June 1965 BROADCAST ENGINEERING, page 21.

NEWS OF THE INDUSTRY

INTERNATIONAL

SMPTE Awards

Dr. Deane Rowland White, associate director of the Research Division of the Photo Products Department, E. I. DuPont de Nemours & Company, Inc., received the 1965 Progress Medal Award of the **Society of Motion Picture and Television Engineers.** The Progress Medal is the premier award of the Society and is awarded to the individual recognized by the Society for his outstanding technical contributions to the progress of engineering phases of the motion picture and television industries.

Dr. White was born in Berea, Ohio, and received his PhD in Physics from Columbia University in 1927. He is internationally recognized for his long and distinguished career in and contributions to photographic science. His professional contributions to photography include his early work at DuPont on the drying of processed films, and the development of improved sensitometers, densitometers, and developing machines. Under his able direction, the DuPont Research Laboratory markedly increased its contributions to fundamental and applied research. One outcome of this research was the development of Cronar polyester film base. Dr. White has been engineering vice-president of SMPTE since 1960.

Otto H. Schade, Sr., Electron Tube Division, Radio Corporation of America, was named 1965 recipient of the SMPTE Journal Award. The Journal Award Certificate is presented annually to the author of the most outstanding paper originally published in the Journal of the SMPTE during the preceding calendar year. Mr. Schade's paper "An Evaluation of Photographic Image Quality and Resolving Power" appears in the February 1964 issue, Vol. 73, No. 2.

Mr. Schade, a Fellow of the SMPTE, was born and educated in Germany. Holder of 75 patents, he has received numerous other honors during his distinguished career.

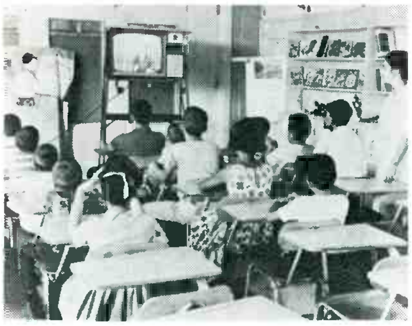
The 1965 Herbert T. Kalmus Gold Medal Award went to Dr. Henry N. Kozanowski, manager, Television Advanced Development, Broadcast & Communications Division, Radio Corporation of America. This award was established in 1955 in honor of the developer of the Technicolor process and recognizes outstanding achievement in color motion pictures for theater or television use. Some of the advanced developments in color TV for color film credited to Dr. Kozanowski include: three-vidicon color-TV equipment for 16- and 35-mm color film; completely stabilized three-vidicon color-TV film-reproduction equipment; demonstration of live-pickup separate-luminance four-tube color camera; completely transistorized separate-luminance-channel four-vidicon color-film chain using modular construction and including transistorized colorplexer and color-bar generator; and many others.

Recipient of the 1965 David Sarnoff Gold Medal Award was Alfred Christian Schroeder, member of the Technical Staff, RCA Laboratories. The award, in recognition of meritorious achievement in television engineering, was conferred upon Mr. Schroeder for his many contributions to the fundamental concepts and decisions which have gone into the development and refinement of color picture tubes and of the NTSC color systems. His efforts have earned him over 60 patents, 30 of which were for developments in color television. He has published, either as author or coauthor, several technical papers. A prolific inventor, Mr. Schroeder has been honored with five successive RCA Laboratory Achievement Awards, all in recognition of his work in the color-TV field.

Formal presentations of all the awards were made during the SMPTE 98th Semiannual Technical Conference in Montreal, Oct. 31 to Nov. 5, 1965.

ETV Sets to Puerto Rico

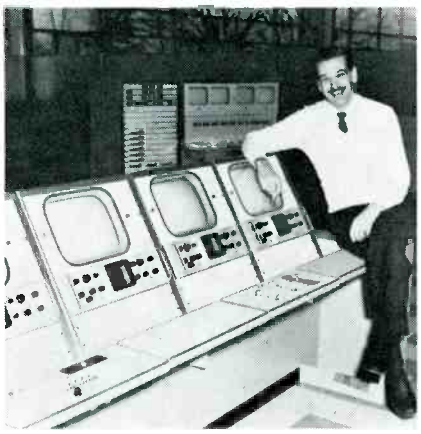
Puerto Rico has placed an order with **General Electric** for nearly 1800 educational TV sets. The $537,000 order is especially significant in view of the heavy effort being made by Puerto Rico's Department of Education to improve the quality of education in the island commonwealth. Through expansion of the ETV program, it will be possible to offer an expanded curriculum to the greatest number of students. At the same time, by watching the televised performance of an excellent teacher, instructors will have an additional resource for improving their own teaching



methods and knowledge of subject matter. When the ETV program was started in 1962, there were only five classroom subjects being taught to about 11,000 pupils. Under the full-scale program, dozens of subjects will reach hundreds of thousands of school children in 71 school districts. The Government-operated ETV network will ultimately extend to Culebra and Vieques islands.

ETV for Brazil

Señor Nelson Purper Lisboa, Director of Engineering, Ministry of Brazil, recently completed negotiations with **Sarkes Tarzian, Inc.** for a complete television broadcast facility to be installed at the University of Sao Paulo, Brazil. The equipment, first to be installed in a Brazilian university, is completely solid-state and includes live and film



camera systems, switching, and control equipment. The Ford Foundation provided funds for the system, which will be utilized in classroom teaching and instruction in television broadcasting.

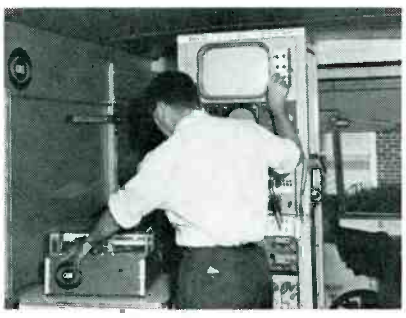
NATIONAL

Tape Standard

The **Record Industry Association of America** has released technical standards for prerecorded magnetic tapes. The standards, developed by RIAA's Engineering Committee and approved for distribution by its Board of Directors, cover reel-to-reel and cartridge tapes and include specifications for two-, four-, and eight-track monophonic and/or stereophonic tapes. Identified as Bulletin No. E 5, copies of the standards are available on request from the Record Industry Association of America, 1 East 57th Street, N. Y., N. Y. 10022.

Disc Recorder Used in Football Broadcast

A portable television disc recorder has been used to record and instantly play



back action highlights of a Baltimore Colts intrasquad game broadcast by the **CBS Television Network.** The Model VDR-210CF Videodisc recorder was designed and built by **MVR Corporation** especially for sports telecasting. The instrument provided CBS with complete 20-second segments which could be replayed in regular motion or stopped to provide "freeze-action" shots. The VDR provides virtually instantaneous resetting (1/5 second) and push-button operation. Its cost is approximately $10,000.

2500-mc ETV System

A 2500-mc educational TV transmission system will be put into operation by the Roman Catholic Diocese of Brooklyn, N. Y. The two-channel instructional TV network will serve some 225,000 elementary and secondary pupils in Brooklyn and Queens. Two television transmitters and two repeater stations will be installed to serve microwave receivers at 236 schools. Approximately 4000 classrooms will have receivers available to view both the diocesan-produced live and video-taped instructional material as well as regular VHF and UHF educational programs. Value of the contract for transmitters and repeater and microwave receivers to the **Micro-Link Systems** unit of **Varian Associates** is $350,000.

The 2500-mc television channels were allocated by the Federal Communications Commission in late 1963 for educational use. Although broadcast, the systems are essentially closed circuit, since the signal is limited to line-of-sight transmission and domestic TV sets cannot receive the signals.

Relay of Astronaut Photos

An electric picture-transmission system was responsible for bringing television viewers photographs of the returning Gemini-5 astronauts moments after they stepped onto the flight deck of the U. S. Navy's aircraft carrier Lake Champlain. VIDEX®, developed by a division of **International Telephone and Telegraph Corporation,** translated photos of Conrad and Cooper into electronic pulses. These pulses were sent over ordinary voice-grade telephone and radio facilities to an accompanying receiver, where they were reassembled, line-by-line, into a duplicate image of the original photo. Photos of the GT-5 recovery were sent via radio to a receiving station on Long Island, thence over direct telephone circuits to the receiver in Houston, Texas. As the image unfolded on the screen, television cameras relayed the photographs to the nationwide audience. As the image remained on one screen, the next incoming signal was switched to the second receiver, and the next photo began to take shape on the screen. Each image can remain on the screen for 15 minutes or until erased to allow reception of another photo. The entire transmission of the complete photo image took only 40 seconds. This same equipment has been used for the past several years in banking, security, educational, and weather-forecasting systems, but this was the first time it had been used to transmit news photographs of a major international event.

NAEB Meets

The theme of the 41st annual meeting of the **National Association of Educational Broadcasters** was "Educational Broadcasting and the National Purpose." Sharing ideas with the broadcasters were members of the Federal Communications Commission, officials from the U. S. Office of Education, U. S. Information Agency, and the Department of State.

The nearly 1500 educational broadcasters assembled in Washington on October 31 to attend four days of lectures, discussions, and panel meetings. They saw more than 40 exhibitor displays of the latest in production and transmission equipment for broadcasters. In addition, they listened to and viewed samples of the best educational radio and television programs produced during the past year.

Baseball by Blimp

Lindsay Nelson and a WOR-TV camera flew over Shea Stadium in the **Goodyear** blimp, "Mayflower," for the Mets-Giants game of August 29. This was the first time segments of a major-league baseball game had been telecast from one of the world's two operational blimps.

Pay-TV Franchises

The operator of the country's only pay-TV station (Channel 18, Hartford, Connecticut), **RKO General,** has obtained options to the **Zenith Radio Corporation's** Phonevision system in five additional markets: New York City, New Haven, Philadelphia, Washington, D.C., and San Francisco. The exercise of these franchise rights will depend upon further results of the Hartford operation and Federal Communications Commission approval.

Subscription television service may become a commercial reality in Chicago under an agreement between Zenith and **Field Communications Corp.** The agreement grants Field the right to acquire the Chicago franchise for Zenith's systems and to establish subscription TV facilities as promptly as possible after FCC approval has been obtained.

Zenith and the Field organization plan to investigate jointly all aspects of the over-the-air subscription system for Chicago, pending action on Zenith's current petition to the FCC for approval of subscription TV.

Field's interest in subscription TV will not alter its plans for UHF channel 32 in Chicago; the Field UHF station, WFLD, will be on the air early next year.

Conference Committee Named

A 10-member committee has been named by president Vincent T. Wasilewski of the **National Association of Broadcasters** for the 20th Annual Broadcast Engineering Conference to be held in Chicago next March 27-30 as part of NAB's 44th annual convention. Thomas E. Howard, vice-president for engineering, Jefferson Standard Broadcasting Co., Charlotte, N. C., was named chairman of the group. Appointed to serve with him were: James W. Cooper director of engineering, WFAA AM-FM-TV, Dallas, Tex.; William S. Duttera, director, allocations engineering, National Broadcasting Co., New York, N. Y.; J. B. Epperson, engineering vice-president, Scripps-Howard Broadcasting Co., Cleveland, Ohio; Philip B. Laeser, manager of engineering, WTMJ Radio & Television, Milwaukee, Wis.; Leslie S. Learned, director of engineering, Mutual Broadcasting System, New York, N. Y.; Clure H. Owen, American Broadcasting Co., New York, N. Y.; James D. Parker, director, transmission engineering, CBS Television Network, New York, N. Y.; Russell B. Pope, director of engineering, Golden Empire Broadcasting Co., Chico, Calif.; and Benjamin Wolfe, vice-president, engineering, Group W (Westinghouse Broadcasting Co.), New York, N. Y.

Report on ETV Financing

In the past 12 years, 102 ETV stations have come on the air throughout the continental United States, according to a 182-page report issued by the Educational Television Stations division of the **National Association of Educational Broadcasters.** The report emphasizes that the largest single problem confronting the new system is inadequate financial support. While more than $700 million was spent last year in operating 565 commerical stations, only $35 million was put into educational stations. The three commercial networks spent an estimated $580 million compared to $6 million spent by education's counterpart, National Educational Television.

The typical educational station broadcasts 9½ hours daily, 5 days a week. Of this time, some 42% is broadcast for in-school use. The profile of a typical station indicates an investment of $540,000 in facilities, an income of $370,000 a year, and 26 full-time and 10 part-time employees. The typical station's income sources include its parent educational institution, 54%; gifts and grants, 23%; and contract services to schools and others, 21%.

The report also describes a meeting held in Washington, D. C. last December. Representatives of the governing boards of all ETV stations and station managers met to consider recommendations for the future of ETV financing in this country. One of the recommendations made by the group was that support be found for additional national program resources and a means for national program exchange among ETV stations. Plans will be announced shortly for the establishment of the ETS Program Service as a direct result of the Conference's mandate, to be supported initially by approximately $500,000 in grants from foundations and other private sources. Another recommendation was that a national commission or committee be appointed to study educational television and to suggest courses of action for its future development. The conferees also concluded that regional and national interconnection will be vital to the future of the medium, and that encouragement should be given immediately to plans for the further development of regional networks.

At the time of the study (December 1964) there were 95 ETV stations on the air; 31 of them were licensed to universities, 13 to state ETV commissions, 19 to public schools and boards of education, and 32 to community organizations.

Copies of the research report can be obtained from the Educational Television Stations division of the National Association of Educational Broadcasters (1346 Connecticut Avenue, N.W., Washington, D. C. 20036), at $2.00 per copy.

ETV Grant

A grant of $10 million for the assistance of America's 32 community-owned educational television stations has been made by the **Ford Foundation.** Grants will be between $50,000 and $500,000 per station per year on a diminishing 4-year matching plan. For example, a $100 gift from an individual or organization to a community ETV station in 1965 will actually bring that station $175.

TV System for Detroit Schools

A private educational television network for the Detroit Board of Education is to be installed by the **EMCEE** division of **Electronics, Missiles & Communications, Inc.** The system will broadcast on two channels in the 2500-mc band to 58 Detroit public schools and will be in operation early in the Fall semester. The system is expandable to provide up to five channels to all schools in the Detroit area. EMCEE is presently expandin gits system at Bradley University in Peoria, Illinois, and was recently awarded a contract to provide a similar system for the University of California Medical Center at Berkeley, California.

New Equipment Company

J. Paul Audet, Chicago Heights, Illinois, is forming a new company, **International Broadcast Industries.** Associated with Mr. Audet is Mr. Peter Jackson. IBI will represent the interests of EMI Electronics, Ltd., for sales and service in the United States for all EMI broadcast and recording equipment, camera tubes, video recording tape, etc.

The company is also establishing manufacturing facilities in the midwest for production and fabrication of broadcast equipment for video switching, audio, pulse assignment and distribution, house monitoring, intercommunications, etc. Solid-state, modular equipment will be offered to broadcast, CCTV, and CATV users. Automation systems based on memory-core, computer-type technology are also planned.

PERSONALITIES

Walter C. Schafer, a veteran of 33 years in radio and newspaper work, has joined Radio Station WGNU in Granite City, Illinois as vice-president, general manager, and sales manager. Mr. Schafer started in radio work as an announcer in 1932 at WDZ (then located at Tuscola) and held various positions as salesman, merchandising manager, and advertising manager before serving four years as general manager. He was then employed 8½ years as assistant manager and sales manager of Radio Station WCIL in Carbondale. Prior to his latest position, Mr. Schafer had been general manager of WFRX, West Frankfort, since 1956.

Mr. **John H. McGuire** has joined **Van Nostrand Radio Engineering Service** as engineer responsible for FCC applications, antenna design, and allied fields.

Mr. **H. Grant McCormick** has joined **Hoyles, Niblock and Associates,** Consulting Telecommunication Engineers and Attorneys, Vancouver, Canada, as a senior project engineer. Mr. McCormick received his bachelor of applied science degree in electrical engineering from the University of British Columbia. Following graduation he was employed by the General Electric Company Ltd., Toronto, Canada, and, initially, was engaged in broadcast-engineering design activities in the company's development laboratories. In his position as a senior project engineer, Mr. McCormick's responsibilities will include serving television-station clients in the planning and implementation of color-telecasting conversion projects.

PROPERTY TRANSACTIONS

Radio Station **KVRE,** Santa Rosa, California, has been sold, subject to FCC approval, by **Santa Rosa Broadcasting Company** to a newly formed California corporation headed by **William H. Colclough** and **Edward LaFrance** for a total consideration of $100,000. KVRE operates with 1000 watts, daytime only, on 1460 kc and has operated since 1962.

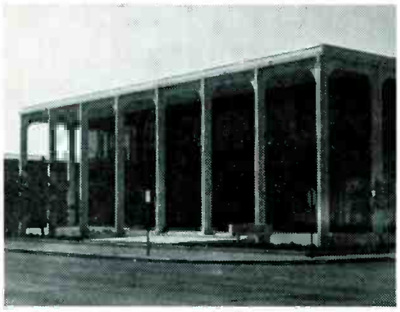
Peoria Broadcasting Company has sold Radio Station **WAAP,** Peoria, Illinois to **Syl Binkin** and **Melvin Feldman** of Springfield, Illinois. WAAP, an NBC affiliate, is a 1000-watt full-time station on 1350 kc. The sale price was $262,500.

Radio Station **KDOT,** Scottsdale, Arizona has been purchased by **Central Arizona Broadcasting Co.** Principal investors are John E. Cox (president) and L. Wayne Beal (executive vice-president). Other officers and directors include Stanley E. Whiteaker, secretary-treasurer; Cyrus W. Long, vice-president and general counsel; G. Dal Stallard, vice-president and general manager; and Earl F. Allvine, vice-president and consultant. ▲

In the

December

Issue . . .



Broadcast Engineering

examines modern trends in television studio design at WISH-TV.

Also in next month's issue:

- A Primer on Directional Antennas
- Emergency Broadcast System
- Understanding and Using the Field-Intensity Meter (Part 2)

PLUS

1965 Annual

Subject-Reference Index

To reserve your copy, just fill out and send us the convenient subscription form bound in this issue—you'll receive the Broadcast Engineer's Maintenance Guide free of charge.

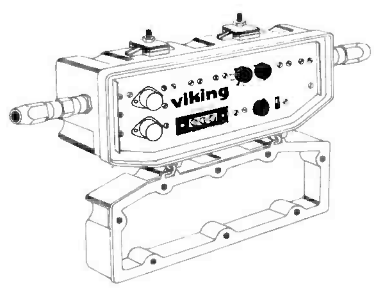
NEW PRODUCTS

Automation Control/Logger

Automation of both radio-station programing and logging is provided by the **International Good Music** Model 600 control system. Of "random select" type, the control unit works from punched cards, automatically controls programing for a full day or more, and types the log complete with time and all required FCC data.

Modular units can be added one at a time to expand the system. As shown, they include: upper left, digital clock read-out and "next-event" indicator; lower left, automatic network switcher; center, monitor unit; upper right, first four tape-channel modules; lower right, three additional channel modules and playback control. Interphase and clock controls are housed behind the panel below the desk. The high-speed NCR punched-card reader and automatic IBM typewriter are on the desk.

Circle Item 108 on Tech Data Card



Trunk-Line Amplifiers

The No. 574 trunk-line amplifier has been designed by **Viking** to make it possible to cascade 60 main-line amplifiers. The 574 is intended to give a maximum noise figure of 10 db and an output capability of 50 dbmv. The built-in AGC system operates by changing gain after the second stage of the amplifier so that there is a minimum change in noise figure with AGC action. The AGC is also designed to compensate for tilt change in cable attenuation due to temperature variations. A switch allows for either manual or AGC operation, and a control with a 10-db continuous range may be used to set output level in either operation. The unit is remote powered with 17-30 volts AC from either input or output. AC power is fed to the built-in −10-db output directional tap for powering an associated bridging amplifier or line extender. The solid-state amplifier is built so that its internal construction can be replaced quickly without the need for unsoldering wires or disconnecting cable fittings.

Circle Item 109 on Tech Data Card

Video Analyzer

The equivalent of "line selection" is provided at field rates by the **Colorado Video** Model 301 video analyzer. The design of the analyzer also permits display of video waveforms on the screen of a normally operating TV picture monitor, providing a large trace and direct correlation between picture content and video waveform.

The unit includes both vertical and horizontal marking signals for convenience in making point-by-point scene-brightness analysis. Other features include remote control, internal calibration, and a reference grating generator. Price of the Model 301 is $875.

Circle Item 110 on Tech Data Card

Tape Recorder

The Model R70 tape recorder/reproducer has been engineered by **Stancil Hoffman Corp.** for radio stations, industry, and public-safety organizations requiring a rugged mechanism for continuous use. The recorder is available with tape speeds from 7½ ips to 15/32 ips. From one to eight tracks may be recorded on ⅛"-wide tape.

The self-contained electronics is designed around the A70 series silicon-transistor, octal plug-in amplifiers. Local control is handled by five colored push buttons, and remote control is available. The machine can be used for automatic operation such as start/stop from time clocks, optical or foil-contact change-over, and auto-stop or transfer in the event of tape breakage or power-supply failure.

The unit measures 8¾"x19"x11½" and handles reels up to 9¼" in diameter. Forty-eight hours of continuous recording is available at 15/32 ips and three hours at 7½ ips. Prices range from $775 for single-track to $1215 for four-track models.

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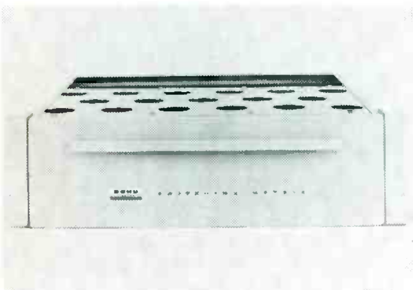


Video Switchers

A series of high-resolution video switching systems, custom-assembled from off-the-shelf components, is available from **Cohu Electronics.** Designed for operation in closed-circuit and broadcast applications, the 9000-series systems can be used to interconnect video display devices, recording equipment, and transmission systems to video sources. System inputs may be any combination of composite and noncomposite, monochrome and color video. Interlocked sync insertion adds sync when noncomposite video inputs are selected and inhibits sync addition when composite video inputs are selected. Other features of the systems include capabilities for unlimited number of inputs and outputs, vertical-interval switching, delay equalization for single or double re-entry (compatible with special effects and faders), and program flexibility.

The basic component of the systems is a switching matrix unit that provides single, double, or triple matrices which can be used independently, or units can be interconnected to form larger configurations. The switching matrices may be controlled manually or automatically by remote devices such as switches, relays, computers, punched cards, and tapes. Switching may be direct or by means of a vertical-interval control unit.

The switching-matrix and vertical-interval control units — of solid-state, modular construction—consist of standard 19", rack-mountable chassis with internal power supplies and plug-in modules.

Circle Item 112 on Tech Data Card

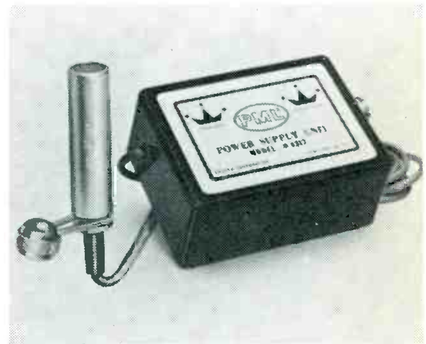
Plastic Radome

Ghosting is a troublesome phenomenon that plagues some TV stations operating in areas subjected to freezing rain, soft

snow, or ice accumulations. This accumulation sometimes results in a high VSWR of the system with subsequent ghosting and, in some cases, requires a reduction in power. Deicing heaters are widely used to help reduce this interference. **Radio Corporation of America** reports that plastic radomes used with traveling wave broadcast antennas minimize ghosts on TV sets and eliminate the need for deicers on TV station transmitting towers.

The RCA radome is a rugged, heavy duty cylinder of fiber-glass reinforced Hetron® polyester resin, that acts as a cover to protect the antenna. The radomes are constructed of 32" fiber-glass panels, formed in 180° segments, and are attached to the steel antenna pole by fiber-glass reinforced brackets. Joints are caulked to assure a weather-proof installation.

Circle Item 113 on Tech Data Card



Condenser Microphone

This microminiature microphone has an omni-directional pattern and a frequency response of 30 cps to 18 kc ±3 db. In addition to the inherent properties of condenser microphones, such as smoother transients, hum-free reproduction, and linear response, the **Ercona Corporation's** PML EK-61A features vibration-proof construction, locking connectors, and high sensitivity.

The microphone comes complete with 10' of signal and power-supply cable and clamp-on mike stand adapter. It measures 2 11/16" x 11/16"; weighs 1¼ oz; sells for under $100. A matching battery-operated power supply, Model 4317 is designed for use with the EK-61A and has a hi-Z unbalanced output and a battery life of approximately 500 hours. A cardioid version of the PML, Model EC-61A, is available for $109.50.

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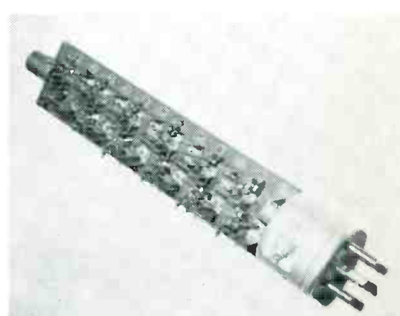

Silicon Tube Replacement

The SR-24-15 is a direct plug-in replacement for the 869B mercury-vapor tube; no rewiring is necessary. This silicon rectifier is rated at 24 kv peak reverse voltage and 15 amps average current. Its surge-current rating exceeds 200 amps, and it can handle peak reverse-voltage transients of 28.8 kv. The unit is nonencapsulated, and individual diodes in the stack may be replaced. A light indicator for each diode warns of diode failure and serves to show that high voltage is present. **Wilkinson Electronics** has priced the assembly at $225.

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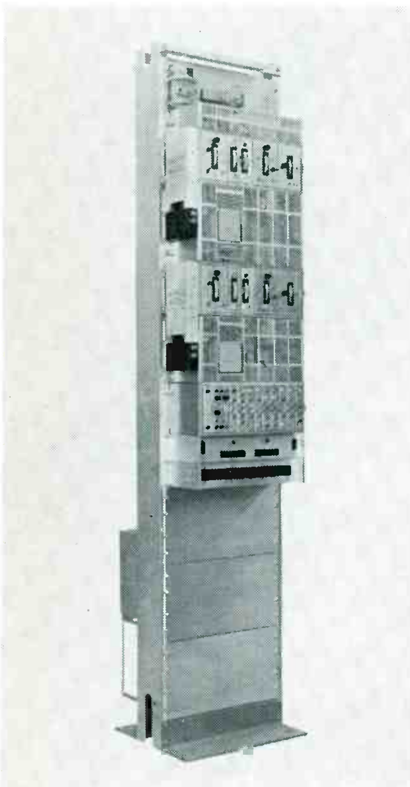
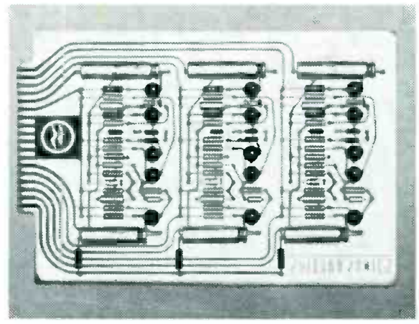


Microwave RF Equipment

A 1-watt Universal Microwave Group U/M/G provides high performance on intermediate range television relay systems carrying video and audio programs, or video only. The equipment is available for operation at 6-, 11-, and 12-gc bands, using the remodulating method of repeating. **Collins** U/M/G 1-watt video equipment may be arranged for simplex (one way), duplex single-, or multiple-channel operation using a single antenna system. It is fully transistorized except for klystrons and is part of a group of compatible microwave radio products that features common basic modules. Specific performance requirements can be met by utilizing 1- or 5-watt U/M/G equipment in the same system with a minimum of spare parts and training requirements. A periodically tuned, phase-equalized IF strip and klystron waveguide linearizers are used to minimize intermodulation and phase distortion. An Ebullator is used for close tolerance temperature stabilization of the 1-watt transmitter klystron. Precision crystal referenced AFC circuitry provides .002% transmitter frequency stability. Basic powering is from 24-volt battery banks with options for 48-volt DC and various AC sources. Line amplifiers, clampers, program channels, and off-the-air monitors are available.

Circle Item 116 on Tech Data Card



Solid-State Amplifier

A new solid-state, all silicon, audio amplifier has been developed by **Spectra Sonics.** The Model 100 is a low noise, low distortion amplifier, designed specifically for audio applications up to line or buss level (microphone preamplifier, booster, line amplifier). Specifications at +18 dbm include unmeasurable distortion, a flat response from 10 cps to 500 kc and a noise output of not more than −127 dbm. The amplifier is available in modular printed circuit card form; card sizes are 5″ x 7″ x ½″ and 2½″ x 5″ x ½″.

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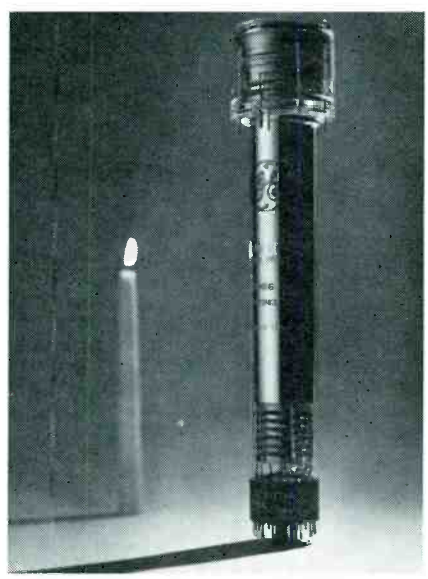
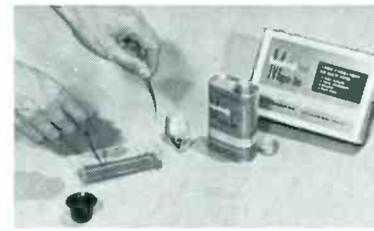


Sensitive Image Orthicon

The illustration shows an image orthicon developed by the **General Electric Company** to provide improved quality of remote television color pickup and substantially lower costs of converting local studios from black and white to live color. The 27866 is for use under low-light-level conditions in the studio, as well as for such remote pick-ups as nighttime sports and news events. While the new tube has the sensitivity of previously available low-light-level image orthicons, it promises improved signal-to-noise characteristics which increase picture quality. The tube is intended to produce good-quality color pictures with 50-100 foot-candle illumination and black-and-white pictures in 25-50 foot-candles. Typical operating life is expected to be about 4000 hours.

Circle Item 118 on Tech Data Card



Solution Shows Magnetic Tape Tracks

Two nontoxic, noninflammable chemical solutions permitting users to view the magnetic track on video, instrumentation, and sound recording tape are being produced by the **Reeves Soundcraft Division** of **Reeves Industries, Inc.** Known as "Magna-See," the solutions provide a means of checking such factors as head alignment, track uniformity, balance, and head wear. In addition, they aid in the editing of tapes. Dropout areas and the magnitude of dropouts are made discernible, and, in multichannel recordings, differences in intensities between the various tracks can be observed to provide a check of relative channel output.

Kits containing ½ pint of solution, plastic bath, an eyepiece magnifier for close track inspection, a roll of pressure-sensitive tape, and 5 glass slides are available. The price is $12 for kit "PRK" for video and instrumentation use or kit "SDK" for sound recording use. ▲

Circle Item 119 on Tech Data Card

Circle Item 51 on Tech Data Card

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

69. EUPHONICS—Eight-page bulletin No. 201 includes both installation instructions and a section titled "How to Design Your Own Circuit" for the Miniconic semiconductor cartridge.
70. KODAK—Folder No. B3-1 lists physical, magnetic, and electromagnetic specifications for complete line of sound recording tape.
71. 3M—Cost sheet M-V-20 covers 379, 379T, and 377 video tape. Illustrated brochure gives assembly instructions and other data on quick-load cartridges.
72. QUAM—General catalog No. 65 lists speakers for color-TV replacement, PA systems, high-fidelity, and general replacement.
73. SCULLY—Specification sheets and brochures give data on solid-state Model 270 tape player and Model 280 tape recorder.
74. VIKING OF MINNEAPOLIS—Pictorial folder shows plug-in components, mechanism, outside views, and specification chart for Model 230 tape transport.
75. WARD—Brochure features AA-601 solid-state audio distribution amplifier.

COMPONENTS & MATERIALS

76. AMPEREX—Condensed form of standard catalog lists available tube types useful in wide range of applications.
77. MILWAUKEE RELAYS—Engineering manual describes complete line of general- and special-purpose relays.
78. SWITCHCRAFT—New product bulletin No. 154 illustrates "TINI-D-JAX" molded two-conductor phone jack which is designed for PC-board and/or panel mounting.
79. TENSOLITE—Bulletin 103 provides graphs and construction data on high-voltage wire and cable.

80. WATERS—Flyers depict complete line of coaxial switches, amateur-radio equipment; prices and specifications are included. Specification sheet for UEW-572B triode supplies constant-current characteristics graph, plus maximum-rating and normal-operation chart.
81. WILKINSON ELECTRONICS—Specification sheets give full particulars on plug-in silicon-rectifier stacks designed for mercury-vapor-tube replacement.

MICROWAVE DEVICES

82. MICRO-LINK—Planning guide covers 2500-mc ITV systems. Brochures and specification sheets provide data on Model 420A portable link and Model 600 fixed link.
83. MICROWAVE ASSOCIATES—Sixteen-page brochure, bulletins, and technical report detail applications and specifications for TV-broadcast solid-state microwave-relay equipment.

MOBILE RADIO & COMMUNICATIONS

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

POWER DEVICES

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

RADIO & CONTROL ROOM EQUIPMENT

86. VISUAL ELECTRONICS—Literature lists specifications for MM-1A AM modulation monitor.

REFERENCE MATERIAL & SCHOOLS

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

STUDIO & CAMERA EQUIPMENT

88. CLEVELAND ELECTRONICS — Data concerns modifications using new yoke assembly to update 3" image-orthicon camera.
89. COHU—Specifications and photographs supplied in two-page bulletin 6-378 provide information on microcircuit synchronizing generators for monochrome or color television cameras.
90. TV ZOOMAR—New literature features Autocam programed remote control pan and tilt equipment; literature describes lenses for IO, *Plumbicon*, and vidicon use.

TELEVISION EQUIPMENT

91. COLORADO VIDEO—Sheet gives data for the Model 301 video analyzer which displays TV waveforms directly on picture monitors.
92. COOKE ENGINEERING—Folder and catalog sheets cover line of video and RF coaxial patching and switching equipment.
93. DENSON—Flyers and catalog describe new, used, and surplus electronic equipment.
94. 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

95. HICKOK—"Quick Reference" catalog M865 features cross section of custom-built meter line; Chargicators, automobile DC circuit testers, meter shunts, multipliers, and current transformers are also included.
96. PRECISE—Eight-page catalog shows line of test equipment available in kit or factory-wired form. Special features, complete specifications, and prices are covered.
97. TEKTRONIX—Flyer sheets provide waveform photo samples, specification lists, and general information on Type 529 and RM 529 video waveform monitors.

TOOLS

98. ENTERPRISE DEVELOPMENT—Bulletins feature Models 300 and 100A desoldering-resoldering iron for PC-board use.

TRANSMITTER & ANTENNA DEVICES

99. GATES—Booklet titled "How Much Does New Equipment Really Cost" cites advantages of buying new equipment with reference to revised Federal Income Tax Laws; accompanying folder "What $10,000 Will Buy" describes equipment packages selected for maximum tax benefits. "FM for AM Broadcasters" is a commentary on financial and technical aspects of FM broadcasting.
100. MOSELEY ASSOCIATES — Condensed catalog illustrates complete line of broadcast equipment. Both wire and STL remote-control systems are featured. ▲

Advertisers' Index

Professional Services

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

EQUIPMENT WANTED

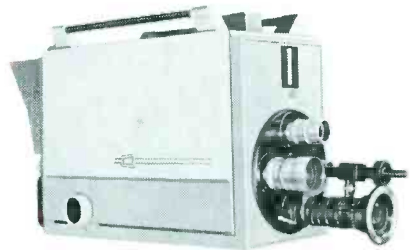
Employment

Business Opportunities

DAGE

The Best Value In Broadcast Equipment!

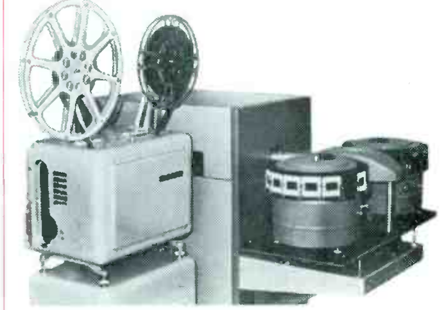
Broadcast Camera



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

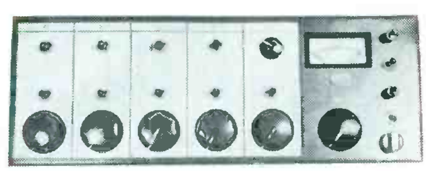
Dage Prism type multiplexer accepts up to 4 film or slide sources to compliment studio broadcast. New FC-11 film camera provides 800 lines of resolution.

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

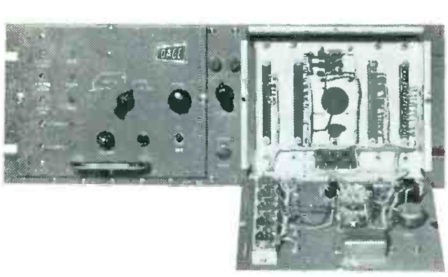
5 mixer channels with provisions to handle up to 8 mikes and 5 program sources-program and audition bus.

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 53 on Tech Data Card