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NOVEMBER 1962 75c

the technical journal
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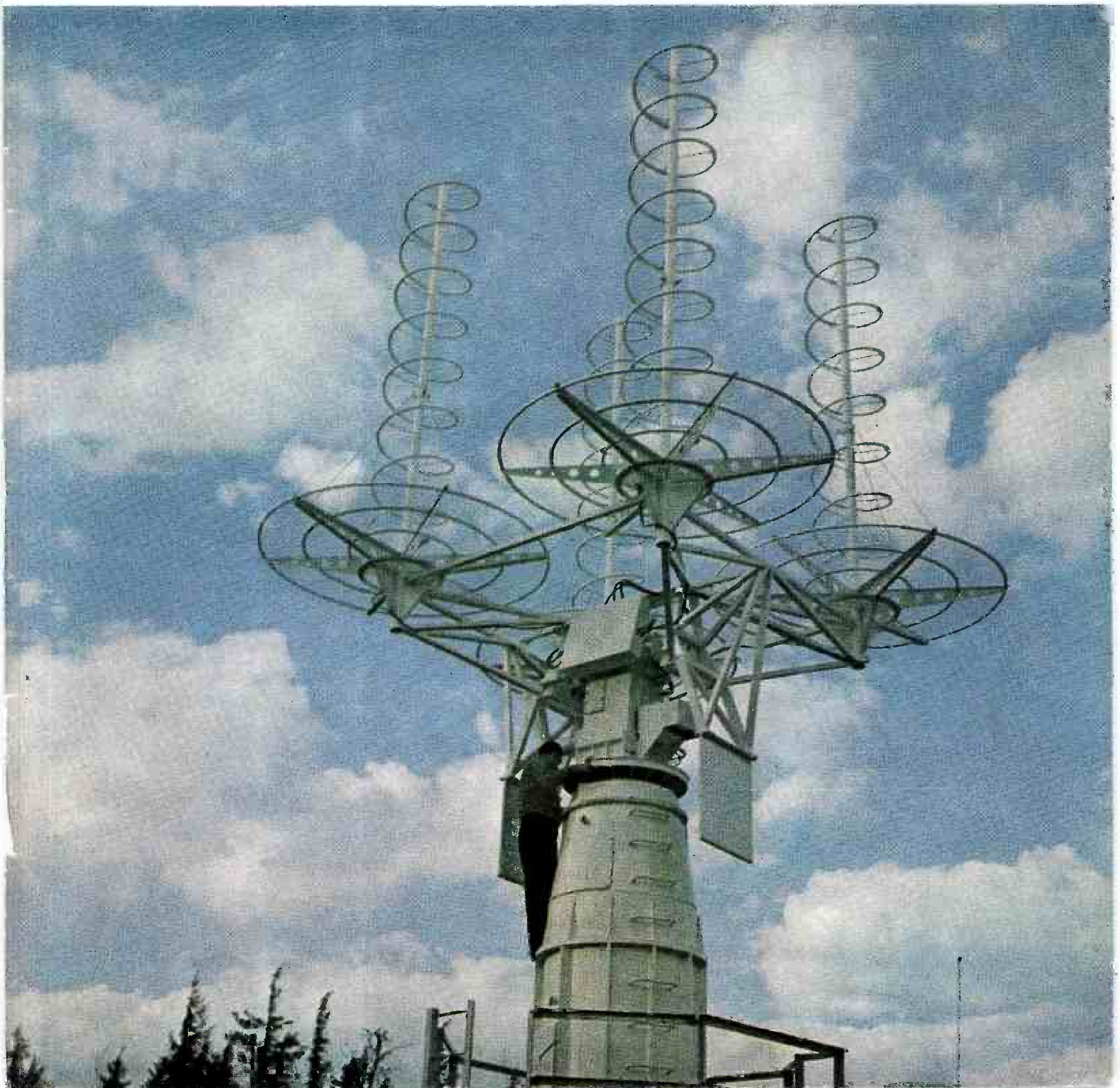
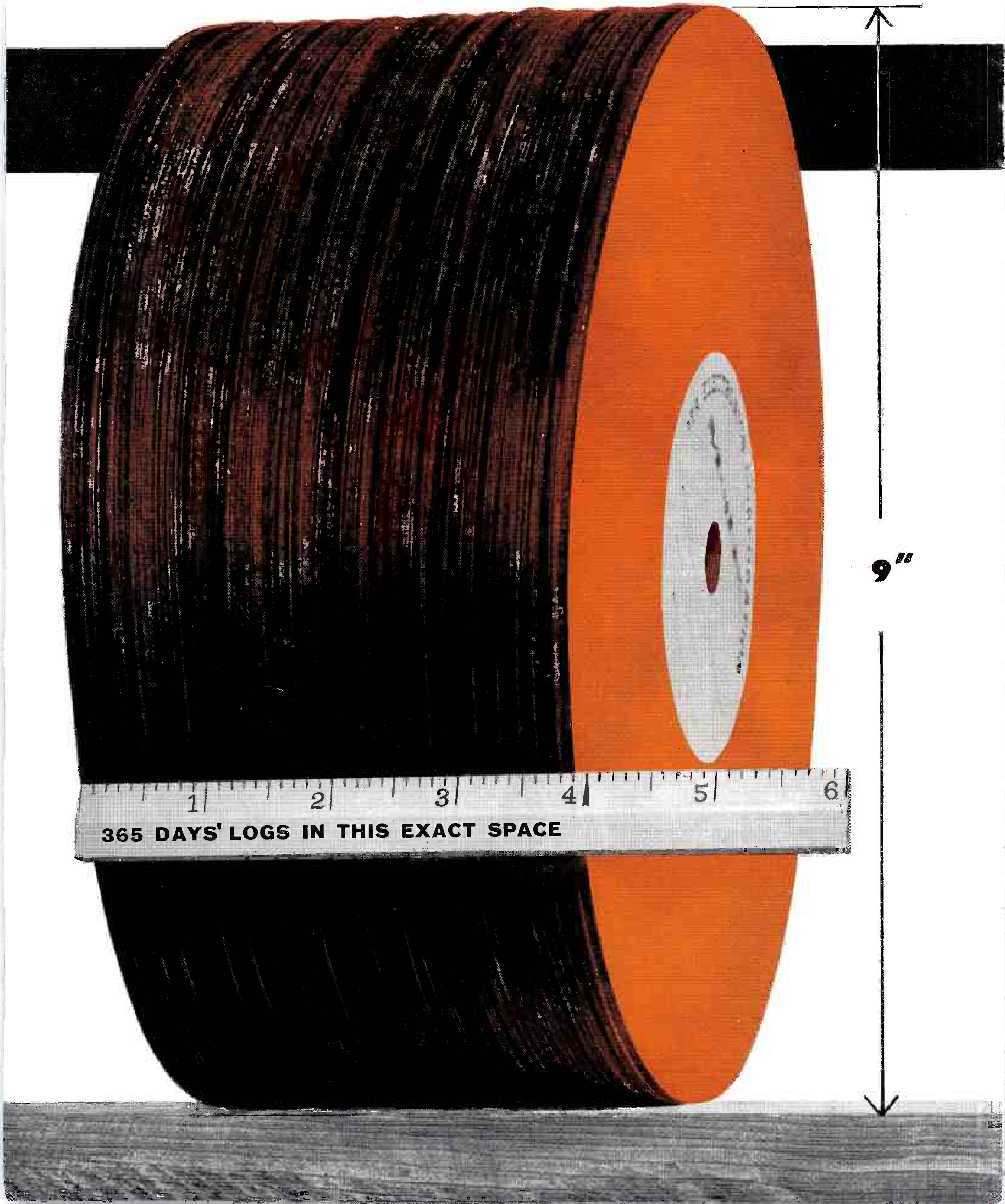
communications industry

Broadcast Engineering





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Broadcast Engineering

Volume 4, No. 11 **NOVEMBER, 1962**

CONTENTS

FEATURES

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LETTERS

to the editor

DEAR EDITOR:

I read your request for manuscripts and articles, and decided to send you this one for your consideration. Included are several supporting photos and schematics.

I also have a relay and transistor video switcher here that performs beautifully. If you would like an article on this, I would be pleased to write it for your approval.

JAMES FRENCH, JR.
Studio Engineer
KRMA-TV, Channel 6
Denver, Colo.

Oyez, oyez! You made this issue with the "Party Line Plus," Jim. You'll find it in the "Engineers' Exchange" column. Readers are cordially invited to submit material for consideration—and for some of that "long green," too! Photos and clearly drawn circuits are of prime importance. We're also on the lookout for good 4-color transparencies for use on future covers. Who's next?—Ed.

DEAR EDITOR:

I've been keeping up with your "Audio Studio Maintenance," by Thomas R. Haskett, and all I can say is **Bravo!** I found Part III particularly interesting—in fact, the Studio Maintenance Schedule is being put into effect at our station. To us, being "clean" is of major importance, and a periodic check is a **must**. Your Log is just what the doctor ordered. Many thanks for the idea.

MEL ALDRIDGE
Staff Engineer, WYSI
Ypsilanti, Mich.

We're happy to learn you liked the "sugar-coated pill." You'll note Mr. Haskett has rewarded us with a 3-part series on Radio Transmitter Maintenance (see Part III, page 16 of this issue).—Ed.

DEAR EDITOR:

I have really enjoyed and received much benefit from the articles on "Audio Studio Maintenance," by Mr. Haskett. I really think you would do well to have many more articles like this. I would like to see you cover transmitter maintenance, tower monitoring instruments, pads, etc.

Can you tell me where I may obtain the NAB Engineers Handbook, also the price?

We operate a 1-kw AM transmitter by remote control. I could send you a short article on maintenance and operation if you are interested.

HENLY McELVEEN, JR.
Chief Engineer, WJOT
Lake City, S. C.

Transmitter Maintenance, you see, was on the press even before you wrote! The Handbook is available from the NAB office at 1771 North St., N.W., Washington 6, D. C. Let's have a look at that article.—Ed.

ADD A PAGING SYSTEM TO YOUR MONITOR

by ***Robert Kastigar**** — Clever use of "phantom lines" and careful balancing results in a versatile system.

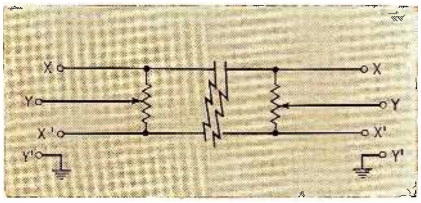

Fig. 1. Diagram of how to put two signals on one pair, without interference.

Most broadcast stations utilize some form of sound-monitoring system which permits anyone in the building to hear whatever is on the air. Many of these systems consist of a single high-power amplifier which drives paralleled speakers at various locations.

Often, a simple input switch is added to operate this arrangement as a paging system. However, the usual system uses only a single pair of wires connected throughout the office to each speaker location; thus, no paging calls can be originated at points away from the amplifier. Since running another pair of wires from the paging point to the amplifier often involves a great deal of work, an alternate solution is desirable.

*Radio Station WFMT, Chicago 1, Ill.

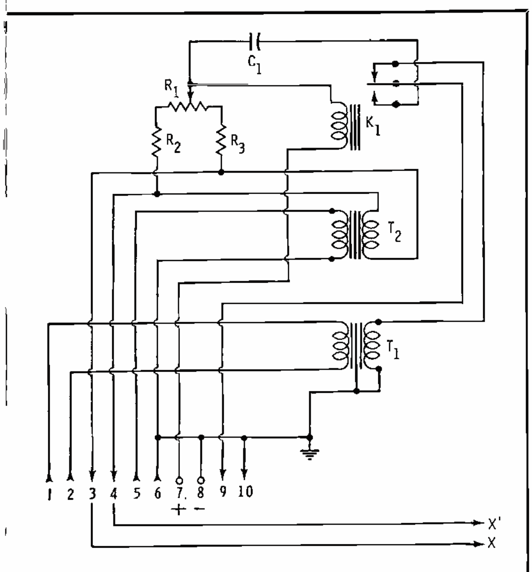

Fig. 2. "Companion" unit which must be added to the existing monitor amplifier.

A single pair can be used to carry the input and output signals of the same amplifier, as well as the current to actuate the input switching device. If proper care is taken, the quality of the air monitoring signal will not be degraded in the least, and the quality of the paging calls will also be satisfactory.

System Principles

As illustrated in Fig. 1, a signal may be fed between points X and X′. A separate and entirely different signal may be introduced at points Y and Y′. At the opposite end of this system, the signals are separate and can be applied to an amplifier or some other device. If the balancing pots are carefully adjusted, none of the X-X′ signal will appear at the Y-Y′ terminals, and vice-versa. Therefore, we may consider this system as being composed of three wires and a common ground; the two physical wires carry the X-X′ signal and the Y-Y′ signal is developed between a "phantom" wire and ground.

In the proposed system, the only special considerations are that the X-X′ signal must come from a floating source, the Y-Y′ signal must operate unbalanced, and some common ground must exist between the input and output of the system (a conduit is sufficient).

Components

Fig. 2 shows the "Monitor Companion" unit. Input transformer T1 is not an integral part of the paging system, but is used to match the impedance of the 600-ohm bridging control connected across the air-signal source to the input impedance of the amplifiers. Switching is on the grid side of this input transformer.

T2 is an output isolation transformer. Since most high-fidelity amplifiers utilize feedback from the output transformer, it is necessary to isolate its secondary from ground. If the output secondary is not used for feedback, or if a tertiary winding provides feedback, it may be possible simply to disconnect the ground end of the secondary winding and thus eliminate the need for T2.

Since T2 is the only component that might detract from the quality of the monitoring signal, we used a transistor output transformer (Triad TY-67A or equivalent) connected backward to lower the output impedance by a factor of 8/3. In order not to limit the fidelity of the air-monitoring system, this isolation transformer must be of high quality, have extremely low DC resistance, provide good frequency response and must be capable of handling the required power.

Relay K1 performs the input switching. Capacitor C1 is used to isolate the DC switching voltage from the audio, so that it does not appear at the input of the amplifier. Relay power is obtained from a DC supply. If such a supply is not available, it may be advantageous to build one into the calling unit to be described.

The terminal strip designations for the "Monitor Companion" are as follows:

1, 2—Balanced input from low-impedance, low-level, on-the-air signal.
3, 4—Floating pair (output) to each speaker location.
5, 6—Unbalanced output from the monitoring amplifier. (Terminal 6 is grounded.)
7, 8—24-volt DC input. (Terminal 8 is grounded.)
9, 10—To monitoring amplifier input; signal selected by relay. (Terminal 10 is grounded.)

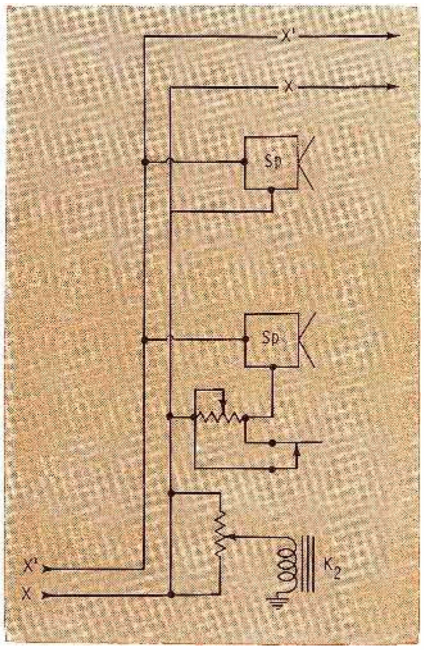

Fig. 4. Speaker in paging room can be "quieted" to prevent acoustical feedback.

Paging Unit

The calling unit, consisting of the power supply, microphone amplifier, switches, and output arrangement, is shown in Fig. 3. The power supply is straightforward, except that the on-off switch is connected to interrupt the microphone relay when the power is turned off. This prevents accidentally cutting out the air-monitor system by turning on the microphone.

The amplifier is a simple two-stage affair capable of delivering one watt, if this much output is needed. The 600-ohm T1 secondary is connected between ground (through the microphone push-to-talk switch) and the center-tap of the floating pair. When the microphone is keyed, the output of the amplifier appears between the phantom wire and ground. A DC current flows through the secondary of the output transformer along this same path. At the "Companion," the DC current actuates the relay, applying the "phantom" audio signal to the input of the monitoring amplifier. This signal, after amplification, appears across the balanced floating pair at terminals 3, 4.

The values of R2′, R3′, and R1′ are low enough that the DC voltage drop across them will not prevent the relay from pulling in, and they will absorb little power from the monitor amplifier.

The system calls for a monitoring speaker at the same location as the calling unit. It may be necessary to cut off this speaker when paging, to prevent feedback. This speaker can be disabled by inserting the winding of a normally-closed relay in series with the secondary winding of the output transformer, as shown by dotted lines in Fig. 3. (The output transformer of the calling unit is connected so that the magnetic fields created by the DC currents in the primary and secondary oppose and tend to cancel, to avoid saturation of the core.)

Adjustments and Operation

If hum and noise become objectionable, because of the nature of the signal path from the calling unit amplifier, its output can be increased and a suitable voltage divider installed in the Monitor Companion for a better signal-to-noise ratio. The value of C1 in the "Companion" may also be decreased so that low frequencies are attentuated, since all that is required of this part of the circuit is intelligibility.

A DC voltage appears between the phantom wire and ground when the calling unit is not keyed; when it is keyed, this voltage drops to zero. Because of this fact, a sensitive relay may be installed at each speaker location, as shown in Fig. 4, to maintain paging calls at a predetermined level—even though the speaker may be turned completely down. (Note that the relay is de-energized only when the calling unit is keyed.)

Thus with simple additions to an already operating system, paging facilities can be established. Little expense is involved, and the effects on the monitor signal are negligible. ▲

PARTS LIST

C1	.01-mfd capacitor.
K1	24-volt DC relay.
R1	50-ohm 2-watt potentiometer.
R2, R3	25-ohm 1-watt resistors.
T1	Input transformer, line-to-grid.
T2	Output-isolation transformer, low impedance (Triad TY-67A or equiv.).
C1	10-10-mfd 25-volt DC electrolytic capacitor.
C2	40-40-mfd 450-DC electrolytic capacitor.
C3	.1-mfd capacitor.
C4	.01-mfd capacitor.
D1	4 1N1696 diodes.
K2	Sensitive relay (Sigma 4F-1000 S-SIL or equiv.).
R1	2000-ohm 10-watt resistor.
R1′	50-ohm, 2-watt pot.
R2′, R3′	25-ohm 1-watt resistor.
R4	2.2-megohm ½-watt resistor.
R5	10K ½-watt resistor.
R6	1200-ohm ½-watt resistor.
R7	680K ½-watt resistor.
R8	270K ½-watt resistor.
R9	270-ohm 2-watt resistor.
R10	1-megohm audio-taper pot.
S1	DPST switch.
Sp	Monitoring speakers.
T1	Plate-to-line output transformer (Stancor A 3250 or equiv.).
T2	Power transformer (Stancor PC 840 or equiv.).
V1	6AU6 Tube.
V2	6AQ5 Tube.
Mic	Electro-Voice 729SR or equiv.
Mic Connectors	Cannon XLR-4-13N and XLR-4-12C or equiv.

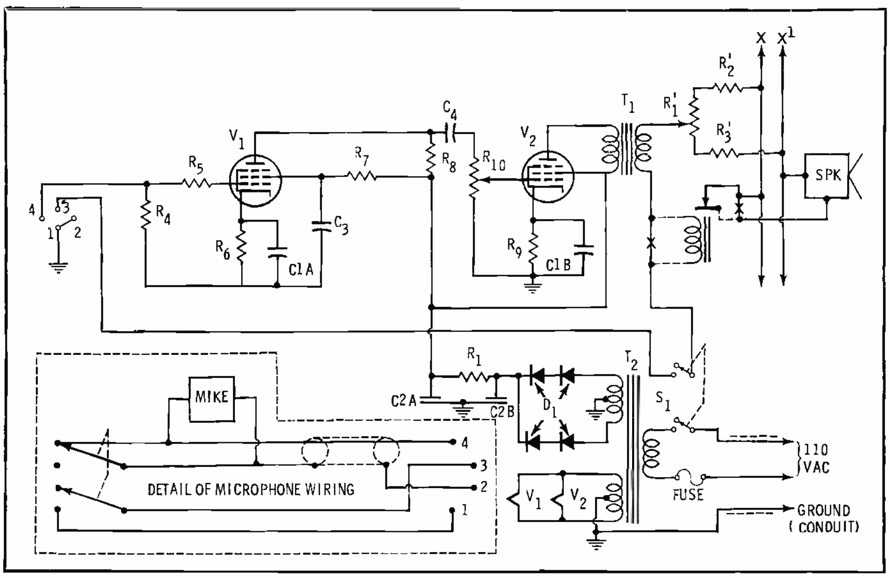

Fig. 3. Two-tube "calling-unit" is built from easy-to-find standard parts.

PLANNING A NEW FM STEREO STATION

*by Lloyd M. Jones** — PART ONE. Selecting proper equipment is one of the primary considerations.

If you are planning a new FM stereo station, some suggestions are included herein that may help save dollars, as well as prevent a few headaches. After forty years in broadcasting, and having been connected with the building of many AM, TV and FM radio stations, I have learned several points that should be carefully considered before purchasing station equipment. Fig. 1 shows a block diagram of the studio and transmitter equipment used at KMUZ.

Transmitter Considerations

At KMUZ, we did not buy a transmitter employing vacuum-tube rectifiers. Power diodes cost a little more to start with, but more than pay for themselves in a very few years. They generate little heat, and permit 10- to 50-kw transmitters to be built into rather small cabinets. With a cooler cabinet, the useful life of other components is prolonged considerably.

The transmitter should be supplied with a second-harmonic filter for the transmission line. This filter will prevent possible interference to certain high-channel TV stations. If your transmitter will be located on a mountain, be sure to advise the manufacturer of the altitude, and ask for a guarantee that the blower and motor will adequately cool the transmitter without the motor overheating.

Since the advent of stereo, the old type of serrasoidal-modulation exciter is not too well suited, especially if you intend to use a 67-kc SCA. (Watch for some manufacturer to come out with a direct-FM exciter unit with only four or five tubes, and using a variable-capacitor diode as the modulating device. The crystal could be a third-overtone unit with a frequency of 25mc, for direct frequency modulation.) The exciter and stereo generator could be on one panel, for directly replacing the present exciter.

*Chief Engineer, KMUZ, 4050 State St., Santa Barbara, Calif.

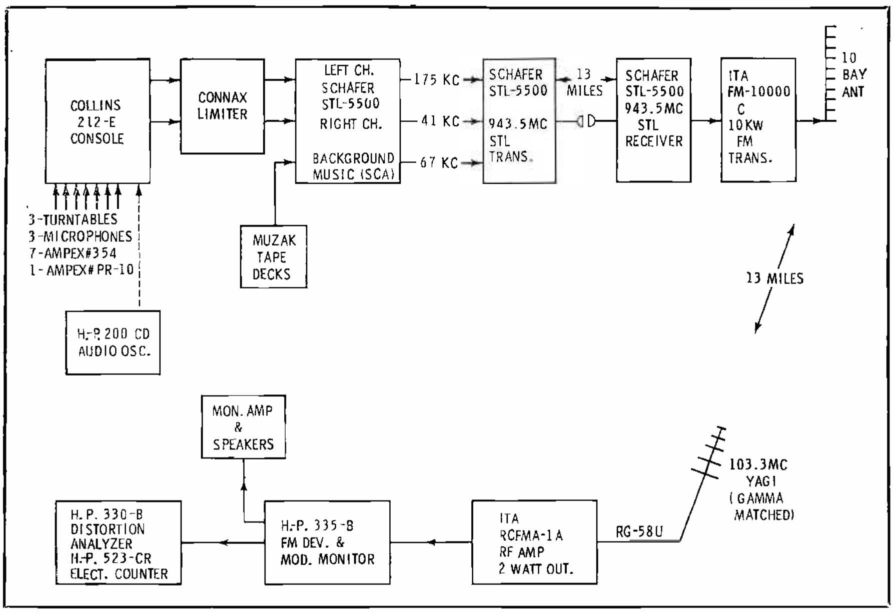

Fig. 1. Arrangement of KMUZ FM-stereo station, showing transmitter and monitors.

What's the Power?

There are a few important points concerning transmitter power versus effective radiated power. If the erp is to be 100 kw, should you use a 10 kw transmitter with an antenna having a power gain of 10, or a 50 kw transmitter with an antenna power gain of 2?

If your site is out in the great flat plains, with a tower height of 500′ to 1,000′, it is probably better to use a 10 kw transmitter with an antenna having a power gain of 10. This way, the initial transmitter cost will be considerably less, as will operating cost. If your transmitter site is on a mountain, and you wish to cover the homes located in canyons, as well as those in rural areas, you have a different problem. From observations and experience, we favor the 50 kw transmitter and the antenna with a power gain of 2, for this application.

An antenna with a low power gain radiates quite a bit of power in the vertical and downward directions and has less-pronounced nulls. This permits a strong signal to be radiated in the immediate vicinity. There are many locations where TV and FM transmitters are located on 3,000′ to 6,000′ peaks; in some of these areas, homes that are quite close receive a very weak signal, while homes that are located 20 to 60 miles distant receive a strong signal. A 25 kw transmitter with an antenna power gain of 4 might serve your particular purpose best. (And, of course, you shouldn't neglect the cost-per-radiated watt.) We'll look at antennas further, presently.

Unpacking

Regardless of what equipment you buy, when it arrives take every piece of equipment out of the racks, turn it, shake it, and clean it with compressed air. (Save all the loose nuts, bolts, washers, brackets, and other small components that you find; they may be needed later.) Discard all wire trimmings, blobs of solder, drill chips, blocks of wood, and other unidentifiable objects.

Then place each unit on the workbench where you can have the aid of a very bright light. Inspect each connection for cold-soldered joints. You might even use long-nose pliers to pull the individual wires to be sure that all connections are good. Check every nut, bolt, and screw for tightness. Time spent on this project at the outset will save many a call to the transmitter site after you are on the air, and will give you an even chance to have a transmitter that is stable, quiet, and free of parasitics.

Antennas

The antenna might be a 2 bay, 10 bay, or whatever intermediate arrangement provides the appropriate power gain to arrive at the desired erp.

Now the question arises as to whether the tower should be self-supporting or guyed. If a guyed tower is used, will the guy wires disturb the radiated pattern? Breaking up the guy wires with insulators poses a problem at FM frequencies. Should the insulators be placed every ⅜ wavelength, 1⅛ wavelength, or at lengths other than ½ wavelength or multiples thereof? If the guy cable is longer than ½ wavelength, then you really do not know what is happening to your radiation pattern, vertically or horizontally. Actual measurements are expensive. So, a self-supporting tower is to be preferred.

Order your antenna to be tuned for the size and shape of your tower, to insure a low SWR and a good circular pattern. Also specify that you want 3°, 4°, or 5° of electrical tilt to your antenna, so an adequate amount of power will be radiated to nearby areas that might otherwise receive a weak signal. It is very expensive (and off-the-air time is required) to put an electrical tilt into an antenna after it is assembled. Consult antenna suppliers for help in deciding what is best for your particular location.

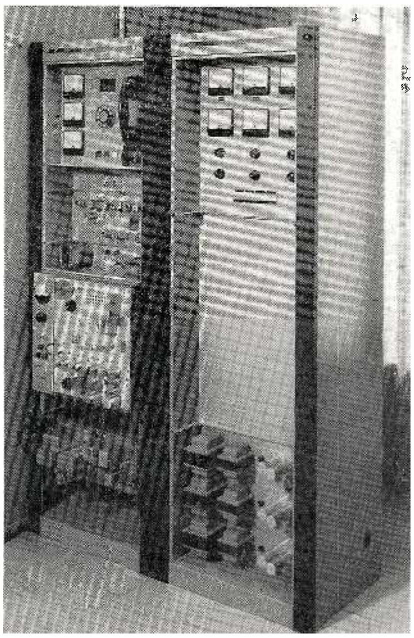

Fig. 2. Equipment racks contain STL, subcarrier, background music, and other gear.

A much more critical subject is how the elements of some antennas are fed and matched. Some antennas waste a great deal of power in the form of heat, instead of radiating it. In any event, you should not accept an antenna system which reflects more than 1% of the transmitted power back down the transmission line. A standing-wave-ratio of 1.1:1 (or less) is excellent.

If your antenna site is located where you get snow and ice, you should go to the expense of antenna de-icing equipment. A high standing-wave-ratio caused by ice (or any other problem, for that matter) can cause heating and damage in the transmission line and/or final tank circuits. By all means, pressurize your transmission line with dry air or nitrogen. These expenditures are quite justifiable, when compared to time and money lost when equipment breaks down.

Auxiliary Antennas

While on the subject of antennas, let's consider auxiliary antennas you may use. Microwave dishes for an STL system should be of the mesh, or open, type; solid dishes present too much wind resistance. If you need an antenna for the 26-mc range, choose a steel whip—spring mounted—with a ground-plane consisting of the steel in a building, or radial wires that are strong enough to support 2″ or 3″ of ice.

Since you are going to broadcast stereo, you must use a receiving antenna (for the studio air monitor) that has a very low SWR or you will have cross-talk problems. Three-element yagi's are good where the signal is quite strong, but where the signal is weaker, use a five- or ten-element antenna. Choose a gamma-match antenna; this unit is for use with either a 50- or 75-ohm coaxial line, depending on the exact design. TV ribbon lead-in is not desirable, due to its susceptibility to unwanted signals and noise. Remember that FM stereo requires the same exactness and care as TV, if you are to receive a signal with no crosstalk, no multipath distortion, and good separation. On TV you see the faults—

° Please turn to page 34

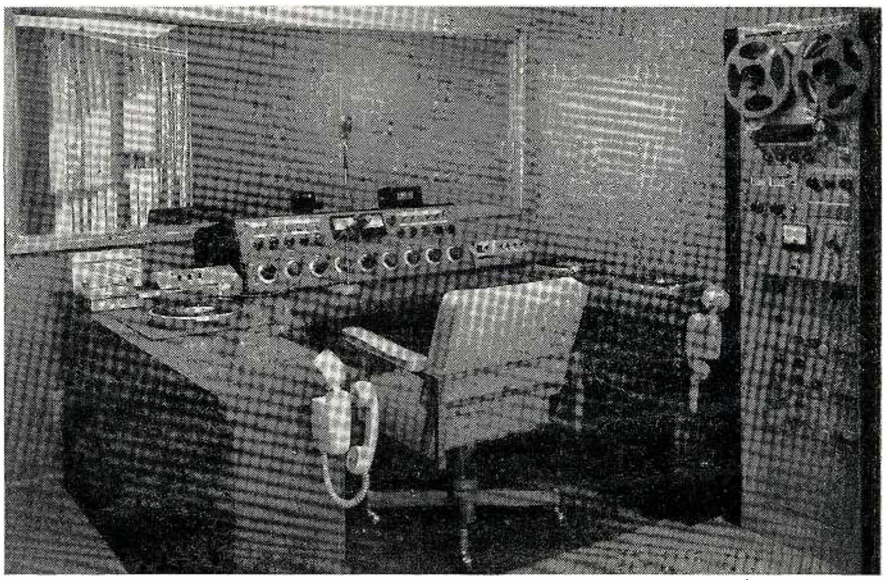

Fig. 3. Control-room console, looking into the studio, alongside rack containing stereo tape deck, monitor amplifier, silence sense deck, 25-cps cuing generator.

INSTALLING A DIRECTIONAL ANTENNA?

*by Joe Novik** — Here's essential information for completing that critical job.

When a broadcasting station must provide a serviceable signal into a specified area, at the same time limiting its radiation toward other localities, a directional antenna system is required. The Federal Communications Commission requires that the proposed radiation pattern of a directional antenna system be filed by the applicant before a construction permit can be granted. This radiation pattern is derived mathematically, is based on accepted electrical concepts, and assumes ideal conditions. It is necessary, therefore, to exercise great care during the installation, so that variations from the ideal conditions are held to an absolute minimum.

Spacing and orienting the towers is a critical process. A reference azimuth to true north must be determined, and a precise bearing of the line of towers plotted from this reference.

The only really acceptable means of determining true north is by observing Polaris (the North Star). Because of the earth's motion, this observation is most conveniently carried out only once in 24 hours.

To provide an accurate tower layout and to satisfy the terms of the specifications, the services of a registered civil engineer or surveyor should be obtained. A traverse of his measurements, duly attested, should be supplied to the consultant in charge of system design.

Towers

Towers must be designed and installed to withstand the maximum wind velocities that may be encountered. The degree of protection in this matter is at the discretion of the individual station, but skimping is hardly advisable. The tower designer can give specific information regarding anchors and guying.

*I.T.A., Washington, D.C.

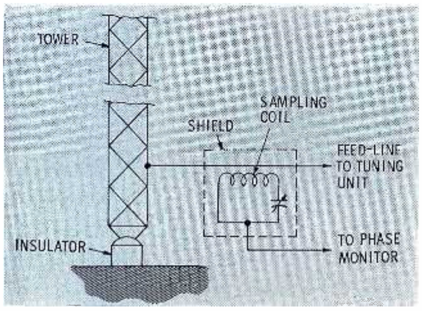

Fig. 1. Shielded sampling-coil unit is mounted inside the tower tuning house.

The concrete for bases and guy anchors should be poured at least a week or ten days before any steel load is applied. For maximum strength, even more than ten days should be allowed for curing.

After the towers have been erected, being certain they are absolutely vertical, and before they are painted, all joints should be bonded to provide a stable RF path which will not be affected by oxidation or by movement of bolted tower joints. In some cases, towers are painted prior to erection; care should be taken with these to assure a good surface contact at all joints. Painting must conform with FCC/FAA regulations. Further, the sections of guy wire should be no longer than ⅛ of the operating wavelength, so they will not affect the pattern.

Grounding

The plate of the base insulator should be bonded to the ground system with one or more heavy cables, or a copper strap. Until the system is in operation, the ball gap should be strapped across, and the tower tied to the ground system to prevent lightning from damaging the piers or foundations. After the installation has been completed, and the transmitter has been connected to the system, the lightning gaps should be set. They should first be adjusted to flash at 100% modulation, then opened to approximately twice that flashover distance.

As an additional aid in lightning control, "Johnny Ball" insulators (if used) should be ganged both at the tower and at the anchor. It is best to use two or three in series, rather than just one.

A fence is required around each tower to prevent unauthorized tampering and vandalism. These protective structures can be made of metal or wood; however, if they are constructed of metal, they must be carefully bonded to the ground system, and should be completed before any tower-resistance measurements are made.

Ground Systems

Since the antenna radiation pattern is computed on the basis of a perfectly conducting ground, and since earth conditions always depart from the ideal, a ground system of buried copper wires or ribbons must be installed. The FCC requires a system of buried radial wires, each at least ¼ wavelength at the operating frequency. A minimum of 120 evenly spaced radials (and more, if possible) should be installed.

Ground Screens

If high base currents are encountered, a 24″ x 24″ ground screen must be placed in position at the base of the tower. It should be of 28-gauge expanded copper mesh, or the equivalent, and should be covered with earth. Each radial wire must then be electrically bonded to the ground screen; a simple twisted connection will not suffice—each connection must be silver soldered.

In lieu of the copper ground screen, additional radials may be used, interspaced with the aforementioned 120. They should be placed around the base of each tower and installed in the same manner as the others. All the radials should then be bonded to a heavy bus consisting of a 3″ (or wider)

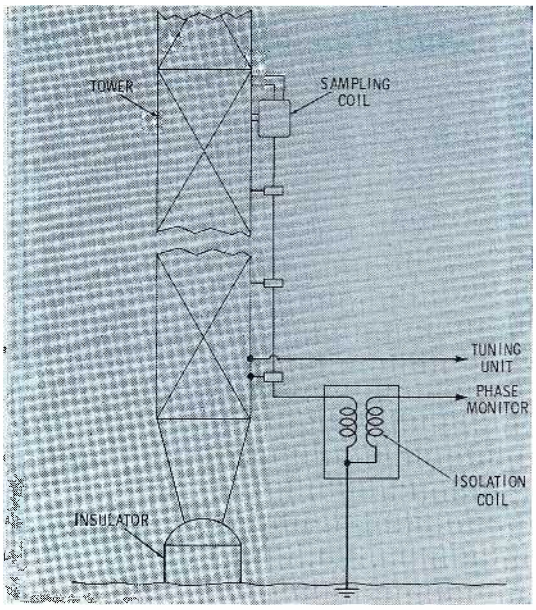

Fig. 2. Isolation-coil method of coupling signal to the tower-phase monitor.

copper ribbon, or to a bundle of copper wires next to the concrete base of the tower. The insulator base and the lightning gap are also bonded to the screens, or to the ground bus at the tower base.

A similar bus or wire bundle is used to interconnect the short (intersecting) radials between the towers. If the towers are spaced more than ½ wavelength apart, the radials should be extended to overlap; thus, they can be bonded the same as the short radials.

Bonding

In all bonding connections, only silver soldering, brazing, or copper welding should be employed. Lead-tin solder will corrode, and will melt readily under lightning surges. During installation, close supervision should be exercised to insure conformance with bonding specifications. It is recommended that a No. 10 soft-drawn copper or a No. 10 copper-weld wire be used for the radials and for the bundle of wires making up the bus.

Care should be taken that no two ground wires come in contact with each other unless a firm bond is made, except within a 2′ or 3′ radius of the tower base or copper screen.

Transmission Lines

The outer conductor of the transmission line should be bonded to the ground system every 20 feet, preferably to the heavy copper strap running between the towers.

Provision should be made to flush dry air through the line and hold it at the pressure recommended for whatever transmission line is used. Air may be provided by a hand pump and a small silica gel chamber, or by an air-pressure tank and dehydrating equipment. All joints, plugs, and end seals should be tested for leaks with soapy water.

Extra gaskets should be available in case of damage to, or defects in, the original ones. Insulated end seals will be required at both ends of the transmission line, one at the phasing-and-branching equipment and another at the antenna-tuning unit. The outer conductor of the transmission line is connected to the ground system at the phasing unit and at the tower-tuning units.

Phase-Monitor Lines

Either semirigid or flexible coaxial lines may be employed in the sampling system for the phase monitor. All lines should be of the same electrical length in order to produce correct phase indication; i.e., all lines must be the same length as the longest line from the antenna to the phase monitor. Excess line on the shorter runs may be coiled and stored at either the antenna or the phase monitor. Alternatively, it may be folded back upon itself.

The characteristic impedance of the sampling lines must be chosen to match the input impedance of the phase monitor. These lines can be buried in the ground or carried back in the trough that supports the main transmission lines. If semirigid line is used, provision should be made for expansion and contraction caused by temperature changes.

One method of sampling antenna current consists of mounting a sampling coil in the tuning house (Fig. 1) as part of the tower tuning-unit or as a separate kit.

Another method of sampling is with a shielded or unshielded loop at the tower (Fig. 2). If the tower height is less than ½ wavelength at the operating frequency, and if the power is not too great, the sampling cable can be insulated from the tower; if so, isolation coils need not be included in the system.

If isolation coils are required, sampling cable or air-dielectric coax can be "wrap-locked" to the tower members and connected to the isolation coils in the tuning house at the base of the tower. From the isolation coil, transmission cable is run to the phase monitor in the transmitter building. The "cold" end of the isolation coil should be bonded to the main ground system.

Line Termination

The transmission line for feeding the line-terminating unit can be buried, but it is often desirable to install the line above ground. This is particularly important in the case of aluminum-sheath cable, as it will deteriorate very rapidly underground without a protective sheathing such as polyethylene.

Support posts should be either completely insulated or, if they are steel, bonded to the ground system. If air-dielectric coax is used, it should be laid out as straight as possible with no bends, sags, or bumps; bending strains may cause flanged seals to leak. One end of the line should be anchored, and the other left free to move as the line expands and contracts.

Trough supports should measure at least 4″ × 8″, have a removable top, and be above the maximum snow level. For convenience, the trough should be no higher than 36″ above the ground unless terrain conditions make this impossible.

Line-terminating units can be connected to the tower by means of copper tubing, flattened at one end, and drilled for connecting to the antenna-tuning-unit terminal. The tubing is run through a feed-through insulator in the tuning-house wall, and attached to the tower with a bolt or by brazing. At a point between the tower and feed-through insulator (as shown in Fig. 3), the line should be formed into a one- or two-turn coil, 12″ to 18″ in diame-

• Please turn to page 36

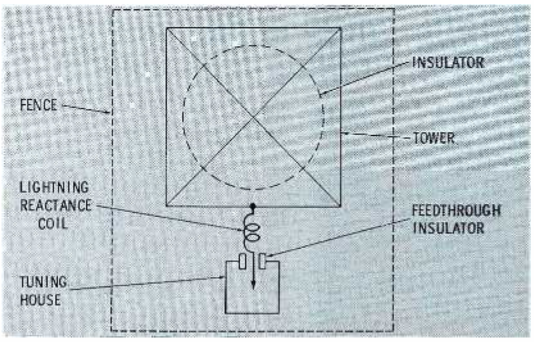

Fig. 3. Layout of each tower enclosure showing tower, fence, and tuning house.

RADIO TRANSMITTER MAINTENANCE

*by Thomas R. Haskett**—PART THREE

How to plan a system maintenance schedule designed to assure maximum operating efficiency.

Apart from electronic troubleshooting, a portion of the station maintenance program is concerned with mechanical functions — chiefly visual inspection and cleaning. Transmitters generally have blowers to force air around the power tubes for cooling. Although filters are always used at the air intake, the continuous air stream speeds up the accumulation of dust within the equipment cabinet. It is for this reason that units with forced-air cooling require cleaning at more frequent intervals than those which have no blowers.

Internal Cleaning

Each regularly-used transmitter should be cleaned monthly. At yearly intervals the transmitter(s) should be cleaned even more thoroughly; auxiliary equipment should be cleaned at this time, too. The cabinet must be entirely blown (or vacuumed) out, to eliminate most of the dust. A portable, combination blower-vacuum cleaner is indispensable for this job.

Relay contacts can be wiped off with either a soft, lint-free rag or a narrow strip of bond paper dipped in alcohol or contact cleaner. (The strip of paper is especially effective when pulled through normally-closed contacts.) Occasionally, it may be necessary to use a burnishing tool to polish the contacts—sandpaper or files should never be used, as the contact shape may be altered and proper operation impaired. Porcelain standoff insulators should be dusted or wiped clean, as an accumulation of dust or grime could cause arc-over. Meter faces should be wiped off and reset manually for zero indication; this must be done only when all power is completely off. All door interlocks and high-voltage grounding straps should be inspected, cleaned, and checked for good contact.

Besides the points mentioned above, all tubes should be removed, wiped clean, and their pins and caps polished free of grime. All tension clips and contacts (such as the tap on the final tank coil) should be removed and polished. It is a good idea to wash the cabinet face with a mild detergent and inspect the entire transmitter visually for anything out of the ordinary.

Convection-Cooled Equipment

Equipment which is not forced-air cooled will not accumulate dust as rapidly as blower-equipped units, but will still require periodic cleaning. The blower or vacuum should be used to clean the chassis and/or housing. A close visual inspection should be made, at quarterly intervals, for signs of overheating, moisture accumulation, and leaky electrolytics. All socket voltages must be measured and compared with recommended values, panels cleaned, "pots" squirted with control cleaner, and all components closely inspected.

Measurements

The socket voltages of all stages should be measured with a VTVM and compared with recommended and previously-recorded values. Extreme caution should be used when making measurements. The only safe way to connect meter leads is before the power switches have been turned on, and after a grounding stick has been applied to the particular point in case of a bleeder or interlock malfunction. The interlocks don't have to be cheated; the doors can be closed, and the transmitter fired up in the normal manner while the VTVM is read. Although time-consuming, this system may well save your life. After the reading is taken, the process should be reversed; use the grounding stick on the terminal before removing the meter lead.

A grounding stick for this purpose is shown in Fig. 1. It is a wooden pole about 2′ long (a section of a broom handle will do nicely) to which a large-size stranded wire (AWG10 or 12) has been taped. At the "hot" end, the insulated wire is exposed and extended beyond the stick for perhaps an inch or two; half way to the other end the wire brought out through the tape, cut to a convenient length (approximately 8′) and terminated in a large automobile-type battery clip. When the clip is attached to an unpainted part of the transmitter frame (ground), the hot end can be used to discharge terminals prior to making measurements, adjustments, and repairs.

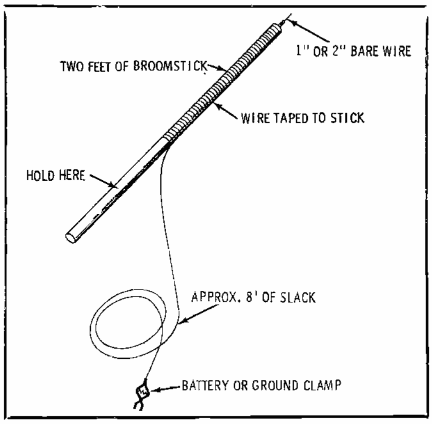

Fig. 5. Grounding stick can be made from simple materials, and may save your life.

Panels and Cabinets

The subject of panel and cabinet cleaning merits further discussion, as it should be done rather thoroughly on an annual or semiannual basis. Notations should be made of all normal control settings, before any knobs are removed from their shafts.

The panels are then dusted with

*Broadcast Consultant, Michigan City, Indiana.

a soft, damp cloth. After this, cracks and corners which were missed (panel and meter junctions, for example) can be cleaned with a small, dry paint brush. Smooth panels should be washed with a mild detergent, and buffed briskly with automobile-type polish or wax.

Crackle- or wrinkle-finish cabinets can best be cleaned with a stiff-bristled scrub brush, detergent, and warm water. This method must be employed with care, however, to avoid spilling water inside the unit, or on nearby equipment. One way of avoiding damage from spillage is by draping several large cloths over nearby units. Rags should never be used for cleaning crackle-finish panels because the rough surface will shred the cloth and cause lint to adhere to the paint. Wax may be applied to a wrinkle finish with a rather soft brush, such as that used for polishing shoes.

Naturally, glass meter faces should be carefully wiped off with soft, lint-free, slightly damp rags, using warm water only—no detergent. Finally, before the knobs are replaced, the screws, bolts and nuts which secure the controls (i.e., attenuators or capacitors) to the panel should be checked for tightness.

Suggested Transmitter Maintenance Schedule

Weekly

1. Calibrate all remote-reading meters, including those used (in conjunction with a remote-control system) to read transmitter operating parameters from the studio or other control point.
2. Test-operate all auxiliary and standby gear.
3. Make written record of the meter readings on every transmitter. (Optional—note control settings.)

Monthly

1. Clean main or on-air transmitter(s); check air filters and replace if necessary.
2. Clean remote-control system; check all voltages with a VTVM; measure resistance of solid-state rectifiers; check proper operation of all functions and metering circuits.
3. Have transmitter(s) and frequency monitor(s) checked by a commercial measuring service.
4. If any type of FM multiplex is used, check or cross-talk with main channel.

Quarterly

1. Inspect tower-lighting control devices, indicators, and alarm systems, making proper entries in the operating log.
2. Run "spot proof" on audio portion of main transmitter(s), and all regularly used audio equipment; make visual inspection, clean, and check power-supply voltages; check resistances of solid-state rectifiers.
3. Check operation of and recalibrate all monitors; include visual inspection, cleaning, and checking of power-supply voltages.
4. Check operation and alignment of multiplex gear and RF preamps; include visual inspection, cleaning, and checking of power-supply voltages.
5. Run shelf-spare transmitting tubes, or rotate with those in use.
6. Optional: Sweep-align FM exciter, depending on make, age, and condition.

Semi-Annually

1. Clean all attenuators and pots; clean and check operation of all jack panels and patch cords. (Techniques were described in Part 2 of this series.)

Annually

1. Run complete audio proof-of-performance as required by FCC.
2. Run a complete "unit proof" on each transmitter and each unit of audio equipment, whether main or standby; include close visual inspection, thorough cleaning, and checking of all socket voltages.
3. Make close visual inspection of all towers, tower-lighting systems, feedlines, guy wires, "doghouses," and coupling assemblies. Determine if tower cleaning and/or repainting is necessary to maintain visibility in compliance with FCC regulations. (Optional: Again measure impedance of antenna system.)

Passive Equipment

Also located at the transmitter plant are such items as phasing equipment, transmission line, line-matching equipment, antenna(s), tower(s), and the ground system. They are passive elements—normal station operation has little effect on them. Degraded performance or failure of these items is almost always due to some external agent—moisture, wind, lightning, electrical discharge, rodents, and vandals, to name a few.

The effect of these elements can usually be determined by observing the transmitted signal as read on the antenna ammeter, the frequency and modulation monitor, and the quality of the sound from the station monitor. A closer inspection of such passive equipment should be made annually, looking for evidence of deterioration.

One possible defect which may develop within the passive equipment concerns impedance matching and the possible presence of standing waves on the transmission line. With a kilowatt or more of RF energy on a line, a high standing-wave ratio can cause overheating and subsequent breakdown. However, such a condition would not go unnoticed for long; the antenna ammeter or reflectometer readings would indicate an abnormality. If the transmitter is operating normally, the defect can be traced to the line.

Tower Lighting

FCC regulations require that nearly all towers be lighted, and that spare bulbs be kept on hand at the transmitter plant. If any portion of the tower-lighting system should fail, the nearest office of the FAA must be notified since the tower then constitutes a hazard to air navigation. As a general practice, tower lamps are replaced on a yearly basis, even though they might still be in working condition; this procedure tends to minimize failure in service.

In addition to the daily tower-light check required by the FCC, the licensees must also inspect all tower-light control devices, indicators, and alarm systems at least once every three months. It is further required that a record of this inspec-

	JAN				FEB				MAR				APR				MAY				JUN			
AM PLANT	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MAIN XMTR	C	F			C				C				C	S			C				C			
MAIN LIM		F						S												U				
AM FR MN					R												R							
AM MD MN		F				R												R						
AM PH MN							R												R					
CONL MN								R												R				
AUX XMTR					C																			
AUX LIM													C											
SBY CONS														C										
SBY PREA															C									
JACK F																C								
SBY MIC																X								
FM RMC			C				C				C				C				C				C	
FM PREA											A												A	
FM MON			F						R												R			
SCA MON										R												R		
FM PLANT																								
MAIN XMTR		C	F			C				C				C	S			C				C		
SCA GEN												A												A
MAIN LIM			F									S												U
SCA LIM				S												U								
AM TWRS					L												L							
FM TWR						L												L						

	JUL				AUG				SEPT				OCT				NOV				DEC			
AM PLANT	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MAIN XMTR	C	U			C				C				C	S			C				C			
MAIN LIM								S												S				
AM FR MN					R												R							
AM MD MN						R												R						
AM PH MN							R												R					
CONL MN								R												R				
AUX XMTR	U			C																				
AUX LIM		U											C											
SBY CONS			U											C										
SBY PREA				U											C									
JACK F																C								
SBY MIC																X								
FM RMC			C				C				C				C				C				C	
FM PREA											A												A	
FM MON									R												R			
SCA MON										R												R		
FM PLANT																								
MAIN XMTR		C	U			C				C				C	S			C				C		
SCA GEN												A												A
MAIN LIM												S												S
SCA LIM				S												S								
AM TWRS					X												L							
FM TWR						X												L						

Code:

A — Clean, inspect, measure power supply voltages, align and check operation.
C — Run complete FCC proof—clean, inspect, measure power supply voltages.
F — Clean, inspect, measure power supply voltages.
L — Inspect tower-lighting controller.
R — Clean, inspect, measure power supply voltages, check operation and recalibrate.
S — Run spot proof—clean, inspect, measure power supply voltages.
U — Run unit proof—clean, etc., as above.
X — Inspect and replace light bulbs if necessary.

Fig. 6. Sample maintenance schedule covers entire year, and divides work evenly.

tion be kept, showing the date, condition of the equipment and adjustments, replacements, or repairs.

All towers must be cleaned or repainted as often as necessary to maintain good visibility from the air. From the administrative standpoint, such tasks belong on the operating schedule and log rather than in the maintenance schedule; however, some stations include them in both as a precautionary measure. At any rate, appropriate entries **must** be made in the operating log, whether or not any other logs are kept.

Antennas

An AM ground system may not appear to need maintenance. One small point might be mentioned in passing, however—vandals seem to enjoy pulling up the copper wire. After a few raids of this nature, the impedance of the antenna system will have changed, resulting in a mismatch at the feedpoint. There isn't much that can be done to prevent such nefarious activity at remote transmitter sites, although financial loss can be averted by carrying theft insurance.

At any rate, whenever the ground system is disrupted, and at least part of it replaced, the antenna impedance must be measured again and the coupling rechecked for optimum transfer. With a directional array, this can be a costly undertaking.

Most stations don't have the requisite equipment, so they hire consultants for such jobs. From the standpoint of preventive maintenance, however, it is a good idea to measure the station's antenna system now and then (perhaps on a yearly basis). Any change in the impedance can cause considerable loss in signal strength. If the impedance is different from that stated on the license, the new measurements must be reported to the FCC. (Part 3 of the Rules and Regulations will explain these matters.)

Schedules

On a yearly basis, the various maintenance tasks should be scheduled according to their required time, and staggered so that each period will contain a nearly equal amount of work. Depending on the size of the engineering staff, the transmitter jobs may be coordinated with those at the studio. A plan to cover almost any situation appears in the accompanying box.

A complete transmitter maintenance schedule (except for weekly tasks) for a hypothetical AM-FM station with separate transmitters (each separate from the studio) is shown in Fig. 6. Note that the AM plant is manned, while the FM plant is remotely-controlled from the AM site. This style of schedule is identical to that shown for studio work in Part 2 of this series, and makes it possible to schedule various jobs so there isn't too much work in any one week. And yet, each piece of gear gets proper attention. As the work is done, it should be written up in a separate maintenance log, showing the date, engineer's name, work done, and any comments. All staff members can then be aware what has been done, what is to be done, and how the equipment has been acting.

The secret of dependable station operation lies in regular, effective maintenance. If the suggestions in this series are followed you can feel you have done much toward keeping your station "on the air." ▲

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DO YOU UNDERSTAND DBU's AND DBK's?

*by Jack Alexander** — These units are becoming common in transmitter-system calculations.

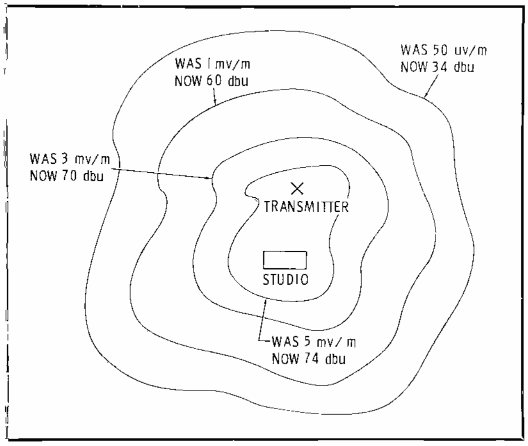


Fig. 1. FM contour map indicating the new designations set forth by the FCC.

About ten years ago, the FCC developed and made public some new curves for television in which they refer to "dbu's" and "dbk's." Many broadcast engineers were rather puzzled by these terms, but after a short time the more observant found that instead of making calculations harder they actually made them easier! Instead of having to multiply unwieldy numbers, using these curves made it necessary only to add them.

More recently, with the changing of the FM rules (see "The New FM Rules Affect You"—in this issue), the FCC has made use of the dbk and the dbu on a much wider scale. It is most likely that, before long, the term will also spread to AM calculations.

*TV Consultant, Washington, D.C.

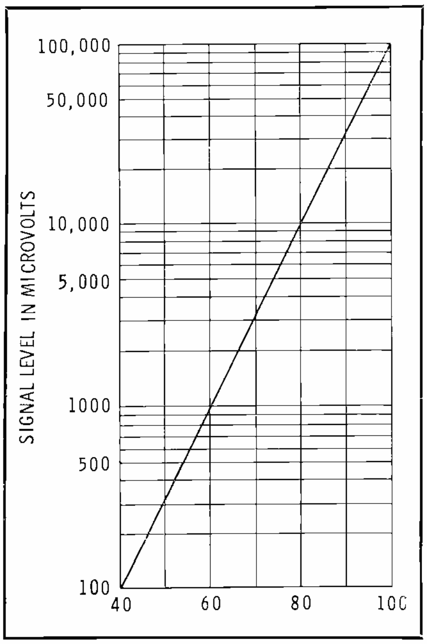


Fig. 2. New conversion scale for dbu's

Definitions

What do these terms mean? The symbol "db" stands for decibel which, as most readers know, is a ratio only and not an expression of an absolute value or unit. The letter "u" signifies that the value shown is above a reference value of 1 microvolt. (It will be recalled that "u" is used in most writing to signify the Greek letter mu, which represents the prefix "micro.") Thus, 60 dbu would be a value 60 decibels above 1 microvolt.

In the case of "dbk" we again have an expression of so many decibels above a reference, which in this case is 1 kw. We know that "k" generally signifies kilowatts, so the expression 20 dbk is easily accepted as being 20 decibels above 1 kw. In some instances, we can even go into negative dbk values (i.e., a 100-watt transmitter would have an output of —10 dbk, or 10 db below 1 kw).

Contours

For the purpose of this article we shall explain the use of the db in connection with FM contours, and will take examples from current FM-coverage standards.

For years, the standard service (protected) contour for FM radio has been termed as the 1 millivolt-per-meter (1 mv/m) contour—see Fig. 1; this contour is protected from interference from other stations. By the same token, the 5 mv/m and 3 mv/m contours represent the minimum coverage requirements for studio and city, respectively. Now, under the new rules, the Commission provides for interference protection within the limits of a 60 dbu contour. Likewise, the 5 mv/m and 3 mv/m contours have been changed to 74 dbu and 70 dbu. The former outer limit of service, the 50 uv/m contour, has been altered to a 34 dbu contour.

We normally measure field intensity in millivolts-per-meter. Therefore, our dbu term is based on a voltage ratio. The db formula for voltage ratios appears in the computation section of this article.

Similarly, when we discuss transmitter power we refer to watts (generally kilowatts); as a result, we shall find the power ratio used when

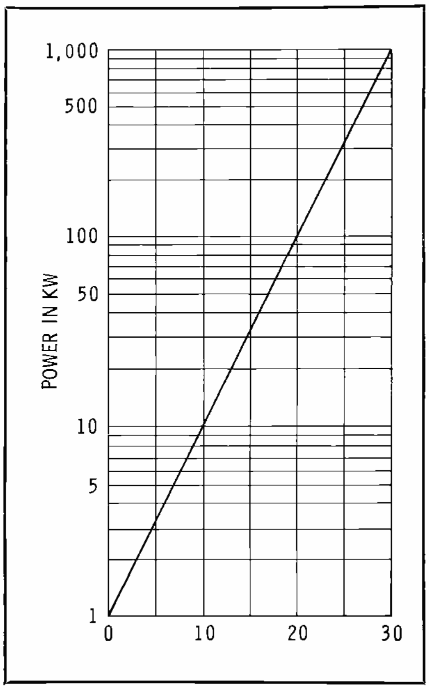


Fig. 3. New conversion scale for dbk's.

computing dbk's—decibels above 1 kw.

Computations

At first sight, many engineers throw their hands up in horror at the thought of tangling with decibel formulas; what they expect is complicated math. As a matter of fact, decibel math is one of the easiest types to work with. Because we can all add simple numbers, the dbk/dbu method is rapidly becoming preferred by most engineers.

DBU's

The basis of the dbu's, or decibels above 1 microvolt, is the ratio for voltage:

$$20 \log_{10} \frac{E_1}{E_2}$$

An example: How many dbu's is a field intensity of 1,000 uv (or 1 mv)?

This represents a voltage ratio of 1000:1 (E_1/E_2). We convert the ratio into a logarithm. From the table of common logarithms we find that the log of 1000 is 3. Thus, 20 log 1000 is the same as 20 × 3, or 60 dbu. Easy, isn't it?

Similarly, 100 microvolts can be expressed as 40 dbu. In this case, $20 \times \log_{10} E_1/E_2$ equals 20 × the log of 100:1, or 20 × 2, equals 40 dbu. Our old friend, 50 uv/m can be computed in dbu's easily. The ratio is 50; so, $20 \times \log_{10} 50$ equals 20 × 1.7. Thus, 50 uv/m equals 34 dbu. If the user remembers first to find the ratio of the desired voltage to 1 microvolt and then multiply the logarithm of that ratio by 20, he cannot go wrong.

Table 1 — Common Voltage-Power Ratios.

Contour	dbu's	Power	dbk's
100 mv/m	100	1000 kw	30
10 mv/m	80	316	25
5 mv/m	74	200	23
3 mv/m	70	100	20
		50	16
1 mv/m	60	20	13
		10	10
500 uv/m	54	5	6
100 uv/m	40	500 watts	-6
50 uv/m	34	100 watts	-10

DBK's

Power ratios are handled in a manner similar to that of handling voltage ratios. The only difference is in the formula, which becomes:

$$10 \log_{10} \frac{P_1}{P_2}$$

Thus, a transmitter output of 1000 kw can be expressed as 10 × log of the ratio of 1000:1, or 10 × 3 equals 30 dbk.

It should be apparent that power ratios work in the same manner as voltage ratios, except that the constant is 10 instead of 20. By the same token, an important point to observe is that a small change in dbk's will result in a large change in power, whereas a small change in dbu's would not produce so great a change in field intensity.

Specifications, in the future, will be expressed more and more often in these units. The engineer who has a grasp of their use will find his system computations greatly simplified. The charts in Figs. 2 and 3, and Table I, should greatly assist in quick calculations. ▲

FRAME-LOCK DEVICE FOR THE AMPEX VTR

by Bill Kessel* — Details of a simple frame-locking generator which eliimnates roll-over during tape-machine transitions.

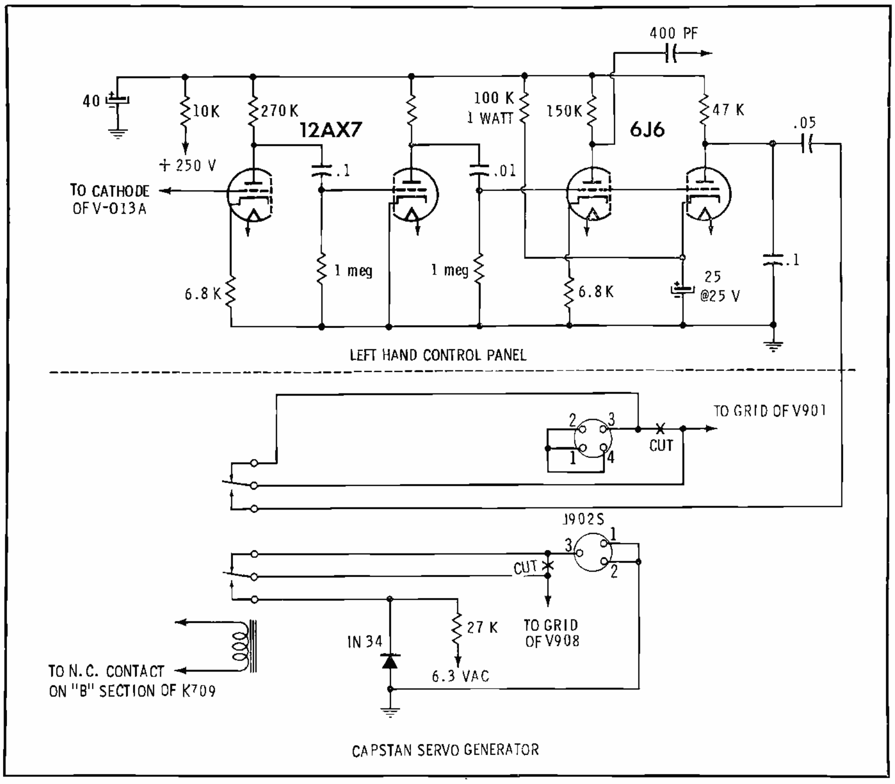


Fig. 1. Circuitry added to the "A" machine.

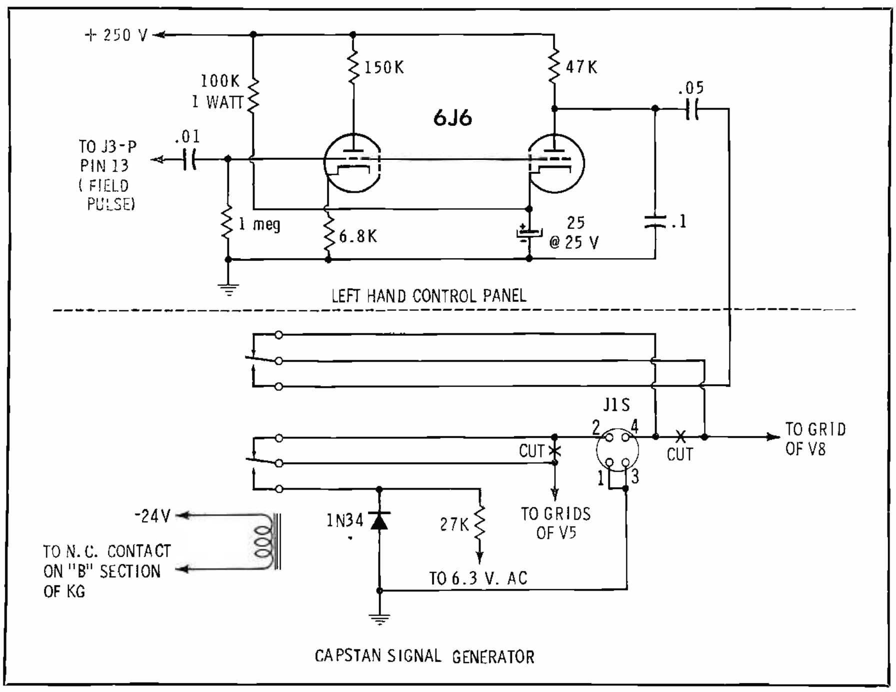


Fig. 3. Circuitry added to the "B" machine.

In common with other sources of "unlocked" composite video, the tape machine switching can cause a picture roll-over. We use a number of pretaped inserts in our recording, and it is essential that there be no flop-over during the transition between machines. Our supervisor of tape operations, O. G. Kelly, solved this problem with a simple device which uses a minimum of circuitry but is quite stable and dependable.

Theory of Operation

The solution, of course, is to lock the capstan during the four-second stabilization period so that the tape picture will be vertically coincident with the local sync generator. Normally, during stabilization, the capstan generator is fed a 240-cps signal. There are then four possible locking modes, only one of which is coincident with the generator. Fortunately, there is a signal on the tape which can be used to lock the capstan at the proper point. This is the edit, or field, pulse.

Fig. 1 shows the circuit used in the "A" machine. The positive-going edit pulse is taken from the cathode of V-013A in the left-hand control panel. It is amplified by two 12AX7 stages and fed to a 6J6 which develops a sawtooth that later becomes a square wave. Fig. 2 shows the two-tube sub-chassis mounted on the right wall of the left-hand control-panel unit in the "A" machine.

A DPDT 24-volt DC relay is mounted on the back of the capstan servo generator as shown in Fig. 2 (lower center). The relay coil is connected between —24 volts and the unused normally-closed contact

*Chief Engineer, KTVT, Ft. Worth, Tex.

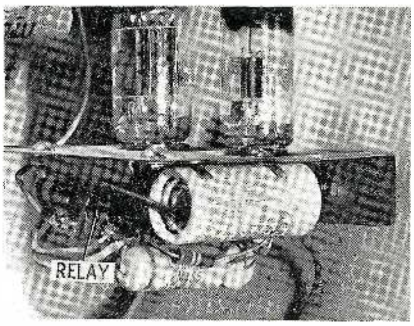


Fig. 2. Two-tube subchassis assembly in the control panel of the "A" machine.

on the "B," or four-second delay, section of K709. Thus the relay is energized until K709 has "timed out" and the tape guide is pulled in. Then the relay drops out and the normal 240-cps pulses are reapplied to the capstan generator.

During the four-second stabilization period the square wave developed from the edit pulse is applied in place of the 240 cps from the photocell. Instead of the 240-cps signal from the control track, there is a square wave which has been developed from 60-cps AC. If the AC is properly phased, the capstan will lock so that machine sync will coincide with local sync. It may be necessary to reverse the AC leads of the capstan generator for correct phasing.

Circuit Details

The circuit for the "B" machine, shown in Fig. 3, is almost identical to that for the "A" machine except that the 12AX7 amplifier is not necessary. The field pulse is taken from J3-P, pin 13, in the left-hand control panel and is handled by the 6J6 and the relay in the same manner as in the other machine.

It will be necessary to bring local sync into the machine and to operate with the sync selector switch in the Local Sync position at all times. The sync can be brought into machine "A" at the Color Sync jack and into machine "B" at the External jack. Some rephasing of the sync generator may also be required.

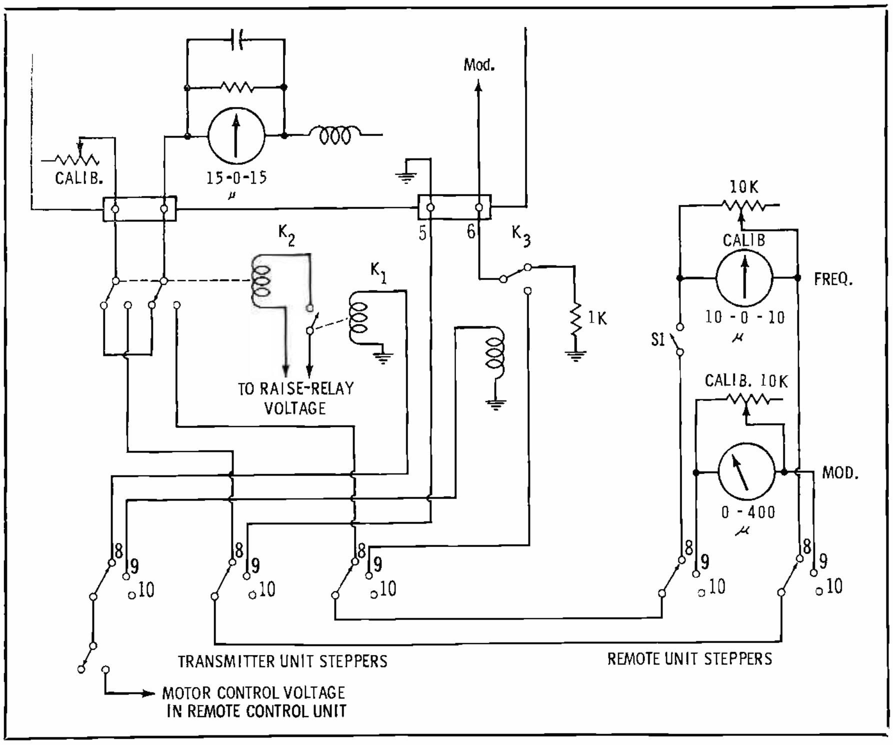
In both circuits the resistors are ½ watt, 10%, and the capacitor values are shown in microfarads at 400 volts, unless otherwise marked. The circuitry is not critical and, once adjusted, should operate for a long period of time with no trouble.

There is a bonus available in the "A" machine circuit (Fig. 1). The lead marked "connect to S.001" has nothing to do with the frame-lock. This is an arrangement for making the edit pulses available at the scope when the switch is thrown to the System Stability position. They are superimposed on the Lissajous pattern. The "B" machine already has this feature built in.

The operation of the unit may be conveniently checked by feeding the output of the machine into a master monitor which has been switched to "Non-Comp." Machine sync will then be mixed with local sync in the monitor and the relationship between the two can be readily observed.

This unit has worked faithfully in our operation for two years with no attention except an occasional tube check. All that is needed are good, solid edit pulses on the tape, and the roll-over problem is completely solved. ▲

ENGINEERS' EXCHANGE



Relay Switching for Remote FM Monitoring

by Melvin G. Hart, Chief Engineer, WIL-AM-FM, St. Louis, Mo.

When the Hewlett-Packard frequency and modulation monitor is used with a remote-controlled FM transmitter, it is necessary to employ a sensitive and delicate (10-ua) meter at the studio, or remote point, for frequency indication.

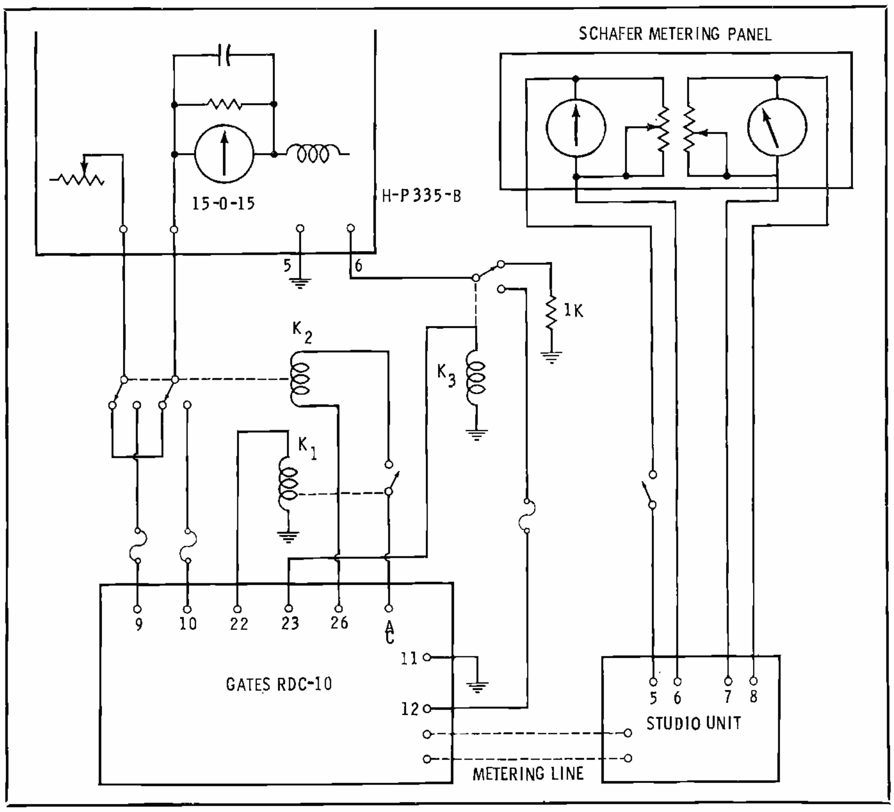
With the meter across the remote stepper switch and the monitor output across the transmitter stepper (the usual arrangement) up to 300 volts can be inadvertently applied to other sensitive meters in the remote unit. Besides this, switching transients and other voltages can be applied to the frequency meter in both the remote and transmitter units. This is likely to cause bent pointers and bobbin burnouts.

Unless relay switching is provided to complete the circuits, and unless the frequency or modulation positions are dialed up from the studio, the frequency and modulation meters in the Hewlett-Packard monitor will not work. This system, however, hinders maintenance at the transmitter. By using the circuit shown, you can avoid these problems.

In the Gates RDC-10 when the FREQ position is selected on the remote control system, 6 volts DC is applied to K1. This sets up the path to K2. When the "raise-lower" switch is put in the "raise" position, 110 volts AC is applied to the K2 coil, and K2 closes, transferring the output of the monitor to the remote meter through the steppers. Space contacts on the studio unit isolate the remote meter from the stepper until the "raise-lower" switch is actuated. Both the remote and transmitter steppers must be in the proper position, and the "raise-lower" switch actuated, before continuity is established. This prevents "banging" of frequency, modulation, and other meters during switching.

Since the modulation circuit has no high voltage, when not being operated it is simply connected through an isolating relay which reconnects the original 1,000 ohms to ground.

With the steppers in any position other than for measuring frequency or modulation, the monitor operates independently of the remote control. This assures complete accuracy when taking readings at the transmitter, during maintenance, and during weekly calibration.



The Party Line Plus

by James French, Jr., KRMA-TV, Denver, Colo.

Many television stations have the old headache of an obsolete "party-line," or PL system. The circuits and explanation given here should help solve some of the difficulties encountered in PL, intercom, and talk-back systems. This system eliminates sticking of carbon granules in the mikes, has individual gain controls for the listen circuits, and provides more than sufficient volume for any occasion.

The units described herein make up a very functional system. The PL section may be used exclusively or in a custom installation including intercom and talk-back (IC and TB). The system's complexity can be determined by the needs of the individual station.

Individual amplifiers are used to amplify the PL line signal (which is approximately .1 volt peak to peak) to a volume in excess of any normal listening requirement. Each amplifier has its own "listen-gain" control (see Fig. 1). The total current drain of each amplifier is approximately 15 ma at 7.5 volts DC.

The circuit is simple, with no transformers, and only one transistor. The units may be built to most any configuration which suits the application. The physical design shown in Fig. 1 was chosen for simplicity and ease of mounting in nearly all applications. The only deviation from this configuration was in the image orthicon cameras, where available space was at a premium (see Fig. 2).

Where "listen" is the only function desired (such as on the boom mike) the mic circuit can be replaced with a 2700-ohm resistor.

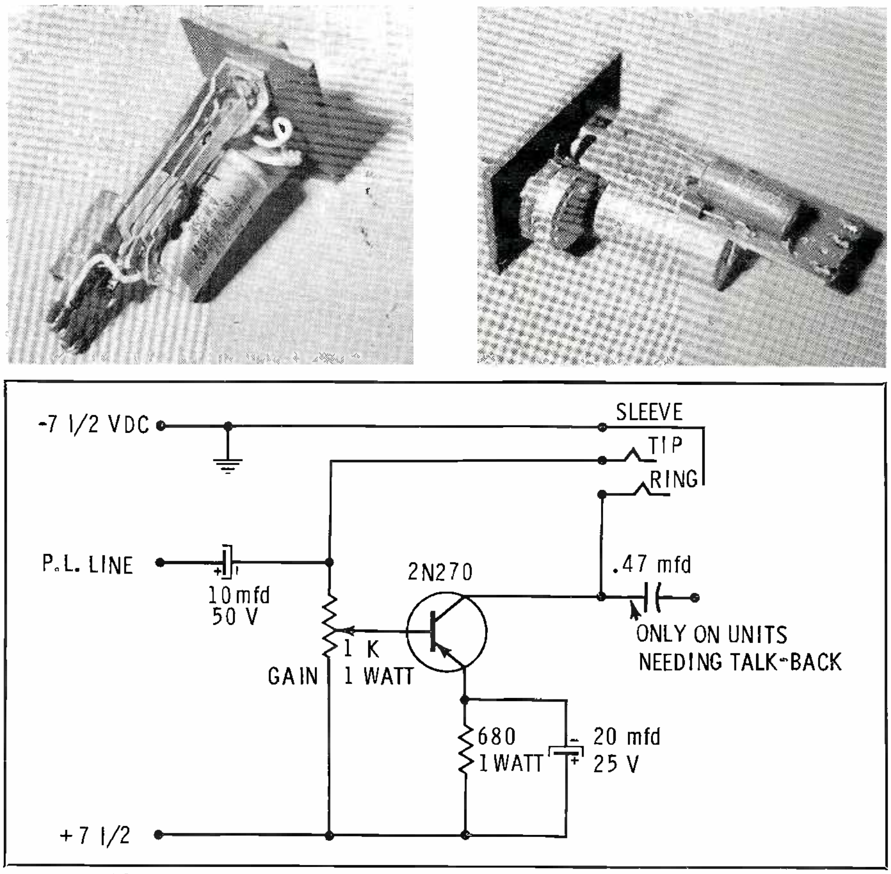


Fig. 1. Photos and circuit diagram of transistorized amplifier unit.

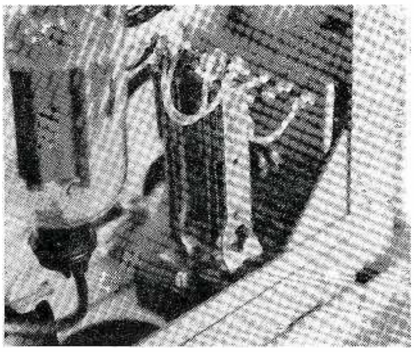


Fig. 2. Alternate design and construction for image-orthicon camera units.

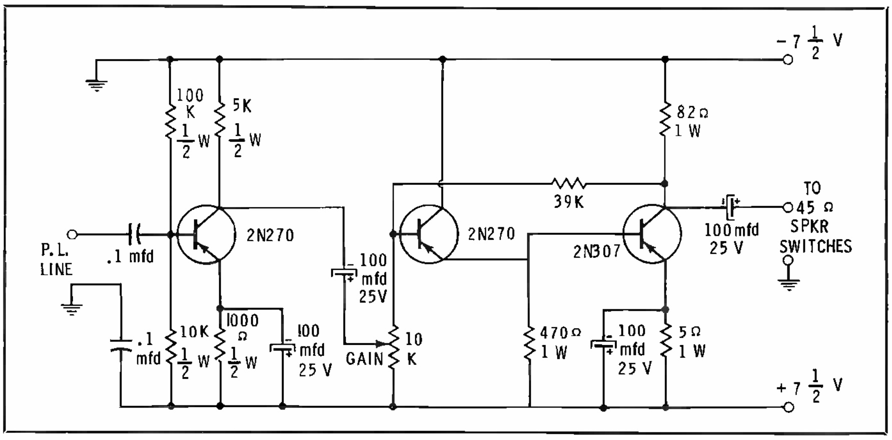


Fig. 3. Three-transistor intercom amplifier circuit.

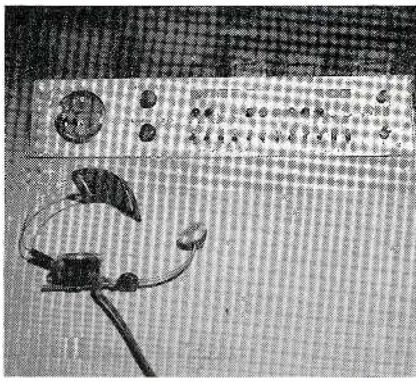


Fig. 4. View of the selector-switch panel at the control director's position.

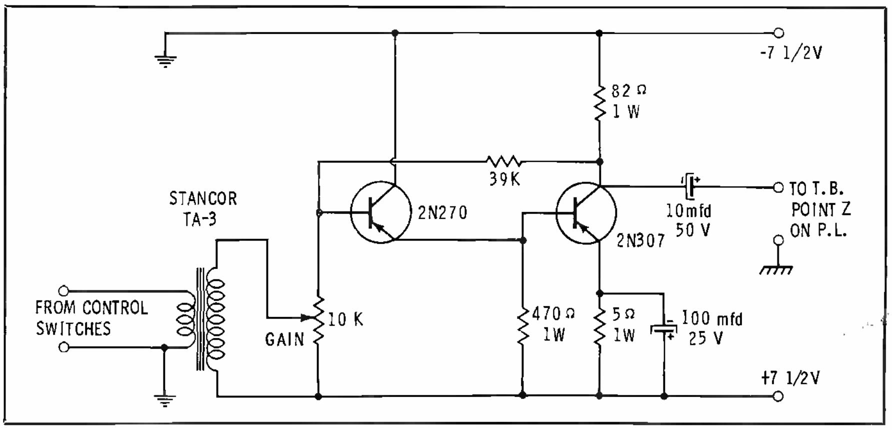


Fig. 5. Two-transistor talk-back amplifier circuit.

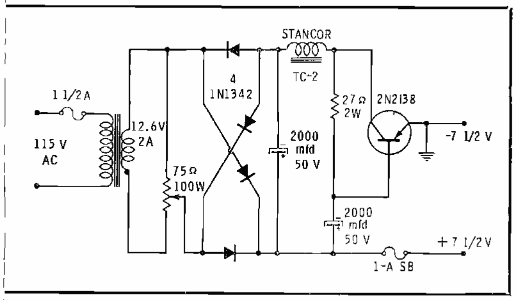


Fig. 6. Power supply serves all units.

Shielded wire is recommended for the interconnect cable, to reduce stray hum pickup. Point Z is a connection from the talk-back amplifier.

The 1C amplifer (Fig. 3) is a three-transistor unit. The input is connected to the PL wire and the output to individual 45-ohm speakers through control-selector switches at the director's position (Fig. 4). A gain control is provided to set the speaker level.

The TB amplifier is a two-stage transistor amplifier (Fig. 5) used to raise the TB speaker level to the power required to feed the director and/or technical director headsets at the control position. The output of the amplifier connects across the

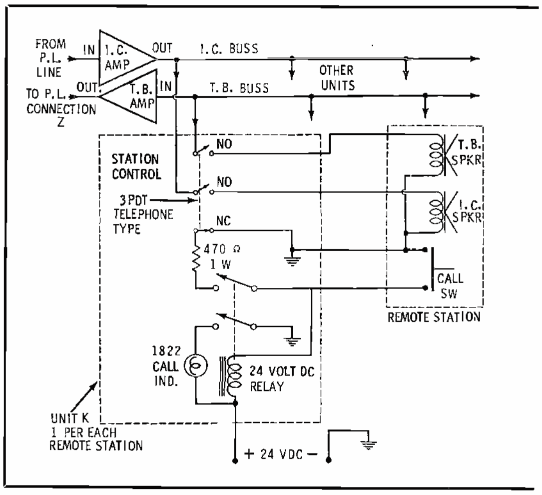


Fig. 7. Details of master control unit.

headset section of the PL at point Z, and does not affect normal use. A gain control is provided to adjust the level and, once set, need not be changed.

The power supply (Fig. 6) consists of a 12-volt transformer and a bridge rectifier. A rheostat is used for adjusting the DC voltage for the required listening level. A power transistor is used for filtering.

The supply has been used on systems with IC, TB, and as many as sixteen PL units. The one supply is sufficient for all units.

The control unit is usually located in the control room, at a place convenient to the director or technical director. This unit consists of several telephone - type switches and relays, the number depending upon the remote stations used (studios, offices, art department, rack room, and kine room). An indicator lamp for each position indicates a call from a remote station. A buzzer or other aural alarm may be used, if desired. Two 45-ohm speakers are required at each remote station, in case you want simultaneous talk and listen functions.

Handling Tape Cartridges

by Guy C. Rauer, WEJL, Scranton, Pa.

If the felt pads supplied in tape cartridges are not perfectly aligned, the tape may not lay properly against the gap, resulting in loss of level and high frequencies. In addition, if the felt picks up enough lubricant to become hard and shiny, both tape and head wear will result. A better material than felt for these pads is polyurethane foam. This can be found in hardware stores in 18′ rolls, 3/8″ wide and 3/16″ thick. It is made with adhesive backing, and used for weatherstripping.

To install the new pads, remove the old felts and, with a solvent, clean the springs of all adhesive. Cut the foam to size, by stripping the back from a short length and sticking the foam to a clean piece of glass. Use a razor blade and straightedge to cut a foam strip slightly wider than the spring. The cut pieces are easily removed from the glass, if they are not left too long. A pair of tweezers is best for handling the pads, which should be applied with a slight amount of overlap, and pressed firmly into place. Roll the lapped portion down over the edge of the spring. If the edges of the foam remain compressed after cutting, try picking at the edges with something pointed.

Much better tape-to-head conformity is obtained with the foam, and the spring adjustment is less critical. Also, because of its porous nature, this material will not load up with lubricant, nor will it remove as much lubricant from the tape.

When dismantling cartridges for repair or reloading, all old grease should be cleaned from the hub and bearing. Relubricate sparingly with silcone grease, which may be obtained from sporting-goods stores (sold as silcone fly-line dressing).

Occasionally, one or more of the graphite rods in the reel may be broken or missing, or after much use may become worn flat. These rods may be replaced with thin mechanical-pencil leads. Merely cement the leads into the slots with a small amount of service cement.

Cracks in cartridge cases may easily be repaired, using a tiny amount of polystyrene dope thinner or trichloroethylene. The latter does a better job. Drop a small amount onto the crack and it will immediately run into the vacancy and weld the edges together.

For running the solvent into narrow places, a device may be made by heating the end of a glass eye dropper in a flame until it can be drawn into a fine tip. The finer the tip, the smaller the hole and the better it will be for the purpose. Let it cool, break off the end, and it is ready for use. ▲

THE NEW FM RULES AFFECT YOU

by A leading Washington Communications Attorney —

Information on new station requirements, power rules, and tower regulations.

The Federal Communications Commission recently released its "First Report and Order" in Docket 14185, which was a rule-making inquiry into the revision of FM broadcasting rules, particularly as to allocations and technical standards. Although the "Order" was to be effective in early September, numerous petitions for reconsideration were filed, none of which have been acted upon at the time of this writing.

The document presents the Commission's conclusions about matters raised in the rule-making proceedings. These matters include adopting minimum mileage separations between co-channel and adjacent-channel FM stations (which will be strictly followed in future allocations), classifying stations and setting forth maximum and minimum facilities for each class, and dividing the country into zones different from the present Areas 1 and 2.

Simultaneously with the release of the "First Report and Order," the FCC issued a "Further Notice of Proposed Rule Making" which suggests the adoption of a Table of Assignments for commercial FM channels, outlines priorities to be used in preparing the Table, proposes rules relating to directional antennas, and moves to reduce the facilities of stations which have more than the maximum specified for their class. It is expected that considerable interest will be shown in this proceeding, with emphasis on the Table of Assignments and on the question of "grandfathering" in stations presently operating with excessive facilities.

Table 1—Power and Height Requirements.

	Minimum*		Maximum		
Class A	100 watts	(-10 dbk)	3 kw	(4.8 dbk)	300′
Class B	5 kw	(7 dbk)	50 kw	(17 dbk)	500′
Class C	10 kw	(10 dbk)	100 kw	(20 dbk)	2000′

*No minimum antenna height is specified.

The New Zones

Under the former rules covering FM allocations, the country was divided into two areas: Area 1, a portion of the northeastern U. S. considerably smaller than television Zone I, and Area 2, the rest of the country.

The Commission has now divided the country into three zones: Zone I, which is coextensive with television Zone I; Zone IA, that portion of California below the 40th parallel; and Zone II, the rest of the country.

The division was based upon differences between the general areas. These differences make high-powered stations, which render wide-area coverage, both less needed and less feasible in the Northeast than in the West, where population is sparse and cities are far apart. The Commission considered that stations operating with facilities of the former Area 1 maximum should have an adequate basis of economic support, because of the populous character of the Northeast. Because of the similarity to conditions in the Northeast, assignment rules for Zone IA are the same as for Zone I.

Classes of Stations

The former FM rules provided for two classes of stations on commercial channels: (1) low-power class-A stations, with no more than 1 kw erp and a 250′ antenna (above average terrain), operating on 20 channels in both Area 1 and Area 2; and (2) higher-powered class-B stations operating on 60 channels, with up to 20 kw erp and 500′ antenna height in Area 1, and with no fixed maximum in Area 2.

Under the new rules, class-A and class-B stations will be assigned (on the channels now specified) in Zone I and Zone IA. In Zone II, which includes most of the country, class-A stations will be assigned on the 20 channels presently reserved for this class; class-C stations will be assigned on the remaining 60 channels. No new class-B assignments will be made in Zone II.

Minimum Facilities

The former rules required a 3 mv/m signal over the principal city and otherwise at least 250 watts of transmitter power for class-A stations and 1 kw for class-B stations. Because of the pressure to "squeeze-in" stations, numerous class-B stations were assigned with minimum facilities, which made somewhat less than optimum use of the limited number of channels.

The new minimum standards continue the 3 mv/m requirement; therefore, the transmitter where possible should be located to provide line - of - sight transmission throughout the principal city. The standards also set forth the following minimum effective radiated power for new stations: class A, 100 watts; class B, 5 kw; and class C, 10 kw. The Commission considers these new minima high enough to safeguard over-all efficiency and, at the same time, low enough to permit reasonably economical operation and thus encourage the development of the FM service. Table 1 shows power and antenna-height requirements.

Table 2—Minimum Separations (Miles).

	Class A				Class B				Class C			
	Co-ch	1st	2d	3rd	Co-ch	1st	2d	3rd	Co-ch	1st	2d	3rd
A	65	40	15	15	—	65	40	40	—	105	65	65
B	—	—	—	—	150	105	40	40	170	135	65	65
C	—	—	—	—	—	—	—	—	180	150	65	65

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Audimax differs in *concept* from ordinary level controls (limiters, compressors, AGC's, etc.) and accomplishes what they attempt to, without the additional problems they introduce. With such devices, the gain is always either rising or falling. With fast recovery times, pumping sounds occur. Slowing the recovery time allows short bursts of sound to put "holes" in the program. Audimax, instead, works like a competent engineering assistant.

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Audimax II RZ	$625.00
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Maximum Facilities

For class-A stations, the former maximum facilities of 1 kw and 250′ are increased, under the new rules, to 3 kw and 300′ (above average terrain). This should give the class-A facility a maximum service radius of 15 miles, under the new mileage separations. The Commission considers this area size enough to meet the coverage problems presently encountered, while not large enough to create serious over-all assignment problems.

The former maximum for class-B stations (in Area 1) of 20 kw and 500′ has been increased to 50 kw erp and 500′. The increase was considered desirable for adequate coverage of metropolitan areas which are expanding rapidly in suburban development. A class-B station operating at maximum would provide a 3 mv/m signal to a distance of 24 miles and a 1 mv/m signal to a distance of 33 miles.

For class-C stations, which are to be assigned only in Zone II, the maximum permitted facilities will be 100 kw erp and 2,000′ of antenna height. These stations often serve sparsely settled areas where there are relatively few sizeable communities, and are expected to render wide area coverage; therefore they must be permitted to operate with great height and power, whenever possible.

The Commission rejected arguments that there should be no absolute maximum on facilities in Zone II; they felt such assignments would be wasteful and inconsistent with a rational approach.

Signals for Service

The Commission has reaffirmed the former standards which assume a signal of 50 uv/m is sufficient for service to rural areas and a signal of 1 mv/m is adequate for city, factory, and business areas. For convenience, a signal standard of 70 dbu (which corresponds to 3.16 mv/m) will be used for principal-city service. The other mv/m requirements can also be converted to dbu values, as pointed out in "Do You Understand dbu's and dbk's?" in this issue.

Protected Areas

The former concept of co-channel and adjacent-channel protection in terms of a particular service-area radius has been abandoned in the new rules, except as would be provided by station mileage separations.

The mileage separations adopted for co-channel stations (Table 2) are as follows: between class-A stations, 65 miles; between class-B stations, 150 miles; and between class-C stations, 180 miles. With these spacings, the protected service radius for class-A stations would be 15 miles; for class-B stations, 40 miles; and for class-C stations, 65 miles.

These spacings provide protection to the following field-strength contours: class A, 927 uv/m; class B, 562 uv/m; class C, 944 uv/m. First - adjacent - channel spacings which are necessary to afford the same degree of protection are—by class—105 miles between B and B, 150 miles between C and C, 65 miles between A and B, and 105 miles between A and C.

The new rules provide for separations which will space stations on second and third adjacent channels farther than the "protected" co-channel distances mentioned above—i.e., 15 miles where the existing station is class A, 40 miles where it is class B, and 65 miles for class C.

Other Technical Matters

The present rules provide that stations already operating with antenna heights greater than the maximum provided for their class and zone, will be required to reduce power so their 1 mv/m contour extends no farther than would be the case if their maximum antenna height and erp conformed to the new rules.

Notwithstanding impressive arguments for other equivalence methods (for example, increased power at lower antenna heights without restriction as long as the equivalence maximum is not exceeded), the Commission rejected them and reaffirmed the former equivalence method—apparently because it was felt that the present approach has proved at least reasonably satisfactory.

Although the new rules reject the use of directional antennas as an assignment tool to be used in reducing co-channel and adjacent-channel spacings, consideration will

• Please turn to page 34

The sound of quality from Continental's 315B/316B 5/10 kw AM broadcast transmitter holds instant appeal for progressive broadcasters everywhere. The Regulinear* Screen Modulation system results in unusually low levels of distortion. Frequency response between 30 and 15,000 cycles is within 1.5 db or less. Carrier shift is less than 1%. Performance is not limited by heavy iron core components in the modulation system. Transmitter can be continuously modulated 100% at any audio frequency without damaging components or sacrificing quality. "On-the-air" quality is comparable to that of F.M. To get more information about putting the sound of quality to work in your market, write or call:

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NEWS OF THE INDUSTRY

New TV Satellite in Alaska

A new satellite televison station on the Kenai peninsula handles rebroadcasts of CBS affiliate **KTVA-TV** in Anchorage, reaching an estimated 5,000 viewers in the Kenai-Soldotna-Wildwood area. The system is operated by **Northern Television, Inc.,** which also has a satellite in the Delta Junction area of Alaska, which includes Ft. Greely, rebroadcasting **KTVF-TV,** Fairbanks, and another at Eklutna, rebroadcasting **KTVA.**

GEL Revamps Sales Policy

All sales representatives of **General Electronic Laboratories, Inc.,** now function as a "single source," enabling them to sell any individual items required by broadcasting stations, up to and including complete installations. In announcing the new plan, **Mr. Sal Fulchino,** Broadcasting Equipment Sales Manager for GEL said, "Through an agreement with selected manufacturers we have added other lines to round out the equipment package our sales representatives can offer to the Broadcasting Industry." Manufacturers represented by GEL produce AM transmitters, automatic cartridge-tape and control equipment, FM antennas and transmission line, FM and AM towers, monitors and audio equipment. GEL manufactures FM transmitters as well as stereo, multiplex, SCA, and remote control equipment.

SMPTE Announces Two Awards

The recipient of the **Society of Motion Picture and Television Engineers** Journal-Award is **Dr. Fred H. Perrin,** research associate at **Eastman Kodak Co.,** Rochester, N. Y. Dr. Perrin was presented with the award for his paper, "What is the Sensitivity of a Photographic System," in which he discussed exposing equipment, light sources, and the recording medium as related to the formation of the photographic image. **Pierre Mertz,** engineering consultant for broadband transmission problems, has been named as recipient of the David Sarnoff Gold Medal, awarded annually by the SMPTE in recognition for outstanding contributions to the development of new techniques or equipment for improving the engineering phases of television. Dr. Mertz's contributions include the development of a mathematical theory for television scanning and studies of noise and echo effects on the quality of television pictures.

Free Conversion Slide Rule

A do-it-yourself slide rule from **Blonder-Tongue Laboratories, Inc.,** offers a decibel to voltage times conversion rule on one side and a calculator of distribution system losses on the other. Original sheet can be folded and stapled into the finished slide rule, as shown, in a few minutes. Available free by writing to Blonder-Tongue at 9 Alling Street, Newark 2, N. J.

New Technique For Automatically Cuing TV Film

A new electronic technique for automatically stopping and cuing television films has been developed by NBC engineers and installed in 35-mm and 16-mm film projectors in New York and at WNBQ-Chicago. The new system utilizes a proximity sensor developed by **Electro Products Laboratories, Inc.,** Chicago, and completely eliminates contact between the film and the shut-off device. Proximity switches consists of three basic parts: a sensing head; a connecting cable; and a control amplifier. The sensing head detects stationary and moving metals without contact and sends an electrical impulse to the control amplifier. The control amplifier, in turn, automatically actuates a relay to control electromechanical or electronic devices. A strip of pressure sensitive aluminum tape is mounted at right angles to the film between commercials. At the end of a commercial, this tape is detected by a Model 4913-BL Proximity Sensing Head, which is mounted right in the projector itself. (This type of mounting is made possible by the compact diameter of the sensing head—⅜ inch). Electrically, the sensing head itself and the cable that connects it to the remotely mounted Proximity Control Amplifier constitute the resonant circuit of a modified Hartley oscillator. The remainder of the oscillator circuit, along with two stages of amplification, an output tube biased beyond cutoff, and a fast-acting mercury relay are housed in the Model 4907-JIC Proximity Control Amplifier, which is mounted on the camera pedestal base. When the aluminum strip is in proximity to (but not in contact with) the sensing head, it causes a reduction in the Q of the resonant oscillator circuit. As a result, the oscillation stops, removing the bias from the output tube. Therefore, the output tube conducts, energizing the mercury relay. The fast-acting mercury relay in the control amplifier (maximum rate is 3600 operations per minute) will close after the aluminum strip has been in proximity to the sensing head for only 8 milliseconds. When the relay closes, it operates the precision stop mechanism on the projector bringing it to a stop properly cued for the next segment.

NEW LITERATURE

Antenna Systems Catalog

Technical Appliance Corp., Sherburne, N. Y., has just released a new 16-page catalog which gives detailed data on its complete line of telemetry antennas and systems. The TACO line starts with huge, remotely-controlled multi-mode telemetry and command types and runs to small special-purpose antennas. Some of these systems include: cross-polarized yagis, steerable parabolic antennas, manually positionable parabolic telemetry antenna systems, 4, 6, 8, and 10 turn helical antennas, and tri-helical and quad helical servo-controlled telemetry antennas.

Tantalum Capacitor Manual

A 28-page technical manual presenting general considerations about solid-electrolyte tantalum capacitors and basic facts about tantalum, has just been released by **Aerovox Corp.,** New Bedford, Mass. The booklet describes complete technical specifications in addition to a summary of applications.

Precision Power Resistor Catalog

Availability of a 16-page catalog describing standard precision power resistors has been announced by **California Resistor Corp.** (CAL-R), Santa Monica. Cal. The fully-illustrated brochure provides specifications and standard ranges, tolerances, and resistance information on silicone-coated and metal-clad resistors.

New Cable and Connector Catalog

Prodelin, Inc., Hightstown, N. J., designers and manufacturers of antenna and transmission line systems, has announced an expanded catalog describing its newest semiflexible aluminum-sheated coaxial cables, matching connectors, and accessories. The 52-page illustrated edition provides engineering data on mechanical and electrical properties, shipping information, and dimensional details. Special attention is given to step-by-step installation and assembly procedures, pressurization practices, descriptions of typical installations, VSWR specifications, and the method for computing power ratings.

New Toroid Catalog

Complete technical data and product ordering information for "CTL" toroids are provided in a new 6-page brochure just issued by Hi-Q Division of the **Aerovox Corp.,** Burbank, Calif. Catalog 57C includes technical data on frequency range, maximum inductance, Q vs frequency, and dimensional information for each toroid style. All toroids described, when encapsulated, will meet the requirements of MIL-T-27.

Guide For TV Color Films and Slides

A manual of suggested standards for color-TV film and slides has been widely distributed recently to labs, producers, and advertising agencies by **ABC Engineers. Frank Marx,** President, said that "in the absence of industry standards, we have carried out exhaustive studies resulting in criteria believed of benefit to the industry for obtaining optimum results with color."

PERSONALITIES

. . . **Stuart S. Wood** has been named Sales Manager of **Gray Research and Development Co., Inc.,** Elmwood, Conn. In announcing the new appointment, **Mr. T. Gerald Dyar,** President, stated that Gray will implement plans at once for expansion into closely allied fields, in addition to strengthening the company's present position in audio and broadcast areas.

. . . President **LeRoy Collins** of the National Association of Broadcasters recently announced the appointment of two officers. **Paul B. Comstock** was named vice president for government affairs of NAB as of Sept. 1.

. . . **Melvin A. Goldberg** also recently joined the staff of NAB as vice president and director of research, to head a new industry-wide program of objective research into broadcasting techniques and their effects on society.

. . . **Tom J. McMullin,** President of **Decibel Products, Inc.,** Dallas, manufacturer of antennas and related products, has announced the addition of **Mr. Floyd D. Shipley** to its engineering and development staff. Mr. Shipley has an extensive background in antenna design work.

. . . **Gates Radio Co.,** subsidiary of Harris - Intertype Corporation, recently announced the appointment of **Jack R. Elliott** as Sales Engineer. Formerly the technical director at **KYW Radio** in Cleveland, Mr. Elliott will cover southern Ohio, southern Indiana, and eastern Kentucky.

. . . The appointment of **Stuart E. Arnett** as director of marketing for **ITT Industrial Laboratories** was announced by **Dr. Robert T. Watson,** division vice president and general manager. Mr. Arnett will be responsible for marketing special-purpose electron tubes, and instrumentation as well as other equipment, including ITT's new VIDEX telephone-line TV transmission system.

. . . **George A. Ohlmann** has joined the staff of the Electron Tube Division of **Litton Industries** as a klystron sales engineer in the Linear Beam Department. The Litton division develops and manufactures super power klystrons for long range search radar and space applications.

. . . **Roy E. Morgan,** executive vice president and general manager of **WILK,** Wilkes-Barre, Pa., has been named to the Board of Directors of the Association for Professional Broadcasting Education. In announcing the appointment, NAB President **LeRoy Collins** said Mr. Morgan's "wide experience and background in both broadcasting and education" will be of great benefit to the APBE.

. . . **Dr. Gabriel M. Giannini,** President, **Giannini Scientific Corp.,** has announced the appointments of **Jack Horowitz** as President, and **Donald J. Dudley** as Vice-President, Sales, for the recently acquired Telemet Company. As with other Giannini Scientific companies, Telemet will operate independently of the parent company.

New FM Rules (Continued from page 30)

be given to their use for improving service. Standards on the use of directional antennas are the subject of a further rule-making proceeding.

For the time being, at least, existing stations that exceed the maximum power and height limitations will be permitted to continue operation with present authorized facilities. However, in the interest of equalizing competition, the Commission may later require certain stations to cut back so they comply with the new rules.

Conclusion

The Commission has offered their new FM rules in the interest of the orderly growth of the FM service, but several observers disagree with the Commission's conclusions. Notwithstanding these feelings, it is likely the new rules are here to stay, and both present and future FM broadcasters should be familiar with them. ▲

Stereo Station

(Continued from page 13)

in stereo you can hear the same faults.

Stereo Generators

There are many types of generators on the market today, and all are designed to meet or exceed FCC specs. Anything less than 30 db separation for all audio frequencies from 50 to 15,000 cps is not acceptable. Beware of tuning adjustments that must be made after the stereo generator is set up. Any tuned tank circuit following the point of stereo injection can and will have some effect on the phasing and, therefore, the separation. Some stages that immediately follow the injection point are quite critical; change their tuning only when absolutely necessary, such as after a tube replacement.

In some cases, it is ideal to locate the generator at the studio, even though the transmitter is remotely controlled. The L+R and L—R the STL transmitter, and from the signals would be fed directly into STL receiver into the exciter. This would permit regular checking of the stereo-generator phasing, and pilot-carrier injection, without having to go to some remote spot in the middle of the night.

Remote Control

Remote control and STL systems (Fig. 2) are available from most suppliers of FM equipment. Equipment is available in the 950-mc band for handling stereo, voice intercom, and remote-control functions. In all the equipment we are familiar with, functions of remote control are more than adequate.

Next month, we will discuss the special audio requirements of an FM-stereo station, along with a few generalized suggestions for more adequate planning. ▲

About the Cover

This month's cover shows the quad-helix Telstar command tracker, located at Space Hill, Andover, Maine. Used to achieve initial acquisition of the satellite as it rises above the horizon, and for sending commands and receiving telemetry reports, tracking functions are assumed with much greater accuracy when the tracker locks on the satellite's 4080-mc beacon. (Photo courtesy A. T. & T. Photo Service.)

SARKES TARZIAN SILICON RECTIFIERS

eliminate broadcast interruptions caused by vacuum tube rectifier failures

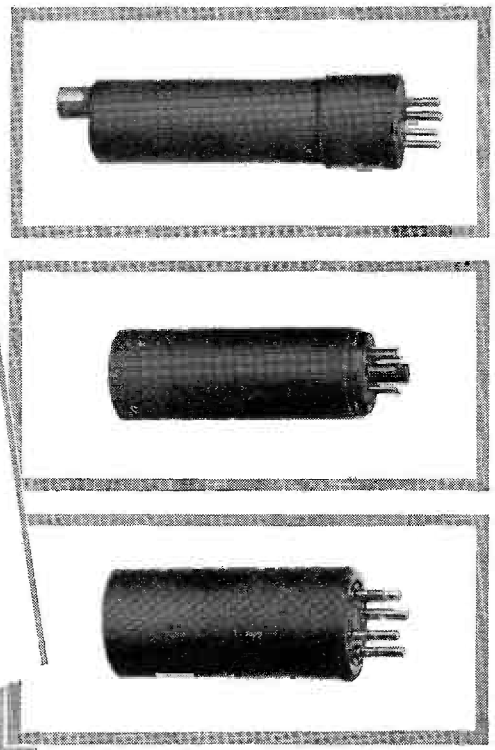
Here's proof of long, trouble-free life of Tarzian Silicon Rectifiers—

We have had excellent results thus far with the silicon tube replacement rectifiers. We have several S-5019's which have been in service since July of 1957. We have put many more in service since this time and have yet to have one fail.

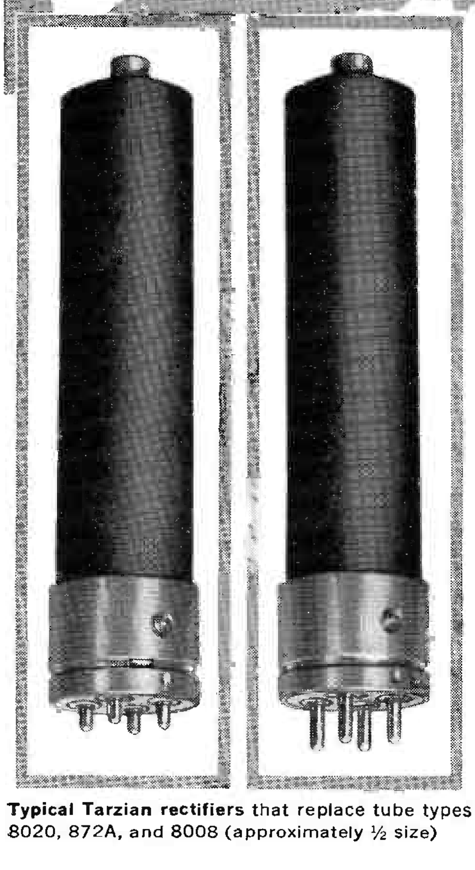
We have also installed the S-5373 at the transmitter and they too are doing very well.

Probably the biggest advantage is the extremely long life and secondly, the absence of heat produced by the rectifier.

FRED MOLCHIN
Chief Engineer, Station WTTV
Indianapolis, Indiana



Typical Tarzian rectifiers to replace tube types 80, 82, 83, 83V, 5Z3, 0Z4, 5X4, 5Y4, 6AX5, 6X5, 866, 866A, 3B28, 6AU4, 6AX4, 6BL4, 6W4, 12AX4, 17AX4, 25W4, 6U4, and 5R4 (approximately ½ size)



Typical Tarzian rectifiers that replace tube types 8020, 872A, and 8008 (approximately ½ size)

Long life and cool operation are two advantages of the 13 Tarzian silicon rectifiers that replace over 95% of all popular vacuum tube rectifiers.

They are generally smaller than the tubes they replace. DC current ratings are as much as three times as high.

Electrical stability is greater. Operation is instantaneous. No warmup. No filament supply.

Special designs and modifications are available. Application engineering service is free of charge.

Specifications and prices are waiting for you.
Write today.

SARKES TARZIAN, Inc.
World's Leading Manufacturers of TV and FM Tuners • Closed Circuit TV Systems • Broadcast Equipment • Air Trimmers • FM Radios • Magnetic Recording Tape • Semiconductor Devices
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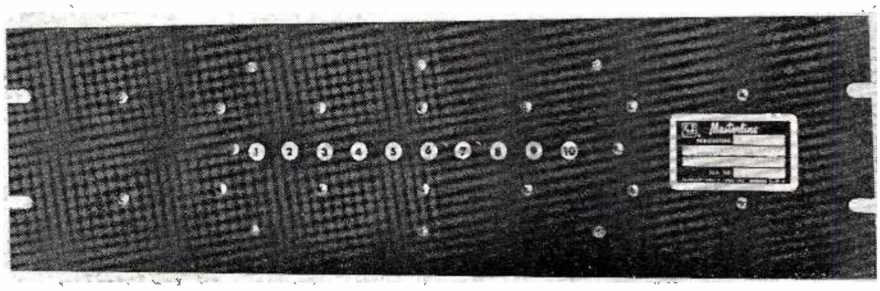
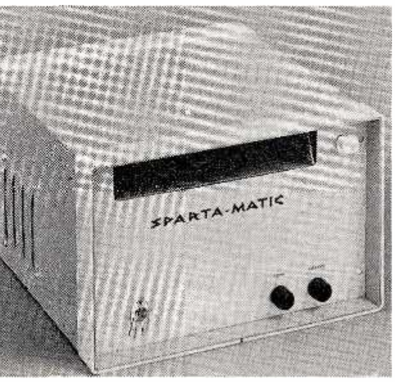
NEW PRODUCTS



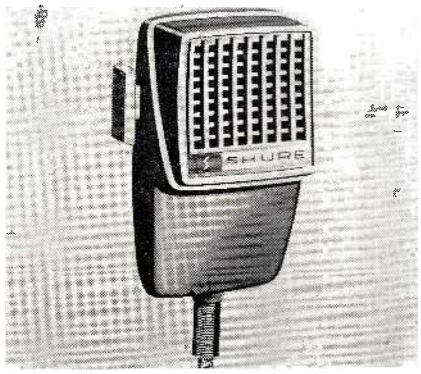
New Video-RF Switcher For CCTV Systems

Blonder-Tongue Laboratories, Inc., Newark, N. J., recently announced the availability of a new video- and RF-distribution device for closed-circuit TV systems. The Model VS-1 Video RF Thru Line Switcher contains 10 isolated through lines with push-button switches which permit any one of ten inputs to be connected to a separate "switched-input" terminal; when this is done the corresponding output will then be connected to a "switched-output" terminal. A typical use of the device is to combine a closed-circuit TV channel with off-the-air channels in a master antenna system. It can also be employed as a 10-circuit video switcher, in which case a monitor may be switched into any one of the 10 circuits on a **loop-thru** basis. The newly developed switcher is designed for 19" rack-panel mounting. Frequency range is 0 to 216 mc; input and output impedance is 75 ohms; price is $500.00 net.



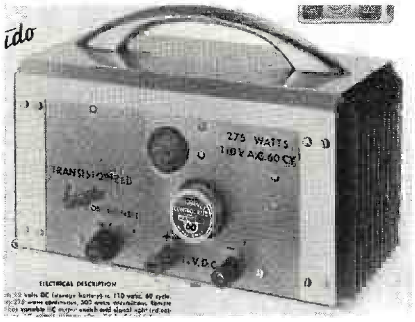
Portable Cartridge-Tape Playback

The Sparta-Matic CP-5 portable playback unit, made by **Sparta Electronic Corp.,** Sacramento, Calif., is a lightweight device for playback of continuous-loop tape cartridges. Providing station account executives and other personnel with a versatile tool for increased sales and greater production flexibility, the CP-5 is ready in a moment's time to play the sponsor's message, leaving sales personnel free to devote their thoughts and attenton to the client's needs. In the station, it provides cartridge-tape audition facilities without interfering with busy control room operations. Tone and volume are adjusted by front panel controls. Constructed of aluminum, the case is handsomely finished in grey baked enamel.



Low Cost Palm Microphones

A new series of inexpensive palm-held microphones has been announced by **Shure Bros., Inc.,** Evanston, Ill. All models feature a response patterned after professional mobile and SSB amateur curves to assure maximum intelligibility. Construction includes a virtually indestructible Armo-Dur case, a coil-cord that won't kink or crack, a rugged hang-up bracket, and a push-to-talk switch guaranteed for a full year. The new units, ideal for low-cost Citizens band or ham use in either fixed or mobile installations, are available as a ceramic high-impedance Model 201 at $18.00; a "controlled magnetic" high-impedance unit (401A) at $22.00; and a "controlled magnetic" low - impedance unit (401B), also at $22.00.



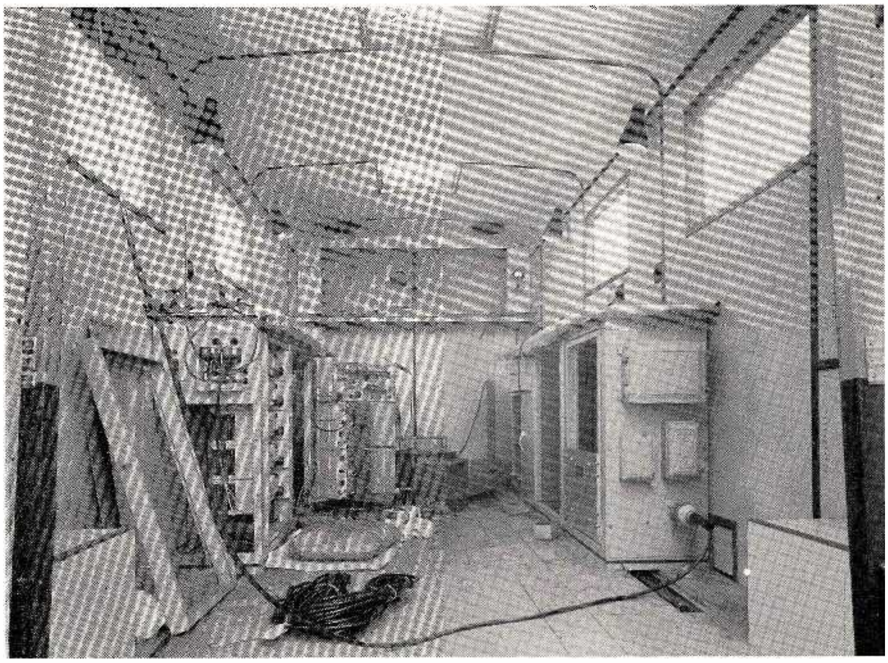
300-Watt Power Inverter

The Model 50-191 Continental power inverter, by **Terado Corp.** of St. Paul, Minn., changes 12 VDC battery potential to 110-volt 60 cps AC. Rated at 300 watts intermittent, or 275 watts continuous, the unit is fully transistorized and filtered. This inverter has application in mobile units and remote mobile studios for powering amplifiers, tape recorders, and turntables. Output frequency is accurate to within 1 cycle, regardless of varying load or input voltage. Equipped with remote controls, the inverter is housed in a copper-clad steel case and has an electric fan for cooling. The unit measures 10¾" x 6" x 6" and weighs 30 lbs.

Self-Contained
Miniature Dry Air Systems

A new series of miniature compressor-dehydrators, designed to supply clean, dry, oil-free air for small equipment, has been announced by **Trinity Equipment Corp.,** Cortland, N. Y. These units can be used for wave guide and cable pressurizing, as well as microwave antenna pressurizing. The matched components are enclosed in a console cabinet suitable for bench or floor installation. Dry air output is 2.8 scfm at an outlet pressure adjustable from 0.5 psig to 75 psig. The ambient temperature range of the unit is −20° F to +110° F. The compressor is a single-stage, non-lubricated air-cooled system with stop-start control. Accessories include an inlet air filter and integrally mounted pressure switch. Dual desiccant chambers are used to provide continuous drying operation.

Features Included in the December Issue



MOBILE VIDEOTAPE INSTALLATION — TWW, ENGLAND

The remote vehicle used to cover South Wales and western England utilizes some ideas U. S. engineers should consider.

LOCATING DIRECTIONAL ANTENNA SYSTEMS

Three members of a leading consulting engineering firm explain in detail how to go about properly siting directional antennas.

PREVENTIVE MAINTENANCE IN THE STUDIO AND CONTROL ROOM

A schedule devised by Chief Engineer Jack Walsh, for use at Radio WMAK, Nashville, can be adapted for use in any station.

PRACTICAL APPLICATION OF FCC ENGINEERING RULES

How to comply with Form 301 requirements without the aid of a consulting engineer.

PLANNING A NEW FM STEREO STATION

The concluding half of this special feature discusses factors that contribute to a good audio system, and points out pitfalls you should avoid.

CAMERA TUBE ALIGNMENT USING 30 CPS

How a simple oscillator can be used to provide a rocking signal for focusing cameras while in use.

TECHNICAL TALKS

In his new monthly column, John Battison provides some helpful hints on calculating radiation contours.

PLUS, of course, the ever-popular ENGINEERS' EXCHANGE column, containing numerous suggestions and ideas for improving broadcast operations.

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☐ FM Radio Station
☐ Television Station
☐ Network
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☐ Manufacturer or Distributor
☐ Recording Studio
☐ Government Agency, Library, School

☐ Owner, Manager, Officer
☐ Engineer, Technician
☐ Other ....

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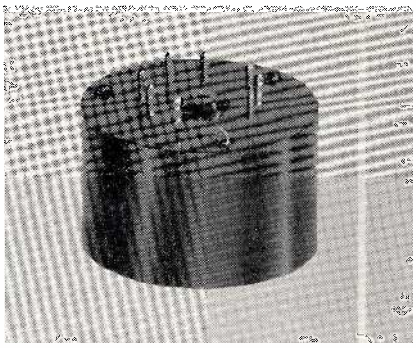
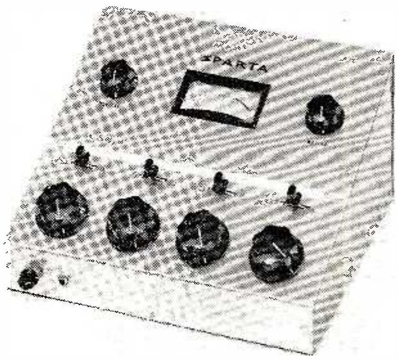


Encapsulated Toroid

A new encapsulated toroid specifically designed for printed-circuit mounting has been announced by **Sangamo Electric Co.,** Springfield, Ill. Featuring pin terminals, standoff pads, and an identical terminal layout for up to eight terminals, this unit is available in five case sizes with a variety of windings ranging from the basic two-terminal inductor to eight-terminal tapped inductors. Epoxy-encapsulated into a rugged unit with excellent moisture resistance and good magnetic and temperature characteristics, the toroid cases correspond to the five most popular sizes of pressed powder cores.

Transistorized Audio Control Consoles

A line of three fully-transistorized audio control consoles is now available from **Gates Radio Co.,** Quincy, Ill. Included are a single-channel push-button console, a dual-channel push-button console with eight mixing channels, and a dual-channel console with ten mixing circuits.



New Solid-State Audio Console

A transistorized audio console, powered by AC line or batteries, can be used as a main-studio board, production-studio console, or remote amplifier. Announced by **Sparta Electronic Corp.,** Sacramento, Calif., the A-10 console employs modular construction, has eight inputs, four mixing channels, monitor amplifier, and plug-in preamplifiers. Standard readily-available parts are used throughout.

Microwave Power Meter

A transistorized, battery-operated microwave power meter boasting a built-in battery charger, is available from **Narda Microwave Corp.,** Plainview, L. I., N. Y.

The self-balancing meter provides accurate, direct-reading measurements of CW or pulsed power. For use with all 100- or 200-ohm bolometers, or thermistors with positive or negative temperature coefficients and bias currents up to 18 ma, the instrument has seven scales for reading from 0.001 to 10 mw. The nickel-cadmium battery supply can be recharged, either overnight or during operation, without effecting performance. A complete line of accessories is available, including attenuators, directional couplers, bolometers, thermistors, and mounts. Price of the meter is $250.

40-Watt Miniature Soldering Iron

Ungar Electric Tools, Hawthorne, Calif., has introduced the Imperial 6060 soldering iron. This unit consists of a pastel-colored "Perma-Cool" handle with matching cord set and a 40-watt long-life heat cartridge (750° to 950° F). Two of the most popular thread-on soldering tips, and a can of "Heat Seal," for maximum heat transfer, are included. Designed to meet most electronic soldering needs—especially in printed circuits and miniature radios—the kit is priced at $4.99, a saving of $1.77 over the cost of individual parts.

Tape Recorder Cleaner

A new tape recorder cleaner guaranteed not to affect plastic parts has been announced by **Chemtronics, Inc.,** Brooklyn, N. Y. The cleaner is designed to completely clean the play-record head, erase head, capstan and pressure rollers, thus eliminating "wow" and "tape squeal." It also increases the life of tape and tape heads, improves fidelity, and reduces distortion. A felt applicator makes it easy to get right to the critical parts. Packaged in a dual-seal 2-oz. bottle to eliminate evaporation, list is $1.49.

Professional Services

Transistorized Remote Amplifier

Collins Radio Co., Cedar Rapids, Iowa, is offering a new lightweight all-transistorized remote amplifier which will operate for 300 hours with the power from ordinary flashlight cells. The matching microphone boasts frequency response from 40 to 15,000 cps, while reducing background noise as much as 50%. Recently offered on a pre-football season special, the combination of the 212H-1 amplifier and the M-50 microphone is now priced at $440.

Crystal Bandpass Filters

Ortho Filter Corporation, Patterson, N. J., now offers immediate delivery on a complete line of low cost crystal band-pass filters. Called the Series 2000, the new units have specific application in doppler radar, receiver IF, single-sideband, comb filter sets, and wherever filters of high stability, narrow bandwidth, and low insertion loss are required.

Low-Light Image Orthicon

A new precision-constructed low-light level image orthicon for broadcast-quality color and black-and-white TV cameras is being offered by the **RCA Electron Tube Division.** The RCA-4415V1 was previously available only as a part of the color image-orthicon set (RCA-4415-4416) but increased demand from broadcasters have resulted in its being offered as a single tube.

Classified

Advertising rates in the Classified Section are ten cents per word. Minimum charge is $200. 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

Transmission line, styroflex, heliax, rigid with hardware and fittings. New at surplus prices. Write for stock list. Sierra Western Electric Cable Co., 1401 Middle Harbor Road, Oakland 20, California. 6-61 tf

Commercial Crystals and new or replacement crystals for RCA Gates, W. E., Bliley and J-K holders; regrinding, repair, etc. BC-604 crystals. Also A. M. monitor service. Nationwide unsolicited testimonials praise our products and fast service. Eidson Electronic Company, Box 31, Temple, Texas. 9-61 tf

GOVERNMENT SURPLUS, NEW 10 CM. WEATHER RADAR SYSTEM—Raytheon, 275 KW peak output S band. Rotating yoke P.P.I. Weather Band 4, 20 and 80 mi. range. Price $975 complete. Has picked up clouds at 50 mi. Wt. 488 lbs. Radio Research Inst. Co., 550 5th Ave., New York, New York. 5-62 8t

Will buy or trade used tape and disc recording equipment—Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 295 Main St., Tuckahoe, N. Y. 10-62 6t

ONE USED RCA Type 5-D 5/1 kw broadcast transmitter complete except for interconnecting cables. In excellent condition with large stock of spare tubes and spare parts. For technical information write or call, L. A. Brogger, Chief Engineer, Radio Station KUOM, University of Minnesota. For bid blanks write or call, Purchasing Agent, University of Minnesota, 404 Morrill Hall, Minneapolis 14, Minnesota. 10-62 2t

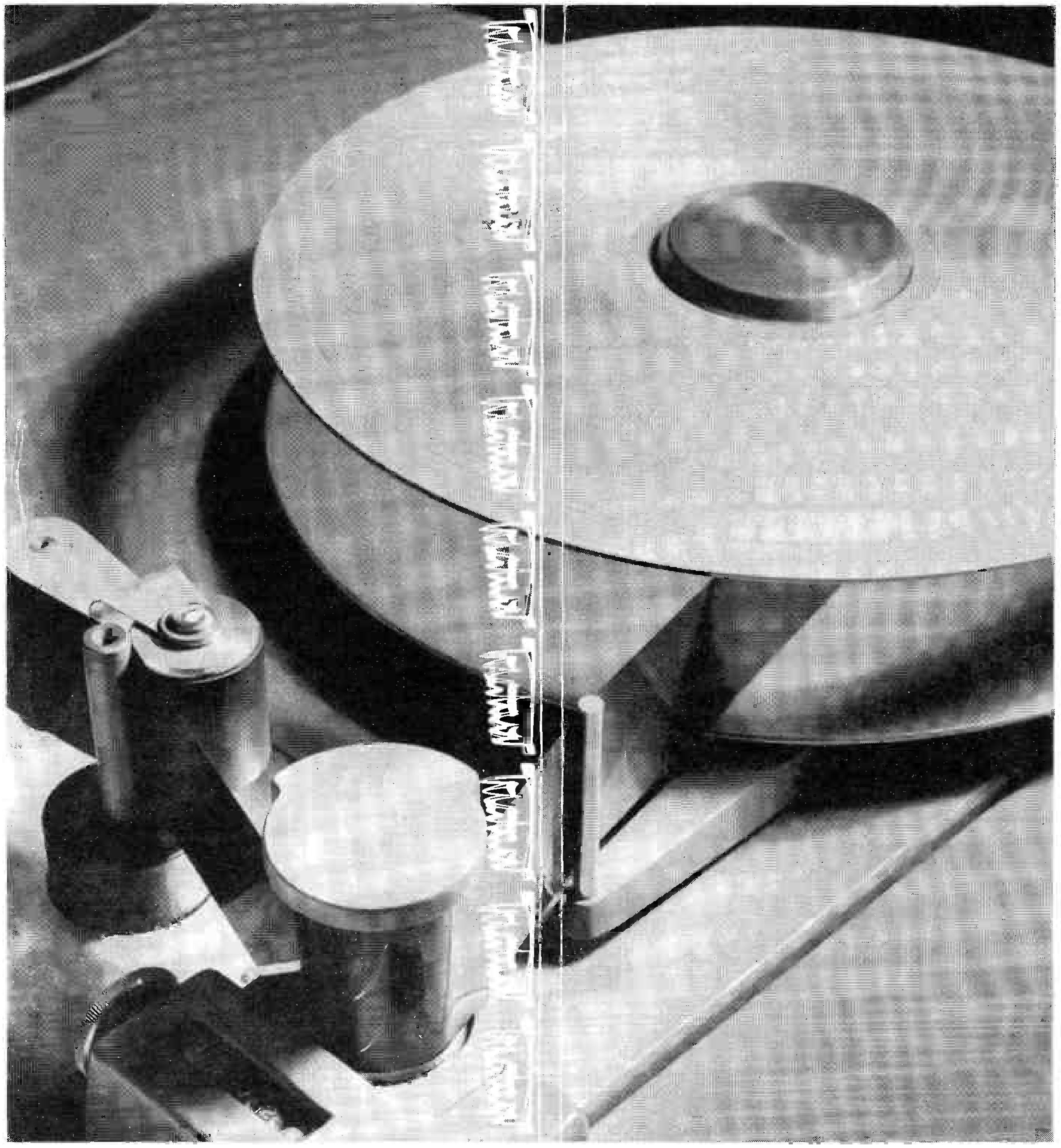
Collins Tape cartridge machines $275 ea. Gates Sta-Level $150. Concertone Stereo Recorder $375. Excellent condition. Write —Box 125, Lafayette Hill, Pa. 11-62 2t

500 watt AM xmtr. Engineers dream. Trade for 250w FM, 2 bay antenna, freq/mod monitor. Write for details, don't miss this. Reynolds, 927 Piedmont, Erlanger, Ky. 11-62 1t

POSITION WANTED: Will receive my BS degree in Speech, with Area Concentration in Radio and Minor in Psychology, Jan. 63. Have 3 years experience announcing and producing news, classical and popular music, sports, and commercials. Can run my own board. Seek permanent position on Broadcasting Staff—will relocate for right opening. BROADCAST ENGINEERING Box 1162-1

MISCELLANEOUS

ENGINEERING And Art Degrees earned through home study. Electronics, Mechanical, Liberal Arts. When writing specify course desired. Pacific International College of Arts & Sciences, primarily a correspondence school. Resident classes also available. 5719-W Santa Monica Blvd., Hollywood 38, California. 8-62 6t



Now: who has a video tape as reliable as Ampex Videotape* recorders? AMPEX.

This is the year video tape reaches a new standard of performance. This is the year you can get video tape from Ampex. Coated using the exclusive Ferro-Sheen* process, this new tape has been tested for maximum tape life, minimum head wear. Into each reel has gone the technological skill and engineering excellence that has made Ampex the world leader in Videotape recorders. Ampex video tape is now available only in limited quantities. So you may have to wait for your supply. But it's well worth the wait. For more details write the only company providing tape and recorders for every kind of application: Ampex Corporation, 934 Charter Street, Redwood City, California.

*TM Ampex Corp.