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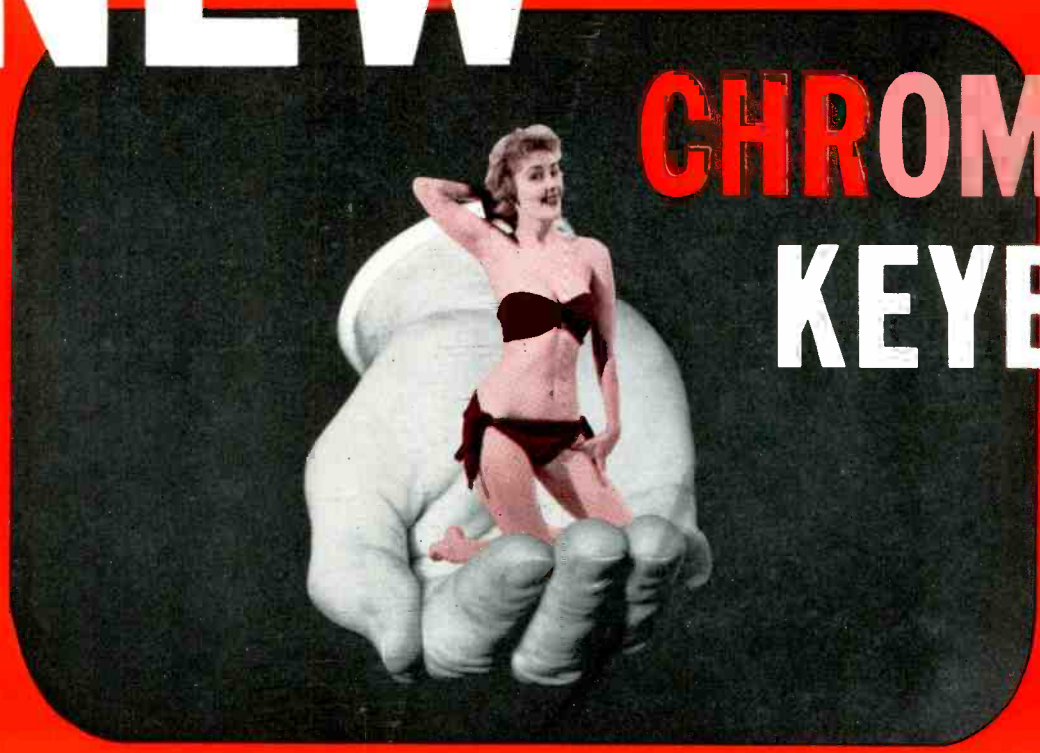
JULY 1966/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry

NEW RIKER CHROMA KEYER



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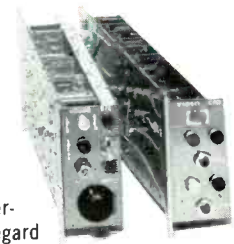

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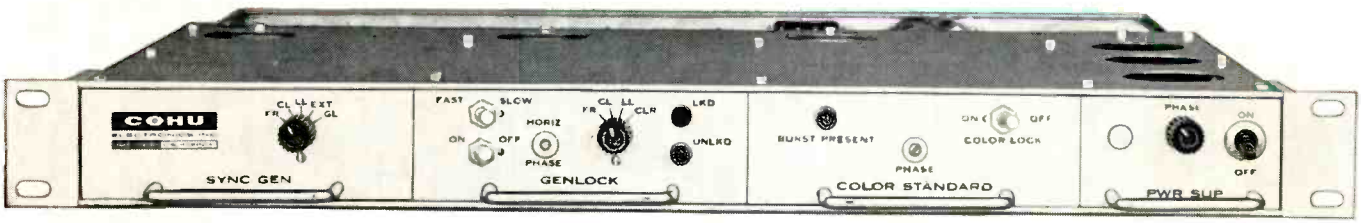

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the technical journal of the broadcast-communications industry

Broadcast Engineering

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Features

Departments

High above Manhatten Island in New York, a new FM antenna has been installed on the needle-like Chrysler Building spire. For the complete story of this unusual project, see page 12.

This is the new FM Volumax.
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LETTERS to the editor

DEAR EDITOR:

I would like to offer for your consideration a few comments on the February issue of BROADCAST ENGINEERING.

1. "Overmodulation and the FCC" Page 15, column 1, paragraph 2 —In the numerical example starting in this paragraph, I wonder if the carrier-frequency value of 1,000kc might not be a bit misleading to some readers, since FM would not be found in this range.

   Page 42, column 3, last paragraph—The figure of 700% stumped me for a moment—it must have been a misprint of 100%.

2. "Removing the Mystery From Grounding"
   Page 19, column 1, paragraph 3; and page 23, column 1, last paragraph—The word *algebraic* for the sum of resistance and reactance implies simply plus and minus combinations to most engineers, rather than the right-angle combinations of *complex algebra*.

   Pages 21 and 22 — Figs. 7 and 8 don't quite seem to jibe with the descriptions in the text material — or at least require extra straining to figure out.

   Page 22, column 2, paragraph 3 — The description of electrostatic shielding might avoid later confusion by stressing that a shield in the magnetic path (between windings) must be

• *Please turn to page 38*

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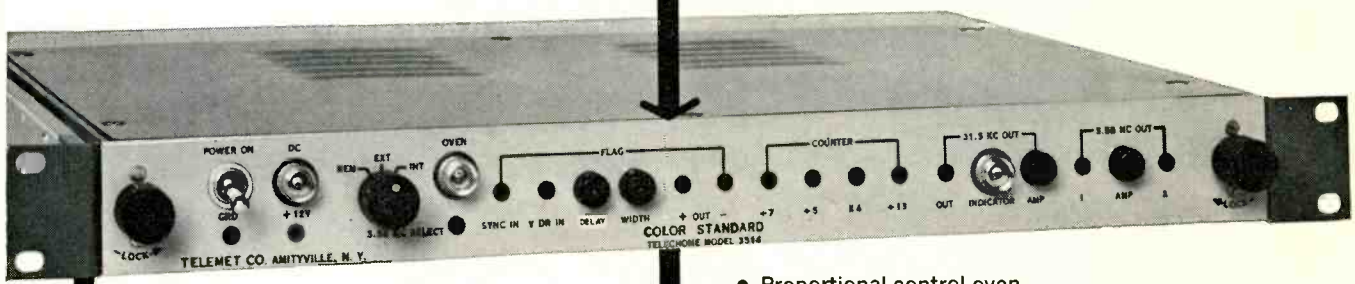

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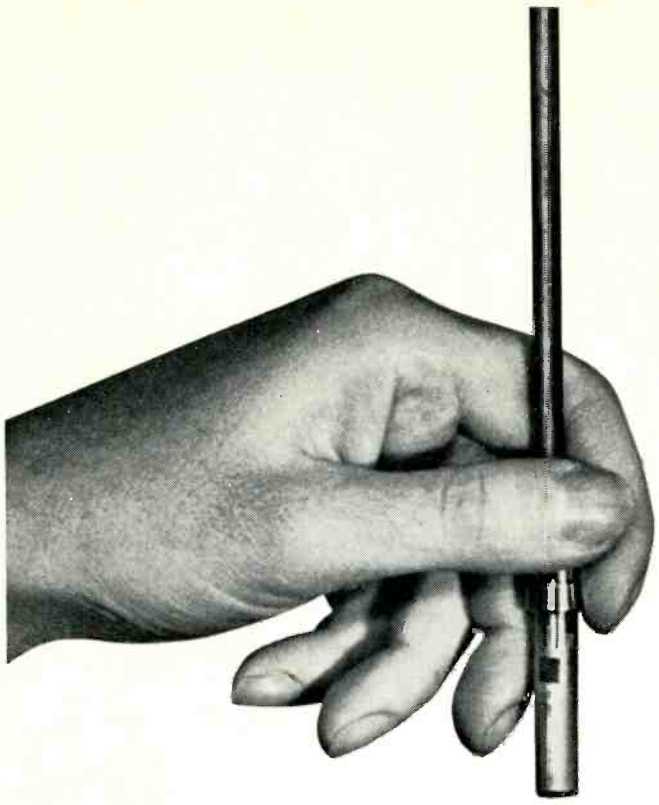

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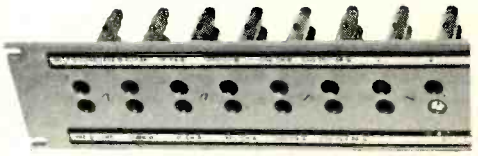

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FM ANTENNA ON THE CHRYSLER BUILDING

by Richard Pouliot and Edward French*
—A difficult installation required the construction of a one-seventh and a full-size model of the structure's spire.

Early in 1965, Station WTFM of Fresh Meadows, New York, considered the possibility of locating an FM broadcast transmitting facility on the superstructure of the Chrysler Building in New York City. Proposals were sought for an antenna system which would radiate in both horizontal and vertical polarizations.

The location of the transmitting facility and the desired coverage dictated the electrical and mechanical characteristics of the antenna array. Fig. 1 shows a horizontal pattern specification for the antenna.

The suppression requirements shown in Fig. 1 are based on limiting the effective radiated power in the direction of Station WNNJ-FM in Newton, New Jersey, to 270 watts and also limiting the effective radiated power in the direction of Station WPRB in Princeton, New Jersey, to 360 watts. The shape of the desired horizontal pattern is further defined by FCC Regulations that limit the change in radiation on either side of the null to a maximum of 2 db for every 10° change in azimuth. An additional problem created by the specification is that the Chrysler Building is symmetrical about a 74° azimuth while the required horizontal radiation pattern is approximately symmetrical about a 90° azimuth (due east).

The development of an antenna to meet the specifications proceeded as follows:

1. A 1/7 scale-model antenna was constructed for evaluation at seven times the actual frequency.
2. A full-scale antenna structure was designed from the scale model after evaluation of the model.
3. The scale model was reworked to include pertinent details determined in the course of designing the full-scale antenna.
4. The scale-model antenna was re-evaluated.

Fig. 2 shows the 1/7 scale model of the Chrysler Building superstructure and the proposed WTFM antenna array. This model was used to answer a variety of questions that arose during the development of the antenna system. For instance, the minimum spacing between the horizontally and vertically polarized antennas was determined by meas-

*Alford Manufacturing Company, Boston, Massachusetts

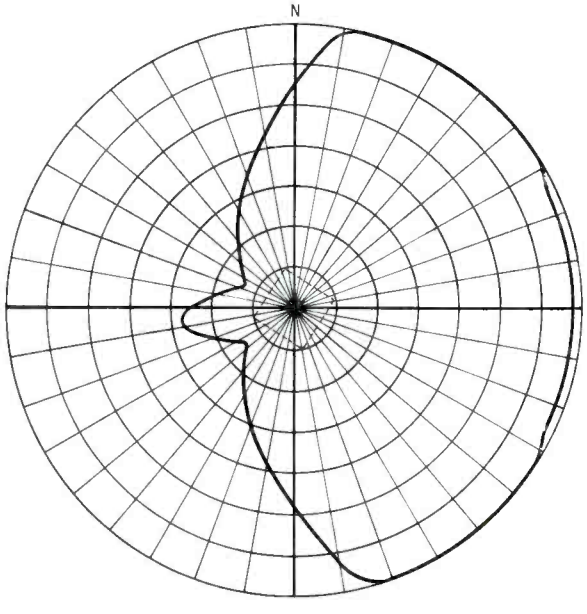


Fig. 1. Calculated pattern for the Chrysler Bldg. spire.

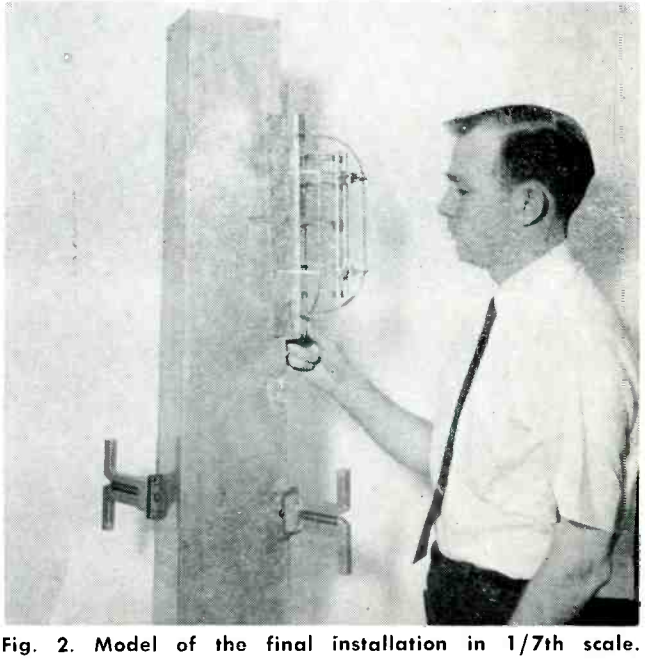


Fig. 2. Model of the final installation in 1/7th scale.

uring the electrical characteristics at various spacings on the scale model. The exact final spacing was selected to accommodate the internal structure of the spire. This final spacing was, of course, within the limits established by the model measurements.

An antenna consisting of one element was chosen for the horizontally polarized antenna. This slotted ring antenna was made to radiate the desired directional pattern, in conjunction with the spire of the building, by the addition of fed radiating directionalizing members. Only one element is required for the horizontally polarized antenna to radiate some signal in all azimuths, since horizontally polarized radiation can be made to diffract around the vertical spire.

Two elements, however, are required to radiate some signal in all azimuths for the vertically polarized antenna because the Chrysler Building spire behaves like a solid reflector with respect to vertically polarized signals. Two dipoles were chosen for the vertically polarized antenna.

The mechanical specifications for the WTFM anntena array were developed by using experience gained in the design and manufacture of the 16-element Channel 2 antenna array installed on the Chrysler Building in 1948. The mechanical requirements developed for the earlier array can be summarized as follows:

1. The antenna was provided with sufficient deicing capability to prevent an appreciable accumulation of ice. All parts of the antenna were deiced—not just those areas where ice build-up might affect electrical performance.
2. The antenna was very ruggedly constructed to insure reliability and maintenance-free operation. (The antenna location is relatively inaccessible.)
3. The antenna was constructed of noncorrosive materials so that the building would not be stained.

In view of the satisfactory experience with the earlier installation, similar specifications were adopted for the new antenna.

In the design of the slotted ring FM antenna, an important considertion was the deicing of the directional members and associated supports, since the basic design of the antenna permitted all significant parts to be deiced. In order to deice the oddly shaped directional members and the associate supports, custom deicers were designed to fit within the members. These members consisted of extruded thick-wall aluminum tubes with approximately one-inch outer diameter and 7/16-inch inner diameter. The heating wire was supported by continuous ceramic insulation. A hermetically sealed transformer was used to supply the proper voltages to these deicers.

The vertically polarized antenna consisted of two dipoles of a type previously designed for use on the Empire State Building Master FM antenna. Each dipole is constructed from a rugged aluminum casting. One side of the casting is closed, with removable aluminum covers to provide a means for installing internal deicers. The dipole castings were X-rayed.

As previously mentioned, the dimensions and shape of the directional radiators for the slotted ring antenna were determined by testing the scale model. From these tests it was also determined that rotating the horizontally polarized antenna 5° east yielded a horizontal pattern closer to the calculated pattern.

For the vertically polarized antenna, scale models of two dipoles

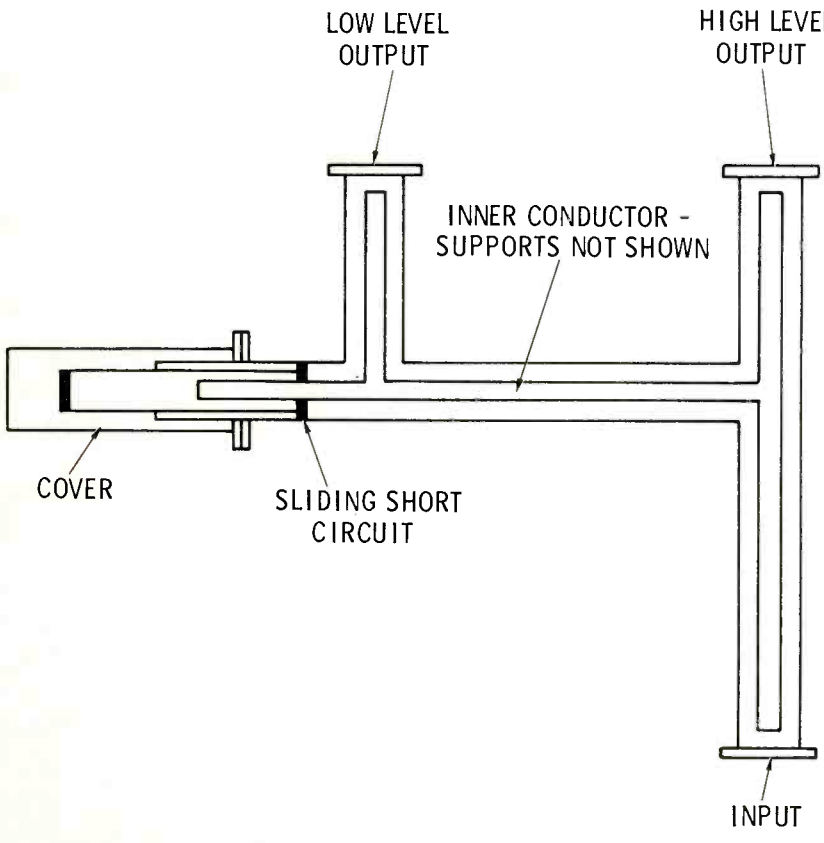


Fig. 3. Construction of power divider feeding vertically polarized elements.

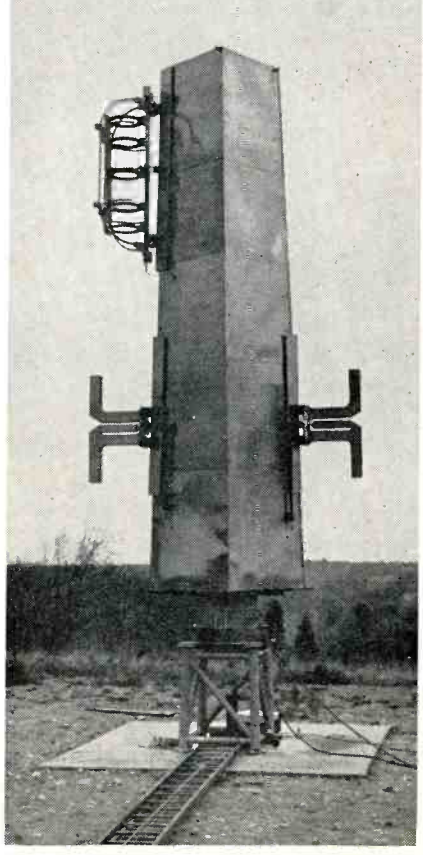


Fig. 4. Full-size model of installation.

were mounted on diagonally opposite corners with one dipole directly below the horizontally polarized antenna. The power split between the dipoles was then adjusted to obtain the desired horizontal pattern. A ratio of approximately 100:1 (i.e., feeding 99% of the vertical power to the dipole directly below the horizontal antenna and 1% of the vertical power to the diagonally opposite antenna) yielded an acceptable horizontal pattern. From the model measurements it was found that rotating the dipoles 12° east resulted in a more desirable horizontal radiation pattern.

Because the antenna was to be installed in a relatively inaccessible place, the three antenna elements were fed with separate semi-rigid transmission-line feeders, and power dividers were installed in the transmitter area. The semi-rigid feeders were installed on the outside of the building superstructure because the 200°F temperature recorded within the deiced spire[1] would substantially reduce the average power ratings of the transmission lines.

Fig. 3 shows the construction of the power divider to feed the two vertically polarized antenna elements. This power divider consists of a short-circuited stub in shunt with a main transmission-line feeder. The low-power transmission line is tapped off this stub at a small distance from the short circuit, and the actual power division ratio is adjustable over a small range by moving the sliding short circuit. The stub end is provided with a means for locking the sliding short circuit in place, and with a cover for sealing prior to pressurization.

Fig. 4 shows the antennas mounted on a full-scale model of the Chrysler Building spire. This model was constructed in order to measure the full-scale horizontal patterns for both polarizations and to tune the input impedances of the antennas. Results of testing the actual radiated pattern for the horizontally polarized antennas are shown in Fig. 5.

After installation, the antenna array was tested on December 29, 1965. The input voltage standing-wave ratio (VSWR) of the antenna array and transmission line, as measured at the input to a coaxial switch in the transmitter area, is shown in Fig. 6. The measured VSWR includes the effects of the three 200-ft lengths of semi-rigid transmission line, the two power dividers, various transmission-line fittings, the coaxial switch, and the antenna array. The completed installation is shown in Fig. 7. ▲

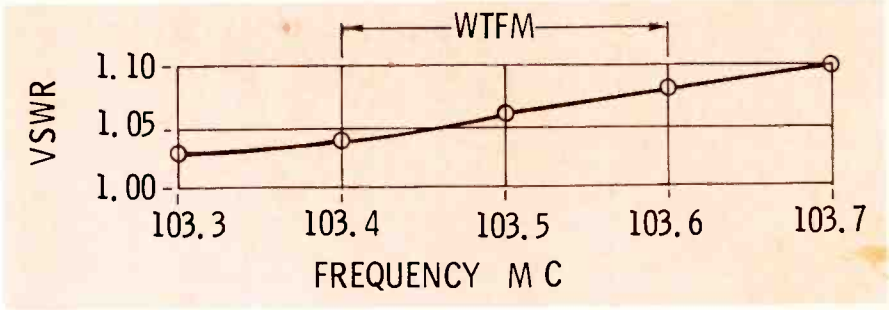


Fig. 6. Voltage standing-wave ratio (VSWR) measured at coaxial input switch.

[1]The whole spire of the building is heated by heating the air inside, sometimes to temperatures around 200°F. The 1948 channel 2 installation used special transmission lines made to withstand this temperature.

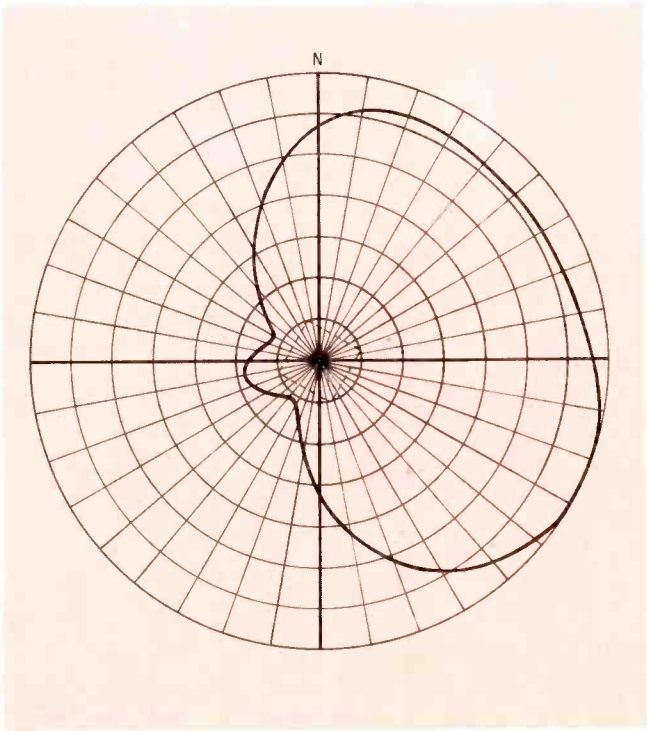


Fig. 4. (Above) Measured pattern from the full-size model.

Fig. 7. (Right) View of spire shows two antenna systems.

A PRESUNRISE POWER-REDUCTION SYSTEM

by Robert A. Jones, Midwest Regional Editor, and **J. R. McDonald, Jr.,** Chief Engineer, KCFI, Cedar Falls, Iowa—A system for reducing power without affecting normal operating parameters.

As a result of FCC Public Notice B, FCC 64-201, entitled "Adjustment of Presunrise Operating Disputes," dated March 5, 1964, several stations have been ordered to reduce their presunrise power to accommodate full-time cochannel stations. Commission Rules had allowed all daytime stations operating on regional channels to operate prior to local sunrise with their licensed daytime facilities. In our case, this meant operating with a 500-watt daytime pattern from 4:00 a.m.

However, Section 73.87 of the FCC Rules provided for presunrise operation only if no objection was made by cochannel stations licensed for full-time operation. Many of these stations have recently filed complaints against daytime operators, even though they have been operating during presunrise hours for years. To prevent complete loss of this service, the Commission's ruling is to allow daytime stations to continue presunrise operation but with reduced power.

Calculations of interference to our complaining regional full-time station determined that our radiation in its direction should be limited to 76.3 mv/m. Our new presunrise power should therefore be limited according to the following computations:

Since field strength is proportional to the square root of the power:*

$$\frac{E_1}{E_2} = \sqrt{\frac{P_{LIC}}{P_{RES}}}$$

*For development of this statement see: F. E. Terman, *Radio Engineering* (New York: McGraw-Hill Book Company, Inc., 1947) p. 611.

where,

E_1 = licensed field strength in mv/m

E_2 = restricted field strength in mv/m

P_{LIC} = licensed full power in watts

P_{RES} = restricted power in watts

therefore,

$$P_{RES} = \left(\frac{E_2}{E_1}\right)^2 P_{LIC}$$

in our case,

$$P_{RES} = \left(\frac{76.3}{205}\right)^2 500$$

$$= 69.1 \text{ watts}$$

Sec. 73.54 (e) of the FCC Rules and Regulations allows increased power to be supplied to directional antenna systems to compensate for systems dissipation.
Therefore:

$$\frac{69.1}{0.925} = 74.7 \text{ watts}$$

Our problem then was to reduce power to 74.7 watts with minimum interference to normal operation. The simplest solution made use of resistors to dissipate excess power. By selecting a suitable matching network with proper component values, we could offer the same load to the transmitter and reduce power without affecting transmitter operating values.

There are two basic matching networks which lend themselves to power reduction. These are the "L" and the "T".

The "L" Type Network

Fig. 1 shows the basic "L" matching network. This is inserted between the transmitter and the phasor. The values of R_1 and R_2 are determined by the "two equations, two unknowns" method. Power dissipated by this network consists essentially of the losses of a series circuit presented to the transmitter:

$$P_{DIS} = P_1 + P_2$$

where,

P_{DIS} = power dissipated in the network

P_1 = power dissipated in R_1

P_2 = power dissipated in R_2

therefore,

$$P_{DIS} = (I_A^2 R_1) + (I_2^2 R_2)$$

where,

I_A = current through R_1

I_2 = R_2 branch current

and,

$$E_A = (I_A R_1) + (I_2 R_2)$$

We know the value of P_{DIS} from the formula

$$P_{DIS} = P_{LIC} - P_{RES}$$

Allowing for system losses in licensed power:

$$P_{DIS} = 540 - 74.7$$

$$= 465.3 \text{ watts}$$

I_A is a licensed operating parameter, in our case 3.0 amps. It is necessary to develop I_2 from the basic formula

$$P_{RES} = I_B^2 R_B$$

and

$$I_B = \sqrt{\frac{P_{RES}}{R_B}}$$

where,

I_B = current into phasor at reduced power

R_B = phasor input resistance in our case

R_B = 60 ohms (measured)

therefore,

$$I_B = \sqrt{\frac{74.7}{60}}$$

$$= 1.12 \text{ amps}$$

Solving for I_2

$$I_2 = I_A - I_B$$

$$= 3.00 - 1.12$$

$$= 1.88 \text{ amps}$$

E_A may be found by using Ohm's law

$$E_A = I_B R_B$$

$$= 3(60)$$

$$= 180 \text{ volts}$$

In recapitulation, our known values are

P_{DIS} = 465.3 watts

E_A = 180 volts

I_2 = 1.88 amps

I_A = 3.00 amps

In order to solve for R_1 and R_2 it is necessary to find E_1 and E_2:

$$E_A = E_1 + E_2$$

where,

E_A = total voltage across the network

E_1 = voltage drop across R_1

E_2 = voltage drop across R_2

We can find E_2 from the equation

$$E_2 = I_B R_B$$

$$= 1.12 \times 60$$

$$= 67.2 \text{ volts}$$

Therefore

$$E_1 = E_A - E_2$$

$$= 180 - 67.2$$

$$= 112.8 \text{ volts}$$

solving for R_1 and R_2

$$R_1 = \frac{E_1}{I_A} \qquad R_2 = \frac{E_2}{I_2}$$

$$= \frac{112.8}{3} \qquad = \frac{67.2}{1.88}$$

$$= 37.6 \text{ ohms} \qquad = 35.7 \text{ ohms}$$

Since

$$P = I^2 R$$

$$P_1 = I_A^2 R_1 \qquad P_2 = I_2^2 R_2$$

$$= (3)^2 37.6 \qquad = (1.88)^2 35.7$$

$$= 338 \text{ watts} \qquad = 126 \text{ watts}$$

The "T" Type Network

The basic "T" network is shown in Fig. 2. The easiest solution to this network is to compute the db loss:

$$\text{db loss} = 10 \log \frac{P_{LIC}}{P_{RES}}$$

$$= 10 \log \frac{540 \text{ watts}}{74.7 \text{ watts}}$$

$$= -8.58 \text{ db}$$

For a "T" network in which the input and output impedances are equal (as in this case):

$$R_1 = R_2 = Z \frac{k - 1}{k + 1}$$

where

Z = characteristic impedance

k is a constant depending on the loss

$$R_1 = R_2 = 60 \frac{2.67 - 1}{2.67 + 1}$$

$$= 27.3 \text{ ohms}$$

The value of R_3 is calculated as follows:

$$R_3 = \frac{2Zk}{k^2 - 1}$$

$$= \frac{2(60)\ (2.67)}{(2.67)^2 - 1}$$

$$= 52.5 \text{ ohms}$$

Power dissipation in each resistor is found by determining the voltages and currents for R_1, R_2, and R_3.

P_1 = 246 watts

P_2 = 34 watts

P_3 = 185 watts

Comparison of "L" and "T" Networks

A comparison of the "L" and the "T" networks will show that there is a better distribution of power in the "T" network, and no one resistor is required to dissipate the 338 watts required by R_1 in the "L" network.

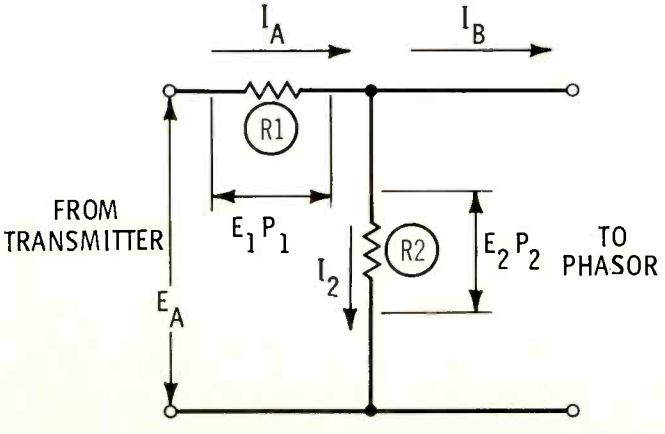


Fig. 1. The "L" matching network where Z_1 equals Z_0.

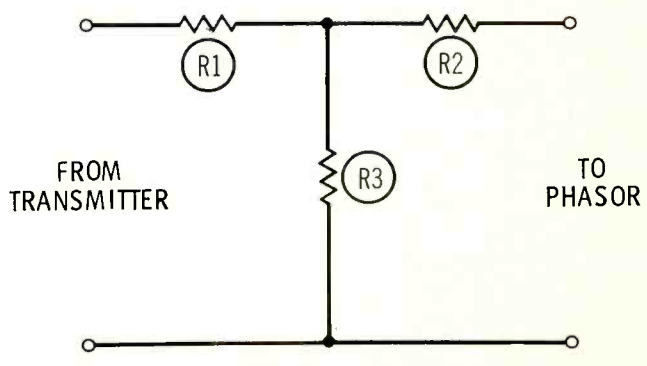


Fig. 2. "T" impedance-matching network where $R_1 = R_2$.

For this reason we elected to use the "T" network.

Construction Details

The resistors chosen had a total resistance of 100 ohms for each unit. These were selected to assure a wide working resistance range for final adjustment. The power rating of each resistor is 200 watts. It was necessary to divide the value of R_1 between two resistors. The initial adjustment of the resistors to the derived values was made with an ohmmeter.

After installing the network a problem arose — the inductive effect of these resistors was greater than expected and was sufficient to present a very high impedance to the transmitter. On the first try, the RF line current was very low and the transmitter final tubes showed much color. To minimize the inductive effect of the resistors, each resistor was mounted at right angles to the others. This was not sufficient, and it was necessary to add capacitance in series with the pad to minimize this inductance. The only capacitors obtainable locally were of the small, fixed mica type. Although less than ideal, they worked.

The station was fortunate in obtaining several small mica-type capacitors rated at 0.002 mfd, 2000 volts, and unknown current limitations. It is advisable to use porcelain-type capacitors similar to those found in a phasor. This type has current ratings sufficient to permit operation with maximum safety and efficiency. In addition, a 75-pf variable capacitor was placed in parallel for fine control. The variable capacitor used had a plate spacing of ⅛ in. The final circuit, as it evolved, is shown in Fig. 3.

The capacitors were adjusted to cancel the inductive action of the resistors. Several mica capacitors plus the variable were tried in several combinations until the unwanted impedance cancelled out.

The final adjustment was made by monitoring the meters on the transmitter. The proper readings with the pad in place were calculated to be 3.1 amps on the RF line meter and 1.06 amps on the common-point meter at the phasor end of the pad. By using Ohm's law and knowledge of power and impedance

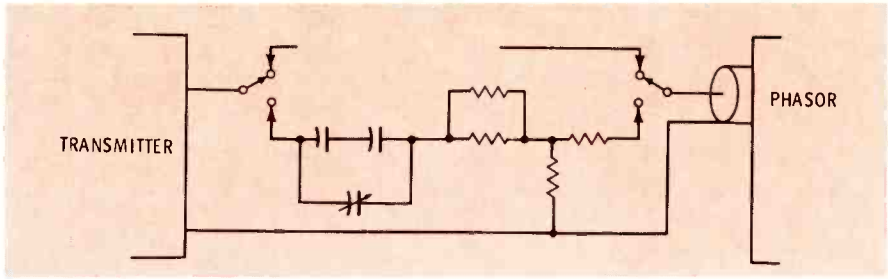


Fig. 3. The power-reducing "T" pad circuit in its final state at KCFI.

division, it was not difficult to find the proper voltage and to effect correct adjustment.

Several points were found in the final adjustment at which the voltage and current readings were close to the desired values, but plate dissipation on the transmitter finals was too high. These conditions were found to exist at points where the impedance of one or more of the legs of the pad was incorrect. We concluded that one of the other legs was trying to compensate for the improper loading and the result of roughly the proper amount of attenuation, but not the correct load impedance to the transmitter. It was necessary to find the proper adjustments for each resistor and repeat each adjustment, watching all the meters and the tube plates until all read properly and the tubes showed normal color.

After many overnight adjustments and meter readings, we were pleased when the resistive network began to function correctly.

The entire assembly was constructed on a ¾-in. board and each component mounted on two-in. porcelain standoff insulators. The two 0.002-mfd micas were electrically in series, so they were connected together with a single screw. One end of the mica capacitor combination was mounted to the stator plate of the variable capacitor. An antenna relay, used to switch the pad in and out, was mounted in the center of the board and wired so that it could be energized remotely. Construction and wiring were made so that relay contacts were normally in the 500-watt mode. The completed unit is shown in Fig. 4.

Because the unit is used for a limited time each day, it appeared unnecessary that it be shielded. In order to comply with FCC safety requirements the board is located on top of the transmitter. Also, in the open it can more easily dissipate heat generated by the resistors. RF currents carried at the input and output terminals are safely out of reach. An electric fan blows on the resistors to help dissipate heat; this fan is wired through the relay so that it runs only when power is fed to the pad.

With this installation, KCFI was able to comply with the Commission's reduced-power ruling. ▲

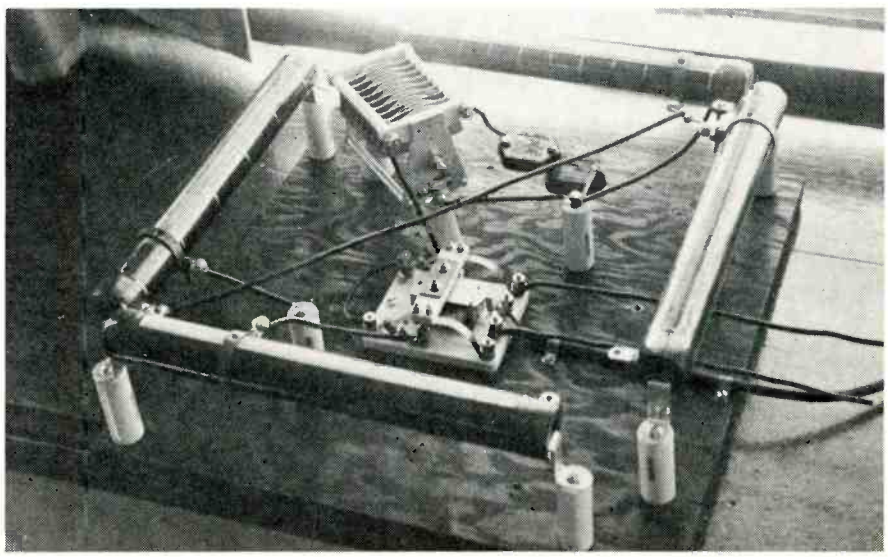


Fig. 4. Finished power-reduction unit as it was installed on the transmitter.

SERVICING SOLID-STATE AUDIO EQUIPMENT

by Larry J. Gardner, Chief Engineer, WKIX, Raleigh, North Carolina—Repairing and maintaining transistor circuits often requires a new approach to servicing.

In the past year or two the use of transistors in broadcast equipment has increased until nearly every new device now contains semiconductors in some application. This includes consoles, audio and video tape recorders, cartridge machines, turntable preamplifiers, amplifiers, limiters, transmitters, cameras, projectors, receivers, monitors, condenser microphones, and tower-light flashers. Because of reliability, high quality, and power requirements, semiconductor incorporation into broadcast equipment has been slow and carefully approached. Consequently, broadcast engineers with more than a cursory experience with transistors and diodes are rare. While it is impossible to cover the entire scope of semiconductor principles in this article, an attempt will be made to explain basic operating theory compared to vacuum tubes and general rules which govern servicing techniques.

Transistors in Tube Terms

Rough comparisons between vacuum tubes and transistors can be made. The emitter functions much the same as the cathode, the base as the grid, and the collector as the plate. In transistor circuits, however, there is base current in a class A stage, but in vacuum-tube circuits there is not.

Try this approach to transistor thinking: Imagine a zero-biased triode (a triode which is biased near cutoff when the grid is grounded) considering that with the grid at ground potential the tube is at cutoff. Such a tube would behave similarly to a typical NPN junction transistor. If the grid becomes positive with respect to the cathode, plate current flows. In other words, if the grid voltage has the same polarity as the plate voltage, the tube will conduct. Thus, in a transistor, if the base voltage is of the same polarity as the collector voltage, the transistor will conduct. Therefore, the emitter-base junction is forward biased and the base-collector junction is reverse biased; these are the two requirements for transistor action.

Using this approach to analyze Fig. 1, the reason for relative voltages is evident. With base voltage applied, the transistor conducts. A voltage drop is produced across both the emitter and collector resistors, with the emitter voltage being at a value near, but slightly lower than, the base voltage. By looking at the stage as an emitter follower (the familiar vacuum-tube cathode-follower), it can be observed that any change in the base voltage will produce a resultant change in emitter voltage, so long as current is flowing. PNP transistor circuit operation is identical except that polarities are reversed. There is of course, no vacuum-tube equivalent to a PNP transistor, and this new factor must be remembered when servicing transistor circuits.

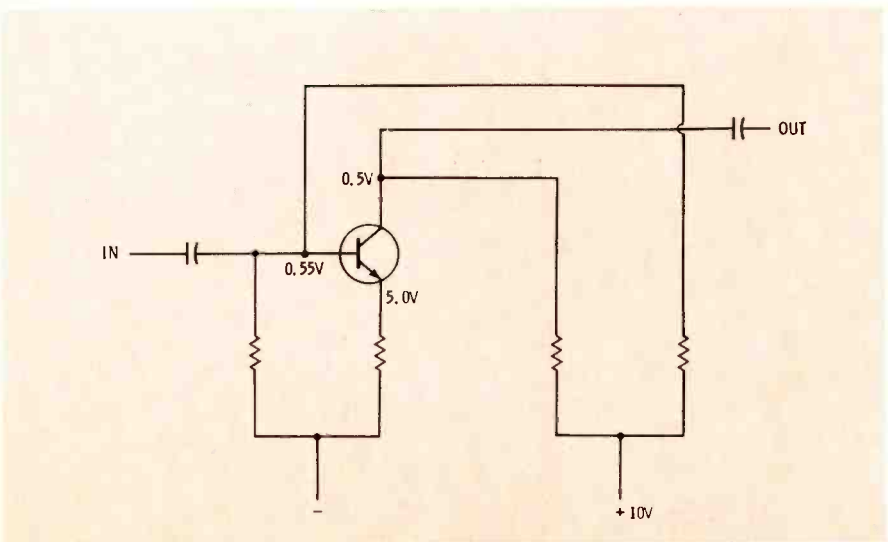


Fig. 1. Operating voltages in a typical R-C coupled solid-state audio stage.

Complementary Symmetry

Fig. 2 represents the circuit of a phase inverter which employs a PNP and an NPN transistor in series. It occasionally appears in audio amplifiers and is called a complementary-symmetry circuit. The top transistor (PNP) operates as an emitter follower, and its output is in phase with the input. The bottom

transistor is an NPN transistor used as a conventional grounded emitter so that its output will be out of phase with its input. This is typical of transistor circuits which do not have a vacuum-tube counterpart. The relationships between base, emitter, and collector, however, remain valid.

Because complementary symmetry is possible, and because of the resultant circuit simplification, designers often use direct coupling between transistor stages. An example is shown in Fig. 3. This arrangement has the advantage of excellent frequency response and a minimum of components.

This circuit has one serious disadvantage that is important in transistor-circuit troubleshooting. If the input transistor is shorted, voltages throughout the circuit are affected. The base of the PNP driver is grounded, and no current flows through it. Consequently, there is no voltage on the emitter of the NPN driver. Essentially the same thing happens to the output stage. For a technician accustomed to stage-by-stage troubleshooting techniques the situation is frustrating.

How To Troubleshoot

Start with the first stage. If it has about the same voltage on all three transistor terminals it is either saturated or shorted. If saturated, grounding the base will change the collector voltage greatly. If shorted, there will be only a small change, if any. If the first stage is normal, proceed to the second stage. When troubleshooting any direct-coupled amplifier, always go from input to output.

The same approach applies to certain of the more complex regulated power supplies. The regulator is the output stage of a direct-coupled amplifier which corrects output-voltage variations by comparing them with a known reference, usually supplied by a zener diode. The zener behaves in much the same way as the familiar voltage-regulator diode vacuum tube.

Finding trouble in circuits which are not direct coupled is similar to the process used in vacuum-tube circuits. Check voltages, and when one is wrong, find out why. In a well designed circuit transistor failures are rare, but some of the other components can cause trouble. Perhaps the most common problem in transistor units is gradually rising noise level. More common in older equipment than new, the noise increase is most often caused by deterioration of resistors in the input stage. Because optimum operating conditions for low noise require that a transistor be biased for very low collector current, small changes in resistor values can cause large shifts in the operating point. This brings up the noise level. When in doubt, check the resistors with a good ohmmeter, or replace them with 1% deposited carbon types. It is also

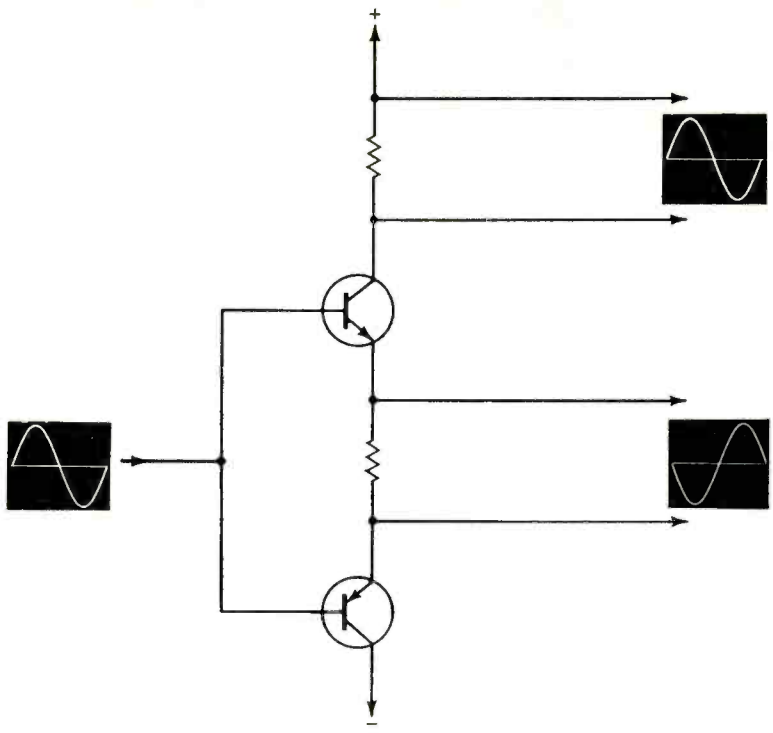


Fig. 2. A complementary-symmetry phase inverter possible with semiconductors.

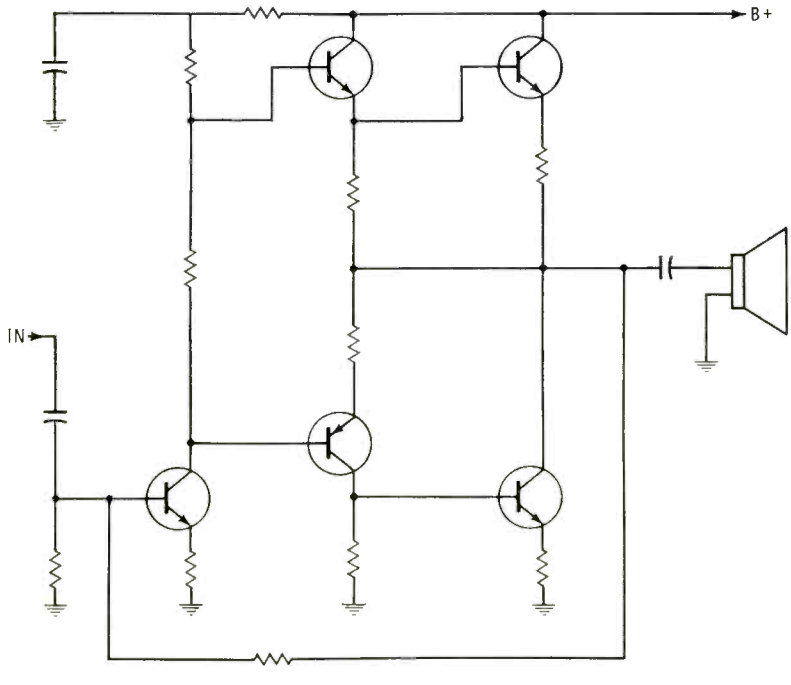


Fig. 3. Complete circuit of a direct-coupled transistorized monitor amplifier.

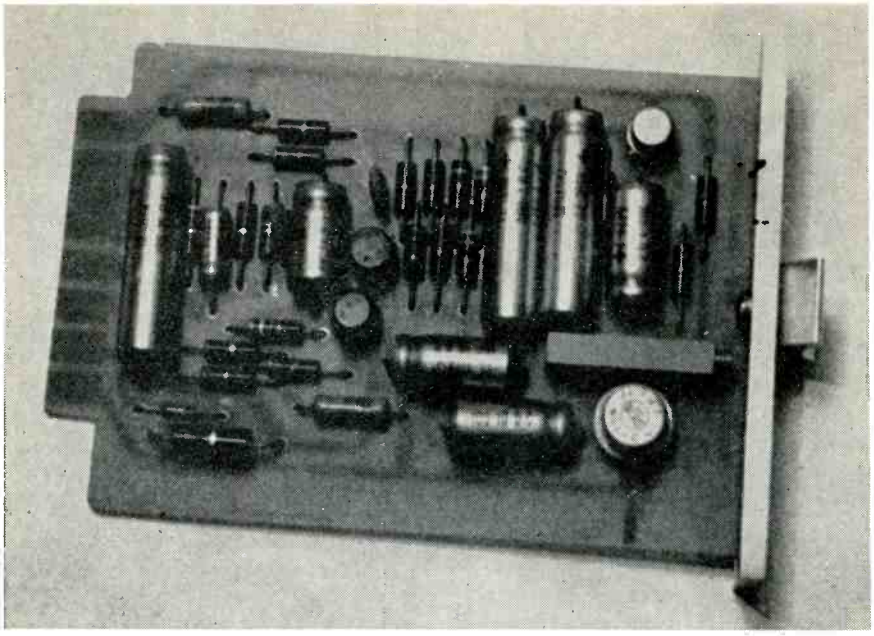


Fig. 4. A typical solid-state amplifier made up on an etched circuit board.

possible to reduce noise level by selecting an input transistor from a number of the same type, or by substituting a special low-noise type such as the 2N220 or the 2N508.

Another problem is loss of low-frequency response. This trouble is also more common in certain of the older equipment than in the new. It is almost always the result of electrolytic capacitors decreasing in value. These capacitors, usually rated at from 3 to 25 volts, are operated in the circuit at less than their rated voltages; therefore, they never "form up" to full capacitance. Applied voltages on these capacitors is generally lowest where they are used as emitter bypass capacitors. Consequently, a loss in capacitance produces negative feedback at the low frequencies and reduces the low-frequency gain. In order to determine whether this is the trouble, substitute for the emitter bypass capacitors one at a time and check overall frequency response. If the original capacitor was defective, the frequency response will return to normal. Recent developments have greatly improved these small low-voltage electrolytics, so that replacement with a new unit should restore and maintain satisfactory response. It is a good practice to replace all the emitter bypass capacitors in a unit where this problem has occurred. Interstage coupling capacitors seldom present this problem because they are normally operated at close to their rated voltage. Input capacitors in preamplifiers are also prone to this problem, although the symptoms may include an increase in low-frequency noise which resembles turntable rumble. This is caused by incomplete bypassing of noise generated in the emitter-base junction of the input stage through the tape head or turntable pickup.

When servicing power amplifiers, such as monitors, be sure to check the schematic diagram for fuses. It has been a practice to locate fuses in inconspicuous places. They can burn out when the output stage is overloaded. If the amplifier has no fuses and the output has been short-circuited, it is likely that affected transistors have been destroyed.

Because of high-current and low-voltage requirements of transistor circuits, unusual difficulties can develop if the wiring between the power supply and the amplifier has too much resistance. Crosstalk between two amplifiers using the same power supply, distortion, motorboating, and instability can often be cured by wiring the power circuits with No. 14 wire instead of No. 22. Running a separate power line from the power supply to each amplifier can also improve the situation. This is important for amplifiers with Class B output stages in which currents are high and vary with the signal.

In Fig. 4 a method of construction used in many high-quality audio amplifiers is shown. An etched circuit board is employed. Etched circuit boards are rugged and reliable, but can be damaged if it is necessary to replace a component on one of them. The correct procedure, when replacement is necessary, is first to clip the old component off the board. Then, heat the soldered connection on the reverse side of the board and remove the old leads with small pliers or a knife blade. Use as little heat as possible, since too much heat may cause the copper conductor to come loose from the board. Next, using a very small drill from the component side of the board, gently drill a new hole through the solder still adhering to the copper. Insert the leads of the new part through the holes, bend them over as close to the board as possible, solder quickly using as little heat as possible, and trim off the excess lead length.

If some of the copper conductor should accidentally peel off the board, extend the lead and solder it to an undamaged portion of the same conductor. A little service cement applied over the connection may help to prevent further damage. When soldering transistors or diodes on the board, keep heat away from the body of the components, and solder as quickly as possible. Using a soldering gun with any miniature device is bad practice. A small, commercial-type iron of about 50 watts is entirely adequate. It is also wise to use a heat sink between the component and the connection to be soldered.

To summarize, here are a few rules to follow when servicing transistor equipment:

1. Never insert or remove semiconductors with power on. Transients generated may permanently damage them.
2. Use as little heat as possible when soldering semiconductors or other small components. Use a heat sink.
3. Do not use short-circuit troubleshooting techniques in transistor circuits.
4. Employ a voltmeter that is accurate on the low ranges. A small error can be very misleading.
5. Be especially careful at any time when troubleshooting semiconductor circuits. They damage easily. ▲

U. S.—MEXICO AGREEMENT

By the President of the

United States of America

A PROCLAMATION

Whereas an agreement between the United States of America and the United Mexican States concerning radio broadcasting in the standard broadcast band was signed at Mexico City on January 29, 1957, the original of which agreement, in the English and Spanish languages, is word for word as follows:

The Mexico-United States Agreement concerning broadcasting in the Standard Broadcast Band has been extended until December 9, 1967. The effect of the agreement has been to limit, to some extent, the radiated power of all but a few standard broadcast stations in both countries. During the next seventeen months negotiations will be held to effect a new agreement.

Understandably, broadcast interests in each country would like to influence the new agreement to their own advantage. More than 250 United States stations assigned to Mexican clear channels are currently restricted to daytime operation, and along the border to limited power.

In order that engineers can properly apprise their station's management of the specific provisions of the agreement and how it can affect the station directly, BROADCAST ENGINEERING herewith presents the agreement in its entirety.

The text from which this copy has been taken is printed by the United States Government Printing Office in Volume 12, United States Treaties, starting at page 734. To the best of our knowledge, it is the only place where this agreement appears in print. It is unlikely that this binding and influential document has ever been made wholly available to involved stations in a reference form.

We suggest that engineers study the agreement, and that management be informed of its specific effects upon your station.

AGREEMENT BETWEEN THE UNITED STATES OF AMERICA AND THE UNITED MEXICAN STATES CONCERNING RADIO BROADCASTING IN THE STANDARD BROADCAST BAND

The Governments of the United States of America and the United Mexican States, being desirous of promoting the effective technical use in the two countries of the standard broadcasting band with a minimum of interference between stations in the two countries, and believing that this purpose can best be served by making provision in common agreement between the two Governments, have designated for that purpose their undersigned Plenipotentiaries who, having communicated to each other their respective Full Powers, found to be in good and due form, have agreed as follows:

ARTICLE I

PURPOSE AND SCOPE OF AGREEMENT

A. *Sovereign Rights of Contracting Parties—Purpose of Agreement*

While fully recognizing the sovereign right of each country with respect to the use of all of the channels in the standard broadcast band, the Contracting Parties also recognize that, in the absence of technical developments permitting the elimination of radio interference of an international character, agreement between them is necessary in order to promote and maintain the effective use by both countries of the standard broadcasting band.

In the exercise of their respective sovereign rights and for the purpose of eliminating objectionable interference, the United States of America and the United Mexican States have concluded earlier agreements, under which it has been possible to establish and develop their respective standard broadcasting installations and services. The maintenance and protection of these services constitute a principal objective of this Agreement, while at the same time a harmonious development of the broadcasting services of both nations for the future is sought.

It is the purpose of this Agreement to accomplish these objectives by establishing rules and principles relating to the use of the standard broadcasting band by each country so that both countries may utilize it in the most effective manner and with a minimum of interference between their respective broadcasting stations. This Agreement shall govern the relations between the United States of America and the United Mexican States in the use of the standard broadcast band (535-1605 kc/s).

The Contracting Parties agree to take the necessary measures to require the observance of the provisions of this Agreement upon the private and other operating agencies recognized or authorized by them to establish and operate broadcasting stations within their respective countries, possessions or territories.

If either Contracting Party acts in a manner deemed to be inconsistent with the provisions of this Agreement by the other Contracting Party, there shall be consultations at the request of the latter party regarding the matter. In the event that such consultations do not result in a resolution of the matter to the satisfaction of both parties, the latter Contracting Party may avail itself of the provisions of Article VB.

The United States of America and the United Mexican States declare their objective to incorporate, in substance, the pertinent provisions of this bilateral Agreement into the next North American Regional Broadcasting Agreement that is concluded.

B. *Annexes to this Agreement*

The following annexes complete and form an integral part of this Agreement:

Annex I:
- (A) Table of Class I-A Priorities.
- (B) Secondary Use of Class I-A Clear Channels.

Annex II Table of Class I-B Priorities.

Annex III Protected Service Contours and Permissible Interfering Signals from Co-channel Stations.

Annex IV Figure 1: Angles of Departure versus Transmission Range. Figure 2: Sky Wave Curves 10% and 50% of the Time.

Annex V Specific Cases.

Annex VI Notification Procedure.

Annex VII Abbreviations.

ARTICLE II

TECHNICAL

A. *Definitions*

1. *Broadcast Station.* A station the

MEXICO

Radio Broadcasting in the Standard Broadcast Band

Agreement signed at Mexico January 29, 1957;

Ratification advised by the Senate of the United States of America February 23, 1960;

Ratified by the President of the United States of America March 9, 1960;

Ratified on the part of Mexico March 14, 1961;

Ratifications exchanged at Mexico June 9, 1961;

Proclaimed by the President of the United States of America June 16, 1961;

Entered into force June 9, 1961.

emission of which are primarily intended to be received by the general public.

2. *Broadcast Channels* — 535 to 1605 kc/s. A broadcast channel is a band of frequencies ten (10) kc/s in width, with the carrier frequency at the center. Channels shall be designated by their assigned carrier frequencies. Carrier frequencies assigned to broadcast stations shall begin at 540 kc/s and be in successive steps of 10 kc/s. No intermediate frequency shall be assigned as the carrier frequency of any broadcast station.
3. *Service Areas.*
   a. Primary service area. The primary service area of a broadcast station is the area in which the ground wave is not subject to objectionable interference or objectionable fading.
   b. Secondary service area. The secondary service area of a broadcast station is the area served by the sky wave and not subject to objectionable interference. The signal is subject to intermittent variations in intensity.
4. *Dominant Stations.* A dominant station is a Class I station, as hereinafter defined, operating on a clear channel.
5. *Secondary Station.* A secondary station is any station except a Class I station operating on a clear channel.
6. *Objectionable Interference.* Objectionable interference is that which exceeds the maximum interference permissible under the terms of this Agreement.
7. *Power.* The power of a radio transmitter is the power supplied to the antenna.
8. *Spurious Radiation.* A spurious radiation from a transmitter is any radiation outside the frequency band of emission normal for the type of transmission employed, including any harmonic modulation products, key clicks, parastitic oscillations and other transient effects.

B. *Classes of Channels and Allocation Thereof*

1. *Three Classes.* The 107 channels in the standard broadcast band are divided into three principal classes: Clear, regional and local.
2. *Clear Channel.* A clear channel is one on which the dominant station or stations render service over wide areas and which are cleared of objectionable interference within their primary service areas and over all or a substantial portion of their secondary service areas.
3. *Regional Channel.* A regional channel is one which the several stations may be assigned to operate with powers not in excess of 25 kW. However, within an area 100 kilometers (62 miles) of the common border powers in excess of 5 kW may not be used.
4. *Local Channel.* A local channel is one on which several stations may operate with 1 kw daytime, and 500 watts nighttime, at distances of 150 kilometers or more from the common border. Stations located more than 100 kilometers from the common border, but less than 150 kilometers from said border, may be assigned to operate with powers not in excess of 1 kW daytime and 250 watts nighttime. Stations located 100 kilometers or less from the common border may be assigned to operate with powers not in excess of 250 watts daytime and nighttime.
5. *Number of Channels of Each Class.* The number of channels of each class shall be as follows:

Clear channels	60
Regional channels	41
Local channels	6
	107

6. *Allocation of Specific Channels to Each Class.*
   The channels are allocated to the several classes as follows:
   a. *Clear Channels.* The following channels are designated as clear channels:
      540, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 940, 990, 1000, 1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110, 1120, 1130, 1140, 1160, 1170, 1180, 1190, 1200 ,1210, 1220, 1500, 1510, 1520, 1530, 1540, 1550, 1560, 1570, and 1580 kc/s.
   b. *Regional Channels.* The following channels are designated as regional channels:
      550, 560, 570, 580, 590, 600, 610, 620, 630, 790, 910, 920, 930, 950, 960, 970, 980, 1150, 1250, 1260, 1270, 1280, 1290, 1300, 1310, 1320, 1330, 1350, 1360, 1370, 1380, 1390, 1410, 1420, 1430, 1440, 1460, 1470, 1480, 1590, and 1600 kc/s.
   c. *Local Channels. The following* channels are designated as local channels:
      1230, 1240, 1340, 1400, 1450, and 1490 kc/s.
7. *Use of Regional and Local Channels by Countries.*
   The Contracting Parties may use all regional and all local channels, subject to the power limitations and standards for prevention of objectionable interference set forth in this Agreement.
8. *Priority of Use of Clear Channels.*
   a. Each of the Contracting Parties hereby recognizes the Class I priorities of the other in the use of clear channels, as set forth in Annexes I and II.
   b. Neither Contracting Party shall make any nighttime assignment on the channels upon which the other Contracting Party has Class I-A priority under this Agreement, except as provided in Annex I.
   c. Daytime Class II assignments by either Contracting Party on clear channels upon which the other Contracting Party has the Class I-A priority will be subject to the following conditions:

(1) *Permissible Hours of Operation:* Sunrise to Sunset at the location of the Class II station.

(2) *Permissible Signal Intensity at the Boundary of the Country Which Has the Class I-A Priority on the Channel Involved:*
   Not more than 5 uV/m ground wave.

(3) *Permissible Power:* 50 kW, except that:
   (a) The United Mexican States may assign stations to operate with powers not in excess of 5 kW on the following channels: 700 kc/s, 720 kc/s, 1120 kc/s, 1210 kc/s.
   (b) The United States of America may assign stations to operate with powers not in excess of 5 kW on the following channels: 730 kc/s, 800 kc/s, 900 kc/s, 1050 kc/s, 1220 kc/s, 1570 kc/s. Furthermore, stations with powers in excess of 1 kW may not be assigned in areas within the following distances of the locations specified:
      i. 800 kc/s: 1319 kilometers (820 miles) from Ciudad Juarez, Chihuahua.
      ii. 1050 kc/s: 998 kilometers (620 miles) from Monterrey, Nuevo Leon.
      iii. 1570 kc/s: 998 kilometers (620 miles) from Ciudad Acuna, Coahuila.

   d. It is recognized and agreed by the Contracting Parties that the secondary use of Class I-A clear channels permitted under the terms of this Agreement imposes no obligations on the Contracting Party having the Class I-A priority to protect such secondary use, and that the Contracting Party having the Class I-A priority retains full freedom to make such use of the channel upon which it has Class I-A priority as it deems necessary to meet its domestic service needs. However, if either of the Contracting Parties contemplates changes in its use of such Class I-A clear channel which would increase the adjacent channel sky wave interference to stations in other country, such proposed changes shall be the subject of consultation between the Contracting Parties, with a view toward minimizing such interference before the changes are implemented.

C. *Classes of Stations and Use of the Several Classes of Channels*

1. *Classes of Stations.* Broadcast stations are divided into four principal classes, to be designated Class I, Class II, Class III, and Class IV.
2. *Definitions of Classes.* The four classes of broadcast stations are defined as follows:
   a. Class I: A dominant station operating on a clear channel and designed to render primary and secondary service over an extended area and at relatively long distances. Class I stations are subdivided into two classes:
   b. Class I-A: A Class I station which operates with power of 50

kW or more and which has its primary servcie area, within the limits of the country in which the station is located, free from objectionable interference from other stations on the same and adjacent channels, and its secondary service area, within the same limits, free from objectionable interference from stations on the same channel, in accordance with the engineering standards hereinafter set forth.

c. Class I-B: A Class I Station which operats with power of not less than 10 kW or more than 50 kW and which has its primary service area free from objectionable interference from other stations on the same and adjacent channels and its secondary service area free from objectionable interference from stations on the the same channel, in accordance with the engineering standards hereinafter set forth.

d. Class II: A secondary station which operates on a clear channel and is designed to render service over a primary service area which, depending on geographical location and power used, may be relatively large, but which is limited by and subject to such interference as may be received from Class I stations. A station of this class shall operate with power of not less than 0.10 kW or more than 50 kW. Whenever necessary a Class II station shall use a directional antenna or other means to avoid interference, in accordance with the engineering standards hereinafter set forth, with Class I stations and with other Class II stations.

e. Class III: A station which operates on a regional channel and is designed to render service primarily to a metropolitan district and the rural area contained therein and contiguous thereto. A station of this class operates with power not less than 0.5 kW and not more than 25 kW. The service area is subject to interference in accordance with the engineering standards hereinafter set forth.

f. Class IV: A station generally using a local channel and designed to render service primarily to a city or town and the suburban and rural areas contiguous thereto. The power of a station of this class shall not be less than 0.1 kW and not more than 1 kW daytime and 0.5 kW nighttime. Its service area is subject to interference in accordance with the engineering standards hereinafter set forth.

3. *Additional Provisions Concerning the Use of Clear Channels.*

a. In principle, Class I stations shall be assigned only to clear channels.

b. Except as otherwise provided in this Agreement, Class II stations may be assigned to clear channels only on condition that the interfering signal does not exceed that permitted under the standards in Annex III.

4. *Use of Region Channels.*

a. In general, only Class III stations shall be assigned to regional channels.

b. On condition that interference not be caused to any Class III station, and subject to such interference as may be received from Class III stations, Class IV stations may be assigned to regional channels.

5. *Use of Local Channels.* Only Class IV stations shall be assigned to local channels.

D. *Service and Interference*

1. *Satisfactory Signal.* It is recognized that, in the absence of interference from other stations and in regions where the natural electric noise level is not abnormally high, a signal of 100 uV/m constitutes a usable signal in rural and sparsely settled areas but that, because of the higher electrical noise levels in more thickly populated communities, greater field intensities (ranging as high as 25 mV/m or more in cities) are necessary to render satisfactory service. It is further recognized that it is not possible to accord protection to stations from interference over the entire area over which their signals are or may be above the electrical noise level, particularly at night, and that it is necessary to specify boundaries or contours at or within which stations are protected from objectionable interference from other stations.

2. *Areas Protected From Objectionable Interference.* The boundaries or contours at and within which the several classes of stations shall be protected from objectionable interference are set forth in Annex III. No station, however, need be protected from objectionable interference at any point outside the boundaries of the country in which such station is located except as provided elsewhere in this Agreement.

3. *Objectionable Interference on the Same Channel.*

a. Daytime: to All Classes of Stations: Nighttime: to Class I Stations. Objectionable interference shall be deemed to be caused to an existing station when, at the boundary or field intensity contour specified in Annex III with respect to the class to which the station belongs, the intensity of the field produced by another station exceeds, for 10 per cent or more of the time, the value of the permissible interfering signal set forth for such class in Annex III.

b. Nighttime: to Class II and Class III Stations. Objectionable interference shall be deemed to be caused to an existing station when at the field intensity contour specified for the class of station in Annex III or at the contour within which the station provides interference-free service (whichever is higher) a new signal exceeds 70 per cent of the intensity of the permissible interfering signal set forth in said Annex for the class of station, or 70 per cent of the strongest interfering signal from an existing or duly notified station if the latter is in excess of the permissible signal.

4. *Objectionable Interference on Adjacent Channels.*

Objectionable interference is considered to exist when, at or within the specified contours of a desired station, the field intensity of the ground wave of an undesired station operating on an adjacent channel exceeds a value determined by the following ratio:

Separation between Channels	Minimum permissible ratio of desired to undesired signals
10 kc/s	1 to 0.5
20 kc/s	1 to 30

The undesired ground wave signal shall be determined at or within the 0.5 mV/m ground wave contour of the desired station. These values apply to all classes of stations both day and night and are based on ground wave only. No adjacent channel interference is considered on the basis of an interfering sky wave.

5. *Frequency Stability.* The operating frequency of each broadcast station shall be maintained to within 20 cycles per second of the assigned frequency.

6. *Spurious Radiation.* The Contracting Parties shall endeavor to reduce and, if possible, eliminate spurious radiations from broadcast stations. Such radiations shall be reduced in all cases until they are not of sufficient intensity to cause interference outside the frequency band required for the type of emission employed. With respect to type A-3 emissions the transmitter should not be modulated in excess of its modulation capability to the extent that interfering spurious radiations occur.

E. *Determination of Presence of Objectionable Interference*

1. *Antenna Performance.* For the purpose of calculating the presence and the degree of objectionable interference, stations of the several classes shall be assumed to produce effective field, corrected for absorption, for 1 kW of input power to to the antenna, as follows:

Class of Station	At One Kilometer	At One Mile
I	362 mV/m	225 mV/m
II and III	282 mV/m	175 mV/m
IV	241 mV/m	150 mV/m

In case a directional antenna is employed, the interfering signal of a broadcasting station in any direction, in the absence of actual interference, measurements will be determined by calculations of the horizontal and vertical field intensity patterns of the directional antenna.

2. *Power.* The power of a station shall, for the purposes of notifications required by this Agreement, be determined in one of the following manners:

a. By taking the product of the square of the antenna current and the antenna resistance (antenna input power).

b. By determination of the station's effective field intensity, corrected for absorption, by making sufficient field intensity measurements on at least eight radials as nearly equally spaced as practicable and by relating the field intensity thus determined to the effective field intensity of a station having the antenna efficiency stipulated above for its class.

3. *Methods of Determining the Presence of Objectionable Interference—General.* The existence or absence of objectionable interference from stations on the same or adjacent channels shall be determined by use of ground wave or sky wave curves referred to in paragraph 4, below.

4. *Use of Propagation Curves.*

a. Sky Wave Curves. In computing the distance to the 50 per cent sky wave field intensity contour of a Class I station of a given power, and also in computing the 10 per cent sky wave field intensity of an alleged interfering station, of any class and given power, at a specified distance, use may be made of the appropriate graphs set forth in Annex IV.

b. Ground Wave Curves. The distance to any specified ground wave field intensity contour may be determined from appropriate ground wave curves plotted for the frequency under consideration and the conductivity and dielectric constant of the earth between the station and desired contour. The frequency and the conductivity of the earth must be considered in every case and where the distance is great due allowance must be made for loss due to curvature of the earth. The family of curves to be used for this purpose is similar to the curves of Ground Wave Field Intensity versus Distance for different frequencies, contained in the Regulations, Part 3, Radio Broadcast Services, January 1956 edition, issued by the Federal Communications Commission of the United States of America.

Where several values of conductivity are presumed to occur along a single propagation path, the "Kirke" or "Equivalent Distance" method of computation shall be used in computing the distance to a specific field intensity contour in conjunction with the curves referred to in the preceding paragraph. The application of this method is described in the Regulations of the Federal Communications Commission mentioned above.

F. *Review of Technical Standards and Requirements*

The technical standards and requirements adopted in this Agreement shall be the subject of constant study by both countries in the light of continuing development of the radio art, and shall be subject to such change during the term of this Agreement as the appropriate administrations of the Contracting Parties may find mutually agreeable.

ARTICLE *III*

NOTIFICATION

A. *Recognition of Existing Notifications of Standard Broadcasting Station Assignments*

1. All outstanding notifications of standard broadcasting stations assignments received from either Contracting Party by the Inter-American Radio Office (O.I.R.), Habana, Cuba, on or prior to June 15, 1955, which are not the subject of objection submitted through that Office by either Contracting Party, and are not modified by the specific assignments in the Annexes hereto, are hereby recognized and accepted.

2. The notifications of standard broadcasting station assignments set out in the Annexes to this Agreement are also hereby recognized and accepted. All notifications and objections inconsistent with the assignments set out in the said Annexes, or otherwise inconsistent with the terms of this Agreement, are hereby withdrawn.

B. *Notification of New Broadcasting Station Assignments. Changes in Existing Broadcasting Assignments, etc.*

1. New station assignments or changes in existing station assignments made by either Contracting Party shall be consistent with the terms of this Agreement.

2. Each Contracting Party shall notify the other Contracting Party of all new broadcasting station assignments, and all changes in or deletions of existing broadcasting station assignments in accordance with Annex VI of this Agreement. Each Contracting Party shall also notify the other Contracting Party of the deletion of any broadcasting station assignments and of the date of commencement or cessation of operation, and consummation of changes in broadcasting stations.

3. To be valid, each notification must be such that the new broadcasting station, change or deletion proposed therein is in accordance with this Agrement.

4. Each Contracting Party shall, within forty-five days after the date of receipt of such notification, advise the Contracting Party making the notification of any objection it may have thereto under the terms of this Agreement or of its acceptance of the notification. In case the supplementary information required under the provisions of Annex VI does not accompany the basic information and such supplementary information is received within the period specified in the said Annex, the period during which objection may be made shall be extended to thirty days after the date of receipt of such supplementary information.

5. Failure of either Contracting Party to object to a notification within the period specified above shall be deemed to be an acceptance by that Contracting Party of such notification.

6. The date of priority of a notification shall be determined by the date of receipt, by the Agency or Government performing the notification exchange functions, of the basic information constituting the notification, provided the supplementary information with respect to such notification is also submitted within the period specified therefor in Annex VI. If there is a conflict between two or more notifications, priority in the date of receipt thereof by the Agency or Government performing the notification exchange function shall govern.

C. *Cessation of Effect of Notification*

1. Any notification of a new broadcasting station assignment or of a change in an existing broadcasting station assignment shall cease to have any effect if, within the period specified in Annex VI, the supplementary information shall not have been supplied.

ARTICLE IV

RATIFICATION AND ENTRY INTO FORCE

A. *Ratification*

1. This Agreement shall be subject to ratification by both Contracting Parties in accordance with their constitutional procedures.

2. The Contracting Parties agree to take the action appropriate and necessary to ratification as expeditiously as possible consistent with their consitutional procedures.

3. The instruments of ratification shall be exchanged in Mexico, Distrito Federal.

B. *Entry into Force*

1. This Agreement shall enter into force upon the exchange of instruments of ratification.

ARTICLE V

TERM AND DENUNCIATION OF AGREEMENT

A. *Term*

This agreement shall remain in force for a period of five years unless, before the end of that period, it is terminated by a notice of denunciation pursuant to paragraph B of this Article or replaced by a new agreement between the Contracting Parties.

B. *Denunciation*

Either Contracting Party may terminate this Agreement by notice of denouncement to the other Party. The denunciation shall take effect one year after the date of receipt of the notice thereof, except that denunciation pursuant to the provisions therefor in Article I of this Agreement shall take effect ninety days after the date of receipt of the notice thereof.

IN WITNESS WHEREOF, the respective Plenipotentiaries have signed this Agreement in duplicate in the English and Spanish languages. The texts in both languages shall be equally valid. An authentic copy thereof shall be forwarded by the Government of the United Mexican States to the Governments of the United Kingdom of Great Britain and Northern Ireland for the Territories in the North American Region (Bahama Islands and Jamaica); Canada; Cuba; Dominican Republic; and Haiti; to the Secretary General of the International Telecommunication Union and to the Agency performing the notification exchange function.

DONE at Mexico, Distrito Federal, this twenty-ninth day of January, one thousand nine hundred fifty seven.

For the Government of the
United States of America:
FRANCIS WHITE
Francis White
Ambassador Extraordinary and Plenipotentiary of the United States of America to the United Mexican States.
ROSEL H. HYDE
Rosel H. Hyde
Chairman of the United States Delegation
[SEAL]

For the Government of the
United Mexican States:
W BUCHANAN
Ingeniero Walter C. Buchanan
Acting Secretary of Communications and Public Works.
E MÉNDEZ
Ingeniero Eugenio Mendez
Docürro
Director General of Telecommunications of the Ministry of Communications and Public Works.
[SEAL]

ANNEX II
Table of Class I-B Priorities

Channel kc/s	Station	Country having I-B Priorities	Antenna	Schedule
680	San Francisco, California	USA	ND	U
690	Tijuana, Baja California	Mexico	DA	U
710	New York, New York	USA	DA	U
710	Seattle, Washington	USA	DA	U
810	San Francisco, California	USA	DA	U
810	Schenectady, New York	USA	ND	U
850	Denver, Colorado	USA	ND	U
850	Orizaba, Veracruz	Mexico	DA	U
940	Mexico, Distrito Federal	Mexico	ND	U
1000	Mexico, Distrito Federal	Mexico	DA	U
1000	Chicago, Illinois	USA	DA	U
1000	Seattle, Washington	USA	DA	U
1060	Mexico, Distrito Federal	Mexico	DA	U
1060	Philadelphia, Pennsylvania	USA	DA	U
1070	Los Angeles, California	USA	ND	U
1080	Hartford, Connecticut	USA	DA	U
1080	Dallas, Texas	USA	DA	U
1090	Rosarito, Baja California	Mexico	DA	U
1090	Little Rock, Arkansas	USA	DA	U
1090	Baltimore, Maryland	USA	DA	U
1110	Omaha, Nebraska	USA	DA	U
1110	Charlotte, North Carolina	USA	DA	U
1130	Shreveport, Louisiana	USA	DA	U
1130	New York, New York	USA	DA	U
1140	Monterrey, Nuevo Leon	Mexico	DA	U
1140	Richmond, Virginia	USA	DA	U
1170	Tulsa, Oklahoma	USA	DA	U
1170	Wheeling, West Virginia	USA	DA	U
1190	Guadalajara, Jalisco	Mexico	DA	U
1190	Fort Wayne, Indiana	USA	DA	U
1190	Portland, Oregon	USA	DA	U
1500	Washington, District of Columbia	USA	DA	U
1500	St. Paul, Minnesota	USA	DA	U
1510	Nashville, Tennessee	USA	DA	U
1510	Spokane, Washington	USA	DA	U
1520	Buffalo, New York	USA	DA	U
1520	Oklahoma City, Oklahoma	USA	DA	U
1530	Sacramento, California	USA	DA	U
1530	Cincinnati, Ohio	USA	DA	U
1540	Waterloo, Iowa	USA	DA	U
1550	Nuevo Laredo, Tamaulipas	Mexico	DA	U
1560	New York, New York	USA	DA	U
1560	Bakersfield, California	USA	DA	U

ANNEX III
PROTECTED SERVICE CONTOURS AND PERMISSIBLE INTERFERING SIGNALS FROM CO-CHANNEL STATIONS

Class of station	Class of channel used	Permissible power	Boundary or signal intensity contour of area protected from objectionable interference		Permissible interfering signal	
			Day	Night	Day Ground Wave	Night 10% Sky Wave
I A	Clear	50 kW or more	Boundary of country in which station is located		5 uV/m	25 uV/m
I B	Clear	10 kW to 50 kW	100 uV/m	500 uV/m (50% sky wave)	5 uV/m	25 uV/m
II	Clear	0.10 kW to 50 kW	500 uV/m	2500 uV/m (Ground wave)	25 uV/m	125 uV/m
III	Regional	0.5 kW to 25 kW as provided in definition of Regional Channel	500 uV/m	2500 uV/m (Ground wave)	25 uV/m	125 uV/m
IV	Local	0.1 kW to 1 kW day as provided in definition of Local Channel 0.1 kW to 0.5 kW night as provided in definition of Local Channel	500 uV/m	4000 uV/m (Ground wave)	25 uV/m	200 uV/m

ANNEX I

A. *Table of Class I-A Priorities*

Channel kc/s	Country having I-A Priority
540	Mexico
640	USA
650	USA
660	USA
670	USA
700	USA
720	USA
730	Mexico*
750	USA
760	USA
770	USA
780	USA
800	Mexico
820	USA
830	USA
840	USA
870	USA
880	USA
890	USA
900	Mexico
1020	USA
1030	USA
1040	USA
1050	Mexico
1100	USA
1120	USA
1160	USA
1180	USA
1200	USA
1210	USA
1220	Mexico
1570	Mexico

*The Parties hereto recognize the limitation to the Mexican operation on 730 kc/s caused by operation of stations in the United States of America on the frequency 740 kc/s and agree to continue their study of this matter in an effort to arrive at an adjustment in the use of 740 kc/s that will be mutually satisfactory and upon the basis of which the United States of America may modify its existing priority for the use of 740 kc/s. Each Contracting Party agrees to exchange views and to give careful consideration to any suggestions by the other Contracting Party. [Footnote in original.]

B. *Secondary Use of Class I-A Clear Channels*

1. Neither Contracting Party* shall make any nighttime assignment on the channels upon which the other country has Class I-A priority under this Agreement, except as follows:
   a. The United Mexican States may make the following assignments:
   (1) *660 kc/s*—5 kW maximum power, directional antenna, Mexico, Distrito Federal, with the signal intensity at any point within the boundaries of the United States of America limited to 50 uV/m, 10 per cent sky wave.
   (2) *760 kc/s*—5 kW maximum power, directional antenna, Mexico, Distrito Federal, or south with signal intensity at any point within the boundaries of the United States of America limited to 50 uV/m, 10 per cent sky wave.
   (3) *830 kc/s*—5 kW maximum power, directional antenna, Mexico, Distrito Federal, with signal at any point within the boundaries of the United States of America limited to 50 uV/m, 10 per cent sky wave.
   (4) *1030 kc/s*—Mexico, Distrito Federal, 10 kW-D, 1 kW-N, ND, U, II.

*In the case of the United States of America this also includes Alaska, Hawaii, Puerto Rico, and the Virgin Islands.

ANNEX V

SPECIFIC CASES

540 kc/s Haines City, Florida	10 kW	DA	D	II[a]
550 kc/s Merida, Yucatan	5 kW	DA-1	U	III[a]
550 kc/s San Diego, California	5 kW	DA	U	III[k]
570 kc/s Morelia, Michoacan	1 kW	ND	U	III
580 kc/s Guadalajara, Jalisco	25 kW	DA-1	U	III[a]
#590 kc/s Reynosa, Tamaulipas	5 kW-D/.25kW-N	ND	U	IV
590 kc/s Hermosillo, Sonora	1 kW	ND	U	III
610 kc/s Sabinas, Coahuila	3 kW-D/0.5 kW-N	ND	U	III
620 kc/s Chihuahua, Chihuahua	1 kW-D/0.25 kW-N	ND	U	IV
620 kc/s Mexico, Distrito Federal	10 kW-D/5 kW-N	ND	U	III
630 kc/s Monterrey, Nuevo Leon	10 kW	DA-2	U	III[a]
660 kc/s Ciudad Delicias, Chihuahua	0.5 kW	ND	D	II
690 kc/s Tijuana, Baja California	50 kW	DA-N	U	I-B[ac]
690 kc/s La Mesa, Texas	0.25 kW	ND	U	II
690 kc/s State of Yucatan	50 kW	DA	U	II[j]
710 kc/s Tuxtla Gutierrez, Chiapas	1 kW	ND	U	II
790 kc/s Mexicali, Baja California	0.5 kW	ND	D	III
790 kc/s La Paz, Baja California	2 kW-D/0.75 kW-N	ND	U	III
810 kc/s Kansas City, Missouri	50 kW-D/10 kW-N	DA-N	U	II[a]
810 kc/s Tampico, Tamaulipas	50 kW	DA-N	U	II[a]
850 kc/s Orizaba, Veracruz	100 kW-D/50 kW-N	DA-N	U	I-B[eg]
920 kc/s Piedras Negras, Coahuila	1 kW-D/0.25 kW-N	ND	U	IV
920 kc/s Culiacan, Sinaloa	5 kW	DA-N	U	III[b]
940 kc/s Mexico, Distrito Federal	150 kW-D/50 kW-N	ND	U	I-B
950 kc/s Tijuana, Baja California	2.5 kW	ND	U	III
960 kc/s Nuevo Laredo, Tamaulipas	2 kW-D/1 kW-N	ND	U	III
970 kc/s Ciudad Juarez, Chihuahua	10 kW-D/5 kW-N	ND	U	III
1000 kc/s Chicago, Illinois	50 kW	DA-2	U	I-B[a]
1000 kc/s Mexico, Distrito Federal	10 kW	ND	U	I-B[d]
1000 kc/s Oklahoma City, Oklahoma	5 kW	DA-2	U	II[a]
1010 kc/s Ciudad Acuna, Coahuila	0.5 kW-D/0.2 kW-N	ND	U	II
1070 kc/s Tehuacan, Puebla (will shift from 1080 kc/s)	1 kW-D/0.25 kW-N	ND	U	II
1080 kc/s Zitacuaro, Michoacan	0.5 kW-D/0.1 kW-N	ND	U	II
1110 kc/s Mexico, Distrito Federal	50 kW	DA-N	U	II[e]
1130 kc/s Jalapa, Veracruz	10 kW	DA-N	U	II[a]
1140 kc/s Monterrey, Nuevo Leon	50 kW	DA-N	U	I-B[b]
1150 kc/s Ciudad Obregon, Sonora	5 kW-D/0.3 kW-N	ND	U	III
1150 kc/s Merida, Yucatan	0.5 kW-D/0.35 kW-N	ND	U	III
1150 kc/s Mexico, Distrito Federal	10 kW	DA-N	U	III[a]
1190 kc/s Fort Wayne, Indiana	50 kW	DA-N	U	I-B[a]
1190 kc/s Portland, Oregon	50 kW	DA-1	U	I-B[a]
1190 kc/s Guadalajara, Jalisco	(10 kW	ND	U	I-B[i]
	(50 kW	DA-N	U	"
1250 kc/s Port Arthur, Texas	5 kW-D/1 kW-N	DA-N	U	III[a]
1310 kc/s Torreon, Coahuila	10 kW-D/0.25 kW-N	ND	U	IV
1320 kc/s Mexico, Distrito Federal	1 kW	ND	U	III
1330 kc/s Gallup, New Mexico	5 kW-D/1 kW-N	DA-N	U	III[a]
1360 kc/s Iguala, Guerrero	1 kW-D/0.5 kW-N		U	III
1360 kc/s Celaya, Guanajuato	1 kW-D/0.175 kW-N	ND	U	IV
1370 kc/s Monterrey, Nuevo Leon	10 kW	DA-N	U	III[b]
1370 kc/s Nogales, Sonora	5 kW	ND	U	III
1380 kc/s Tecate, Baja California	0.25 kW-D/0.1 kW-N	ND	U	IV
1380 kc/s Mexico, Distrito Federal	5 kW	ND	U	III
1410 kc/s Nuevo Laredo, Tamaulipas	1 kW-D/0.25 kW-N	ND	U	IV
1410 kc/s Searcy, Arkansas	1 kW-D/0.5 kW-N	DA-N	U	III[a]
1450 kc/s Valle Hermoso, Tamaulipas	1 kW-D/0.25 kW-N	ND	U	IV
1470 kc/s Ciudad Miguel Aleman, Tamaulipas	0.5 kW-D/0.25 kW-N	ND	U	IV
1470 kc/s Mexico, Distrito Federal	10 kW-D/5 kW-N	ND	U	III
1520 kc/s Hidalgo del Parral, Chihuahua	1 kW	ND	D	II
1540 kc/s Los Angeles, California	5 kW	ND	D	II
1540 kc/s Waterloo, Iowa	50 kW	DA-N	U	I-B[ac]
1550 kc/s Nuevo Laredo, Tamaulipas	50 kW	DA-N	U	I-B[a]
1550 kc/s Huntsville, Alabama	5 kW-D/0.5 kW-N	DA-N	U	II[a]
1560 kc/s Bakersfield, California	10 kW	DA-1	U	I-B[ac]
1560 kc/s New York, New York	50 kW	DA-1	U	I-B[ac]
1560 kc/s Ciudad Cuahetmoc, Chihuahua	2 kW-D/0.25 kW-N	ND	U	II

1580 kc/s Hermosillo, Sonora	50 kW	ND	U	II
1590 kc/s Mexicali, Baja California	10 kW-D/1.5 kW-N	ND	U	III
1590 kc/s Mexico, Distrito Federal	10 kW-D/5 kW-N	ND	U	III
1600 kc/s Brownsville, Texas	1 kW	DA-2	U	III[fn]

#The Contracting Parties recognize that operation of XERT, Reynosa, Tamaulipas, on the frequency 590 kc/s, with presently notified daytime power of 5 kW, would seriously limit the ground wave service of co-channel station KTBC, Austin, Texas. The United Mexican States therefore agree to study the possibility of maintaining the daytime power of the Reynosa station at a level where such interference to the Austin station is minimized. [Footnote in original.]

NOTES

a. With presently notified DA pattern, any subsequent change in this pattern must not result in increased interference to stations in the other country under the engineering standards of this Agreement.

b. Directional antenna will protect stations in the other country in accordance with the engineering standards of this Agreement.

c. Future assignments will protect this station in accordance with its I-B classification.

d. Non-directional operation with power not to exceed 10 kW is permissible. If higher power is used a directional antenna will be employed which will restrict the radiation to 715 mV/m or less, unattenuated field, at 1.609 kilometers (one mile), over the arc between the true bearings 11 and 47 degrees (WCFL secondary service area) and to 1125 mV/m, unattenuated field, at 1.609 kilometers (one mile), over an arc between the true bearings 314 and 333 degrees (KOMO secondary service area).

e. The directional antenna shall restrict the radiation to 200 mV/m, unattenuated, at 1.609 kilometers (one mile), over an arc between the true bearings 327 and 10 degrees (KFAB secondary service area) and over an arc between the true bearings 27 to 65 degrees (WBT secondary service area).

f. This station will be subject to interference which may be caused at any time by XEAE, Ciudad Acuña, Coahuila, with power of a 5 kW, or if XEAE changes location to Monterrey, Nuevo Leon, to operate with 1kW. In either case, XEAE will operate with non-directional antenna.

g. *850 kc/s.* The Orizaba, Veracruz, assignment on 850 kc/s will protect the secondary service area (0.5 mV/m, 50 per cent sky wave contour) of KOA, Denver Colorado, in accordance with the I-B classification of KOA.

h. This assignment shall provide I-B protection to the United States I-B station in Richmond, Virginia, except that the unattenuated field at 1.609 kilometers (one mile) toward the northern part of the Richmond station's secondary service area may be increased to the following values at the bearings indicated:

250 mV/m at 19° true
140 mV/m at 22° true
140 mV/m at 35° true
200 mV/m at 52° true

i. Non-directional operation with 10 kW is permissible. If higher power is used the directional antenna shall restrict radiation to 870 mV/m, unattenuated field at 1.609 kilometers (one mile), over an arc between the true bearings 323 and 343 degrees (KEX secondary service area) and to 715 mV/m, unattenuated field at 1.609 kilometers (one mile), over an arc between the true bearings 17 and 59 degrees (WOWO secondary service area).

j. The United Mexican States may operate a Class II station at any point in the Yucatan Peninsula with power of 50 kW using a directional antenna that will give to stations in the United States of America protection equivalent to that which they receive from the present operation of the station in Mexico, Distrito Federal, on this frequency (5 kW, ND-U-II).

k. Protection requirements for other stations to be based on previous operation on 550 kc/s.

b. The United States of America may make the following assignments:

(1) *1050 kc/s*—New York, New York, 50 kW, DA-N, U, II, with the directional antenna pattern used at present for such operation.

(2) *1220 kc/s*—Cleveland, Ohio 50 kW, DA-N, U, II, with the directional antenna pattern used at present for such operation.

(3) *540 kc/s*—Assignments in the United States of America on this frequency:

(a) shall be located outside the area; bounded on the north by the parallel 35° N and on the east by the meridian 93° W; provided that no such assignments may be made within the United States of America south of the parallel 30° N, and

(b) shall not place a signal intensity at any point within the United Mexican States in excess of 50 uV/m nighttime and 10 uV/m daytime.

(4) *730 kc/s*—Santurce, Puerto Rico, 10 kW, DA-1, U, II**.

(5) *800 kc/s*—Juneau, Alaska, 5 kW, ND, U, II.

(6) *900 kc/s*—Fairbanks, Alaska, 10 kW, ND, U, II.

**The maximum permissible signal at the nearest point on the Mexican boundary shall be 17.5 uV/m. [Footnotes in original.]

ANNEX VI

NOTIFICATION PROCEDURE

A. *Notification of New Broadcasting Station Assignments or Changes in Existing Broadcasting Station Assignments*

1. Performance of the Notification Exchange Function.
Notification concerning broadcasting station assignments and changes in or deletions of such assignments, objections thereto, and other communications made pursuant to the provisions of this Article, shall be sent for purposes of exchange to the Agency or Government which performs the notification exchange function for the countries of the North American Region.

2. Notification of New Broadcasting Station Assignments or of Changes in Existing Broadcasting Station Assignments
In making any notifications of a new broadcasting station assignment, or of a change in an existing broadcasting station assignment, the Government shall supply the basic information, which is essential to constitute a notification. The basic information shall be accompanied or followed as soon thereafter as possible, but in no case more than ninety days thereafter, by supplementary information.

(a) *New Broadcasting Station Assignments*

(1) Basic Information. Basic information shall consist of the following: frequency; class of station; location by city and province or state; power; time designation; whether a directional antenna is to be used and the time during which it will be used (DA-1, DA-2, DA-N or DA-D); the date of expected commencement of operation.

(2) Supplementary Information. Supplementary information shall consist of the following: call sign; geographical location of the midpoint of the antenna system in degrees and minutes of latitude and longitude; and,

(i) for a directional antenna system, its electrical and physical dimensions, the horizontal radiation pattern for day operation, and the horizontal and vertical radiation patterns for night operation (the vertical patterns to be supplied only for directions in which protection is required for stations in other countries);

(ii) for omnidirectional antennas, the electrical and physical dimensions (including those of the ground system, etc.)* and the horizontal

unattenuated radiated field at 1.609 kilometers (one mile) for 1 kW of input power to the antenna.

(b) *Changes in Broadcasting Station Assignments*

(1) Basic Information. The basic information shall consist of the nature of the change, together with the date of expected consummation thereof, and any revision of the basic information previously supplied necessary to make it conform to the change.

(2) Supplementary Information. The supplementary information shall consist of any revision of the supplementary information previously supplied necessary to make it conform to the change.

3. Notifications of Deletions of Broadcasting Station Assignments
Notifications of deletions of broadcasting station assignments shall consist of sufficient information to identify the station assignment deleted, including call sign, location, frequency and power, together with the date on which the station has ceased, or is expected to cease operation.

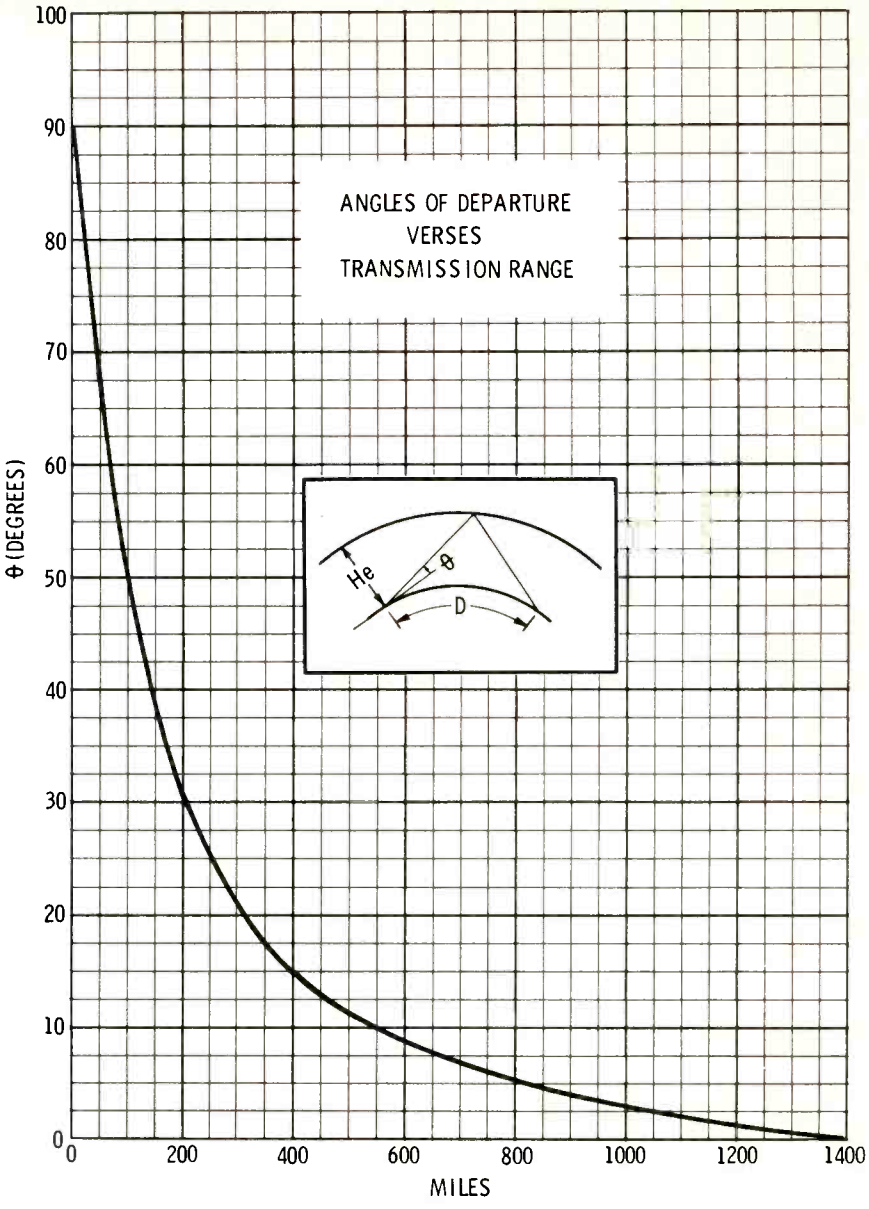
4. Notification of Commencement or Cessation of Operation of, and Consumation of Changes in, Broadcasting Stations
The exact date of commencement or cessation of operation of a broadcasting station, or of consummation of a change in broadcasting station, shall be notified.

*It is assumed that omnidirectional antennas will be guyed or self-supporting insulated towers located on the ground with a buried radial ground system. Where the antenna system deviates from this, (for example: is located on a building; is a type T or inverted L; is shunt fed; is sectionalized or top loaded) full particulars, including a sketch if necessary for clarity, shall be submitted. [Footnote in original.]

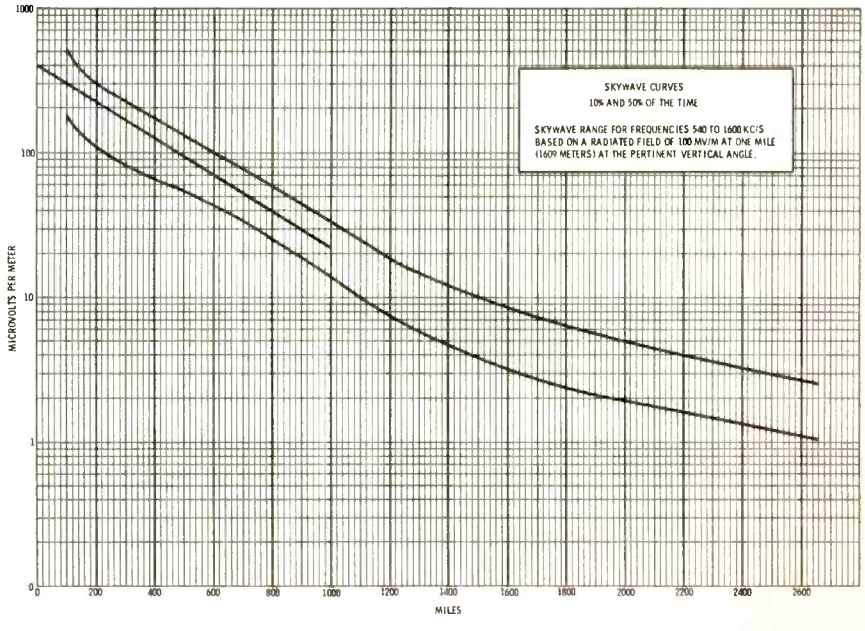
ANNEX VII

ABBREVIATIONS

kc/s	kilocycles per second.
kW	kilowatts.
U	unlimited time (day and night).
D	daytime only.
N	nighttime only.
ND	omnidirectional or non-directional.
mV/m	millivolts per meter.
uV/m	microvolts per meter
DA	directional antenna.
DA-1	directional antenna: the digit indicates same pattern but not necessarily the same power day and night.
DA-2	directional antenna: the digit indicates different patterns day and night, with either the same or different power day and night.
DA-N	directional antenna: the "N" indicates directional antenna used for nighttime operation only; omnidirectional day.
DA-D	directional antenna: the "D" indicates directional antenna used for daytime operation only.

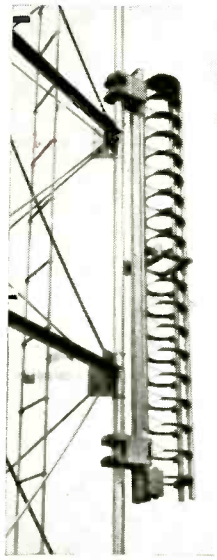


ANNEX IV—Figure 1



ANNEX IV—Figure 2

AMCI BROADCAST EQUIPMENT for VHF and UHF-TV and FM



VHF-TV
Transmitting Antennas

VHF-TV TRANSMITTING ANTENNAS
Mast or tower-corner mounted
DIRECTIONAL OR OMNIDIRECTIONAL
for Channels 5 to 13

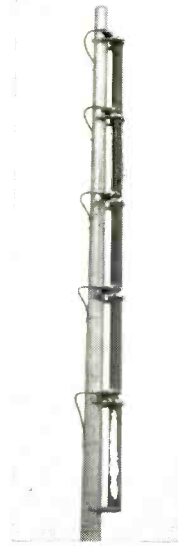
Omnidirectional VHF-TV antennas with power gains up to 20. Directional VHF-TV antennas with power gains up to 36.

UHF-TV TRANSMITTING ANTENNAS
Mast, tower-corner, or truss-mounted
DIRECTIONAL OR OMNIDIRECTIONAL
for Channels 14 to 83

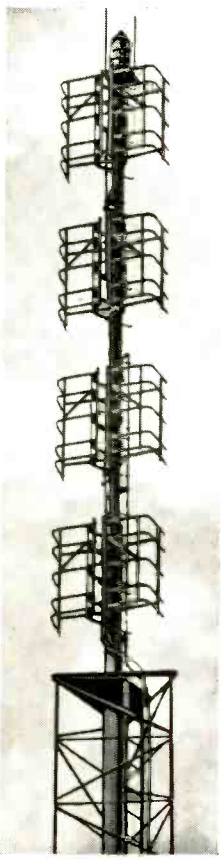
Omnidirectional UHF-TV antennas with power gains up to 50. Directional UHF-TV antennas with power gains up to 80.

FM TRANSMITTING ANTENNAS
Mast or tower-corner mounted
DIRECTIONAL OR OMNIDIRECTIONAL

For single or multi-station transmission.



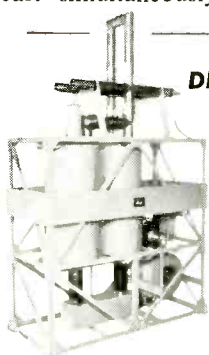
UHF-TV
Transmitting Antennas



FM Transmitting
Antennas

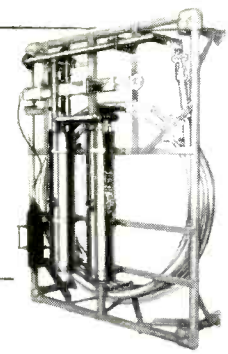
SPECIAL PURPOSE ANTENNAS

The Empire State Building Master FM Antenna; two rows of dipoles around the 102nd floor observation level, the diplexers within the tower, and the transmission line, designed, built, and installed in 1965, permit up to 17 FM stations to broadcast simultaneously from the same antenna.



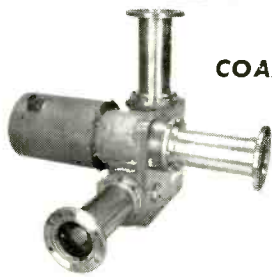
DIPLEXING FILTERS

Temperature compensated. Aural-to-visual and visual-to-aural rejection over 30 db. For use with transmitters up to 50 kw.



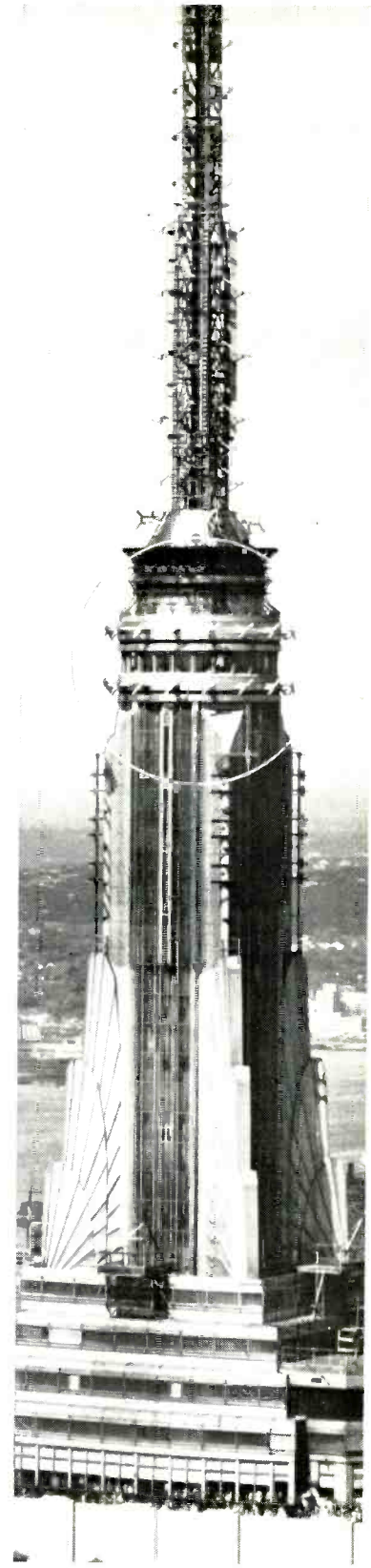
VESTIGIAL SIDEBAND FILTERS

Low insertion loss. Lower sideband of the color subcarrier frequency is attenuated 30 db. or more.



COAXIAL SWITCHES

For 6⅛" or 3⅛", coaxial transmission lines.
SWR over a specified 100 mc band under 1.03, high peak power models under 1.06 over a specified 50 mc band.
CW power rating equal to the mating transmission line.



Special Purpose Antennas

OTHER PRODUCTS

- *Standby Antennas*
- *Dipoles*
- *Power Dividers*
- *Hybrids*
- *Transfer Panels*
- *RF Terminations*
- *Impedance and Transfer Characteristic Plotters*
- *Variable Calibrated Attenuators*
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Circle Item 11 on Tech Data Card

A JUNK-BOX TAPE ERASER

by Sim S. Eagleson, Sr.

Broadcast stations employ many methods to effect tape erasure, but the best method is the use of a bulk-type eraser. To some stations, however, an eraser of this type is a large expense. We at WSBB have developed an eraser using junk parts; our investment has been practically nothing, and the results are nearly as good as those obtained with a commercially manufactured unit.

The electromagnet in our eraser is the power transformer from a defunct television set. The core of such a transformer is not satisfactory as is; hence it must be modified. The object is to rebuild the core so that a maximum magnetic field is placed as close as possible to the tape when it is to be erased.

First, disassemble the transformer. Ease the coil and core from the outer casing carefully because insulation is likely to be brittle. Next, remove the core from the coil. This is somewhat involved because of the core construction. Fig. 1 shows a typical lamination from this type of core. It consists of two pieces; one is a straight, narrow strip, and the other is shaped like the letter "E." In transformer core construction these laminations are alternately reversed so that when completed, the core configuration is similar to the number "8." We wish to realign the "E" shaped laminations so that the legs all point in the same direction.

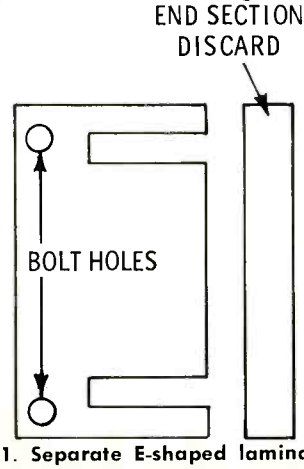


Fig. 1. Separate E-shaped laminations.

Remove the laminations carefully so that insulation on the coils is not damaged. Using a pocket knife and a hammer is helpful. It will not matter if the laminations are bent. It is best to remove them one at a time.

Discard the long, narrow strips, and reassemble the laminations in the "E" configuration. Carefully insert the assembly into the coil. Discard a few laminations if they will not fit comfortably. Bolt the entire core assembly together.

Cover the core block and coil with epoxy glue. This will protect the coil insulation and prevent rattling in the core. When dry, insert the coil into the core.

Build the frame shown in Fig. 2 from ¼-in. plywood. Cut a disc from sheet copper or aluminum (copper is best) seven inches in diameter. Cement the electromagnet to the disc with the open side next to the disc as indicated. Then cement the electromagnet to the plywood housing.

Bolt or cement a pin of suitable size (to fit the center hole in a tape reel) in approximately the center of the metal disc. Drill for and mount a switch and a holder for a neon indicating lamp in convenient positions. Wire the entire unit according to Fig. 3. Install a neon bulb in the holder.

Because this is not a commercial unit, it is vital that operation be limited to a few seconds at a time. Never attempt to erase a "pile" of tape in one operation. With these limitations observed, this "junk-box" eraser should give satisfactory service for a long time. ▲

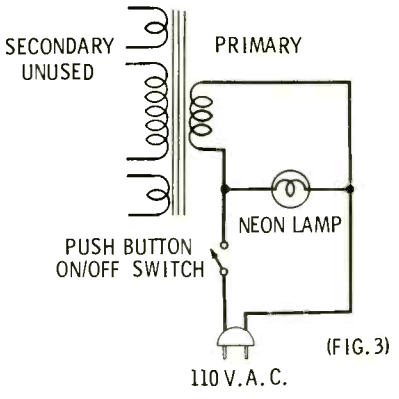


Fig. 3. Wiring diagram of the eraser.

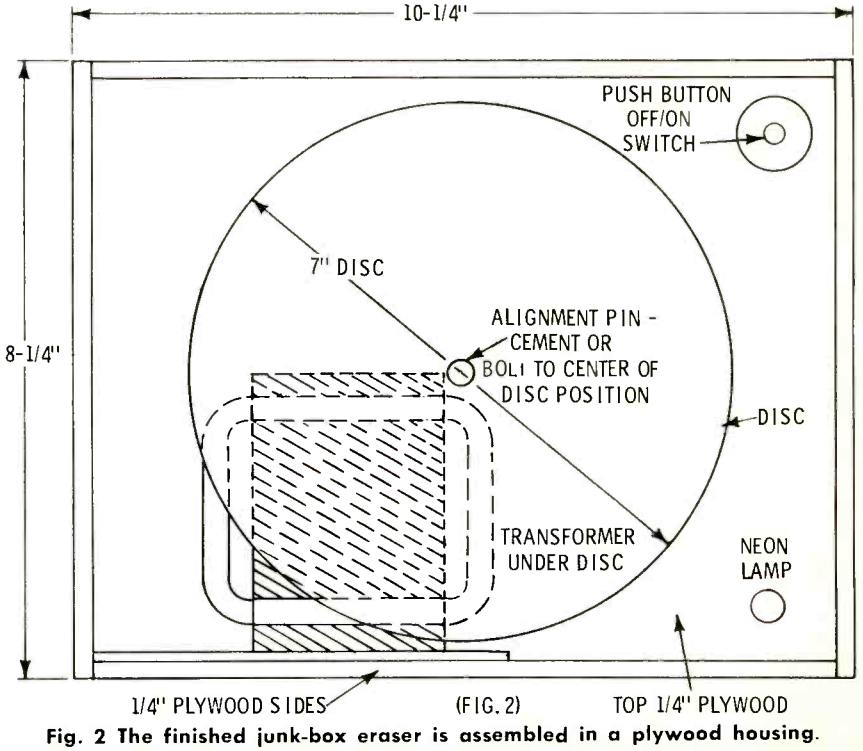
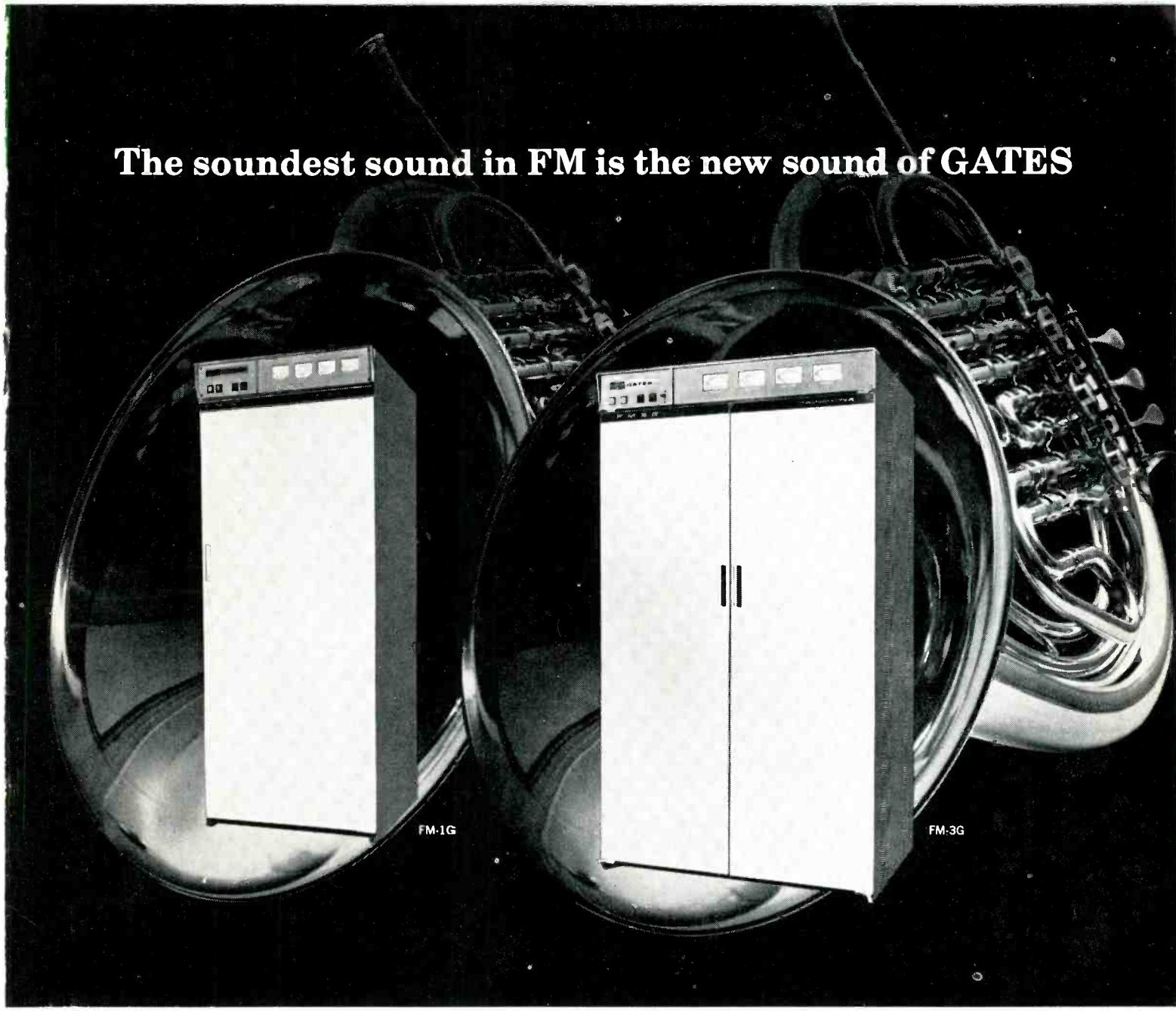


Fig. 2 The finished junk-box eraser is assembled in a plywood housing.



Two New FM Transmitters from Gates!

The Gates FM-1G and FM-3G are the newest additions to the most complete line of FM transmitters in the industry. From 10 watts through 20,000 watts, all models are quality all the way — featuring a high degree of stability, solid-state power supplies, new ceramic power tubes operating at a leisurely pace, plus a careful selection of quality components. Result: the ultimate in FM performance. And proof that the soundest sound in FM is the new sound of Gates.

Ask for complete description and specifications.

Gates FM Broadcast Transmitters—the most complete line in the industry

Model	Power Rating	Frequency Range
BFE-10C	10 watts	87.5-108 mc
BFE-50C	50 watts	87.5-108 mc
BFR-50C	50 watts	50-220 mc
FM-250C	250 watts	87.5-108 mc
FM-250CS	250 watts	50-220 mc
FM-1G	1,000 watts	87.5-108 mc
FM-3G	3,000 watts	87.5-108 mc
FM-5G	5,000 watts	87.5-108 mc
FM-7.5G	7,500 watts	87.5-108 mc
FM-10G	10,000 watts	87.5-108 mc
FM-20G	20,000 watts	87.5-108 mc

HARRIS INTERTYPE CORPORATION

GATES

GATES RADIO COMPANY • QUINCY, ILLINOIS 62302 U.S.A.

A subsidiary of Harris-Intertype Corporation

Circle Item 12 on Tech Data Card

GOOD THINGS COME IN SMALL PACKAGES ...LIKE THE MAGNECORD 1028

Out of the case a Magnecord 1028 weighs less than 50 pounds and measures only 17⅝" x 12⅞" x 12". But its performance is bigger than instruments twice its size. Wrapped up in a single compact unit are big features like 3-motor tape drive, precision lapped Micro-Optic heads, a die-cast mainplate and solenoid operated shoe brakes. A 1028 can handle king-sized jobs too, with excellent fidelity for cutting master tapes and a reel capacity up to 10½"!

You can buy another brand tape recorder/reproducer with about the same capabilities. But it costs about $1,700.00 more; it comes without pre-amps; you get less quality in high and lows; and you would have to put up with a cumbersome, completely unportable machine requiring three separate enclosures. Now, doesn't that prove the best tape instruments come in small packages marked Magnecord? See your nearest franchised Magnecord dealer or write us for a free brochure.

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DIVISION OF THE TELEX CORPORATION
P. O. Box 1526 / Tulsa, Oklahoma 74101

A DIVISION OF THE TELEX CORPORATION / MANUFACTURER OF TELEX HEADSETS AND OTHER FINE ACOUSTIC PRODUCTS

Circle Item 13 on Tech Data Card

IS YOUR VIDEO ON THE LEVEL?

Solid State Color STABilizing AMPlifier
with A.G.C. model VI-500

Ultra Stable Circuitry
through complete and accurate temperature compensation

AUTOMATIC VIDEO LEVEL CONTROL
Maintains video peaks constant to a preset level, with reference to blanking.

CLAMPING
Sync tip clamps remove hum, tilt and other low frequency disturbances.

SYNC LEVEL
Sync level is maintained at a constant amplitude despite large variations in input.

EQUALIZATION
Accurately compensates for losses in up to 1000 feet of coaxial cable.

REMOTE CONTROLS
Automatic/Manual video gain
Sync Level
White Clip
Black Clip
By-pass switch

WHITE CLIP
Adjustable sharp white clip remains fixed with respect to blanking.

BLACK CLIP
Adjustable sharp black clip for monochrome operation.

WHITE STRETCH
Stretch adjustments provide a high degree of flexibility to compensate for transmitter characteristics.

NON-COMPOSITE COLOR OUTPUT
Mono. or **Color** non composite output board in lieu of white stretch is available at additional cost.

APPLICATION
Wherever there is video and you want to assure:

• Constant levels • Constant clean sync • Elimination of tilt, hum and low frequency disturbances.

Price for the VI-500 $1,750.00 Remote controls $150.00 . . . Have you placed your order yet?

GOOD ENGINEERING IS VITAL

Write for complete information and specifications.

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Circle Item 18 on Tech Data Card

ENGINEERS' EXCHANGE

Repairing a Function Switch

by J. R. McDonald, Jr.
Chief Engineer, KCFI
Cedar Falls, Iowa

Trouble experienced while operating our Magnecord P-60 was traced to the function switch. The switch is a four-button selector type whose leaf-pairs contact sliding knives. The knives slide between spring-loaded leaves attached to the phenolic base of the switch assembly. Some of these contacts have high voltage and current demands from the solenoids and motors. After long usage the sliding knives become so badly pitted that they fail to make contact with the leaf-pairs. (See Fig. 1.)

A new switch was not immediately available and the machine was badly needed, so we elected to repair the switch. This was done by reversing the knives so that the pitted area was directed away from

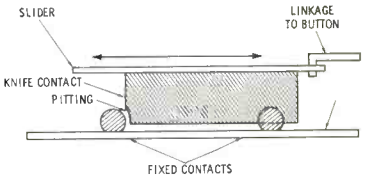

Fig. 1

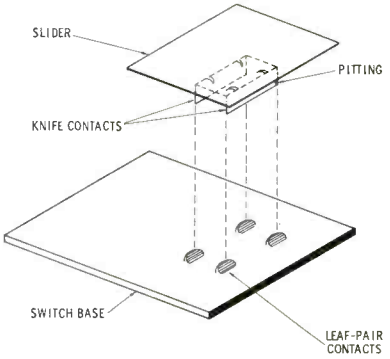

Fig. 2

the leaf-pair contact. It proved necessary to reverse the knives in pairs because a knife directly reversed would not fit. Fig. 2 shows the relationship between contact pairs.

After reversing the knives, all contact surfaces were burnished and the switch was reassembled and installed in the tape machine. It has functioned well for a considerable time, and we do not feel that it will be necessary to replace the switch until pitting occurs in the new contact area.

Reader McDonald's item makes him the winner of this month's contest. Send in your contribution to Engineers' Exchange, and you may win a volume of your choice from the Howard W. Sams Broadcast Engineering Notebooks **or** Modern Communications Course **series.**

Short Cut To Tube Testing

by Walter L. Johnson, Jr.
Chief Engineer
WELS, Kinston, North Carolina
WGOL, Goldsboro, North Carolina

In order to reduce considerably the time required to conduct pre-

July 1966

We interrupt this magazine to bring you...

Late Bulletin from Washington

by Howard T. Head

CATV Transmission Without Permission Ruled Copyright Infringement

The U. S. District Court for the Southern District of New York has held that CATV transmission of copyrighted motion pictures constitutes a copyright infringement under the Copyright Act. The suit was brought by United Artists Television against Fortnightly Corporation, a CATV operator.

In reaching this decision, the court concluded that the distribution of television signals to the CATV audience constitutes a "performance," which applies the Copyright Act to such distribution. Under this doctrine, any CATV system would be required to obtain the permission of the copyright holder to distribute motion pictures or other copyrighted programs. Royalties would presumably be charged.

The decision is certain to be appealed to a higher court, and the New York court has already authorized the appeal to be taken. In the meantime, Congress is considering various revisions of the Copyright Act which would define the status and responsibilities of CATV systems. The problem is particularly vexing in view of the new FCC CATV Rules, which require the signals of specified television stations to be carried by CATV systems, while the effect of the court decision is to require prior approval of copyright holders for such carriage.

New Rules for FM Stereo and Multiplex Monitors

The Commission has adopted new requirements for frequency and modulation monitors for FM stations engaging in stereo and multiplex SCA operation (see June, 1964 Bulletin). Under the new Rules, in view of the stability of modern oscillators, no monitor will be required to check on the frequency of the pilot subcarrier or the SCA subcarrier. Daily frequency checks on both of these subcarriers by suitable means will be required, however.

Modulation monitors will be required for all stereo and SCA operation, effective June 1, 1967. The Commission's Notice observes that some stereo and SCA modulation monitors now in use do not fully meet the new requirements. In these instances, existing monitors may continue to be

used until January 1, 1972. Stations using these monitors, however, will be expected to comply fully with the requirements of the FM Technical Standards.

The Commission has also noted the desirability of reviewing its technical Rules governing the requirements for nonmultiplex modulation monitors (see April, 1965 Bulletin). An inquiry into this problem, however, has been deferred until a later date in order to avoid further delays in adopting new Rules for stereo and SCA modulation monitors.

Forfeiture Schedule for Late Filers

The Commission has adopted a schedule of forfeitures (fines) to be imposed on licensees who are late in filing their renewal applications. (see February, 1966 Bulletin). An application which is filed from 1 to 15 days late will incur a fine of $25; from 16 to 60 days, a fine of $100; and from 60 to 90 days, a fine of $200. The new forfeiture schedule will apply to noncommercial educational stations as well as to commercial broadcast stations.

Experimental FM Translator Test Authorized

A developmental test authorization has been granted by the Commission at China Lake, California, to test the feasibility of a low-power FM translator for serving several small communities in a remote section of California. A 1-watt transmitter located on a nearby mountain will be operated on FM Channel 296 (107.1 mHz). Rebroadcast authorization must be obtained for tests. The public is being notified that the broadcasts are experimental only, and may be terminated at any time without notice.

These tests are expected to provide technical information which may ultimately lead to the establishment of FM translators as a regular service. A petition is now pending before the Commission for regular operation of this type.

Short Circuits

The Association of Broadcasting Standards (ABS) has protested any grants for powers in excess of 50 kw on the Class I-A clear channels (see June, 1966 Bulletin). . . The NAM (National Association of Manufacturers) Communications Committee has asked that television Channels 14 through 17, inclusive, be withdrawn from television service and reassigned to the land mobile services. . .The Commission has acted to halt further expansion of CATV systems bringing distant signals to several of the top 100 markets, including Buffalo, Cleveland, Toledo, and Muskegon. . .Proposed Rules requiring a minimum of 250 watts power for Class IV AM stations on the local channels (see February, 1966 Bulletin) have been made final. . .The first authorization of a Community Antenna Relay system has been issued (see December, 1965 Bulletin), at Santa Maria, California. . . The Commission has proposed to assign 60 channels in the 450-mHz band to provide air-to-ground public telephone service; SSB will be employed with 5-kHz bandwidth. . .The CATV system in eastern Pennsylvania found to have excessive cable radiation (see December, 1965 Bulletin) has worked out an agreement with the Commission for eliminating the radiation and handling interference complaints; monthly progress reports to the Commission are required.

Howard T. Head. . . in Washington

Now—TWO from the leader!

SUPERIOR

Coaxial Cables for CATV

75 ohm coaxials with —"Coppergard" corrugated copper shield

Cell-O-Air® expanded polyethylene dielectric for aerial installations.

"Solid-D" solid natural polyethylene dielectric; for direct burial installations.

75 ohm coaxials with "Alumagard" solid aluminum shield

Newest addition to the quality line!

For aerial installation.

Cell-O-Air® expanded polyethylene dielectric; extra high strength solid aluminum sheath.

As the community antenna market expands, decisions concerning choice of coaxial cable become more critical. Installing less than the best can be an increasingly costly mistake.

That's why it is important to know that millions of feet of Superior's Coaxial Cable are already in service; and performance records for each passing year continue to confirm their built-in reliability.

Long-term transmission stability and full spectrum capability are assured. You can count on the use of all available frequencies, with no attenuation discontinuity; none of the skipping and jumping frequencies often found in ordinary cable.

BOTH TYPES—"Coppergard" Coaxials and "Alumagard" Coaxials—CARRY SUPERIOR'S FIVE-YEAR GUARANTEE!

For performance—call Superior!

SUPERIOR CABLE

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9941

Circle Item 15 on Tech Data Card

Letters

(Continued from page 6)

broken by insulation to prevent its acting as a shorted turn.

HUGH LINEBACK
Tulsa, Oklahoma

These are all valid points, and such constructive comments are always welcome. Figs. 7 and 8 suffered some distortion in their journey from sketch to printed page. They are reproduced below as they should be—Ed.

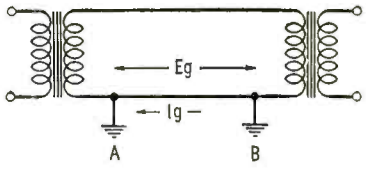


Fig. 7A

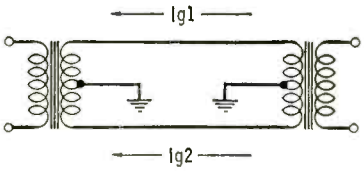


Fig. 7B

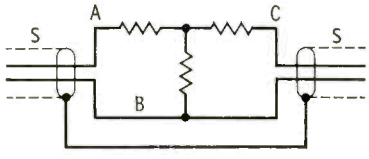


Fig. 8A

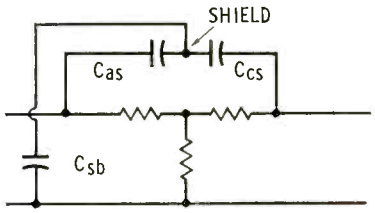


Fig. 8B

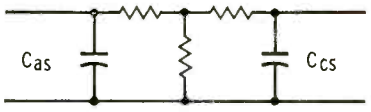


Fig. 8C ▲

New TK-42
Color TV Camera

Separate luminance channel ...like the black plate in full color printing magically sharpens the color

...adds the detail that gives snap to the picture

NEW COLOR PROCESS

From its all-new operating principle to its all-new look, the TK-42 represents an entirely new concept in color camera performance. It adds a separate luminance channel to the red, green and blue (chrominance) channels, to supply high-quality monochrome information. This is like the black plate in 4-color printing, for giving finest detail, superior color pictures.

NEW PICTURE PERFORMANCE

A big picture 4½-inch tube is used in the luminance channel. (It's the same tube used in RCA's deluxe TK-60 camera for superb monochrome reproduction.) Result: highest quality monochrome pictures and highest quality color pictures.

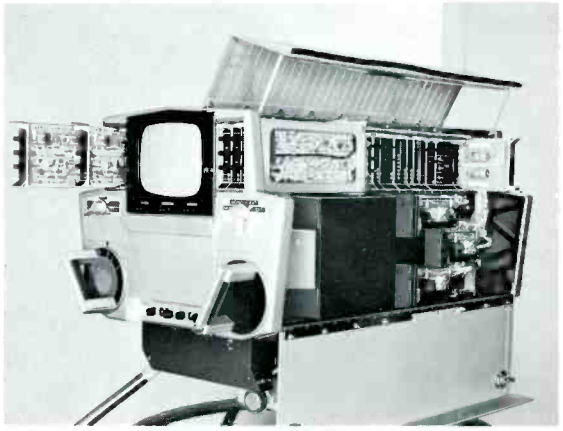
This is the 4-1/2 inch image orthicon tube used in the luminance channel to sharpen the picture.

NEW EASE OF OPERATION

Self-compensating circuits are used to avoid drift, permitting the camera to operate for long periods without adjustment. For ease of operation a zoom lens is built in, also a large 8-inch viewfinder and complete test facilities.

THE CHOICE OF BROADCASTERS

New luminance principle proved by 5 years' intensive engineering, product research, and field testing. Several models have been demonstrated at three NAB Conventions. In 1962, Broadcasters registered their choices regarding the luminance principle, the built-in zoom lens, and other features—the present camera is the result.



Plug-in transistorized modules speed servicing, increase reliability.

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

The Most Trusted Name in Television


RCA
COLOR
RCA
NEW
LOOK
COLOR TV CAMERA . . . "LUMINANCE MAGIC"

(Name of facility or room)								
Type	Equipment	Quan.	Tester Data					
				SH	Fil.	Sel.	Up	Down
5Y3	Ampex 601	1	Test #1	47	5.0	3	4	2
			Test #2	47	5.0	3	6	2
6AN8	ITA Console	1	Test #1	25	6.3	2	6,7,8	4,9
			Test #2	25	6.3	2	1,2	3,4
6AQ5	ITA Console	3		22	6.3	3	1,5,6,7	2,3
6F5	Ampex 601	1		14	6.3	1	4,C	2,8
6SC7	Right TT Preamp	1	Test #1	31	6.3	3	2,3	6,7
	Left TT Preamp	1	Test #2	30	6.3	3	4,5	6,7
12AU7	ITA Console	4	Test #1	25	*6.3	2	1,2	3,4,5
	Ampex 601	2	Test #2	25	*6.3	2	6,7	4,5,8
	Spotmaster	1						
12AV6	Spotmaster	1		25	12.6	3	1,7	2,3

ventive maintenance tube checks, a simple chart for each equipment room has been developed. The charts eliminate the need for finding proper tube checker settings for each tube as it occurs in each equipment.

A sample chart is shown. Column one shows the tube type. It is most convenient to arrange these in alphabetical order. Column two is for the equipment in which the tube is employed. All the equipment for each tube type is listed. Column three indicates the number of tubes in each equipment. Other columns tell the tube checker settings for each tube type. These will vary with individual tube checkers.

Charts should be made for each equipment room and posted in a convenient place or carried with the tube checker.

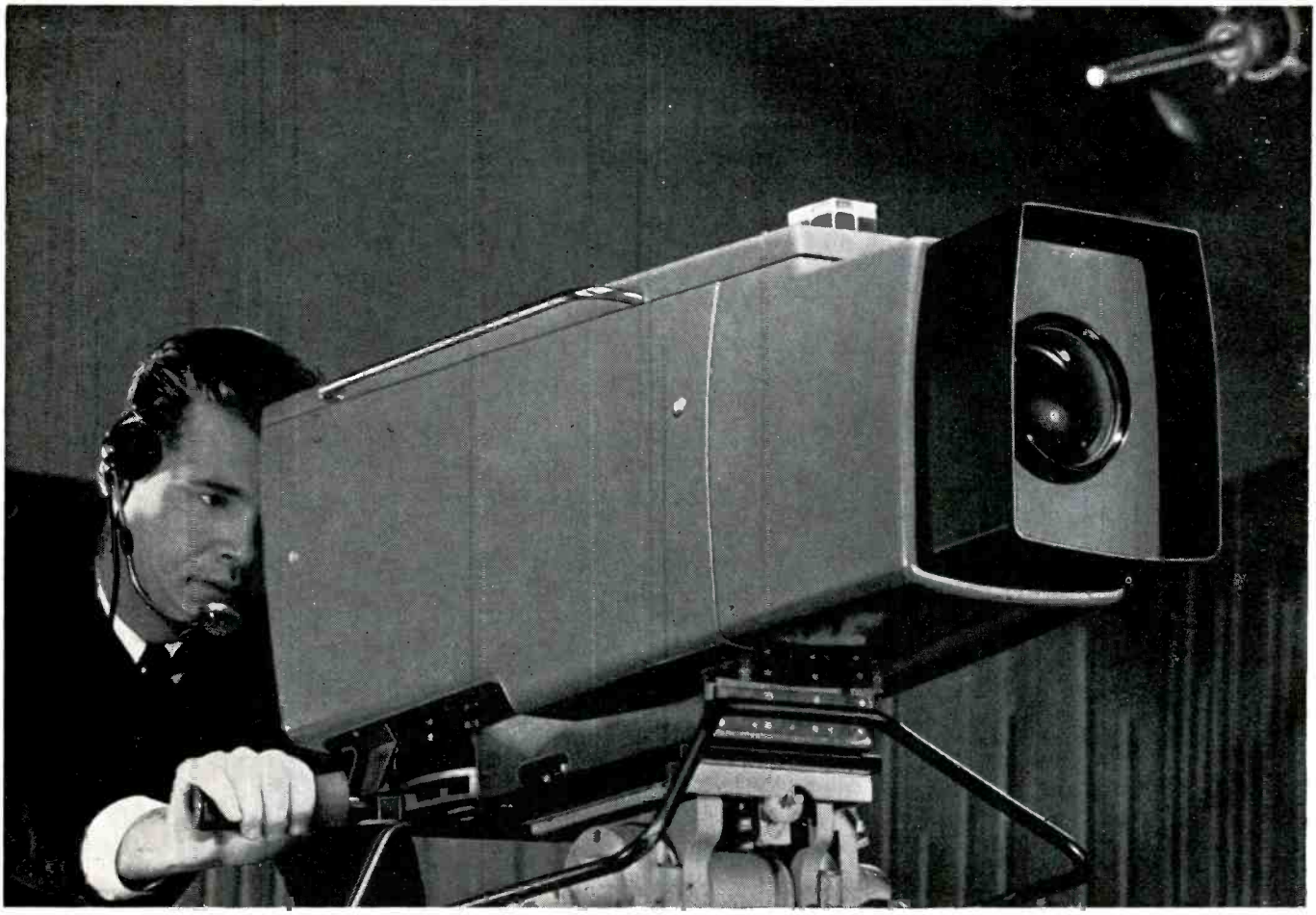
Impedance Measurement Comparison

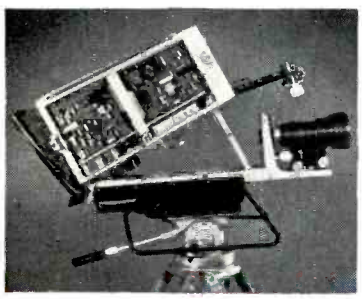
by W. Lindenbach
CFAM, CHSM
Steinbach, Manitoba

The device described permits reading impedance values on an ohmmeter by comparing them with a variable resistance. The unit consists of two potentiometers and two switches. One switch connects an AC VTVM alternately across the unknown impedance and across the two potentiometers, and the other connects either an AC VTVM or an ohmmeter across the two potentiometers. The potentiometers are adjusted so that voltage from an audio generator applied across the potentiometers and the unknown impedance in series is equally divided across the potentiometers in one position and the unknown impedance in the other. When this condition exists, the resistance of the potentiometers is equal to the absolute value of the unknown impedance.

To make a measurement, connect the unknown impedance to the terminals labeled UNKNOWN IMPEDANCE, short the INCREASE RANGE terminals, connect an audio oscillator to OSCILLATOR, and connect an AC VTVM and an ohmmeter to their respective terminals. Set the oscillator for the frequency of interest, and at an output sufficient for a mid-range reading on the VTVM.

Set the READ switch to AC VOLTS, the COMPARE switch to UNKNOWN IMPEDANCE, and take a reading on





VISUAL ZOOM IMAGE ORTHICON camera

The new concept TV camera that established the industry standard...Mark 10 Visual Zoom Camera. This camera combines the utmost in *production flexibility with superior pictures and low operating expense*. Here's how:

- built-in 10-to-1 Zoom lens
- small, maneuverable, lightweight; for studio or remote
- 3" I.O. with easy lighting, crisp pictures, improved S/N; high sensitivity; requires less lighting, less air conditioning
- long, stable operation; simple set-up; less maintenance through Solid State circuitry
- manufactured in New York of standard U.S. components with nationwide field service.

Write for complete information in Visual Bulletin 310.

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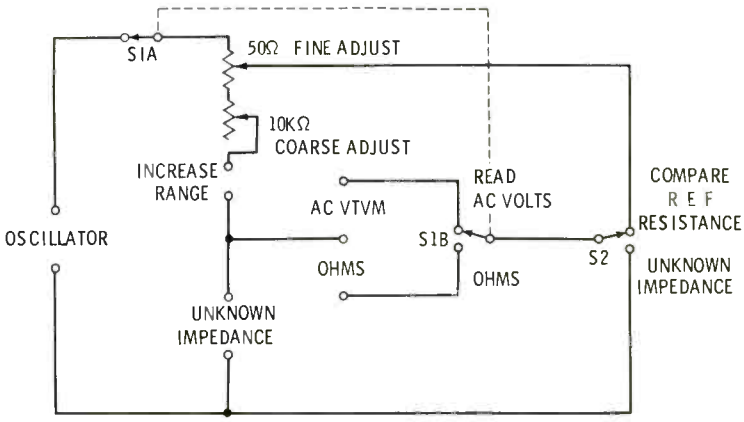
LOOK TO VISUAL FOR NEW CONCEPTS IN BROADCAST EQUIPMENT

Plan for the Finest in High Band VTR Color Performance.

THE CONTINENTAL

Visual/Allen Model V/A 100G
Master Color Video Tape Recorder



the VTVM. The COMPARE switch is now set to REFERENCE RESISTANCE, and the potentiometers labeled COARSE ADJUST and FINE ADJUST are set for a similar reading on the VTVM. Repeat these steps until the VTVM reads identically when the COMPARE switch is operated back and forth. Set the READ switch to OHMS, the COMPARE switch to REFERENCE RESISTANCE, and read the unknown impedance on the ohmmeter.

If it isn't possible to make the VTVM readings identical when adjusting the potentiometers, more resistance must be added at the INCREASE RANGE terminals.

The second portion of the READ switch, labeled "S1A," in series with the oscillator, opens the oscillator circuit when making resistance measurements. This is to prevent incorrect readings resulting from a DC path through the unknown impedance and the oscillator output circuit.

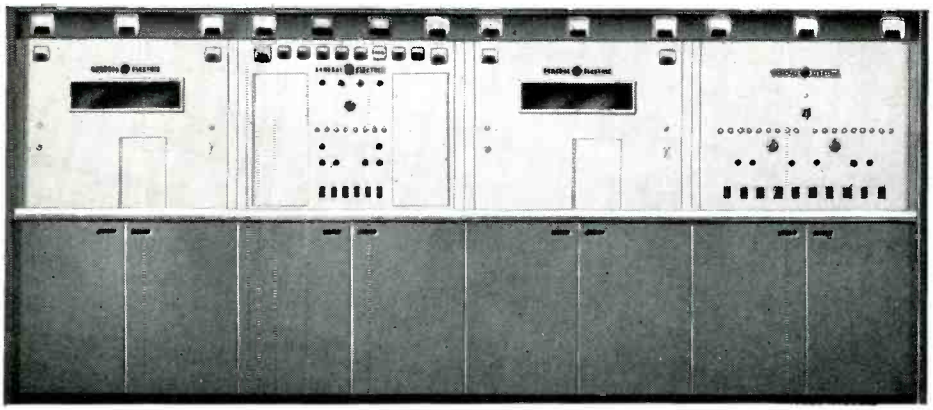
Accuracy of measurement depends on the ohmmeter alone. Up to 100 kHz, stray reactances do not present a problem even when a wirewound FINE ADJUST potentiometer is used. The COARSE ADJUST potentiometer should be carbon.

Modification to 866A Socket

by Ted Shireman
KALI
San Gabriel, California

The familiar 866A rectifier requires only two base connections (these are for the cathode), and the unused socket terminals make attractive tie points for other leads in the equipment. We found that this can cause problems.

Recurrent outages caused by blowing of the plate-circuit fuse in our 1100-volt DC bias supply seemed to happen about the same time of day. Placing a recorder on the power line enabled us to trace this to line-voltage surges caused when power-factor corrections were made at the local substation. The power company advised us it was not possible to eliminate the surges.



A 50 KW UHF-TV transmitter that delivers 50 KW's

You get a *full 50 KW's* of output power *on all UHF channels* from this General Electric UHF-TV transmitter.

General Electric spent 12 years perfecting the design—four, easily accessible, self-contained modular cubicles with new type Klystron tubes operating at improved efficiency in both visual and aural transmitters.

The vestigal sideband filter (low power) is inserted between 100 watt visual driver and the 50 KW amplifier. The outputs of the visual and aural amplifiers are connected to the slot diplexer with —3.58 MC trap—and the output is then fed right to the antenna.

G.E.'s *full line* of UHF transmitters is designed to FCC and EIA specifications for color and monochrome operation—all with remote control capability via external landline and/or microwave terminal equipment. Cubicle combinations are available for 15 and 30 and 50 KW, with visual to aural power ratios of 5-to-1 to 10-to-1.

If you'd like to learn more about this complete line of powerful transmitters, call your General Electric broadcasting representative.

He has the full power story.

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

GE-32

Visual Communications Products

GENERAL ELECTRIC

Circle Item 25 on Tech Data Card

Strangely, the tubes exhibited no signs of damage usual in the case of flashbacks, and there had been periods of several months in which no outages occurred. Finally, it was noted that the transmitter manufacturer had used one of the blank socket connections of each 866A tube as a tie point for the plate lead, placing a high potential on the tube pins and causing arcing inside the tube bases at the time of the power-line surges. Moving the plate leads to another location was the cure.

It appears that 866A tubes made by one manufacturer are more sensitive to this trouble than other makes. Replacing the tubes with another brand has cleared the trouble temporarily.

Electronic Fishing

by R. H. Coddington
Richmond, Virginia

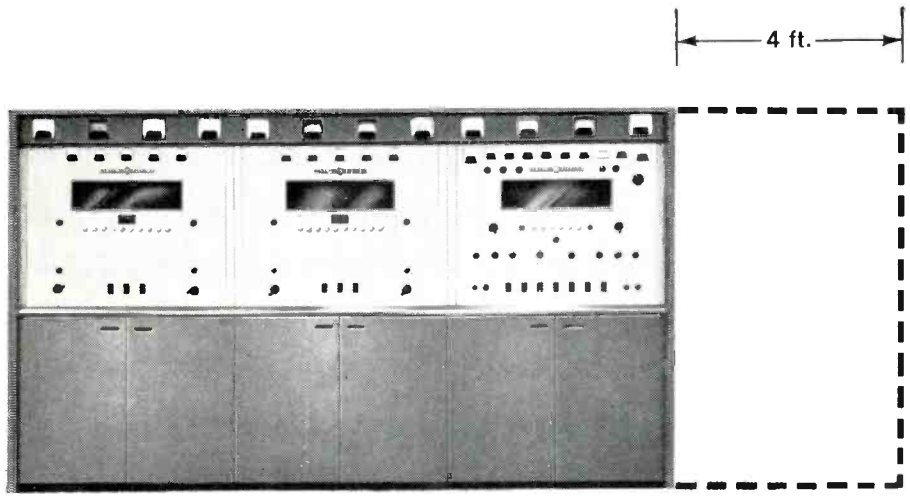
During reconstruction of control room patch bays, it became desirable to use a number of existing audio lines. The nearest access was at a conduit junction box, but the wires within were unmarked. Our problem was how to determine which in the large group of shielded twisted-pair lines were the ones we wanted to use.

Promiscuous cutting and testing seemed an improper approach, and needle prods do not work well through a shield, so an unusual solution was developed. To identify a specific pair, feed a 1000-Hz tone at one end, and terminate the other end with a matching resistor so there will be current in the line.

The resulting magnetic field is scarcely retarded by the braid, which is principally a static shield, and the cancellation attributed to the twisted pair is incomplete in close proximity to the conductors. Thus, there is some magnetic radiation.

An effective search probe is a slender ferrite antenna intended for an AM receiver. Connect its coil directly into a 50-ohm microphone channel on the console, and the 1000-Hz field can be found by fishing among the wires.

By adjusting the oscillator level so that the tone is just detectable when the probe is in intimate contact with the pair, identification of a single line within many is quick and positive. ▲



Save this much space with General Electric's 30 KW VHF-TV transmitter

It's 25% smaller than its closest competitor and gives you 5 KW more power. It measures only 144″ x 37″ x 83″.

The 3 self-contained, modular cubicles are easily accessible and air cooled. They're very simple to install and even more economical to operate and maintain.

The uncompromising quality of General Electric VHF transmitters assures optimum performance and makes it possible to attain maximum ERP at 5 to 1 power ratio.

Available in cubicle combinations for 1, 5, 10, 30 and 60 KW with visual to aural power ratios from 5 to 1 to 10 to 1.

G.E.'s full line of VHF transmitters is designed to FCC and EIA specifications for color and monochrome operation—all with remote control capabilities via external landline and/or microwave terminal equipment.

For further information, call your G-E representative. He'll give you the details on how to provide a lot more transmitting power in a lot less space. General Electric Company, Visual Communications Products, 7-315 Electronics Park, Syracuse, N. Y. 13201 GE-34

Visual Communications Products

GENERAL ELECTRIC

Circle Item 27 on Tech Data Card

NEWS OF THE INDUSTRY

INTERNATIONAL

Closed Circuit Satellite

The first use of a communications satellite to link stockholders and corporate executives on two continents via closed-circuit TV took place in May.

Warner-Lambert Pharmaceutical Company's president, Alfred E. Driscoll, conducted the New York end of the transmission, and Mr. Robert Gleckner, vice president of **Warner-Lambert International,** was the principal spokesman on the London end. The live video and audio transmission, which allowed for questions and answers from stockholders and executives, was produced and coordinated by **TNT International,** a division of **Theatre Network Television, Inc.**

The origination point in London was the **BBC Broadcasting House** where corporate executives from England, France, Germany, and Italy gathered to deliver brief reports on company activities in their countries.

At the annual meeting in the New York Statler Hilton Hotel, TNT's Eidophor projection system focused the picture from London via Early Bird on a large screen enabling everyone present to see the executives.

The video coverage was provided by linking the BBC Studio to Goonhilly earth station by land line, transmitted up to Early Bird and then to the United States earth station at Andover, Maine. From there, land lines carried the signal to the control center in the Statler Hilton. Two-way audio transmission was carried by submarine cable across the Atlantic.

The time of the meeting coincided with the period of peak telephone call traffic overseas, and COMSAT and the **ATT Long Lines Division** cooperated in arranging the clearance with 14 countries involved.

Educational TV for Nigeria

Television cameras will soon be focused on classroom activities deep in northern Nigeria to help train teachers. A complete closed-circuit television system will be delivered by **Dage-Bell Corp.,** a subsidiary of **Raytheon Company,** to Kano Teachers Training College. Equipment will include two studio cameras, a film chain, production and master control consoles, and a distribution system with 21 monitors throughout the college.

The educational television system will be used in the application of modern teaching techniques to accelerate the training of primary school teachers for the northern region, which has Nigeria's smallest percentage of children in primary school.

Five-year-old Kano College, with the help of a U. S. AID assistance program as well as faculty and administrative support from Ohio University, is accelerating teacher training in northern Nigeria so that up to 25% of the area's primary-age children will be able to attend school by 1970. Educational television and other modern teaching and learning devices will be used extensively in the program.

NATIONAL

Broadcast Subscription TV

Joseph S. Wright, president of **Zenith Radio Corporation,** has issued a statement in response to the FCC's "Further Notice of Proposed Rule

Making" on the subject of nationwide authorization of broadcast subscription TV. In his statement, Mr. Wright expressed pleasure with the FCC's step, and was confident that the Commission's analysis of the Hartford experiment could lead to subscription TV in seven major markets in which Zenith has already negotiated broadcast contracts. The statement stressed the supplementary role of the proposed service to regular TV.

Companies Merge

International Telephone and Telegraph Corporation stockholders have approved the merger of ITT and **American Broadcasting Companies, Inc.**

Harold S. Geneen, chairman and president of ITT, outlined for stockholders some of the significant aspects of the merger of ITT and ABC. He stated:

"The further diversification of (ITT) products and services will give improved balance to the combined companies' earnings and future economic potential in the rapidly growing consumer services area.

"There will result a dramatic increase in the size of our company. The combined revenues of ITT-ABC will exceed $2.5 billion for this year, meaning that the company will rise from 31st place among larger industrial companies in the United States to rank within the top 20.

"Given the added support of ITT's resources, it is reasonable to expect that under ABC's management it will further and perhaps more rapidly develop its position through the strengthening of its programming, color, and international sales capabilities.

"Television is only part of an amazing communications revolution in which ITT has already been extensively involved. Let me name a few of these: television, radio, the telephone, the computer, microwave, the transoceanic cables, satellites, facsimile, the transistor, and the laser beam."

Before the merger becomes final, approval must be obtained from the Federal Communications Commission and other appropriate government agencies. A favorable tax ruling with respect to the merger was obtained from the Internal Revenue Service on April 18.

200-Mile CATV System

A **Viking** Subsidiary, **Systems Construction Corp.** will engineer and build the New Castle, Pa., CATV System.

The 200-mile system, owned by **Neptune Broadcasting** and **Rushmore Newspapers,** will incorporate Viking Aluminum Sheath cable and the new 5000 series color-band amplifiers.

New Award

Approval has been obtained for the sponsorship of a new Gold Medal Award to be administered by **Society of Motion Picture and Television Engineers** annually.

The Award is to be known as the **Eastman Kodak Gold Medal Award,** and will recognize an individual selected by SMPTE "for outstanding contributions in the field of engineering development which lead to the introduction of new and unique educational techniques or programs utilizing motion pictures, television, high-speed and instrumentation, or photographic science." The award will recognize the development in equipment and systems that use the various technologies mentioned and result in advancing the educational process at any or all levels. Emphasis will be on directly advancing education rather than on contributions made initially for some other purpose and later found to be useful for educational purposes.

New ETV System

Broadcasting of instructional television has begun on the 2,500-mHz network of the 240-school system of the Roman Catholic Diocese of Brooklyn.

The two-channel system broadcasts in the uppermost UHF range via transmitters and special receiving equipment designed by **Varian Associates' Micro-Link Systems.**

The initial programming consists of lessons and experiments in science, art, language arts, and social studies—all for pupils in the first through tenth grades. Teacher training in modern mathematics also is conducted via TV.

Over the next two years, the $1.25 million Diocesan program calls for expansion of the transmission system to four channels to provide instruction to all school levels and for adult education programs, according to Father Michael J. Dempsey, assistant superintendent of schools and TV coordinator.

PROPERTY TRANSACTIONS

The assets of **The Capital Broadcasting, Inc.** owned by Frank Fitzsimmons and Cal Culver of Bismarck-Mandan, North Dakota, which operates Radio Station KBOM on 1270 with 1000 watts, have been bought by **Richard Power and Associates,** of Stillwater, Minnesota, for a price of $235,000 with terms subject to FCC approval.

Metropolitan Broadcasting Radio, a division of **Metromedia, Inc.,** has purchased radio station KEWB for the sum of $2,500,000, according to John V. B. Sullivan, division president.

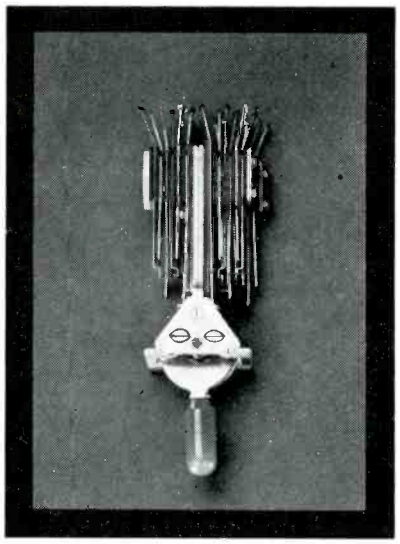
KEWB, formerly owned by Crowell Collier Co., is located in Oakland, California, and serves the greater San Francisco Metropolitan Bay Area.

Varner Paulson, vice president of Metropolitan Broadcasting Radio, and formerly program director for Metromedia's WNEW, New York, will serve as general manager for KEWB.

Mr. Sullivan said, "Significant program changes are contemplated for KEWB in the very near future." KEWB has specialized in a "rock and roll" music format directed primarily at teenage audiences.

In addition to its new ownership of KEWB, Metromedia owns and operates stations WNEW, New York; KLAC, Los Angeles; WIP, Philadelphia; WHK, Cleveland; WCBM, Baltimore; and KMBC, in Kansas City.

Just recently, Metromedia announced its purchase of



The pop-click-hum bug is dead.

Collins' new Speech Console hasn't a mechanical contact in the program circuits.

Photoconductive cells instead of relays and switches.
No contacts to wear and get dirty. Nothing at all to keep clean. Result: your most troublesome maintenance problem is ended. Also: no pops, clicks and hums from mechanical switches. Your audio is the cleanest, clearest audio on the air.

A lot less wire (and a lot less hum).
Audio doesn't have to travel to front panel and back. This means you have a lot less wire to pick up noise. (There is no noise, either, from attenuators. They are sealed in protective capsules.)

Module design ends time-wasting troubleshooting.
Simply take out one card and plug in another. Replace attenuator, input switches, and amplifier output switches with one quick shuffle of cards.

The Collins solid state 212S-1 is for stereo and dual channel operation for FM, AM and TV stations. The companion 212M-1 Console has fewer modules for mono program and monitor outputs.

For details, call your Collins representative. Or write: Broadcast Communication Division, Collins Radio Company, Dallas, Texas 75207.

This is the Collins 212S-1 that killed the pop-click-hum bug.

COLLINS

COMMUNICATION / COMPUTATION / CONTROL · COLLINS RADIO COMPANY / WORLD HEADQUARTERS / DALLAS, TEXAS

Circle Item 32 on Tech Data Card

the San Francisco FM radio station KSFR, as an addition to its growing number of FM stations located throughout the country.

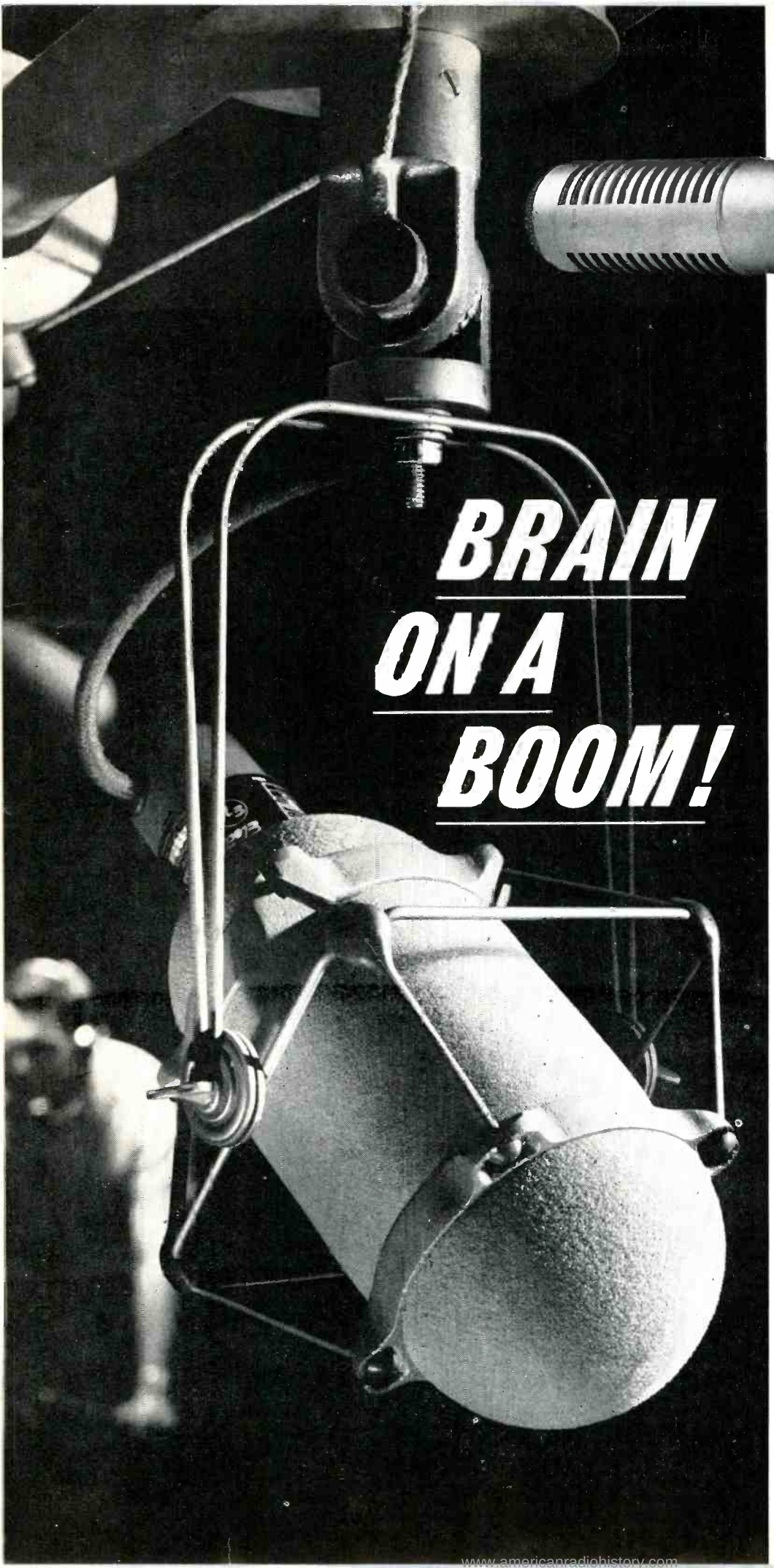
PERSONALITIES

Forrest D. Rees has been appointed field engineer and **Denton Allen** has been named systems test engineer at the **Allen Electronics** facility, Palo Alto, California. Announcement came from parent **Visual Electronics Corporation.**

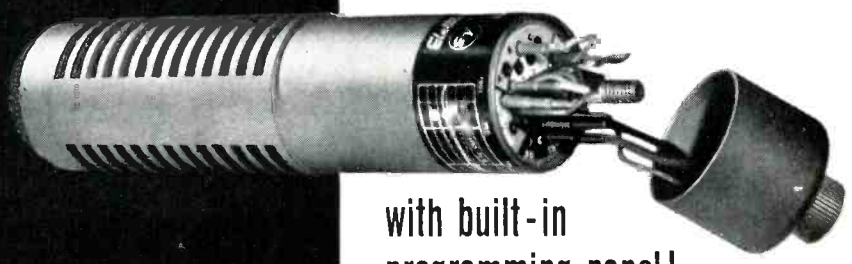
Mr. Rees will perform field engineering duties on the Allen VTR program in the West Coast area. Prior to joining Allen, Mr. Rees supervised in Kaiser Broadcasting Corporation's field pickup and video taping operations.

Forrest D. Rees

Denton Allen



New E-V Model 668 Dynamic Cardioid Boom Microphone



with built-in programming panel!

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

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

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

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

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

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

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

ELECTRO-VOICE, INC., Dept. 761V
638 Cecil Street, Buchanan, Michigan 49107

Electro-Voice®
SETTING NEW STANDARDS IN SOUND

Circle Item 36 on Tech Data Card

He attended the University of Toledo and the DeVry Technical Institute in Chicago.

Mr. Allen will conduct the system testing of the new Visual/Allen Continental VTR products line, as well as the various Allenized VTR machines now produced at the Palo Alto facility.

Eugene R. Hill, director of engineering for **Kaiser Broadcasting,** has announced the promotion of two engineers at WKBS, Channel 48 in Philadelphia. **Gene Gildow** has been named to the post of chief engineer of WKBS, and **Arden Woofter** has been named as technical advisor for transmission systems for Kaiser.

Prior to his appointment, Mr. Gildow was on the WKBS engineering staff. He had formerly served as chief engineer for station WPTA, Fort Wayne, Indiana.

Before assuming his corporate duties, Mr. Woofter had been acting chief engineer for WKBS.

Dennis William Sparks has been appointed vice-president, technical operations for **Spencer-Kennedy Laboratories, Inc.** He will be responsible for all product engineering and manufacturing. Other appointments include eight new district managers and Mr. **Donald Le Mire** as product manager for the precision instrument line and field support specialist for cable system sales. New district managers are **Robert Gault, Bruce Frazier, William Asip, Lawrence Whitehead, Robert Hatter, William Bryant, Robert Lemmon** and **William Laskey.**

Robert E. Ramsey has been named vice president of operations of **Continental Electronics Manufacturing Co.,** and **Continental Electronics Systems, Inc.,** subsidiaries of **LTV Electrosystems, Inc.**

President James O. Weldon said the promotion recognizes Ramsey's significant contribution during the past two years in achieving technical continuity control and timely accomplishment of Continental Electronics projects throughout the free world.

Ramsey, an electrical engineer and member of the IEEE, joined the firm in 1958, and progressed through engineering and management assignments to director of operations prior to this promotion. ▲

HIT OF THE SHOW

Once again the Norelco exhibition was outstanding in attraction and performance . . . and the Norelco Plumbicon* is now firmly acclaimed the pickup tube for *modern cameras.*

The new Norelco PC-70 Color Camera introduced at the NAB, features operational simplicity, short warm-up time, stabilized deflection circuits, built-in test functions and newly designed solid state camera controls utilizing both transistor and integrated circuitry.

The Norelco PC-70 Plumbicon Color Camera permits hours of "hands-off" operation and precise color matching between cameras . . . even for close-up flesh tones and over wide variations of light levels—including highlights and shadows.

Performance at the show was obvious. The Norelco three-tube Plumbicon cameras functioned faultlessly throughout . . . clearly demonstrating the advantages of the three-tube system in producing unmatched resolution, sharp and snappy pictures in both color and black-and-white. The color was magnificent under an array of textures and hues and lighting conditions. It can be magnificent for you too! That's why we say, "Color it Faithful"—with Norelco Plumbicon Color Cameras.

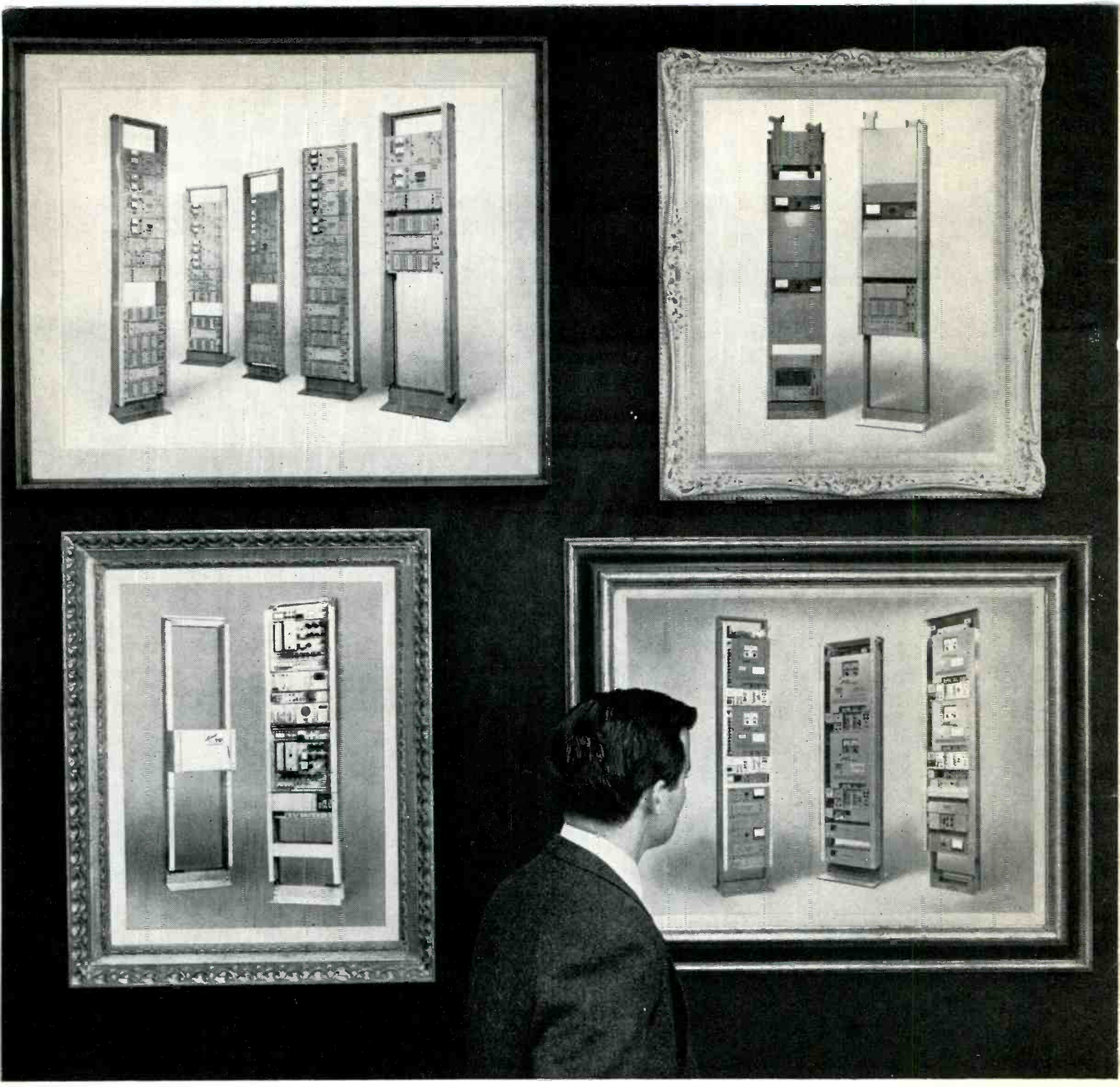
**PLUMBICON is a registered trademark*

Norelco® STUDIO EQUIPMENT DIVISION

NORTH AMERICAN PHILIPS COMPANY, INC.
900 South Columbus Avenue, Mount Vernon, New York 10550

2-66

Circle Item 40 on Tech Data Card



Microwave masterpieces

Lenkurt's gallery of 12 microwave systems . . . put them all together and you have an exhibit unmatchable *anywhere* in the world.

For instance, take our widely-used light route 71 radio systems that provide high quality service for up to 48 multiplex voice channels in the 450 mc band and up to 300 channels in the 2,000 mc band.

Then, there's our time-proved 300 channel 74B that provides high quality, point-to-point communications for common carrier, industrial and government systems.

And, of course, there's our 1 watt solid-state 76 series microwave radios handling up to 960 channels for commercial, industrial, and government services, as well as TV applications. Or our long haul solid-state 5 watt 75 series with heterodyne repeaters.

But just as important as our equipment is our philosophy. Simply stated it's this: We never squeeze you to fit one of our systems. Instead, we tailor a system to fit your needs. It's part of Lenkurt's heritage and reputation for quality and continuity.

When you're thinking of going microwave, get into the picture with Lenkurt. And smile.

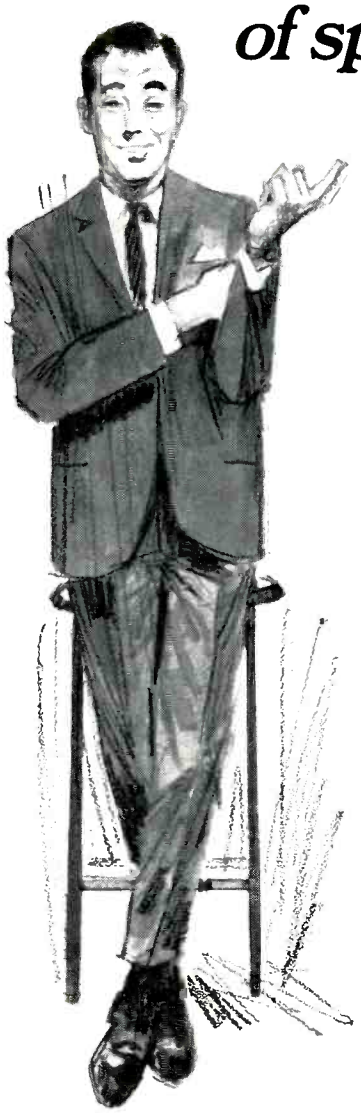
Lenkurt Electric Co., Inc., San Carlos, California. Other offices in Atlanta, Chicago, Dallas, and New York City.

LENKURT ELECTRIC

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS GT&E

Circle Item 41 on Tech Data Card

Of course I can sell $65 worth of spots a week!



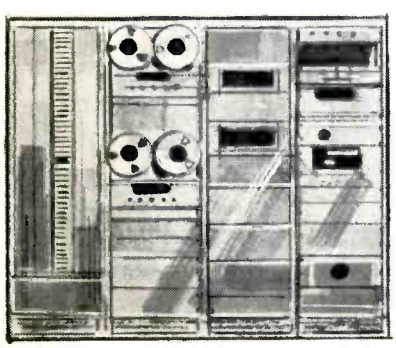
Then you can afford ATC automation right now!

It's a fact. ATC can automate your station for as little as $65.00 per week. In many cases, even less.

You can buy the equipment outright. Or finance it. Or lease it. And simply sell a few more spots a week to pay for it.

Whichever way you choose, one thing is certain. The benefits will completely overshadow the cost.

What benefits? Well, you'll free your announcers from purely mechanical control room work.



Make them available for more productive pursuits. Producing better programs. Better commercials. Better newscasts. More sales.

The beauty of ATC automation is that you buy only what you need. Then if you want to expand, you just add on. And still use the original equipment.

ATC has designed the most comprehensive line of modular automation components in the industry. (In fact, we pioneered the whole thing.)

The Criterion tape cartridge unit. The ATC-55 multiple tape cartridge handler. Stereo and monaural tape sources. Even a unit that prints the official log automatically as the material is being broadcast.

Plus three different automation control systems: (1) by punch card, (2) by magnetic tape, (3) by a time/sequence device.

Automation needs vary from station to station. Our job is to prescribe the system that will best accomplish what you want and what the budget will allow.

All our people are broadcasters. They speak your language.

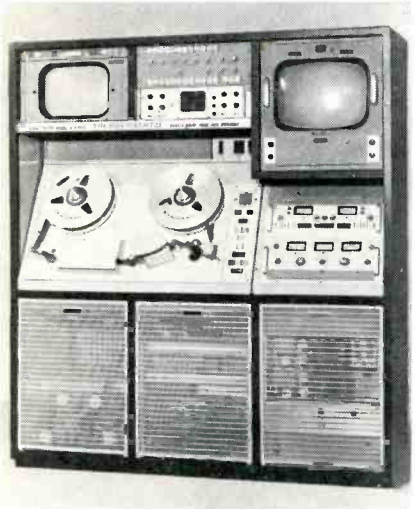
To hear them speak it, call 309-829-7006 or write for descriptive literature.

AUTOMATIC TAPE CONTROL INC.

1107 E. Croxton Avenue
Bloomington, Illinois

Circle Item 42 on Tech Data Card

NEW PRODUCTS



New Color VTR's
(60)

Two new high-band color video tape recorders — Model V/A100G, called the Continental, and Model V/A50G — have been unveiled by **Visual Electronics Corp.** and **Allen Electronics Corp.** The Model V/A100G is enclosed in a console housing also containing a Tektronix 529, modified pulse-cross monitor, and 17-in color monitor. The tape transport is mounted at a 60° angle in a removable subhousing, incorporating tape-transport controls, adjustable in position to suit operator preference.

The headwheel assembly is designed to provide improved high-band performance with long head life. The acoustically shielded air system is mounted in one location, facilitating adjustment and servicing.

The signal control panel provides for selection of audio/video inputs, waveform and picture monitor selection, and color monitor selection. Also provided are playback processing controls. The audio system has two identical channels — one for audio and one for cue. Remote control of tape-transport operating and video-processing controls is available. An alarm panel gives indication of any dangerous condition or loss of important function. A footage counter shows local and remote resettable minutes and seconds counts. The tape transport features a tachometer control of tape tension, centrifugal reel locks, and other improvements.

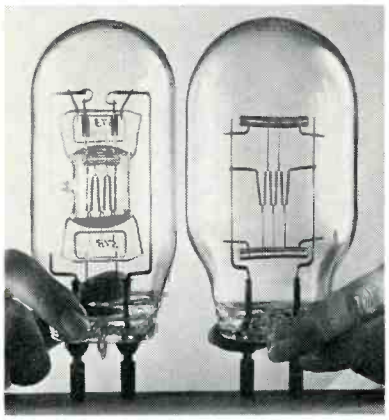
The second model, the V/A50G, is described as a standard economy package for stations with limited budgets.

Panel-Mount Square Potentiometers
(61)

All wirewound and nonwirewound

square adjustment potentiometers of the **TRIMPOT Division** of **Bourns, Inc.** are now available in panel-mount styles. These include the ½"-square Models 3250 (wirewound), 3251 (non-wirewound), and 3255 (wirewound, industrial), as well as the ⅜"-square Models 3280 (wirewound) and 3281 (nonwirewound).

No derating is recommended; the units are intended to offer the same electrical and environmental characteristics as standard types. Sealed bushings make them suited for potting applications.



Spotlight Lamp
(62)

The first of a new family of incandescent spotlight lamps for use in motion picture, television, and photograhic studios; theater stages; and display and architectural lighting has been introduced by **General Electric's** Large Lamp Department. It is a 750-watt tungsten-halogen light source (left in photo) with a planar filament, and operates at a color temperature of 3200°K for studio or stage use. The new lamp has been developed to give four times longer life, four and one-half times greater total light output over life, higher stability of light output and color, and a more compact size than the lamp it directly replaces (right in photo.) The primary application is in focusable, lens-type spotlights.

A Quartzline lamp is the light source and is mounted inside a glass outer bulb, which has a medium bi-post base. In the new lamp, bromine is used instead of iodine as the regenerative agent to make the light free from the pinkish tint sometimes associated with other halogen-cycle lamps.

The increased life of the lamps is attributed not only to the halogen cycle, but also in part to the atmosphere of inert gas in which the filament tube operates. This gas protects lead-in wires against oxidation, and eliminates the need for the seal-temperature limitations associated with unjacketed Quartzline lamps.

List price of the lamps is $32.10.

Motorized Antenna Switch Matrix
(63)

A motorized version of a recently patented antenna switching matrix has been developed by **Delta Electronics, Inc.**

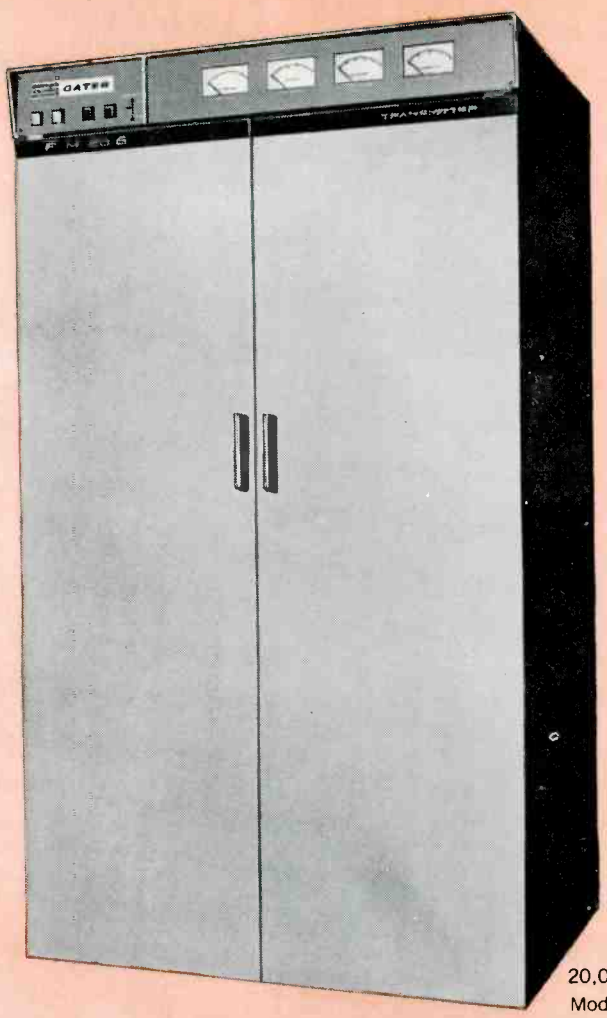
The Model SLS-1M matrix is capable of connecting any number of transmitters to any number of antennas. Motorization enables the operator to control switching from a location remote from the switching matrix. The control console is compact for installation on standard component racks.

Motor-driven lineal actuators accomplish switching within the matrix itself. Each switch in the matrix can handle an average power of 50 kilowatts at frequencies up to 30 mHz. Peak power rating is 200 kw. Characteristic impedance is listed as 50 ohms. VSWR as 1.15 or less, and cross-channel isolation as 65 db or better.

The switch mechanism is a plunger type which removes all residual stubs from active circuits; design utilizes a strip-line technique. Included is an interlock system to prevent accidental feeding of one transmitter into another, or two transmitters into one antenna.

The matrix has no vacuum components, and all parts are replaceable in the field.

The soundest sound in FM is the new sound of GATES



20,000-watt
Model FM-20G

POWER UP
SPACE DOWN

with the Gates all-new 20,000-watt FM transmitter Model FM-20G

Here's top power at lowest per hour operating cost in a compact space-saving cabinet arrangement. The new Gates FM-20G provides maximum installation flexibility. Power supply is 100% solid-state and only one 4CX-15,000A ceramic tetrode delivers 20,000-watts output. This brand-new Gates FM-20G Transmitter is another reason why the soundest sound in FM is the new sound of Gates. *Send today for complete description and specifications.*

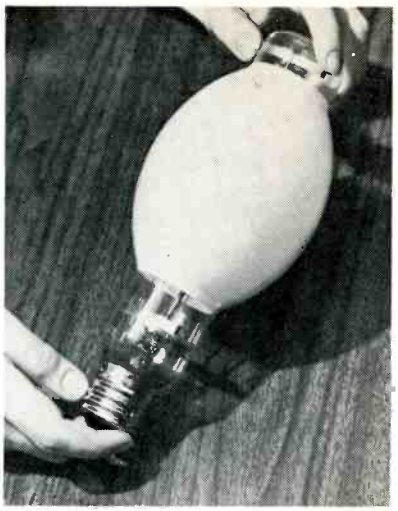
HARRIS INTERTYPE CORPORATION

GATES

GATES RADIO COMPANY • QUINCY, ILLINOIS 62302, U.S.A.

A subsidiary of Harris-Intertype Corporation

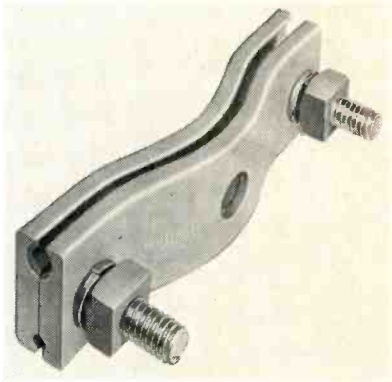
Circle Item 47 on Tech Data Card



Color Arc Lamp
(64)

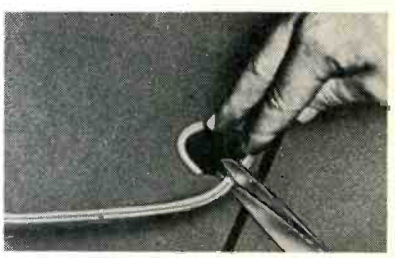
A long-life color arc lamp for greater illumination and lower power requirement than incandescent lamps of similar color temperature is a new product of **Sylvania.** The lamp, initially available in a 400-watt size, is designed for color TV, motion-picture, and commercial-photography applications.

Vertical operation gives 3200-3600°K, while the horizontal range is 3400-3800°K. The 400-watt lamp gives 85 lumens per watt, which is more than twice that of incandescent lamps at 3400°K. Life expectancy should be about 7500 hours. Installation may require socket changes and the addition of ballast.



Support Clamp
(65)

One groove of this support clamp accommodates insulated stranded support members of ¼-in. and 5/16-in. diameters. The other groove accommodates insulated solid support members of .109-in., .134-in., and .148-in. diameters. The design of this high-tensile aluminum clamp installed with ½-in. or ⅝-in. standard through-bolt, prevents spiral migration and longitudinal pull-through; the clamp grooves hold securely yet minimize insulation crushing. For cross-arm installation, a cross-arm bracket assembly is available. Catalog designation of this tangent support clamp is IM-931, accepted by REA per Specification PE-48. The clamp is a product of **Superior Cable Corporation.**



Strip Grommet Material
(66)

Electrovert grommet strip is a U-shaped, strip-type grommeting material extruded from natural polyethylene, a flexible material that is resistant to atmospheric gases, ozone, dampness, acids, and oils. The strips are available in five sizes, to fit material varying in thickness from 20 gauge to ¼" plate. The strip is applied by fitting the U-shaped channel over the metal, around the hole, and cutting the strip to form a butt-joint. No adhesive or special tools are necessary. The material is packaged in 75-ft. lengths.

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

75. AMPEX — Application Engineering Bulletin No. 11 is a 14-page discussion concerning the design and application of tape reels for instrumentation, computer, video, and audio recording. Literature includes NAB standards for precision and non-precision reels and hubs. Offer extends to VR-1100, VR-1100E, and VR-1200 video tape recorders and to Teleproduction accessories.
76. ATLAS SOUND — Catalog 566-67 describes new models of public address loudspeakers, microphone stands, and accessories for commercial sound applications.
77. BAUER ELECTRONICS CORP. — Brochure illustrates product line including audio consoles from 5 to 30 channel inputs (some in kit form), AM and FM transmitters, and automatic logging equipment.
78. QUAM-NICHOLS — General catalog lists speakers for new installation and replacement in public address, background-music, hi-fi, and automotive systems.
79. VIKING OF MINNEAPOLIS — Six-page leaflet outlines specifications of tape cartridge handlers, recording and playback amplifiers, cabinets, and cartridges.

CATV EQUIPMENT

80. BLONDER-TONGUE — Colored folder shows typical application of UHF/VHF/FM master antenna systems.
81. FINNEY — Material provides specifications for various antennas: Form 20-340 for master system antennas — heavy duty gamma matched; Form 20-249 for 300-ohm, single channel Yagi's; and Form 20-353 for 75-ohm broadband.

COMPONENTS & MATERIALS

82. HARVEY RADIO — 512-page catalog contains a special broadcast and professional equipment section.
83. MICROWAVE ASSOCIATES — A short-form 24-page catalog contains complete electrical and mechanical specifications for mixer and detector diodes, power varactors, PIN switching diodes, tuning varactors, harmonic generator circuit characterized varactors, tunnel diodes, and Schottky-Barrier diodes. Technical bulletins detail a new series of broadband balanced mixers and electromechanical coaxial switches.
84. TEXWIPE — Folder includes sample of "Optic-Cloth," designed to clean and polish coated optics.
85. WORKMAN — Coil cross-reference catalog #103 refers other manufacturers' parts numbers to Workman numbers.

MICROWAVE DEVICES

86. AEL — Short form catalogs available are: Bulletin #10-1.1 covering entire microwave line, Catalog #20-50 for antennas, and brochure for varactor diodes. A 20-page brochure describes and illustrates the entire antenna line.
87. EMCEE — Details are offered on a one-watt transistorized VHF TV translator Model SSV-1, which may be powered from a thermoelectric generator.

MOBILE RADIO & COMMUNICATIONS

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

POWER DEVICES

89. EN-POWER — Sheet outlines properties of rechargeable sintered-plate nickel-cadmium "D" battery.
90. HEVI-DUTY — Bulletin 7-22 supplies data on line-voltage regulator using saturable-core reactor.

RADIO & CONTROL ROOM EQUIPMENT

91. ATC — Spec sheet gives details on Model STC-9 programmer designed to provide automatic program control at low cost.

REFERENCE MATERIAL & SCHOOLS

92. CLEVELAND INSTITUTE OF ELECTRONICS — New pocket-size plastic "Electronics Data Guide" includes formulas and tables for frequency vs. wavelength, db, length of antennas, and color code.
93. MARCONI INSTRUMENTS — 24-page booklet discusses non-linear distortion in audio amplifiers. Contains tables and methods of measurement.
94. PRECISION EQUIPMENT — Wall chart provides hard-to-find conversion tables and factors such as horsepower to BTU and kilowatts to foot pounds.
95. HOWARD W. SAMS — Literature describes popular and informative technical publications; includes latest catalog of popular books.

STUDIO AND CAMERA EQUIPMENT

96. CLEVELAND ELECTRONICS — Data concerns modifications using new yoke assembly to update 3" image-orthicon cameras.
97. TELEVISION ZOOMAR — Literature is offered on low-cost 10 × 40, 10:1 image-orthicon zoom lens, and on Autocam programmed remote control for TV cameras.

TELEVISION EQUIPMENT

98. BALL BROTHERS RESEARCH — A four-page pictorial brochure describes the AGC-VIII Automatic-Gain-Control Video Amplifier. Specifications on the amplifier are included.
99. COLORADO VIDEO — Available is data on the model 302 Video Analyzer which allows chart recording of "line selected" video waveforms on either the horizontal or vertical axis.
100. TOPAZ — New product announcement covers a series of transistorized sine-wave output inverters. A catalog for the full line of inverters and frequency changers is also offered.
101. VITAL — Data sheets give specifications of model VI-500 stabilizing amplifier, Model VI-10A video-distribution amplifier, and Model VI-20 pulse-distribution amplifier.

TEST EQUIPMENT & INSTRUMENTS

102. API — Bulletin 46 presents performance data and specifications for a series of magnetic contact meter relays used to actuate an alarm or shut down equipment.

TOOLS

103. CHANNELLOCK — New Catalog #66 covers complete line of Channellock tools. Includes recently expanded line of small "Little Champ" precision pliers.

TRANSMITTER & ANTENNA DEVICES

104. DRESSER-IDECO — Series of pamphlets describes services, facilities, and examples of very tall guyed, self-supported, and candelabra antenna towers for AM, FM, and TV.

Advertisers' Index

Professional Services

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

JAMES C. McNARY
Consulting Engineer
National Press Bldg.
Washington 4, D. C.
Telephone District 7-1205
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CARL E. SMITH
Consulting Radio Engineers
AM, FM, TV and CATV
8200 Snowville Road
Cleveland, Ohio 44141
Phone: 216-526-4386
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CAMBRIDGE CRYSTALS
PRECISION FREQUENCY MEASURING SERVICE
SPECIALISTS FOR AM-FM-TV
445 Concord Ave. Phone 876-2810
Cambridge, Mass. 02138

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

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

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

Classified

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

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

EQUIPMENT FOR SALE

RADAR—RCA Model CR-101 marine radar, 120 VAC, in good operating condition. 35KW "X" band transmitter, 12" PPI indicator, ranges to 50 miles. Make a fine local area weather radar. $1500.00 FOB Chicago. Write P.O. Box 71, Northlake, Illinois 60164. 7-66 2t

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

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

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

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

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

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

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

AMPEX HEADS replaced in your 3 head 300, 350, 351 assembly. Our heads are manufactured under controlled laboratory conditions and are guaranteed to meet or better original equipment specifications. Full track and half track $97.50. We will send free brochure. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California. 4-66-6t

AMPEX HEAD RECONDITIONING SERVICE for 300's, 350's, 351's and 354's, includes the relapping of worn or grooved heads, and the same complete alignment and quality control testing as new head replacements. Full and half track assemblies $45.00, two track $60.00. TABER MANUFACTURING & EQUIPMENT CO., 2619 Lincoln Ave., Alameda, California. 4-66-6t

AMPEX VIDEO TAPE RECORDER AUDIO HEAD ASSEMBLIES REBUILT. Assemblies with cue track lapped $100.00, without cue tracks, $80.00. New heads for assemblies without cue track $220.00, with cue track $310.00. Assemblies without cue converted with four new heads $350.00. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave. Alameda, California 4-66-6t

EQUIPMENT FOR SALE

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

USED, in perfect physical and electrical condition: RCA TK-21C Film Camera Chains; RCA TP-11C Multiplexors; EK-250 16mm Projectors; RCA/HF TD-5A Camera Dolly (2); H/F Microphone Booms; RCA TG-2 Studio Sync Gen. Write or call TELEQUIP CORP., 224 Glen Cove Ave., Glen Cove, N. Y. Tele. No. 516-671-6806 7-66-1t

Mica Transmitting Capacitor G-5, .00015, 35kv, brand-new Sangamo, list price $200. Sacrifice for $150. Got it through shipping error. This size is not stocked. Contact: B. Boehm, WORL, Boston, Mass. 7-66-1t

EQUIPMENT WANTED

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

Employment

SUPERVISING ENGINEER — Graduate electrical engineer with at least 5 years A.M. Broadcast transmitter experience, first class license desirable, for administration, supervision and training assignment at church related shortwave radio station in Ethiopia. For application and further details write Engineering, Box 654, Addis Ababa, Ethiopia. 7-66-4t

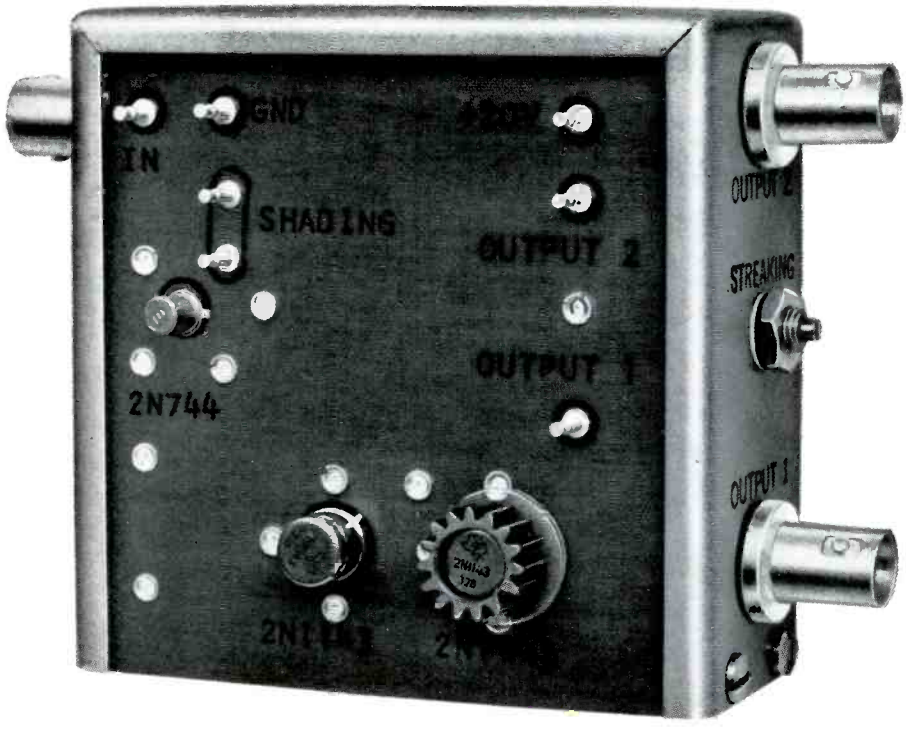
1st Class Engineer with broadcast experience. Excellent working condtions, salary open. WRMN AM&FM, Charles Pettit, 18½ Douglas Ave., Elgin, Illinois—312-741-7700. 6-66-tf

WANTED — Technicians for closed circuit systems planning — closed circuit — color television — video tape maintenance or supervision of installations of RCA equipment. 143-08 94th Ave, Jamaica, New York. 297-3336. 6-66-tf

Immediate Openings with radio and TV stations in all parts of the country for chief engineers, and both transmitter and studio engineers. Send resume today to: Nationwide Radio & TV Employment Agency, 645 North Michigan Avenue, Chicago, Illinois, or call Area Code; 312-337-7075. 5-66-tf

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

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



On-the-air proven

International Nuclear's transistorized TCA3 camera amplifier is used successfully by hundreds of TV stations throughout the world. On-the-air proven in TK10/TK30, TK11/TK31, 4PC4A1 and TA124E cameras. Fits any image orthicon camera (3¼" x 3¼" x 1¼"). Completely transistorized and very simply mounted within the camera. Microphonics are eliminated. Operating voltage obtained from 285 volt source already in camera and is post-regulated. A transistor protective device is included in case the high-voltage blocking capacitor at the image orthicon anode should short-circuit. Signal connectors are made through BNC type connectors as well as through solder-terminals. TCA3 circuit uses but three transistors, all proven EIA types. Output stage delivers signals for view-finder as well as camera chain. Peaking and streaking controls included and are easily adjusted by use of standard RETMA resolution chart. Instructions, necessary hardware and pre-cut cables included.

INTERNATIONAL NUCLEAR CORP.

PRICE, F.O.B. NASHVILLE . . . $295.00 EACH

For more complete information write or phone:

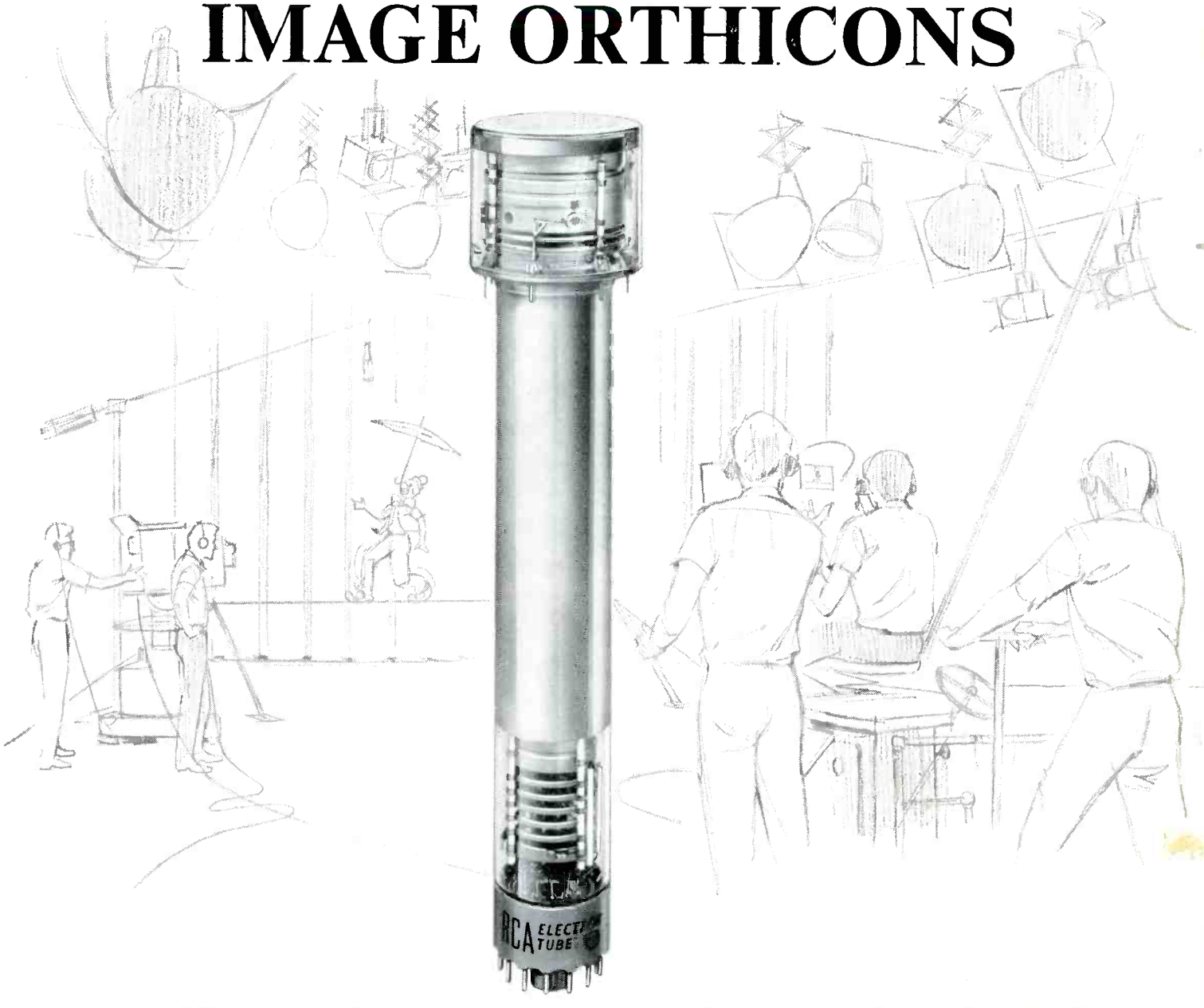
INTERNATIONAL NUCLEAR CORPORATION

"Transistorizing the Television Industry"

608 NORRIS AVENUE • NASHVILLE, TENN. • PHONE 615-254-3366

Circle Item 52 on Tech Data Card

RCA color capability
IMAGE ORTHICONS



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

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

8092A/S For Unequalled Remote Color Pickup

AVAILABLE FROM YOUR RCA BROADCAST TUBE DISTRIBUTOR

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

The Most Trusted Name in Electronics

Circle Item 53 on Tech Data Card