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Circle Item 1 on Tech Data Card

THE 4-400A IN AM TRANSMITTERS

by *Thomas R. Haskett,* Consulting Author, Broadcast Consultant, Cincinnati, Ohio — A review of the circuits in which this tube is used and some useful troubleshooting hints.

At least six major manufacturers of 1-kw AM transmitters in use today employ 4-400A's as both modulators and power amplifiers. In these two stages, the circuits used in the Bauer 707, the CCA AM-1000DK, the Collins 20V-3, the ITA AM-1000A*, the RCA BTA-1R or 1R1, and the new Visual 1-kw AM are very similar. Due to the similarity in circuitry, some faults are common to all, and these faults require similar common troubleshooting procedures. Once you understand the basic configuration, you can work with any of these rigs more easily.

Tube Characteristics

The 4-400A is a beam-power tetrode employing a directly-heated, thoriated-tungsten filament. Nominally 5 volts, filament voltage should not exceed limits of 4.75 to 5.25 volts. Required current is 14.5 amperes. The tube must be operated in a vertical position with the base downward. This base is a metal-shell giant with 5 pins, and the shell must be grounded by means of spring fingers. The plate connection is brought out to a metal cap atop the glass envelope, and a heat-dissipating (finned type) plate connector must be used here. The 4-400A runs extremely hot—the base at 200°C (393°F), the plate cap at 225°C (437°F)—and forced-air cooling must be used. The manufacturer recommends that air flow be applied simultaneously with filament power and that the column of air be directed upward through the base toward the bulb. All transmitters using 4-400A's are therefore interlocked so that filament power is removed whenever the blower stops.

As a class-AB1 modulator (as used here), maximum ratings are: plate voltage, 4000; plate current, 350 ma; plate dissipation, 400 watts; screen voltage, 800. Maximum power output is approximately 1000 watts. As a class-C plate modulated RF power amplifier (also used here), maximum ratings are: plate voltage, 3200; plate current, 275 ma; plate dissipation, 270 watts; screen voltage, 600. Maximum power output is about 800 watts.

*ITA is no longer a transmitter manufacturer, but many ITA transmitters are in use, and parts are still available (see "Letters to the Editor" in the February 1965 issue).

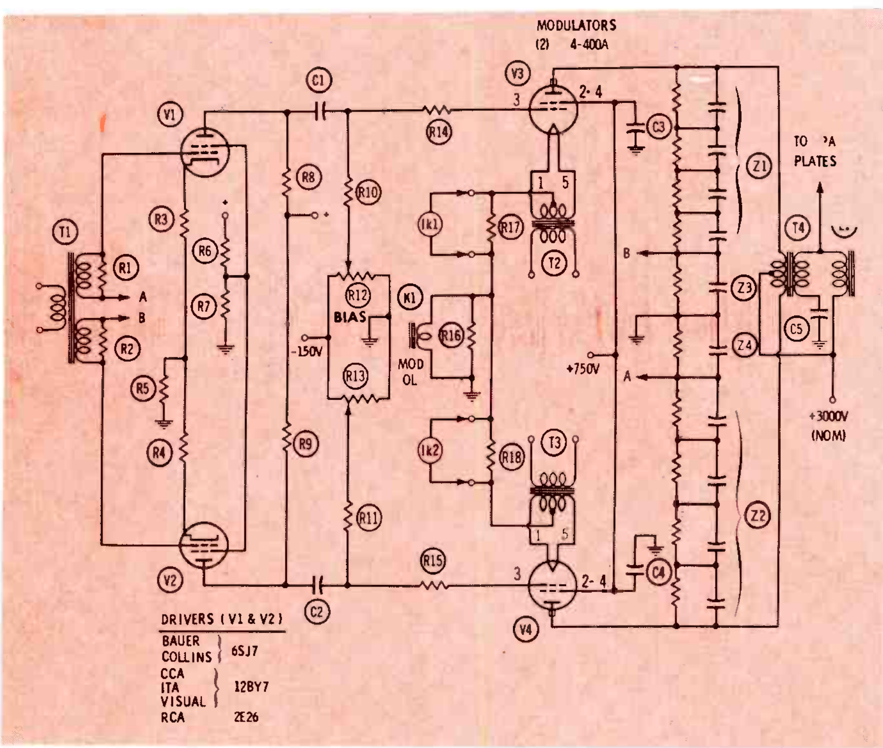


Fig. 1. This simplified schematic shows some typical features of modulators using 4-400A.

Modulator Circuit

Fig. 1 is a simplified diagram illustrating modulator features common to most transmitters. Audio is applied to the primary of input transformer T1, in the range of +4 to +10 VU. T1 has a split secondary to feed the grids of V1-V2, the drivers, in push-pull. A portion of the driver bias is provided by voltage drop across cathode resistors R3, R4, and R5. As R3 and R4 are separate and unbypassed, they provide current feedback which tends to equalize tube differences and balance the stage. Note that the grids of this stage no **not** return to ground at the "cold" end of T1. More on this later.

The drivers are coupled to the modulators by means of capacitors C1 and C2. The modulators are 4-400A's, operated class AB1 in push-pull. Grid bias is obtained through the two bias-set pots, R12 and R13 (Bauer uses a single control here). The purpose of R14 and R15 is to minimize any tendency toward parasitic oscillations. Filament current is taken from transformers T2 and T3; the respective center taps are brought out through R17 and R18, thence together through R16 to ground. Modulator cathode current is monitored by switching a meter across resistors R17 and R18. Shunting R16 is K1, the modulator overload relay; if modulator cathode current exceeds a preset value, K1 trips and removes high voltage. Fig. 2 shows the slightly different cathode systems used by Bauer and Collins.

Feedback ladders Z1-Z3 and Z2-Z4 couple 8 to 10 db of negative feedback from modulator plates to driver grids. The junction of Z3 and Z4 is grounded, forming the ground return for the driver grids. Bauer uses a simplified version (Fig. 3) of this ladder, with no capacitors. CCA and ITA use a resistor and a coil in parallel, as parasitic suppressors in series with each modulator plate. Beyond the feedback ladders, the modulator plates are connected to T4, the modulation transformer. One end of the T4 secondary is grounded (through a capacitor), while the other end is connected to one end of modulation choke L1 and thence to the PA plates.

Modulator Troubleshooting

When one side of a push-pull circuit goes bad, the trouble generally reveals itself as DC unbalance. When the modulators are thus unbalanced, audio distortion results. The most obvious emergency remedies are to try new tubes, reset grid bias, and rebalance the driver stage. If the trouble is severe, the modulator overload relay may kick the rig off the air.

In some cases, however, the trouble persists. Here are some steps to follow in that event (use Fig. 1 as reference):

1. Check cathode resistors R17-R18. Although normally low in value (2 or 3 ohms), they should be equal. (Does not apply to Bauer or Collins.)
2. Check modulator filament voltages with servicing voltmeter; they should be equal when measured at tube socket—not less than 4.75 nor more than 5.25 volts AC.
3. Measure modulator screen voltage. Measuring at socket, you should find equal voltages —about 750 volts DC above ground or chassis.
4. Check DC grid bias on modulators. Depending on setting of the bias pot(s), bias value should be anywhere from 90 to 150 volts negative with respect to chassis. Bauer should show equal bias at each grid; others should be capable of being adjusted to equal values. Bias should not shift when audio driver is applied; if it does, modulator is drawing grid current (see Step 5).
5. Check audio voltages at grids of modulators with AC-VTVM (not VOM). Check for possible grid current; stage operates class AB1 and should not draw current. Grids should remain balanced under drive, same as they were in Step 4 without drive. Grid current here suggests leaky coupling capacitor C1 or C2, wiring or socket partially shorted, or tube defect (probably gassy).
6. Check coupling capacitors C1 and C2 by disconnecting grid end and connecting VTVM between loose lead and ground. With plate voltage on V1-V2, you should read no more than 1 volt DC from the loose end to ground. If either is doubtful, replace with 1000-volt Mylar Difilm type.
7. Check for unwanted continuity from grid pins of modulator sockets (topside of socket) through wiring to plate pins of driver sockets. If doubtful, lift slider connection of bias pots R12 - R13 and measure DC resistance between grids and ground; should be many megohms.
8. Check Driver balance by replacing tubes and measuring DC voltage drop across cathode resistors R3-R4; adjust pot(s) until drops are equal. (Bauer has a cathode balance pot for this purpose.) If doubtful, recheck cathode resistor values, as in Step 1.
9. Defeat the two feedback ladders, Z1-Z3 and Z2-Z4, by strapping a 20-mfd capacitor from point B to ground and another from point A to ground. This shorts the feedback networks for AC, although not for DC; the latter is needed for proper driver bias. Any resulting unbalance suggests trouble in one of the feedback ladders. You can also check the ladders during operation by measuring from point A to ground and point B to ground with an AC and a DC voltmeter, with the primary of T1 shorted. (You don't need the 20-mfd capacitors for this test.) DC voltages from each point to ground should balance within 2%; if they don't, there's a bad resistor in one of the ladders. AC voltages should also balance within 2%; if they don't, there's probably a bad capacitor in one of the ladders. The actual values of the lad-

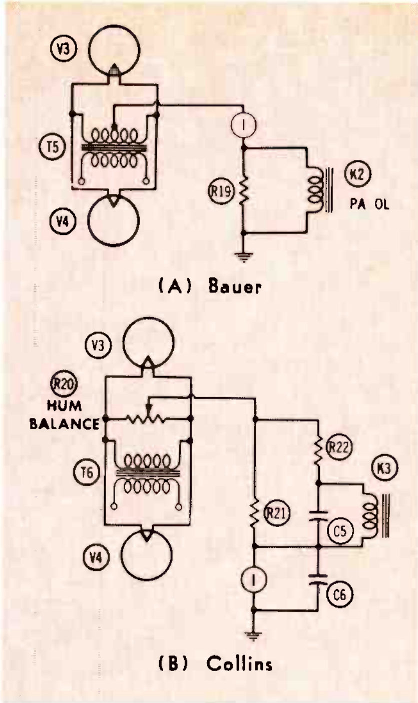


Fig. 2. Two alternate filament schematics.

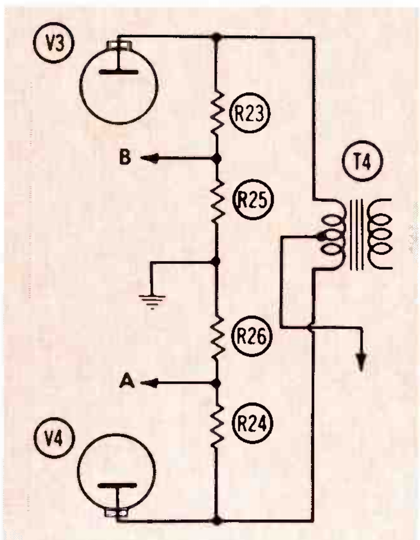


Fig. 3. Feedback in the Bauer transmitter.

der components aren't too important, so long as they are equal overall.

10. Check modulation transformer by reversing plate leads to see if unbalance shifts to other tube. Also try disconnecting T4 completely, putting 117 volts AC on entire **secondary,** and measuring AC voltage from either end of primary to center tap. You should get about 70 volts AC on each side, and values should be within 2% of each other.
11. If RF is suspected of getting into audio stages, use dummy load on modulation transformer to isolate audio section. Completely disconnect secondary of T4. Across entire secondary, connect 4000-ohm, 200-watt resistor in series with 500-ohm, 10-watt resistor, as shown in Fig. 4. Then connect vertical input of scope across 500-ohm resistor. Turn on transmitter and drive a 1000-cps sine wave through modulators. Scope should exhibit clean sine wave if modulators are in balance. If it does, you probably have RF trouble; if it doesn't, you probably have audio difficulties.
12. To completely isolate modulator stage, use dummy load on T4 as in Step 11. Disconnect plate ends of coupling capacitors C1-C2 and connect them to ground. As a final assurance, disconnect the feedback ladders from the modulator plates. These steps will usually eliminate parasitics or undesirable feedback, proving modulator stage itself okay. **Note:** You must disconnect platecap straps from the modulators and connect each plate directly to modulation transformer. **Caution: Be very careful;** with feedback ladders gone, there is no bleeder on HV supply. **Discharge HV filter capacitors carefully** after this test.

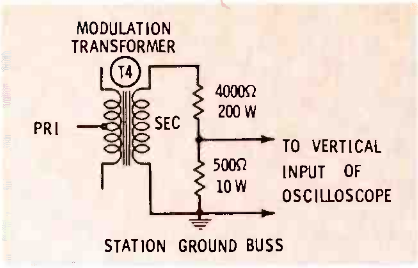


Fig. 4. Dummy load for modulator tests.

After any unbalance has been corrected, run audio proof on transmitter as final qualitative check.

Power Amplifier

Fig. 5 is the simplified diagram of a PA circuit which is more or less common to all six transmitters —two 4-400A's in parallel as class-C modulated amplifiers, with high-level plate modulation. With new tubes, plate efficiency is 70%. RF drive from the IPA stage is applied through coupling capacitor C51 and parasitic suppressors R53-R54 to the PA grids. Grid rectification, and resulting grid current, produces grid bias. L51 and C52 decouple RF, but permit DC grid current to flow through R51-K51 for protection and R52 for metering. K51 contacts are normally open; grid current holds them closed, permitting the application of screen voltage to both PA's and modulators. If grid current disappears, as when there is no RF drive, K51 opens and removes screen voltage. Grid-drive monitoring is accomplished at this point by metering across R52.

Filament power for the PA's is obtained via T51-T52. C53-C54-C55-C56 are RF bypasses at the tube sockets. Filament transformer centertaps are brought out through metering resistors R55 and R56, thence through K52 and its shunt, R57. If PA cathode current exceeds a preset value, overload relay K52 trips and removes high voltage. Note that Collins and Bauer again use but a single filament transformer, as shown in Fig. 6. Bauer has a single PA cathode-current meter; Collins has none. However, Collins has a PA filament voltmeter.

PA screens are decoupled with C57-R58 and C58-R59, and screen-current metering is across R62. Normally, plain plate (and screen) modulation is used, but there is some variation in circuit design among brands. CCA, ITA, and Visual use AF chokes in series with the PA screen supply to cause self-modulation of the screen. RCA's modulation transformer has a tap which feeds modulation to the IPA plate.

Returning to Fig. 5, in the plate circuit, you'll note two parasitic suppressors are used—L52-R60 and L53-R61. (Collins doesn't use these.) RF power is coupled to plate and coupling tank Z51 via C59 and thence to the antenna. The tank consists of several coils and capacitors arranged in either a T or a pi network, along with a harmonic suppressor; the exact arrangement varies from brand to brand. L54 and C60 decouple RF from the modulator and power-supply sec-

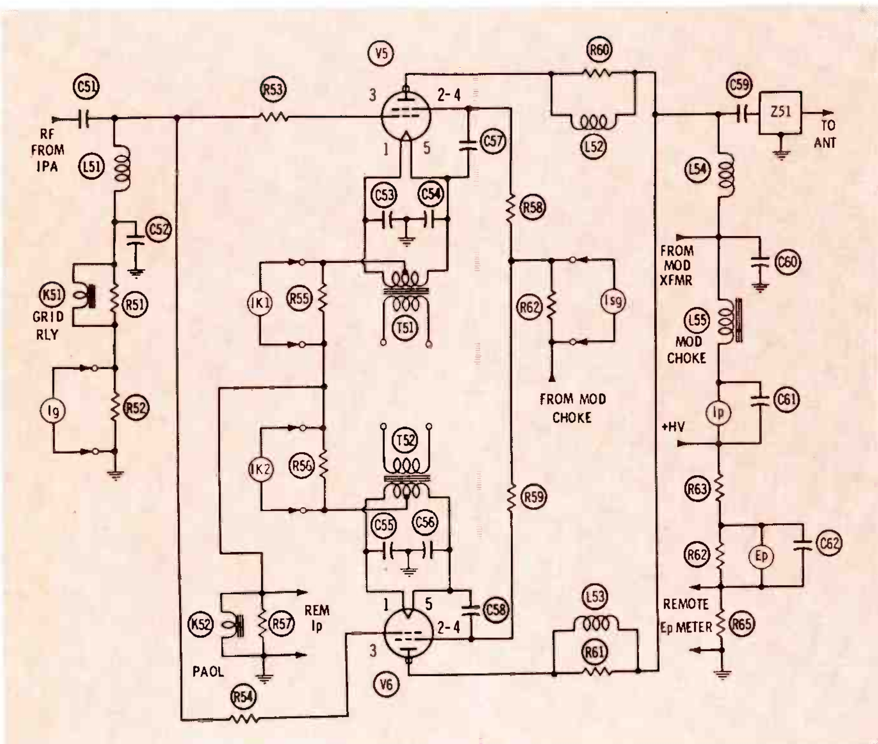


Fig. 5. Simplified diagram of typical final RF amplifier in an AM transmitter using 4-400A.

Some plain talk from Kodak about tape:

Sensitivity and frequency response

Controlling every electrical factor involved in the making and using of sound tape is a bit like trying to watch a three-ring circus . . . it can be done, but you need fast eyeballs. Let's discuss two critically important parameters: sensitivity and frequency response.

Sensitivity means the degree of output for a given input.

We put in a 400-cycle signal and measure the output. The result: low-frequency sensitivity. We choose 400 cycles for a number of good reasons. A 400-cycle note recorded at 15 inches-per-second gives us a wave length that the tape "sees" of roughly .0375 inches, and by a happy coincidence this wave length penetrates the entire depth of the oxide coating, but not the support material. Everything else being equal, low-frequency response is a function of the thickness of the coating. The thicker the coating, the better the bass response. We test at a frequency that penetrates the entire coating. We choose 400 cycles instead of, let's say, 20 cycles because the 400-cycle note tells us just as much—and has an added advantage. An engineer can *hear* 400 cycles, so we have audio monitoring as well as instrumented observation on a scope face.

Just as the low-frequency sensitivity test gives us an idea about oxide thickness, the high-frequency test gives us a fairly accurate picture as to just how smooth the surface of the tape is. Good high-frequency response is impossible on a tape having a rough surface. Here's why: The low points will represent gaps in the oxide and cause a loss of H.F. response. We test our high-frequency sensitivity at 15,000 cycles. (Inches-per-second divided by cycles-per-second gives us recorded wave length.) So at 15 ips the arithmetic looks like this:

$$\frac{\frac{\text{inches}}{\text{second}}}{\frac{\text{cycles}}{\text{second}}} = \frac{\text{inches}}{\text{second}} \times \frac{\text{second}}{\text{cycles}} = \frac{\text{inches}}{\text{cycles}} \text{ which is wave length } (\lambda)$$

THUS:

$$\frac{\frac{15\text{ inches}}{\text{second}}}{\frac{15{,}000\text{ cycles}}{\text{second}}} = \frac{15\text{ inches}}{\text{second}} \times \frac{\text{second}}{15{,}000\text{ cycles}} = \frac{1\text{ inch}}{1000\text{ cycles}} = 1\text{ mil wave length}$$

At this high frequency (short wave length) we are recording only on the surface of the tape. If any roughness is present, big troubles result. If you have a surface condition where the amplitude of the roughness is just .0001 inches and your recorded signal has a 1-mil wave length, you will lose 5.5 db in high-frequency response! Let's rephrase the catastrophe. It takes a surface variation of just one tenth the wave length to knock down response by about 6 db. And this can happen at any frequency!

We are working toward making a point: KODAK Sound Recording Tape has a surface that is unsurpassed in smoothness, a surface that varies no more than 25-50 millionths of an inch from a theoretically perfect plane.

Frequency response is merely the arithmetic subtraction of high-frequency sensitivity from low-frequency sensitivity. Ideally the response is zero. It's quite an easy matter to juggle the characteristics of an oxide around so that frequency response is nice and flat. For instance, if your oxide has poor high-frequency sensitivity, you can reduce the thickness of the oxide layer. This will degrade L.F. sensitivity, and thus effect a flat response. But is the resulting L.F. loss worth it? We don't think so. That's why we designed our coating to give us superior low- and high-frequency sensitivities, as well as a nice flat response.

Next time we'll chat about a few other basic considerations.

Choose KODAK Sound Recording Tape, Type 31A, for all general-purpose and low-print applications. Or Type 34A whenever you need high-output or low-noise characteristics. For extended playing times try our extra- or double-play tapes . . . or try the new triple-play tape—so thin you get 3600 feet on a 7-inch reel. KODAK Sound Recording Tapes are available at electronic supply stores, camera shops, specialty shops, department stores . . . everywhere.

EASTMAN KODAK COMPANY, Rochester, N. Y.

Circle Item 10 on Tech Data Card

tions, while L55 acts as load for the modulator audio. Modulation is decoupled from the power supply by the supply's own output filter capacitor. A plate ammeter is used in series with the plate supply, and a plate voltmeter and its multipliers R63-R65 are used across this supply. Note that remote plate voltage can be read across R65, and remote plate current across R57.

PA Troubleshooting

Whenever the PA operates improperly, the following steps may be followed:

1. Determine presence of grid drive by noting grid current (Ig) across R52. If absent, check for RF output from IPA—you may have to trace all the way back to the oscillator. If the IPA is working properly, suspect an open or leaky coupling capacitor C51 (make DC leakage test as outlined in Step 6 earlier), a shorted C52 bypass, an open or shorted L51, or a change in value of R51 or R52. Make ohmmeter checks of these. If the Ig panel meter is suspect, substitute another.
2. Check tube balance by switching PA's or trying new tubes. Check filament voltages with tubes in sockets. Measure Ik1 and Ik2, try substitute meters, and check resistance of R55 and R56 metering shunts. Check value of R57.
3. Measure PA screen voltages at sockets—they should be equal and not above 600 volts. Suspect leaky or shorted screen bypasses C57-C58, or change in value of dropping resistors R58-R59, if voltages are low. If screen current exceeds normal value (check your transmitter manual), there is probably leakage or a short to ground (C57 or C58), or one of the tubes is defective.
4. If the plate voltage is abnormally high or low, shut down the rig and measure the plate voltmeter multiplier, R63. If doubtful, substitute another voltmeter. With care, even a VOM may be used, if it has a 5-kv range. Make connections carefully **with power off** and make sure the test leads are dressed well away from ground. Suspect a leaky or shorted C60 bypass or a partial short in metering circuits.
5. If audio-RF interaction is suspected, isolate RF section by disconnecting secondary of modulation transformer and using dummy load, as described earlier. With proper grid drive, PA should produce pure RF output. If trouble persists, it probably has nothing to do with audio.
6. When checking continuity of protective relays in interlock circuits with ohmmeter, you must always disconnect the relay coil from its shunt. Otherwise, either the coil or the shunt could be open, and the other would still show continuity.
7. Try RF dummy load (nonreactive) in place of antenna, to eliminate possibility of change in antenna resistance. If directional antenna system is used, put the dummy **before** the phasor. ▲

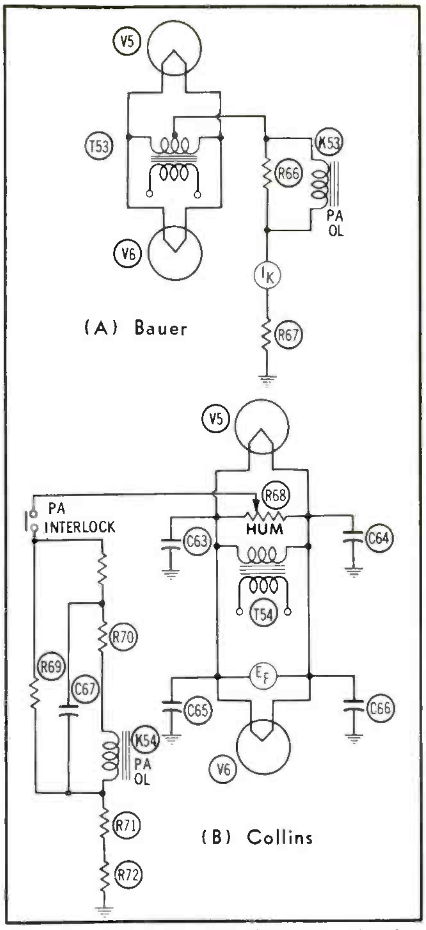


Fig. 6. Alternate PA filament circuits.

March 1965

We interrupt this magazine to bring you ...

Late Bulletin from Washington

by Howard T. Head

Federal Regulation of CATV

As Community Antenna Television (CATV) systems become more numerous, an increasing number of proposals advocating Federal regulation of CATV are being made. At present, the Commission regulates only those CATV systems which employ microwave relays, by conditions imposed on the microwave licenses. Such systems, however, constitute fewer than one-fourth of the total number of CATV installations.

Although the proposals differ in scope and detail, the principal areas in which Commission control is urged are: protection of local broadcast stations from the bringing in of outside programs which duplicate those broadcast locally; requiring CATV systems to carry the programs of local stations; prohibiting "leapfrogging," the bringing in of programs from very distant stations; prohibiting the origination of programs by the CATV system; and the establishment of technical regulations to govern the quality of signals distributed by CATV systems.

The Commission staff is generally in accord with the recommendations, although there is some sentiment in favor of permitting, or even encouraging, CATV systems in smaller communities to provide a degree of local program service. However, the Commission's final action is likely to be closely tied to its belief in the need for a nationwide, locally-operated, competitive television service based on full utilization of the UHF channels.

Sharing TV Channels with Other Users

The Joint Technical Advisory Committee (JTAC) of IEEE and the EIA has under study a recommendation that the Commission permit the shared use of present television channels by the Land Mobile Radio Services (fire, police, taxicab, business, etc.) (June 1964 Bulletin). Television channels would be made available to these other services in cities where the channels cannot be assigned for television-broadcast use because of the Commission's engineering requirements. Land mobile operation would be confined to a band approximately 1 mc wide near the center of a television channel adjacent to an occupied channel. Engineering studies submitted to JTAC indicate that a minimum of interference would be caused to television reception.

Under study by a joint industry-government advisory committee are proposals which would provide for the multiplexing of land mobile base-station transmissions on FM broadcast carriers. The technique would be essentially the same as that employed for regular FM multiplexing, except that by employing narrow audio bandwidths a number of multiplex channels would be provided. Studies indicate that under favorable conditions up to eight 3-kc voice channels could be provided in the portion of each FM channel presently available for multiplex operation.

Stereo Sound for Television

In replies to the Commission inquiry concerning stereo sound for television (January 1965 Bulletin), some receiver manufacturers express the view that the small size of the television screen would render stereophonic sound ineffective. The relatively poor audio quality and lack of stereo material for television use are also cited as reasons in opposition to the proposal. On the other hand, some manufacturers have given their wholehearted endorsement and have offered detailed technical proposals for accomplishing the desired stereo effect. Several parties have asked for additional time to comment, and a final decision from the Commission is likely to be many months away.

Early Release of New UHF Table

Prospects are that the Commission will release at least portions of the anticipated new table of UHF channel allocations (September 1964 Bulletin) in the near future. The revised table, which has been checked by a computer, will probably be released in portions, beginning with the allocations for the congested northeastern portion of the United States. The revised table is expected to make a substantial number of new UHF channel assignments available for both commercial and noncommercial-educational television operation.

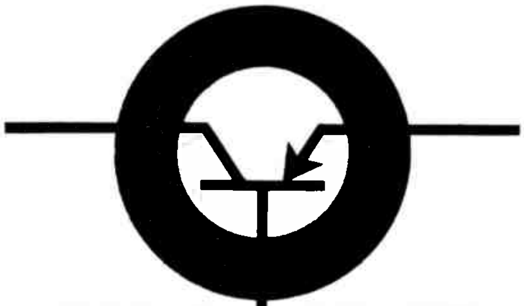
Antenna Farms and New TV Propagation Curves

The Commission is preparing Notices of Proposed Rule Making in connection with the matter of antenna farms for tall towers (November 1964 and February 1965 Bulletins) and the adoption of new field-strength-vs-distance curves for both the VHF and UHF television bands (September 1964 Bulletin). These topics have been linked in this context for two reasons. First, the new field-strength curves will influence the selection of television transmitter locations meeting the Commission's Technical Standards. Second, the proposed antenna-farm Rules contemplate "equivalent protection" of existing television stations when operation is proposed at a farm area which would result in a short mileage separation from other cochannel stations.

Under the new proposal, an applicant for permission to erect a tall FM or television tower would be required to specify operation in a designated farm area unless prior FAA approval has been obtained for a different location.

Howard T. Head ...in Washington

HOW FAR CAN YOU GO IN SOLiD STATE



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MICROELECTRONIC MODULES, 1965

by Allen B. Smith, — An up-to-date report on the state of the search for higher circuit density and reliability.

There is, within the broad field of electronics, an explosive revolution that may soon significantly alter the design and construction techniques now familiar to us all. The microelectronic module, or integrated circuit, has been developed with almost unprecedented speed and with surprisingly little fanfare. Announced at the 1959 IRE Show, the new concept was greeted with much enthusiasm but little hope for immediate practical applications; after all, each module cost nearly $2000. And yet, today, less than six years later, several integrated circuits employing silicon planar epitaxial elements can be purchased "off the shelf" for less than $3. The way in which this solid-state technique has grown so rapidly is another example of a vigorous electronic technology working to fill a need of the industry.

When the first practical semiconductor devices appeared in 1948, engineers wasted little time designing them into a wide range of circuitry. Within a very few years, the transistor became the most challenging and effective device in the quest for greater reliability, smaller size, and adaptability to printed-circuit techniques. It saw widespread use in missile and space-age equipment, in computers, and in home entertainment instruments. However, the transistor as a discrete component is proving to be only a relatively short-lived intermediate step in the development of totally integrated circuit packages. As engineers became more at ease with transistorized circuitry, they began to think more directly of using their expanding knowledge of the atomic, crystalline, and electrical characteristics of metals and semimetals to further increase the reliability and component density of low-power circuits. A variety of techniques has been developed to provide a practical integrated-circuit technology.

Three Major Concepts

Early attempts to unitize component assemblies, developed primarily from transistor-PC-board circuits, used individual miniaturized components mounted on small wafers or cards which, in turn, were stacked and mounted in hermetically sealed cans or were encapsulated. Later, a second concept evolved. Deposited-carbon resistors and semiconductor elements were combined on various substrate chips (glass, ceramic, or fiber) for mounting on transistor-type (TO-5, for example) headers; a more recent, and perhaps the most promising, technique employs deposited metal films for resistive, capacitive, and inductive circuit elements. The third concept is that of the pure solid circuit using metal and semimetal diffusion processes.

High-Density Packages

In many circuits, primarily those used in computer devices where memory sections occasionally may have to be replaced, the stacked or cordwood high-density approach has been widely used. The stacks usually have multifinger contacts for plug-in replaceability and lend themselves well to low-cost design flexibility because they use more-or-less standard components. When it is considered that the cost increase over standard printed-circuit designs is only nominal, integrated circuits of this type offer reliability of a rather high order.

Several companies (Mallory, Micram, Raytheon, Sprague, and Westinghouse, among others) have pursued various high-density concepts from stacking conventional components to "pellet" components of uniform size recessed into cavities in an insulated base and interconnected by printed-circuit wiring (Fig. 1). Pelletized components enable one defense contractor (Arma Div. of Bosch Arma) to build a 20-lb guidance computer for solving space-navigation problems that occupies only .40 cubic foot and draws less power than a small (50-watt) incandescent bulb. A design survey conducted by a prominent space-age contractor (General Dynamics/Astronautics) shows that approximately 80% to 95% of all GD electronics circuits could be pelletized directly or with very

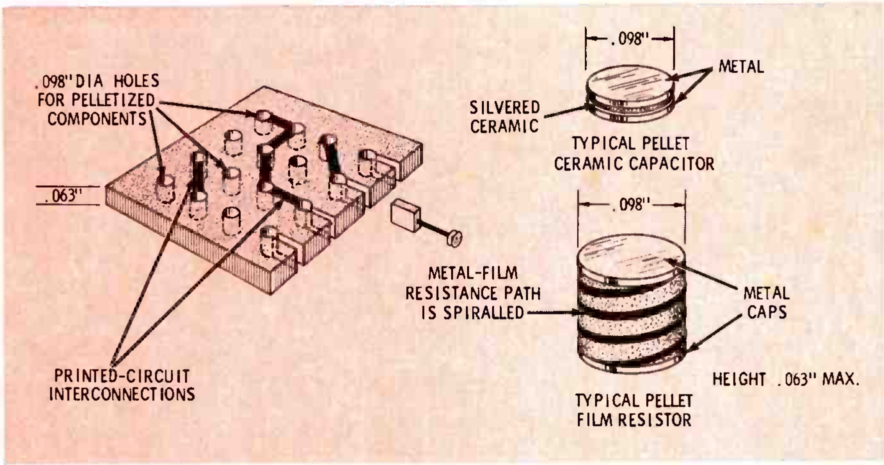


Fig. 1. A graphic representation of the pelletized high density approach to circuit design.


RCA
NEW
LOOK
RCA
BTF-20E
FM TRANSMITTER . . . ALL NEW CIRCUITRY

slight (about 5%) circuit redesign. Automated fabrication processes for this concept are being studied.

Other manufacturers and governmental agencies are performing additional research on high-density packaging of microminiature and standard components. Because of its relatively high power capabilities, the pelletized approach is being used in the design of several communication devices. One communications unit, developed recently by Motorola's Semiconductor Division, uses multiple-wafer construction and offers voltage gains adjustable from about 10 to 40, with an output of 1 watt from an input of .5 volt rms. The device, housed in a TO-5 can, draws approximately 1.5 ma standby current and couples directly to the output load. Its circuit configuration is shown in Fig. 2.

Semiconductor and Thin-Film Integrated Circuits

Even though component-type microelectronic circuitry has shown great promise in many applications, thin-film and semiconductor integrated circuits are gaining significant support from military and civil research groups, particularly in the design of digital data-processing equipment and computers. The need for compact, low-level, and highly reliable logic circuits has produced many different items. As recently as a year ago, most of these devices carried minimum prices of almost $50; one company, however, (Fairchild) now offers many logic circuits at under $5, several under $3. Improved etching, deposition, and diffusion techniques promise further reductions in price, while circuits operating at power levels in the 120 to 800 microwatt region will allow even greater reductions in size than

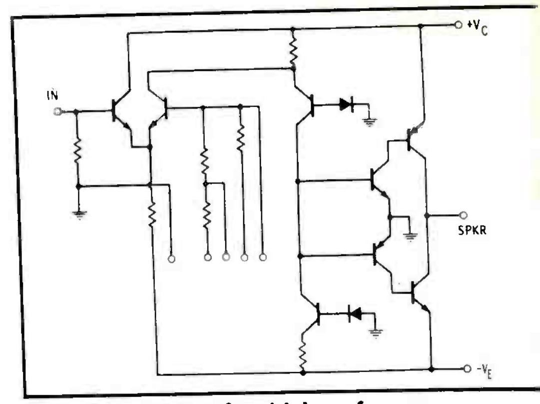
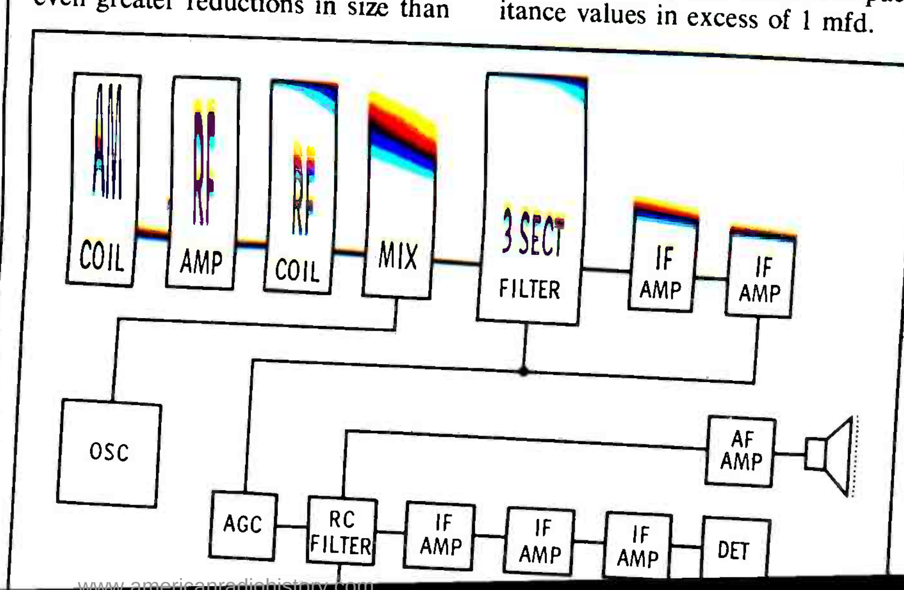


Fig. 2. Schematic of multiple-wafer amp.

are now possible.

In spite of improved manufacturing techniques, production yields of integrated circuits are still fairly low for the more complex functions. Reliability, however, has been improved greatly from a failure rate reported by one company (Texas Instruments) of .13% per 1000 hrs at 85°C in 1962 to less than .006% in 1964. The Bureau of Naval Weapons reports that semiconductor integrated-circuit reliability is higher in many applications than that of standard discrete components.

Several missile-guidance and control systems in the newest generation of ballistic weapons employ semiconductor networks: Minuteman ICBM, EGO and POGO satellite digital signal systems, the Apollo guidance computer, and other computer-navigational systems rely heavily on integrated circuits. Semiconductor limitations in tolerance (20%, nominally) and maximum available values of resistance and capacitance (about 50K and .001 mfd respectively), however, preclude their use in many applications. Thin-film circuits, on the other hand, provide resistance in the megohm region and, with tantalum films, can achieve capacitance values in excess of 1 mfd.



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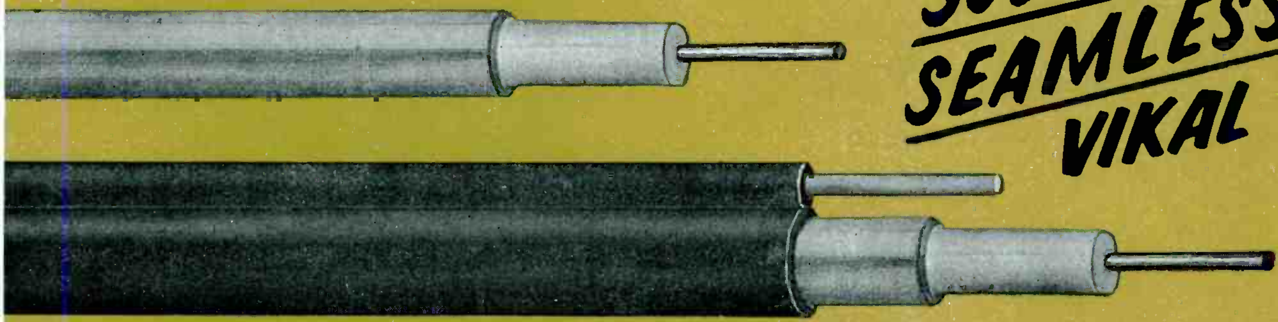

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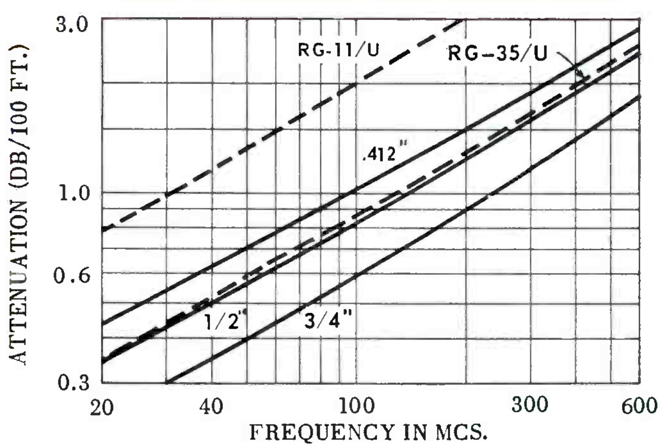

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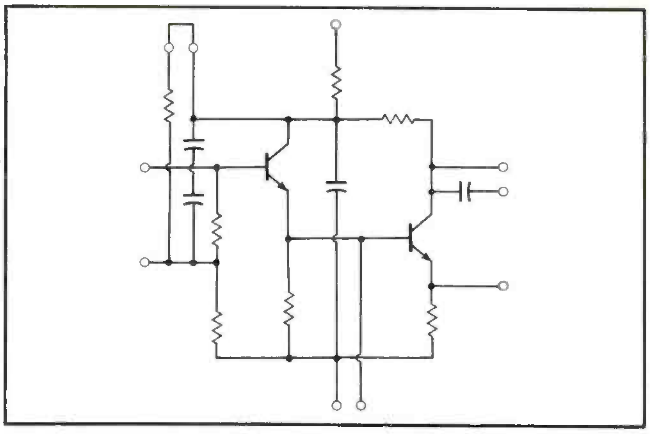

Fig. 4. Schematic diagram of a typical micro IF amplifier.

Using a combination of semiconductor and thin-film techniques, Motorola has developed a 120-mc transceiver giving 60 mw output from an 11-volt supply with a maximum current drain of less than 40 ma. A block diagram of the unit is shown in Fig. 3. Each complete, monolithic (using silicon substrate wafers with diffused semimetals and deposited films) IF stage of the handheld unit is mounted in a TO-5 can and is tuned to 12 mc; gain per stage is 20 db. Five such IF stages are used in the small (5⅞″ x 2⅝″ x 1″) unit. Fig. 4 shows the circuit of one stage.

Single-Block Circuits

In the abstract sense, the term "solid-" or "single-block" circuit denotes the philosophical height of electronic sophistication, because it implies utilization of the basic crystalline and atomic structure of a single material to obtain a desired electronic function. The material is modified by machining, diffusion techniques, etching, and plating so that a known signal input will produce the desired output function or waveform. The term also implies an extremely high level of precision in the manufacture of the devices.

In a practical view, because of their limited power-handling abilities and higher cost, solid-block devices are being used primarily for computer logic functions at this stage of their development. Their level of complexity is generally lower than for semiconductor or thin-film integrated circuits, but recent developments in thin-film transistors promise a wider range of circuits using TFT active devices for linear functions. The application of "pure" electronic circuits will continue to attract the efforts of the creative engineer interested in smaller, more efficient equipment.

Summary

While high-density packaging concepts and the solid-block circuit approach both promise a great deal, it seems that the immediate future will see increased use of integrated circuits using a combination of semiconductor, solid-state, and thin-film techniques.

It is difficult, even dangerous, to make firm predictions that will define the course microelectronic circuits will take within the next few years. It's fairly safe, however, to suggest that the very rapid development of these interesting devices over the past few years has just begun to provide the industry with higher reliability, reduced size, and lower cost. Concerning microcircuits, you haven't seen anything, yet. ▲

A SOLID-STATE AUDIO SWITCHING SYSTEM

by ***Larry J. Gardner,*** **Chief Engineer, WCKY, Cincinnati, Ohio—A useful piece of equipment designed around some unusual components.**

Have you ever wished for the equivalent of a latching push-button switch bank which can be remotely actuated? Have you ever needed an audio switching device which produced a fade-in or fade-out instead of an abrupt switch? Have you ever lost a commercial or a program because of dirty switch or relay contacts? Chances are you have encountered these problems at one time or another. Here is a system that has solved these problems and many more for us at WCKY.

The system is based on two new electronic components, the optical-electronic relay and the silicon controlled rectifier. We used these devices to build a solid-state audio switcher to feed the outputs of three cartridge playback units into a single console input, with a rapid cross-fade between the inputs.

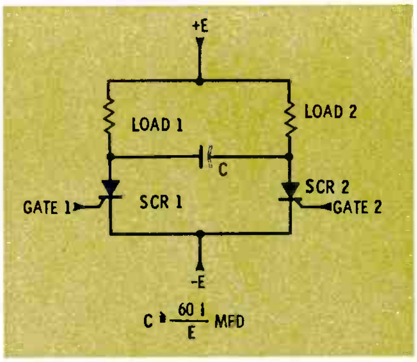

Fig. 1. Basic circuit of SCR static switch.

Fig. 1 shows a basic circuit for an SCR static switch. Being anxious to experiment, we ordered a few small SCR's and wired up some breadboard circuits. To our delight, we found that five or six stages of this kind of static switch worked very well so long as the series capacitance between the anodes of any two SCR's was greater than the value given in Fig. 1. We thus had a solid-state push-button latching switch. The next step was to put it to practical use.

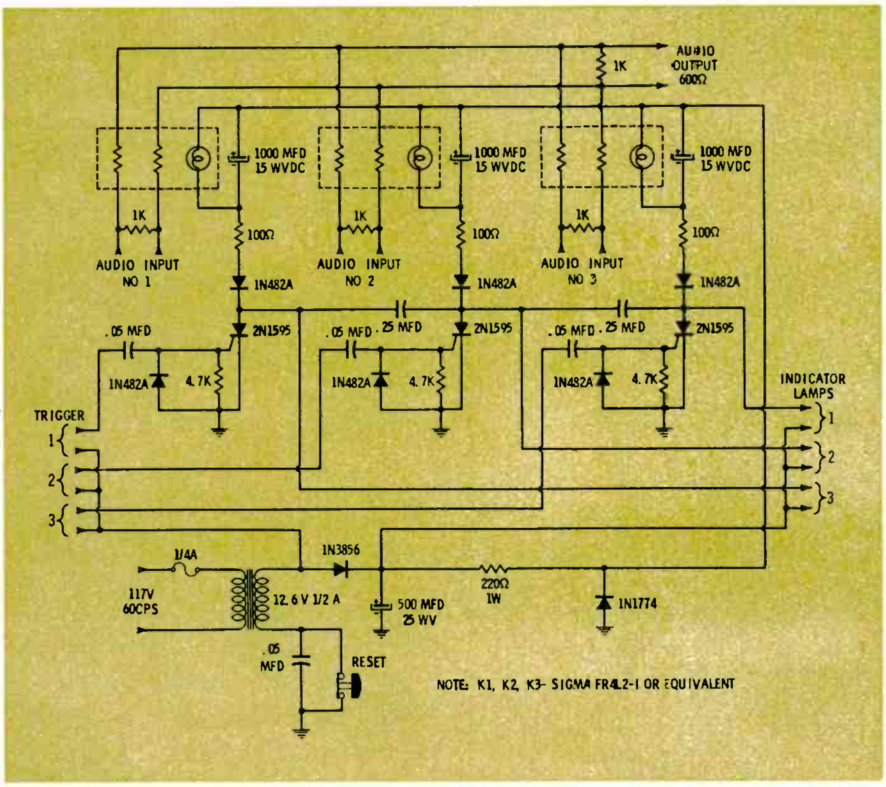

Fig. 2. Complete schematic diagram of the all-solid-state audio switching unit.

In our air studio, three cartridge machines fed three console faders; this sometimes caused operators to wonder which was which. We needed a good way to feed these machines to a single fader. Relay-type switchers had been tried, but they were found to be unsatisfactory because their abrupt switching didn't harmonize with good, tight production.

Then the optical-electronic relay came to mind. This little device contains a small lamp adjacent to one or two cadmium-sulphide photocells. The entire assembly is sealed in a light-tight box about the size of a sugar cube. When voltage is applied to the lamp, the resistance of the photocells drops from over ten megohms to less than 500 ohms. But, unlike in ordinary relays, the "contact" resistance of this unit can be adjusted to any value between the extremes simply by adjusting the lamp voltage. Thus, by usjng suitable RC networks the designer can produce almost any desired fade-in or fade-out characteristic.

Fig. 2 shows the final result of our work, a three-stage static switch in which the lamps in the optical-electronic relays are the loads. The audio passes through both photocells in each relay to maintain a balanced audio-circuit configuration. A few well chosen capacitors and resistors provide a fade-in time of about one-tenth second and a one-second fade-out time. A few isolating diodes and a good power supply complete the design.

The operation of the unit is as follows: First, referring again to Fig. 1, when power is first applied, neither SCR is conducting, and ca-

pacitor C assumes no charge. When a small positive-going pulse is applied to the gate of SCR1, the SCR conducts, and full supply voltage is applied to load 1. Capacitor C then charges through load 2 to full supply voltage. Then, when a trigger pulse is applied to the gate of SCR2, C is in effect placed across SCR1. This causes the current through SCR1 to fall below the holding value, and this SCR is turned off. The same kind of switching action occurs in the three-stage unit in Fig. 2.

The fade-in time is determined by the 100-ohm resistors and the 1000-mfd capacitors. The fade-out time depends on the same capacitors and the 1000-ohm resistance of the lamps in the relays. The 1N482A diodes in series with the SCR's prevent the timing capacitors from discharging through the 24-volt indicator lamps. Other diodes in the gate circuits provide the correct triggering signal. The unit is operated by connecting the trigger terminals to the auxiliary-start terminals on the cartridge machines or to extra contacts on the machine start switches. The indicator lamps used were part of the illuminated remote-start pushbuttons.

Two power-supply outputs are provided: an 18-volt output for the indicator lamps and an 11-volt regulated output for the 12-volt relay lamps (to insure long life). A reset button is provided to turn off all SCR's, and the audio inputs and outputs are terminated to maintain proper impedance matching. The unit has an "on" insertion loss of about 10 db.

Three of these units have been constructed and are going strong, and we are constantly dreaming up new applications for the basic circuit. So far, however, we haven't been able to use it to switch our directional antenna system. Anybody know where to get a 50-kilowatt photocell? ▲

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THIS IS THE TURNING POINT IN TELEVISION TAPE RECORDING:

Broadcast Engineering

Preview of the 1965 NAB Convention and Engineering Conference

The 1965 NAB Convention and Engineering Conference—March 21-24, 1965, Shortham and Sheraton-Park Hotels, Washington, D. C.

An Editorial Comment

From BROADCAST ENGINEERING

All of us associated with broadcasting know from our daily experience that this is a vigorous, dynamic industry. Changes in audience demands bring about changes in programming, which in turn force the development of new techniques and new equipment. Changing economic factors often exert an important influence on the technological evolution of broadcasting. Conversely, new technological advances make possible new concepts in programing and bring into being new economic forces; the development of television provides a somewhat spectacular example of this fact.

The influence of the broadcasting industry on the social, political, and economic state of modern civilization cannot be overestimated, and the responsibility of those in broadcasting is thus enormous. The contribution of the broadcast engineer to his industry is vital; without him there would be no facilities, no maintenance—no broadcasting. Each technical person is therefore obligated to keep himself informed of new trends and developments in broadcast technology. To do less would be to cheat himself and all those who depend on his services.

For the broadcast engineer, the annual NAB Convention provides an opportunity to examine and discuss the latest hardware and to hear and discuss the newest ideas. The most modern designs in automatic programmers and loggers, transmitters, audio gear, camera equipment, solid-state microwave equipment—everything from the microphone and the camera lens to the antenna—will be arrayed on the exhibit floor for your inspection. A number of technical papers will be presented during the Engineering Conference.

But keeping informed must be a year-round activity. It is the function of BROADCAST ENGINEERING to keep you readers informed of what is—and what will be—new in the area of broadcast technology. We also provide a medium of exchange for ideas and solutions to the everyday technical problems that face every broadcaster. But our obligation to our readers does not stop there. It is also necessary for us to provide information of a more underlying nature to add to the store of knowledge of engineering personnel at **all** levels. To do this we seek out and enlist the services of the most qualified authors and reporters available. We strive always to make the editorial pages of this journal as informative and as valuable to our readers as is humanly possible.

Many changes have occurred in broadcasting over the years. In radio, FM broadcasting has achieved an important place in the industry, and stereophonic broadcasting is now a routine service from many FM stations. The use of directional antennas has become almost the rule rather than the exception in AM broadcasting. Television has progressed from the scanning disc to all-electronic compatible color. And yet, all these changes are but forerunners of things to come. Round-the-world television by satellite is almost here. Solid-state equipment is bound to increase in use; the use of microelectronic techniques will bring about entirely new concepts in equipment design and applications. Who can predict what other as yet unforeseen developments may occur to revolutionize broadcast technology? Whatever the future developments may be, you will know about them, because BROADCAST ENGINEERING will report them to you promptly, clearly, concisely, and accurately.

The Editor

Welcome to the 19th NAB

BROADCAST ENGINEERING CONFERENCE

by George W. Bartlett,
NAB Manager of Engineering

For 19 consecutive years, the National Association of Broadcasters has endeavored to provide the engineering fraternity of our great industry with a forum where one can see, hear, and be associated with the latest broadcast techniques and developments currently being unveiled. This forum is the NAB Broadcast Engineering Conference which is held in conjunction with the NAB Annual Convention, whose main curtain will rise at 10:30 sharp on the morning of March 22, 1965, in Washington, D. C.

Each year, our gathering seems to be in the "bigger and better" category. Each year, past attendance figures are broken, better sessions are held, and more equipment is on display. It is a public-relations man's dream, as an inexhaustible supply of superlatives is needed to extol the size and grandeur of the passing parade.

The never-ending firsts which are associated with the conference seem to go on and on, and references to past programs and news releases are indicative of the forward advances constantly being made in broadcast engineering. Video tape, cartridge tape, automation, and electronic set counting are but a few of the revolutionary new developments which have been unveiled at past conventions—developments which have all but changed the face of broadcasting.

Broadcast engineering is a dynamic and challenging activity in which innovations are constantly coming to fruition, producing drastic changes in our methods of operation. It is a challenging field which requires aggressive leadership and forward thinking . . . especially in today's highly competitive marketplace operating within the confines of our free enterprise system.

The Broadcast Engineering Conference attempts to provide not only a focal point for technical innovations but also a medium for the exchange of ideas—ideas which, when discussed in a conducive atmosphere, will eventually add to our ever-expanding storehouse of knowledge.

It is with this background that I take this opportunity on behalf of the Association to welcome you to the 19th Broadcast Engineering Conference—a Conference star-studded with new ideas, new equipment, and unbounded vibrance and vitality, a Conference which is dedicated to the broadcast engineer and the broadcast engineer alone. There is no other gathering in the free world that provides one with such a golden opportunity.

At the Conference, you will hear approximately 27 technical papers on subjects covering the gamut from microphone to antenna, from camera to transmitter. An FCC technical panel, which will answer all your questions on virtually any engineering subject, three engineering luncheons featuring the finest speakers obtainable, plus the usual socializing so necessary to the exchange of ideas, help round out the program. Thousands of square feet of exhibit space will be devoted to the largest display of technical broadcast equipment ever assembled under one roof . . . to be examined, inspected, evaluated, praised, or criticized.

Once again, welcome to **your** Engineering Conference. The program was planned by your Conference Committee with you specifically in mind and was tailor-made to fit your every need. I hope you will take maximum advantage of its every opportunity and carry back to those at home the knowledge and experiences gained at this gathering.

THE SHAPE OF BROADCASTING WORLDWIDE

by Lawrence J. Cervone*—In today's shrinking world it is becoming more and more important for the broadcaster to know what his neighbors are doing.

Nobody knows better than the American broadcaster how great is radio as an instrument for communication between peoples. No matter where man goes in the world, he is potentially within reach of broadcasting. The size and composition of the audience that can be reached by a single broadcast staggers the imagination.

The marvel of television has added sight to sound, and not long ago viewers in New York watched the opening of the Olympic Games in Tokyo. This inspiring event confirms the coming of world television in full color, with all the diversity and enrichment it will hold for viewers of the future. As such technological advances continue, it will become increasingly important for all of us in broadcasting to be aware of the shape of radio and TV in the world outside our 50 states.

Most of us have participated in and know the current status of radio and TV here in the United States. We are fortunate in being a part of an industry which, although subjected to government control, is not government run. The fact is that, with few exceptions, where broadcasting is inspired by competitive factors, it has grown to provide fairly good and diversified service to the people. This applies to programming as well as to the adequacy of stations. Our competitive system is very different from any other almost anywhere in the world. But there is a changing atmosphere, a trend toward commercial sponsorship of radio and TV programs in many countries of the world. This could be significant for us all.

*This article has been adapted from an address given before the Oregon Association of Broadcasters November 17, 1964, by Mr. Cervone, who is Vice-President-Operations of the Gates Radio Company, Quincy, Illinois, a Subsidiary of Harris Intertype Corporation. This adaptation reflects changes in the world broadcasting picture that have occurred since the speech was originally given.

Radio Around the World

Three different methods of radio broadcasting are in general use throughout the world. The most common method is amplitude modulation (AM), mainly in the frequency band of 540 kc to 1600 kc. This system is, of course, the basis for our U. S. system. It is used in Europe and Latin America for domestic broadcasting and, as here, is overcrowded in all civilized areas. In Europe, many high-power AM stations also operate in the long-wave band from 150 kc to 450 kc. There are about 40 such stations with powers up to 500 kw scattered around France, Germany, Scandinavia, middle Europe, and Russia.

The second method is short-wave broadcasting in the band extending from 2 to about 30 mc. The lower portion of this band is used for domestic broadcasting in tropical areas where high atmospheric noise levels limit the service area of medium-wave stations. Most of the short-wave band, however, is used for long-range foreign service and for internal broadcasting by countries which extend over large distances, such as Indonesia.

With few exceptions, high-power short-wave broadcasting is nearly always government controlled because the programs are for foreign consumption and can affect the nation's foreign relations.

Growing in use everywhere in the world is the third method, frequency modulation (FM). This system provides an essentially interference-free high-fidelity signal. Because of the line-of-sight transmission characteristics that prevail at the frequencies used for FM, this method permits better use to be made of the frequency spectrum. The movement to FM is most pronounced in Europe. In Germany there are 155 FM stations versus 83 AM; Great Britain has 160 FM versus 96 AM; Sweden has 74 FM versus 65 AM. FM is also gaining use in South and Central America.

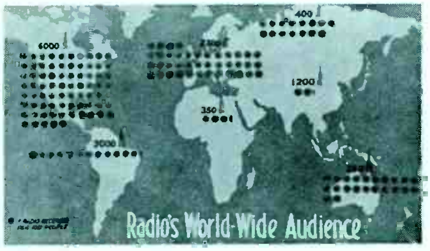


Fig. 1. Radio coverage around the world.

World Radio Coverage

The pictorial radio-coverage map (Fig. 1) shows that today there are about 13,000 radio stations in the world and over 400 million receivers. The U. S. is better served by radio than any other country in the world. About half of the radio stations and half of the radio sets are in the U. S. and Canada, another third are in Europe and North America, and the remaining sixth are scattered over Asia, Africa, South America, and the Near East.

In the United States we have 100 radio sets per 100 people. In Asia the ratio is two sets per 100 people. Near the bottom of the scale is Sudan with only 16,000

Table 1. Tabulation of Worldwide Radio Coverage.

	Sets (millions)	Sets (sets per 100 people)	Wired Speakers (millions)	AM, LF, & FM Stations
Europe	93	40	6	2700
USSR	15	15	31	400
Asia	36	2	7	1200
Australia & Oceania	3	19	--	250
Africa	5	3½	.2	350
South America	18	11	--	2000
North America	198	75	--	6000
	368		44.2	12900

sets for a population of 10 million—less than one set per 100 people.

Worldwide, there are about 370 million radio sets and about 44 million wired speakers in use (Table 1).

Europe

In England, BBC operates all radio—96 AM and 160 FM stations. Even though in 1962 the Pilkington report recommended that this BBC monopoly be retained and that no advertising be accepted on radio, the pressure is on Parliament to authorize low-power commercial AM stations for local coverage. Unlicensed operators of so-called "Pirate Ships" are reported to serve 39 million listeners in England with commercially sponsored programs. There are now four such ships operating in the Irish Sea and the North Sea, and a fifth ship, now being equipped to transmit with 50,000 watts of power, will be managed by personnel experienced in U. S. network advertising sales and operation. The Council of Europe has the entire subject of broadcasting from International waters on its next meeting agenda.

Recently relocated to a new 40-million-dollar circular Radio center in Paris, French broadcasting has four networks (2 AM, 1 FM, and the short-wave external service) all directed by a government-sponsored monopoly (RTF) under the authority of the Ministry of Information. There are no commercials of any sort on the French radio.

Germany has 155 FM and 83 AM transmitters operated by 11 public corporations drawing their revenue from licensing fees and, to a very limited extent, from commercial advertising.

In Italy, RAI, a national network responsible to the Ministry of Ports and Telecommunications, owns and operates all 133 AM and 1000 FM stations (mostly low-power repeaters). Advertising time is limited to restricted periods but represents 5% of total air time.

A very profitable operation in the Principality of Luxembourg is Radio Luxembourg, a privately owned company whose revenue is derived solely from advertising. Broadcasts on AM and FM are in Dutch, German, French, and English. It is reported that the radio station is the nation's second largest industry.

In Russia, a country where wired loudspeakers have traditionally been more important than private sets, there has been an increase in the number of individual radios from 9 million in 1957 to about 15 million today. However, about 31 million wired loudspeakers are still in use, and radio listening is marked by the extensive use of redistribution. About 1 million radio sets per year are produced by the Soviet radio industry. Radio, of course, is all government controlled, and domestic programs in 64 languages are beamed via 400 AM stations.

Africa

Ethiopia has only five transmitters with a total power of 30 kw for domestic and overseas services. Two 100-kw and one 50-kw medium-wave stations, gifts from the U. S., will go on the air for domestic coverage in 1965.

Radio in South Africa means SABC. This is a public utility chartered by the government; some commercials are allowed. Most significant is the program of converting all radio to FM by 1970. There will be a total of 485 FM transmitters providing full national coverage in up to six languages.

Unique and outstanding in Africa is Radio Clube de Mozambique, which is a commercial radio service having 20 transmitters and three networks. In a sense it is the national radio service for this Portuguese Colony.

South America

In Colombia, there are about 200 stations divided into three groups — state-owned, cultural, and commercial. The most outstanding feature is Accion Cultural Popular (ACP), a private educational enterprise which broadcasts courses to elementary schools and to 200,000 listener groups in the early morning and in the evening.

Who would have guessed that Brazil, a nation of 80 million persons has more transmitters than any other country in the world except the U. S.? There are about 1000 stations (5% FM), and almost all of them are privately owned. The government does regulate advertising, but all operating income is derived from commercials.

The Far East

Japan has two systems. NHK, a chartered public corporation (268 stations), carries no advertising. The 126 privately owned commercial stations are nearly all linked to local newspaper groups.

In the Portuguese colony of Macao, off the Coast of China, a privately owned commercial station broadcasts in Portuguese and Chinese. The operation consists of two medium-wave stations; a new 20-kw DA will be on the air soon. Revenue is totally from advertising.

In Viet Nam, high priority is being given to the use of radio for psychological warfare. There are a new 50-kw medium-wave station in the north, a 50-kw AM station in Saigon, and a complete broadcasting system of about 15 stations supplied by the U. S. AID is supplying 125,000 low-cost home radios to sell for less than $14 each. Radio is controlled by the Ministry of Information.

AFRTS

The Armed Forces Radio and Television Service (AFRTS) operates about 140 radio stations in Korea, Greenland, Japan, Libya, Ethiopia, Germany, and wherever we have overseas bases. In Spain, the five AFRTS stations use 1-kw FM transmitters.

Television Coverage

And now a quick review of the status of television. Although VHF is predominant today, UHF is growing rapidly in Europe, as we shall see later. However, first it is important to note that VHF TV broadcasting utilizes five different and incompatible standards:

1. British—405 lines.
2. NTSC—525 lines. Used in the U. S., Latin America, Japan, the Philippines, Saudi Arabia, and Thailand.
3. CCIR—625 lines. Used in Western Europe, Africa, Australia, and Asia.
4. OIRT—625 lines. Used in Iron Curtain countries.
5. French—819 lines. Used in France and parts of Africa.

Fig. 2. Television coverage over the world.

Another specially prepared pictorial map (Fig. 2) illustrates the shape of television. There are about 1900 TV stations not counting satellites and repeaters, and 3800 altogether. The world total of TV receivers is 140 million. Operating TV stations, both VHF and UHF, are on the air in 90 countries of the world. Increases have been spectacular when one considers that in 1950 there were only 150 transmitters in just a few countries and only 11 million sets.

About 50% of the TV sets in use are in the U. S. Turkey, a country of 20 million, has only one station and 1000 sets. India, with 430 million people, has one station and 900 sets. Pakistan, with about 75 million people, has no stations and no sets.

Out of the approximately 120 independent nations of the world, 85 have TV stations, and only about 35 do not. The "have-nots" include major countries, such as Greece, Pakistan, and the Union of South Africa. However, there are many other areas, classified as protectorates, colonies, and possessions, which do have TV. These include Curacao, Malta, Aden, Gibraltar, and Okinawa.

Africa

Zambia, one of the newest African countries, may soon get a new TV station through U. S. aid. Many of the newer nations start TV service with low-power (100-watt or so) transmitters. Such has been the case in Ghana, Sierra Leone, Sudan, Enugu, East Nigeria, and Kaduna, North Nigeria. In South Africa the government has been resisting pressure for TV service; there still isn't any.

Table 2. Tabulation of Worldwide Television Coverage.

	Sets (millions)	Sets Per 100 people	*Main TV Stations
Europe	43	10	600
USSR	9	4	130
Asia	14	½	160
Australia & Oceania	2	8	40
Africa	1/3	nil	30
South America	4	1½	90
North America	68	25	800
	140 1/3		1850

*Excluding low-power satellites and repeaters, of which there are 1500 in Europe, 220 in the USSR, and 150 in Japan.

The Middle East

Since 1957, the Arabian American Oil Company has been operating a 12-kw (ERP) station (on U. S. standards) in Dhahran, Saudi Arabia. A 500-watt repeater is also in service. Now the Saudi Arabian government plans a national TV service and has contracted with the U. S. Army Engineers to construct two new stations as the nucleus of a nationwide 12-station chain.

In oil-rich Kuwait, a TV service was started in 1961 with a 100-watt transmitter. At the outset, TV programs were restricted to readings from the Koran, current events, news, and cultural films. Today there are three stations, two on U. S. standards and one on CCIR.

Latin America

The Caribbean area has provided U. S. broadcasters with opportunities to make investments by actual ownership participation or management contracts. As an example, three TV stations in Haiti, Curacao, and Aruba were built by and initially were operated by Gerald Bartell as commercial enterprises. The ABC network has 35% ownership of TVCR in San Jose, Costa Rica, and minority interests in stations in other Central American countries, Venezuela, and the Philippines. CBS announced in its 1964 Annual Stockholders Report that it had acquired an interest in a new TV station to be built in Antigua, British West Indies, and that it had interests in a channel 2 facility serving Trinidad and Tobago.

In Chile, three educational television stations, two in Santiago and one in Valparaiso, are operated by universities.

Europe

In England, the second BBC TV network, called BBC-2, is on the air with one station out of a planned 64. Eight more will go on the air in 1965. This second BBC TV network is UHF only and operates on the CCIR 625-line standard. England has a commercial TV service called ITA (Int'l. Television Authority), which is now reported to be getting 65% of the total audience. Ultimately BBC-1 (VHF) and ITA (VHF) may be forced to duplicate programs on UHF to facilitate exchange of programs over the Eurovision network without the necessity for standards conversion. Also, color programming, when approved, has been slated for UHF only.

The mention of color brings to mind that here again there is world-wide chaos on standards. England and Western Europe are expected to adopt a color standard in the March 1965 Vienna Conference. Three standards are proposed:

A. NTSC—Used in the U.S. and Japan.
B. SECAM—French system.
C. PAL—A German system.

The English are leaning toward the NTSC system, but this will cause problems if the rest of Western Europe adopts SECAM.

TV is growing rapidly worldwide, and there is a trend toward commercial support in Western Europe. Today seven countries permit advertising: England, Germany, Italy, Luxembourg, Austria, Finland, and Monaco. In France, TV is a state monopoly, and a noncommercial policy prevails. West Germany has two extensive TV networks (⅓ UHF) with 5% of the time allocated for advertising. A third network (to be all UHF) is under construction.

Holland has a complex arrangement in which five separate companies run a national noncommercial TV service. In September 1964, a commercial TV station, called "REM," began operating on a "Texas Tower" off the coast of Holland. Due to strong pressure, the Dutch legislature passed a law permitting Dutch military and police forces to invade the station, and it was forced off the air even though its operation was in international waters.

Switzerland has a national noncommercial system, but providing adequate programs in three languages became costly, and the Swiss government passed a bill permitting commercial TV. Commercial television service, with advertising confined to specific periods, will start soon.

In Scandinavia, only Finland has commercial TV on its 25-station system, which includes about 10 low-power repeaters. Sweden has a large nation-wide TV service of about 75 stations, all owned by the Swedish Board of Telecommunications.

In Russia, the TV system of about 130 stations and 200 relay centers is linked via the Intervision Network with Iron Curtain countries and, through Finland, with Western Europe. By means of this hookup, Soviet TV can be seen in 23 countries. There are 9 million TV sets in Russia.

The Pacific

In American Samoa, a three-station educational VHF TV network, authorized by a two-million-dollar grant by Congress, is now in operation.

In Australia, as in Canada, a government system of TV stations (18) operates side-by-side with commercial stations (28). The system seems to work. Commercial stations devote 60% to 70% of their time to filmed material from the United States.

Then there is Japan, where the number of TV sets in use is second to the number in the U. S. and larger than the number in Great Britain. As in radio, there are two systems, the government-owned Japan Broadcasting Company of 70 stations and about 60 privately owned commercial stations. Although commercial TV in Japan resembles the U. S. system more than any other, there is a basic difference—a Japanese company is allowed to own only one TV station.

Worldwide Services

As in radio, AFRTS has extensive TV service in every part of the world where U. S. servicemen are stationed. The world's most northerly located TV station is the AFRTS operation in Thule, Greenland. The latest are two stations added to the Korean six-station network. AFRTS has TV stations (mainly 100- and 500-watt) in the Panama Canal Zone, in Tripoli, in Ethiopia, in Saudi Arabia, and on Okinawa. It operates UHF stations in Japan, Germany, and Puerto Rico (5 total).

Rediffusion, formed in 1928 to operate broadcast relay systems in England, today operates overseas broadcasting services with transmitters covering a population of 12,500,000. TV stations are operated in Hong Kong, Malta, the Ivory Coast, and other areas of British influence.

Conclusion

After these observations of radio and television on a rather fast "excursion" around the world, some conclusions become obvious. First is the growing trend toward commercial operation. Perhaps more significant is the fact that millions of people in vast areas of the world have little or no modern means of communication or entertainment.

Broadcasters must make every effort to supply the best possible broadcast facilities and programs. Every opportunity must be taken to improve broadcasting as a means of communication between the diverse peoples of the world. Radio and TV influence our lives to a much greater extent than most of us realize, yet one is still an infant and the other is still a child. We are in a young industry, and the promise for the future is bright. ▲

19th NAB Broadcast Engineering Conference

Shoreham Hotel, Washington, D.C.

Monday, March 22

10:30 AM	Joint session with management for opening of convention.
12:30 PM	Engineering Conference Luncheon—Frank L. Marx, President, ABC Engineers, American Broadcasting Company, presiding. Speaker to be announced.

Monday Afternoon

William S. Duttera, Director, Allocations Engineering, National Broadcasting Company, presiding. Eldon Kanago, Chief Engineer, Radio Station KICD, Spencer, Iowa, Session Coordinator.

2:30- 2:40 PM	Opening of the 19th Broadcast Engineering Conference—Vincent T. Wasilewski, President, NAB.
2:40- 2:55 PM	NAB Engineering Advisory Committee Report—John T. Wilner, Vice President for Engineering, The Hearst Corporation (WBAL-WBAL-TV, Baltimore, Md.).
3:00- 3:25 PM	USIA Television Service—Robert C. Smith, Jr., Chief of Operations, USIA/TV.
4:00- 4:25 PM	Use of Wireless Broadcast Pickup Devices; A Studio Wireless Cuing System (combined paper)—CBS.
4:30- 5:00 PM	New Transistorized AGC and Gamma Control Amplifiers—NBC.

Tuesday Morning, March 23

Radio

Leslie S. Learned, Director of Engineering, Mutual Broadcasting System, presiding. R. A. Holbrook, WSB Radio & Television, Atlanta, Georgia, session coordinator.

9:00- 9:25 AM	Automation—Past, Present and Future—Don Coulthurst, Director of Engineering, International Good Music, Inc.
9:30- 9:55 AM	Practical Experience Derived from Dual Polarized FM Antennas—Robert Silliman, Consulting Engineer.
10:00-10:25 AM	Stereophonic Transmissions Via Ranger II Satellite—Carl R. Rollert, Collins Radio Company.
10:30-10:55 AM	The Use of Test Transmitters for Selecting AM Transmitter Sites—Vir N. James.
11:00-11:25 AM	A New Device for Preventing Over-Modulation—Ralph Haberstock, Gates Radio Co.
11:30-12:00 N	The Use of Mobile Radio Telephone Equipment in "On-The-Spot" News Coverage—Norman C. Colby, Manager of Engineering, RCA.

Television

Clyde M. Hunt, Vice-President for Engineering, Post-Newsweek Stations, Washington, D. C., presiding. Charles L. Jeffers, Vice-President, Engineering, WOAI Radio & Television, San Antonio, Texas, session coordinator.

9:00- 9:25 AM	A Simple Trouble-Free Quadruplex VTR System—Steve Allen, Visual Electronics.
9:30- 9:55 AM	Quartz-Iodine Lighting in Television—ColorTran Industries.
10:00-10:25 AM	System Considerations for Paralleling TV Transmitters—RCA.
10:30-10:55 AM	Station Break Automation—Ten Years of Operating Experience—Arthur H. Freilich, Vice-President, Chrono-Log Corporation.
11:00-12:00 N	Color Camera Panel — Frank L. Marx, Moderator. Panel members: R. T. Cavanagh, General Manager of Studio Equipment, North American Philips Company; R. E. Putnam, Manager, Audio/Video Development Engineering, General Electric Company; Dr. H. N. Kozanowski, Radio Corp. of America; and possibly two additional members.
12:30 PM	Engineering Conference Luncheon—Eldon Kanago, Chief Engineer, Radio Station KICD, Spencer, Iowa, presiding. Speaker to be announced.

Tuesday Afternoon—No sessions

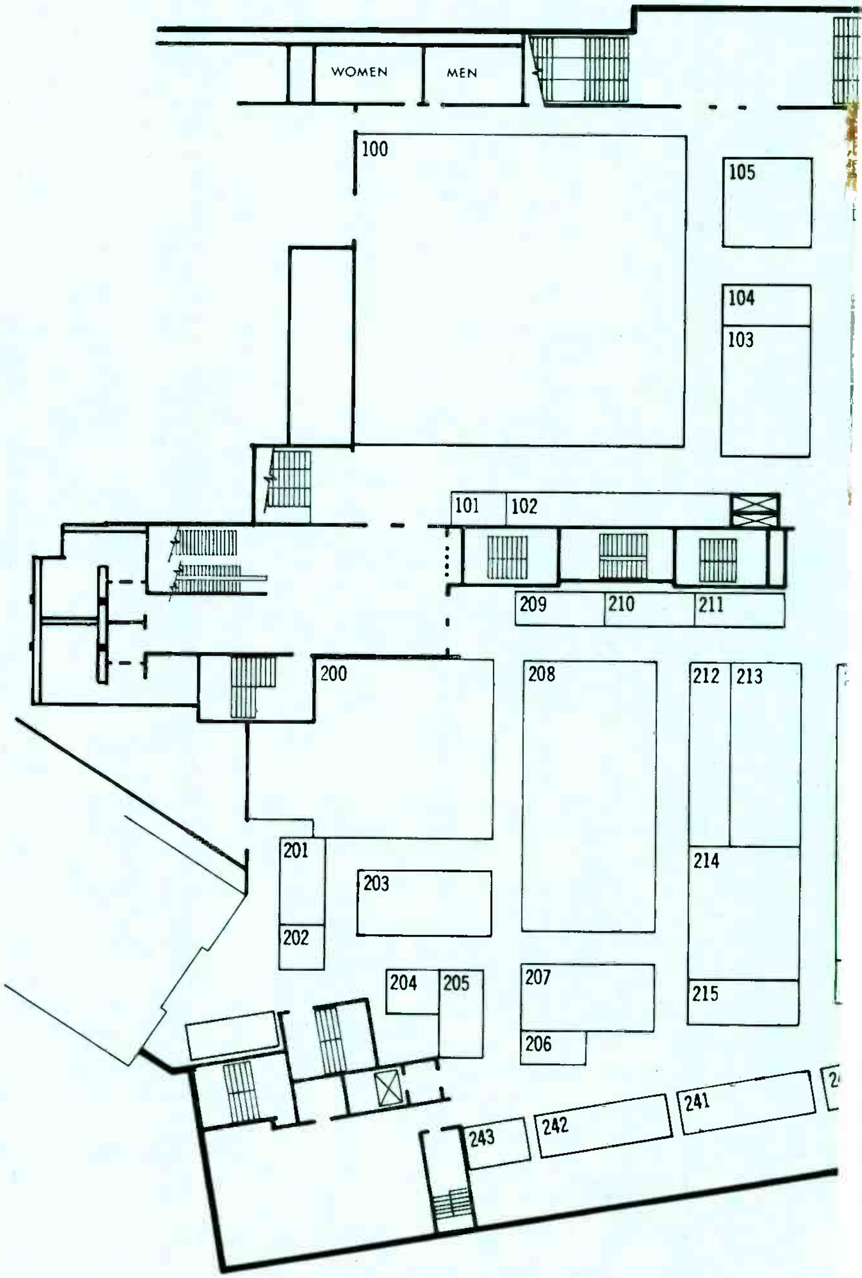
Wednesday Morning, March 24

James D. Parker, Director, Transmission Engineering, CBS Television Network, presiding. Harry B. Whittemore, Director of Engineering, RKO General Broadcasting, Session Coordinator.

9:00- 9:25 AM	The High Band Approach to Teleproduction—Ampex.
9:30- 9:45 AM	Using a Passive Microwave to Bypass Path Obstruction—George S. Driscoll, Engineering Manager, WOKR-TV.
9:45- 9:55 AM	Gyro-Stabilized Lens System—CBS Television Network.
10:00-10:25 AM	Empire State Zig-Zag Antenna Installation and Performance — F. E. Fisk, General Electric.
10:30-10:55 AM	ABC Evaluation of SECAM Color Equipment for Video Tape Use—ABC.
11:00-12:00 N	FCC Technical Panel—James D. Parker, Moderator.
12:30 PM	Engineering Conference Luncheon—Russell B. Pope, Director of Engineering, Golden Empire Broadcasting Co. (Chairman, Broadcast Engineering Conference Committee) presiding. Presentation of Engineering Achievement Award. Acceptance of Award: Edward W. Allen, Chief Engineer, Federal Communications Commission. Speaker to be announced.

Wednesday Afternoon

2:30 PM	Joint session with management.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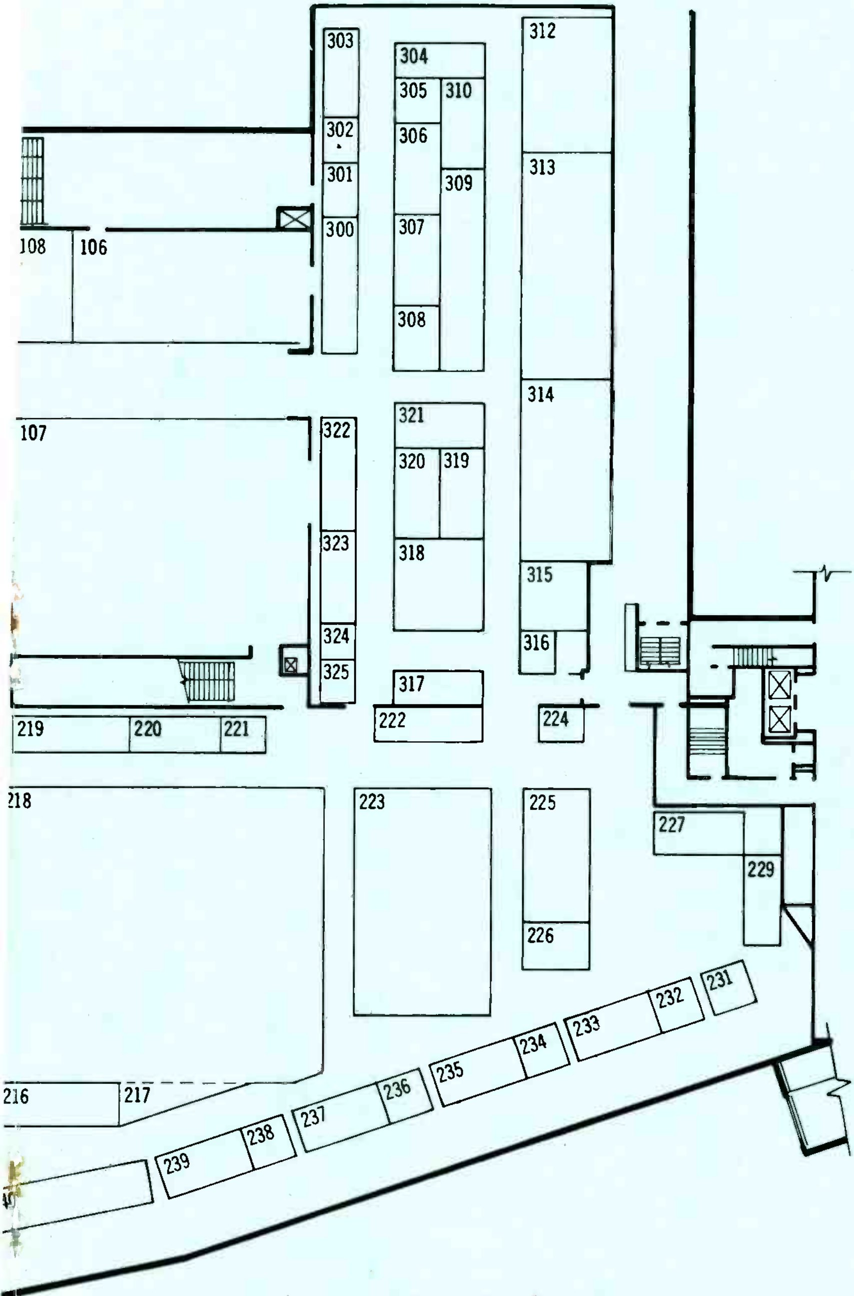


EXHIBIT HALL FLOOR PLAN

1965 NAB Convention — Sheraton Park Hotel
Washington, D.C.

NAB ASSOCIATE MEMBER EXHIBITORS
1965 NAB Convention

Sheraton-Park Hotel, Washington, D. C., March 21-24, 1965

Addressograph - Multigraph Corporation, 1200 Babbit Road, Cleveland, Ohio —307

Adler Educational Systems, Division of Litton Systems, Inc., One LeFevre Lane, New Rochelle, New York—302

Albion Optical Company, Inc., 1410 North Van Ness Avenue, Los Angeles, California 90028—323

Alford Manufacturing Company, 299 Atlantic Avenue, Boston, Massachusetts 02110—209

Altec Lansing Corporation, 1515 South Manchester Avenue, Anaheim, California 92803—211

Ampex Corporation, 401 Broadway, Redwood City, California 94063—200

Andrew Corporation, P. O. Box 807, Chicago, Illinois 60642—238

Arriflex Corporation of America, 257 Park Avenue South, New York, New York 10010—324

Automatic Tape Control, Inc., 1107 East Croxton, Bloomington, Illinois 61702 —309

Bauer Electronics Corporation, 1663 Industrial Road, San Carlos, California —318

Boston Insulated Wire & Cable Company, 65 Bay Street, Boston, Massachusetts 02125—224

CBS Laboratories Division, 227 High Ridge Road, Stamford, Connecticut—242

CCA Electronics Corporation, 716 Jersey Avenue, Gloucester City, Camden County, New Jersey 08030—322

Century Lighting, Incorporated, 521 West 43rd Street, New York 36, New York—221

Chrono-Log Corporation, 2583 West Chester Pike, Broomall, Pennsylvania —308

Cleveland Electronics, Inc., 1974 East Sixty-First Street, Cleveland, Ohio 44103—227

Cohu Electronics, Inc., Kin Tel Division, P. O. Box 623, San Diego, California 92112—316

Collins Radio Company, Dallas, Texas 75207—214

Colortran Industries, 630 South Flower Street, Burbank, California—231

Giannini Controls Corporation, 19217 East Foothill Boulevard, Glendora, California 91740—102

Cummins Engine Company, Inc., Columbus, Indiana—304

Dage Television Company, Division of Dage-Bell Corporation, 455 Sheridan Avenue, Michigan City, Indiana 46360

Dresser-Ideco Company, 875 Michigan Avenue, Columbus, Ohio 43215—305

Dynair Electronics, Inc., 6360 Federal Boulevard, San Diego, California 92114—235

Electronics, Missiles & Communications, Incorporated, 160 East Third Street, Mount Vernon, New York 10550—243

Fairchild Recording Equipment Corporation, 10-40 45th Avenue, Long Island City, New York 11101—222

Filmline Corporation, 43 Erna Street, Milford, Connecticut—306

Fort Worth Tower Company, Inc., 5201 Bridge Street, P. O. Box 8597, Fort Worth, Texas 76112—301

Gates Radio Company, 123 Hampshire Street, Quincy, Illinois—223

General Aniline & Film Corporation, 140 West 51st Street, New York, New York 10020—303

General Electric Company, Electronics Park, Building 7—Room 315, Syracuse, New York 13201—217, 218

Gotham Audio Corporation, 2 West 46th Street, New York, New York 10036—229

The Harwald Company, Inc., 1245 Chicago Avenue, Evanston, Illinois

Houston Fearless Corporation, 11801 West Olympic Boulevard, Los Angeles, California 90064

International Good Music, Inc., P. O. Box 943, Bellingham, Washington 98225—300

Jampro Antenna Company, 6939 Power Inn Road, Sacramento, California 95828—206

Johnson Electronics, Inc., P. O. Box 7, Casselberry, Florida—236

Kliegl Brothers Universal Elec. Stage Lighting Company, Inc., 32-32 48th Avenue, Long Island City, New York 11101—101

Lenkurt Electric Company, Inc., 1105 County Road, San Carlos, California 94070

LTV Continental Electronics Division, 4212 South Buckner Boulevard, P. O. Box 17040, Dallas 17, Texas—213

MaCarTa, Inc., 709 Railroad Avenue, West Des Moines, Iowa 50265—315

MVR Corporation, DBA Machtronics Corporation, 470 San Antonio Road, Palo Alto, California 94306

Marti Electronics, P. O. Box 661 - 105 Poindexter, Cleburne, Texas 76031—234

McMartin Industries Incorporated, 605 North 13th, Omaha, Nebraska 68102—215

Minnesota Mining & Manufacturing Co., 2501 Hudson Road, St. Paul, Minnesota 55119—205, 207

Miratel Electronics, Inc., 3600 Richardson Street, St. Paul, Minnesota 55112—210

Moseley Associates, Inc., P. O. Box 3192—135 Nogal Drive, Santa Barbara, California 93105—237

North American Philips Company, Inc., 100 East 42nd Street, New York, New York 10017—106

The Nortronics Company, Inc., 8101 Tenth Avenue North, Minneapolis, Minnesota 55427—202

Q-TV Incorporated, 342 West 40th Street, New York, New York 10018—239

Quick-Set, Inc., 8121 Central Park, Skokie, Illinois 60078

Radio Corporation of America, Broadcast & Communications Products Div., Front and Cooper Streets, Camden, New Jersey 08102—100

Raytheon Company, 141 Spring Street, Lexington, Massachusetts 02173—104

Reeves Soundcraft, Division of Reeves Industries Incorporated, 15 Great Pasture Road, Danbury, Connecticut

Riker Industries, Inc., Norden Lane, Huntington Station, New York—220

Rohn Systems Incorporated, P. O. Box 2000, Peoria, Illinois—321

Rust Corporation of America, 195 Massachusetts Avenue, Cambridge 39, Massachusetts—225

Schafer Electronics, 235 South Third Street, Burbank, California—212

Shibaden Corporation of America, 250 West 57th Street, New York, New York 10019—226

Shure Brothers Incorporated, 222 Hartrey Avenue, Evanston, Illinois—232

Sony Corporation of America, Industrial Products Division, 580 Fifth Avenue, New York, New York 10036—320

Sparta Electronic Corporation, 6450 Freeport Boulevard, Sacramento California 95822—319

Standard Electronics Corporation, P. O. Box 677, Route 33, Manalapan Twn., Freehold, New Jersey—103

Sylvania Home & Commercial Electronics Corporation, 730 Third Avenue, New York, New York 10017—317

Sarkes Tarzian, Inc., Broadcast Equipment Division, East Hillside Drive, Bloomington, Indiana—201

Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005

Telemet Company, 185 Dixon Avenue, Amityville, Long Island, New York—105

TelePro Industries, Inc., Cherry Hill Industrial Center, Cherry Hill, New Jersey 08034—241

Telequip Corporation, 224 Glen Cove Avenue, Glen Cove, Long Island, New York—203

Telesync Corporation, 43 New Street, Englewood Cliffs, New Jersey—204

Television Zoomar Company, 500 Fifth Avenue—Suite 5520, New York 36, New York—216

Thomson Electric Company, Inc., 50 Rockefeller Plaza—Room 916, New York, New York 10020—313

Townsend Associates, P. O. Box 2210, Springfield, Massachusetts 01101

Utility Tower Company, 3200 N. W. 38th Street, P. O. Box 12027, Oklahoma City, Oklahoma—240

Video-Medical Electronics Corporation, Time & Life Building—Room 4016, New York, New York 10020

Visual Electronics Corporation, 356 West 40th Street, New York, New York 10018—107, 108

Vital Industries, 3614 S. W. Archer Road, Gainesville, Florida

Vitro Electronics, 919 Jesup-Blair Drive, Silver Spring, Maryland—233

Ward Electronic Industries, Inc., P. O. Box 1045, Mountainside, New Jersey 07092—312

Whittaker Corporation GENCOM Division, 12838 Saticoy Street, North Hollywood, California—314

SHOW NEWS

Wasilewski is New NAB President

Vincent T. Wasilewski, new NAB President, is a 15-year staff veteran. Mr. Wasilewski joined the NAB legal staff in October, 1949, was named Chief Counsel in February, 1953, and became manager of government relations in August, 1955. He was named Vice-President for Government Affairs in June, 1960, and was named Executive Vice-President in August, 1961, when the post was created. In his new post, he

succeeds LeRoy Collins, former governor of Florida, who resigned to accept a Federal civil rights position.

Mr. Wasilewski was born in Athens. Illinois, on December 17, 1922. He entered the University of Illinois, College of Engineering, in 1940, but his studies were interrupted by World War II. He served in the U. S. Air Force from September, 1942, until October, 1945, and returned to the University at the close of the War. He was awarded his bachelor's degree in political science in 1948 and his degree of Doctor of Jurisprudence the following year. He was admitted to the Illinois Bar in 1950.

Mr. Wasilewski is a member of Sigma Phi Epsilon, Phi Alpha Delta (legal fraternity), Phi Kappa Phi (honorary), and Order of the Coif (honorary). He is a member of the American Judicature Society, and, as a member of the American Bar Association, he serves on the International & Comparative Law Section (International Communications Committee). He is also a member of the Federal Communications Bar Association and serves on the Committee on Legislation.

Among his other public service posts are memberships on the boards of directors of The Hollywood Museum and the Advertising Federation of America and on the Advisory Council on Federal Reports.

He is married to the former Patricia Callery. They have six children, Jan, Susan, Catherine, Terese, Thomas, and James.

B-E Staff Dinner

Again this year, Forest Belt, Editor of BROADCAST ENGINEERING, will host a dinner in Washington for the members of the B-E headquarters and Consulting Author staffs in attendance at the NAB Convention. At last year's dinner, informative talks were given by James A. Milling, President of Howard W. Sams and Company, Inc., and Robert G. Weston, Executive Secretary of the Committee for the Full Development of All-Channel Broadcasting. An equally interesting program is being planned for this year's get-together.

To Receive Award

The recipient of the 1965 NAB Engineering Achievement Award will be Edward W. Allen, Chief Engineer of the Federal Communications Commission. Presentation of the award will be made during the Engineering Conference luncheon on Wednesday, March 24.

PREVIEW OF NEW PRODUCTS

The newest advances in broadcast equipment and techniques will be reflected in the booths on the exhibit floor at the 1965 NAB Convention and Engineering Conference. To give you an idea of what to expect and what to look for, we have again this year compiled a listing of new products to be introduced at the NAB Convention.

Automation Equipment

Automation continues to find increasing application in broadcasting. Both radio and television automation equipment will be in evidence again this year.

Aitken Communications, Inc.

Highlights of the display will be a new, simple control system for broadcast automation. A complete working unit is to be shown.

Chrono-Log Corp.

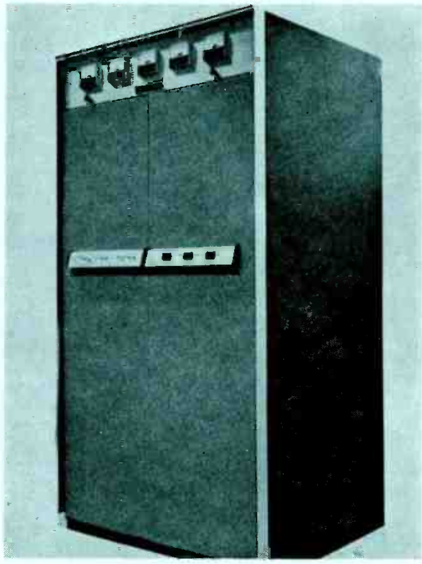
This year two new units will be shown. One is an interface system for connecting the company's step system to the TV station equipment. Also displayed will be a studio digital clock system. The latter equipment is said to be accurate within one second per year. The device features remote digital readouts of time in hours, minutes, and seconds.

Audio and Radio

Those interested in audio and radio equipment will, as always, find a profusion of modern equipment. Here are some samples.

American Electronic Laboratories, Inc.

The AEL booth will show the Model FM-7.5KA, a 7500-watt FM transmitter. Features include overload recycling, block-type solid state rectifiers, fast-operating overload relays, and audio response uniform within ±.5 db from 30 to 15,000 cps. Provision is made for use with any commonly available remote-control panel.



Bauer Electronics Corp.

New additions to the Bauer line include the Model 910 solid-state console (monophonic and stereophonic) and the Model 605 5-kw FM transmitter. Automation equipment will be presented in the form of the newly introduced Model 950A time-delay programmer and Model 440A automatic logging equipment.

Belar Electronics Lab

FM broadcasters will find items of interest in the Belar exhibit. To be shown are the FMM-1 FM modulation monitor, the FMS-1 stereo modulation-monitor adapter, the FME-10 solid-state serrasoid FM exciter, and the SG-1 solid-state stereo generator. This equipment will be used in a demonstration of stereo proof-of-performance measurements.

Fairchild Recording Equipment Corp.

Among the new products will be a radio production desk that includes a six-input mixing system with equalizers, compressors, and reverberation. Also introduced will be the "Maximizer," a device for overload protection and the creation of apparent loudness effects through "frequency shaping."

Gates Radio Co.

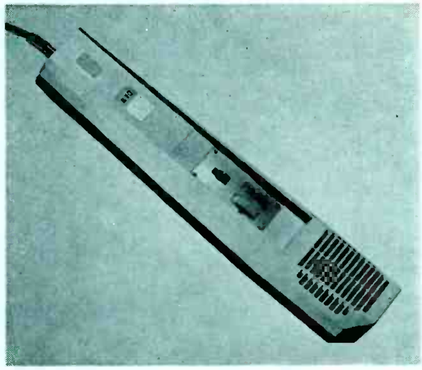
Two new solid-state remote audio amplifiers, the two-channel Courier 70 and the three-channel Attache 70 (illustrated), will be shown. The Courier 70 accommodates two low-impedance microphones, is housed in a vinyl-clad steel case, and provides 300-hour battery life. The Attache 70 features a self-contained tone oscillator and switchable inputs for phono cartridges, tape recorders, etc. A separate PA feed with gain control and an illuminated horizontal meter are included.

Moseley Associates, Inc.

For stations using remote control, a transistor remote-control system will be unveiled. The equipment is available for use with a wire system (using a single standard voice circuit—no DC) or with an STL. The Model ICU-1 Isocoupler (see page 92) will also be shown.

North American Philips Co., Inc.

The Norelco DX-11 microphone includes in the same case a dynamic microphone, a reverberation unit, a transistor amplifier, a control unit, and a battery. The unit is designed to permit the performer to vary the reverberation effect himself. The correct reverberation intensity is automatically related to the delay time. The frequency response is flat within ±3.5 db from 50 to 15,000 cps. Output impedances of 250 and 10,000 ohms are provided.



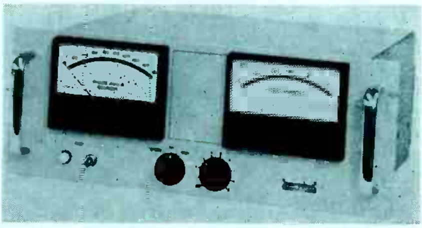
The Norelco booth will have a working display of television studio equipment. The plumbicon color camera will be included in the display.

Shure Brothers, Inc.

New from Shure this year is the SM series of professional microphones. The series includes the SM33 unidirectional ribbon microphone, the SM50 omnidirectional hand-held microphone, the SM56 cardioid stand-mounted microphone (shown here) and the SM57 cardioid hand-held microphone. The SM56 has switch-selected impedances of 30-50 ohms and 150-250 ohms. EIA sensitivity (EIA Standard SE-105, August 1949) is −149 db for 30-50 ohms and −148 db for 150-250 ohms.

Sparta Electronic Corp.

In addition to its regular line of audio equipment, Sparta will be exhibiting its experimental model A-20 audio console and experimental model AS-500 stereo console and turntable unit. The A-20 (in the photo) is fully transistorized, has 16 inputs mixed through 8 step-type faders, and provides program and audition channels and built-in cueing facilities and cue speaker. Demonstrations of all equipment will be conducted.



Vitro Electronics

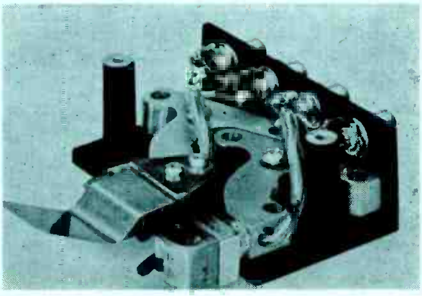
The Nems-Clarke Model 112 phase monitor has a capacity for monitoring up to nine towers — more on special order. The monitor is all solid state, provides indications of phase and loop currents, and is suitable for either remote or nonremote applications. Accuracy of the unit is ±1°, and resolution is better than .5°. Input impedance is 51 or 75 ohms.

Visual Electronics Corp.

New AM and FM transmitters feature local or remote control, standard components, design for easy maintenance, pretuning to specified frequency, silicon rectifiers, color-coded wiring, and vacuum capacitor tuning. AM ratings are 1000, 5000, 10,000, and 50,000 watts. FM output powers are 250, 1000, 5000, 7500, 10,000, and 20,000 watts. Also on display will be an audio automation system, a 10-channel tape-cartridge player, the McCurdy solid-state audio consoles Model SS4724 (illustrated), McCurdy solid-state dual-channel consoles Model SS-4400, a new VTR system, and the Elcon 3″ image orthicon camera tube.

Recording Equipment

Recording and reproducing equipment has become such an integral part of broadcasting that a multitude of these units can be expected as a matter of course at the Show. Among the machines on display will be the new ones described here.



Automatic Tape Control, Inc.

A heavy-duty adjustable head-mounting bracket and assembly is the Model HDHB-1. It is made from heavy machined castings and permits both height and azimuth adjustments; it may be locked in position when the proper alignment has been attained. The assembly fits PB, PC, and Criterion ATC players.

Broadcast Electronics, Inc.

Three new Spotmasters will be shown this year. The "Ten Spot," Model 610, is a multiple-channel tape-cartridge system for use in automated or semiautomated broadcast stations. The unit holds ten Series 600 cartridges and occupies a rack space of 19" x 17". Also on display will be the Model 400, a solid-state economy model, and the PortaPak I, a solid-state, portable salesman's audition unit having a maximum playing time of 31 minutes.

Gotham Audio Corp.

The EMT 930 three-speed studio turntable assembly pictured here includes a preamplifier, an equalizer, and an electromagnetic remote-control brake for close cueing. Also in the display will be the Neumann U-64 linear admittance condenser microphone, designed to give uniform frequency response at angles well off the axis of greatest sensitivity. Rounding out this exhibitor's trio of new products will be the Neumann SM-69 stereo microphone system.

MaCarTa, Inc.

MaCarTa will be introducing its Model 705S tape-cartridge machine (monophonic) and the Model 572 stereo tape-cartridge unit. The 705S operates at 1⅞ ips (standard) or 3¾ ips (on request). Remote control is available. The stereo Model 572 provides dual speeds (3¾ and 7½ ips) or, on special order, a single speed (15 ips). Meter switching is provided to permit reading of record level, output level, and bias level. Sepa-

rate monitoring and equalization are provided for each channel. The transport is shock mounted and employs a hysteresis synchronous capstan motor.

Metrotech, Inc.

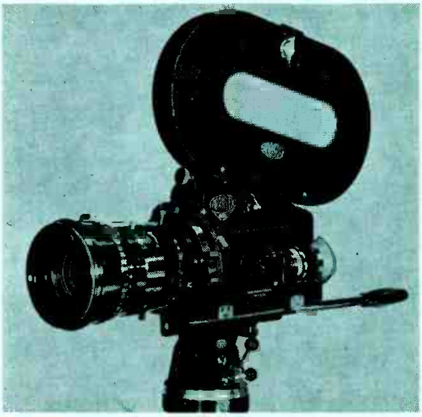
Two-direction automatic reversing permits continuous playing from a single reel of tape by the Model 1050 tape transport. The head-mounting plates permit azimuth and height adjustments and accept any of the commonly used heads. An integrated solid-state audio installation is also available. The transport accepts 10½" NAB reels. It has three motors and operates at 7½, 3¾, and 1⅞ ips.

Midwestern Instruments

The Model 1021 Magnecord tape recorder is a relay-operated unit that can be controlled from one or more remote stations. Tally lights indicate the status of the recorder to all stations. A memory relay precludes tape damage due to "fast-buttoning" of the controls.

Television Equipment

Television-broadcast equipment from the camera lens to the transmitter will be arrayed on the exhibit floor. Here's the picture regarding new TV hardware.

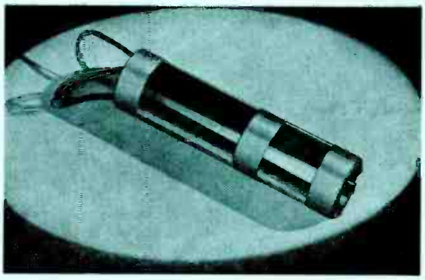


Arriflex Corporation of America

A self-blimped camera, the Arriflex 16 BL, will be available for both single-system and double-system synchronous sound recording. The moving parts are acoustically isolated from the outer housing of the camera to insure quiet operation. The unit accommodates a 400′ film magazine and is provided with a tachometer and footage indicator. Governor-controlled and variable-speed DC motors and a synchronous motor are available.

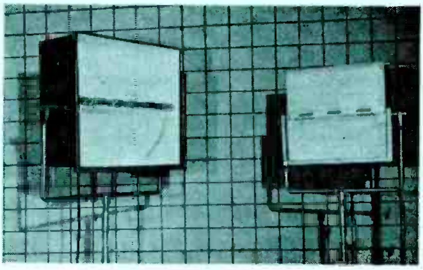
Boston Insulated Wire and Cable Co.

Included in the display of cables, connectors, and cable assemblies for most makes of television cameras will be molded neoprene attachable connectors for mobile-van power-supply use, studio lighting, etc. Also shown will be camera cable-connector adapters to provide watertight reinforced terminations for RCA and GE cables.



Cleveland Electronics, Inc.

The Deflection Components Division will be exhibiting components for operation of the newer-type vidicon and image orthicon tubes and other special-purpose pickup devices. A highlight of the display is to be the 15VYA-333, a 1½″ vidicon yoke-alignment-coil assembly for use with the 8480 and other electrostatic-focus vidicons.



Colortran Industries

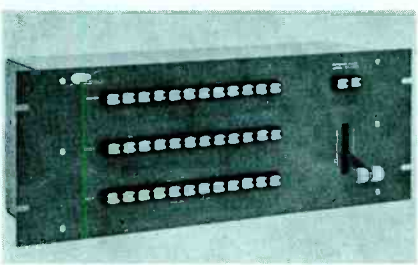
The "Multi-Beam 650" is a 650-watt focusing quartz light that provides an intensity ratio in excess of 7.3 to 1. The beam angle is continuously variable from 16° to 53°. In the same display will be three models of the "Soft-Lite" (two of which are illustrated), which are designed to produce shadowless "sky-light" illumination. These are the LQS-10 (one lamp, 85° coverage, 8500 candlepower), the LQS-20 (two lamps, 75° coverage, 17,000 candlepower), and the LQS-40 (four lamps, 86° coverage, 35,000 candlepower). All four of these lights use 3200°K quartz-iodine lamps.

Columbia Broadcasting System, Inc.

Two members of the CBS family will be displaying new wares at the Show.

CBS International will be showing the Dynalens (above), developed by Dynasciences Corp. in cooperation with CBS. This unit operates by bending the light rays entering the camera lens by an angularity proportional and opposite to the camera deflection angle. Thus loss of picture detail due to camera deflection angle is eliminated.

CBS Laboratories will be displaying the Audimax III (monophonic) and Audimax IIIS (stereophonic) automatic level controls. The monophonic unit is a new solid-state version of the Audimax IIRZ. The stereo unit consists of two Audimax III's mechanically and electrically coupled to provide stereophonic operation. Both units are 19″ wide and 9⅝″ deep; the stereo model is 7″ high, and the mono model is 3½″ high. Both are available for immediate delivery.



Dynair Electronics, Inc.

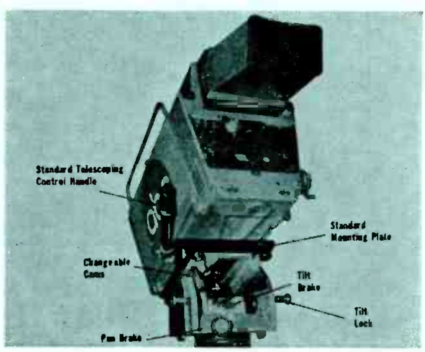
Functional displays of multiple-input, multiple-output video and pulse distribution amplifiers, balanced line amplifiers, and video switchers and switcher-faders ment includes the Model TX-4A solid-will be featured. Newly introduced equip-state closed-circuit television modulator. This device is completely transistorized and generates crystal-controlled visual and aural carriers; a vestigial sideband output is produced. Also shown will be the Series 6000 balanced line amplifiers, a fully transistorized video transmission system for balanced cable; the Model VS-120A solid-state switcher-fader; the Model VS-121A solid-state switcher-fader (shown); and the Model PDA/VDA-3008A solid-state distribution system.

Gencom Div., Whittaker Corp.

Making their debut will be the Type 206 all-solid-state image orthicon, the Type 208 all-solid-state plumbicon studio camera, solid-state tape recorders Type L-4 and BTR-4, and a ½″ vidicon having a low lag characteristic.

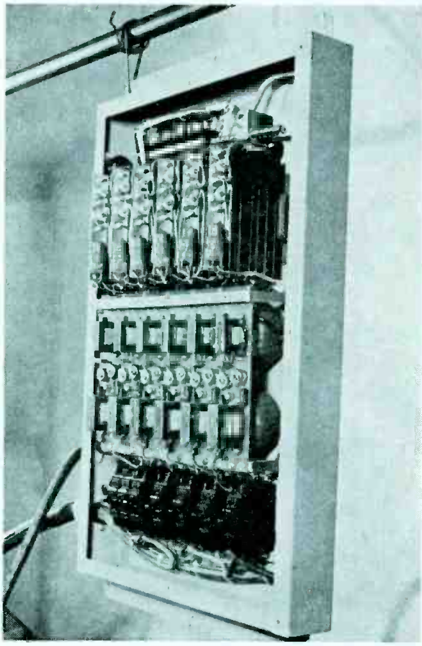
General Electric

The Visual Communications Products Division will be showing the following items: the PE-26 portable solid-state 3″ image orthicon camera, the TT-51-B 35-kw high-band VHF transmitter (with 10:1 visual-to-aural ratio), the BC-35 solid-state audio console, the TT-56 15-kw UHF klystron transmitter, and the TT-57 30-kw UHF klystron transmitter.



Houston Fearless Corp.

New this year is the 16/35 mm Reversal Labmaster. Also new is the head for TV cameras shown in the illustration. Literature on a number of film processors and camera supporting devices will be available.



Kliegl Bros.

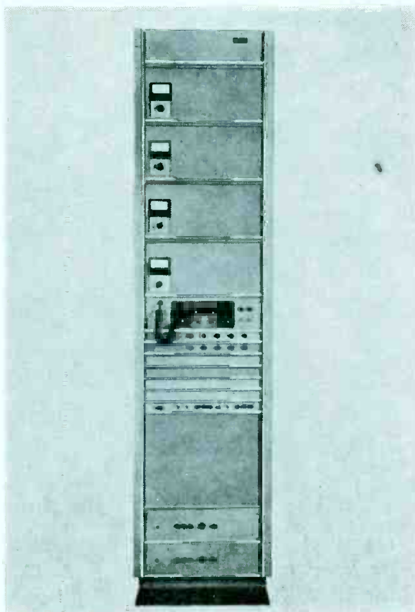
A line of all-quartz TV studio lighting will be shown for the first time. Included are quartz scoops (No. 3450), quartz Fresnels (6", 500-watt No. 3506 and 8", 1000-watt No. 3518), quartz ellipsoidal Klieglights (400 watts, No. 1341, to 1000 watts, No. 1393) and (illustrated) the R-64 solid-state dimmer (available in 2400- and 6000-watt sizes).

Microwave Associates, Inc.

The 2-gc-band solid-state microwave relay equipment to be shown by Microwave Associates has been in use by the networks (see News of the Industry, page 52, January 1965 B-E), but the NAB Show will provide the first exposure of the system to broadcasters in general. A live demonstration of the equipment is planned in the Telequip Corp. booth.

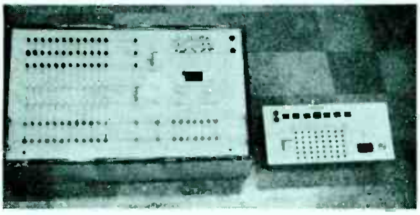
MVR Corp. (formerly Machtronics, Inc.)

The Video Disc Recorder is a completely self-contained unit for recording and reproducing TV signals or similar information. The storage medium is a metallic disc; one TV frame is recorded for each revolution of the disc. The unit can be used for stop-motion effects, or up to about 24 seconds of continuous action may be recorded.



Raytheon Co.

The KTR-II microwave equipment is a solid-state (except for klystrons) system delivering 1 watt in the 5925-to-8400 mc range. Transmission capacity is a single wideband video channel with one or more subcarriers for 15-kc audio or 600 single-sideband, suppressed-carrier message channels. The equipment has an operating temperature range of $-30°$ to $+55°$ C. Frequency stability is $\pm.02\%$.



Riker Industries, Inc.

In the spotlight will be a new all-transistor automated video switcher (shown here) with automatic preroll, manual override, and random access. The automation portion can sequence 20 events and has the capability for a full day's programming. The automation is separate and may be used with any Riker switcher.

Also featured will be the Model 5300 video processing amplifier (February B-E, page 68), the Model 1520 vertical-interval test generator, and the Model 1525 test generator (provides test signals for tape recorders in accordance with SMPTE Recommended Practice RP-10). The Model 5147 Diagonal Bar Generator, Model 557 3.58-mc Subcarrier Regenerator, and Model 5319 additive/non-additive Video Mixer complete the lineup of new gear. The exhibit will be set up in the form of a complete production facility.

Standard Electronics Corp.

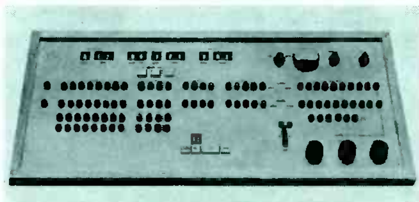
On display will be a new transistor 5-kw VHF transmitter and a new transistor 10-kw UHF transmitter employing an air-cooled klystron. A new application bulletin showing examples of the one-driver, one-amplifier design will be available.

Tektronix, Inc.

The newly introduced Type RM529 video-signal waveform monitor is intended to provide bright, stable display of vertical-interval test signals. A line selector can be used to choose any line for display. The displayed line, as viewed on the picture monitor, is automatically intensified. Four different frequency responses can be selected.

Telemet Company

Complete catalogs and new-product literature will be available, and working demonstrations of all equipment will be conducted. New equipment featured this year includes the Telechrome Model 3203A Clamper Amplifier, Telechrome Model 3209A Color Stabilizing Amplifier, Telechrome Model 3518A Color Bar Generator, and the Telechrome Model 3519A1 Sync Generator.



Ward Electronic Industries, Inc.

A semiautomated television switching system, the CDL Type VSA-102 will be shown. The system includes video and audio switching facilities and a relay memory unit to permit advance storage of audio and video switching events.

Also shown will be CDL solid-state vertical-interval video switchers and a CDL computer-controlled automated switching system.

Sharing the Ward booth will be a new CO. EL. slotted-waveguide UHF antenna. The antenna is available for channels 14 to 83 and with omnidirectional gains up to 33 times. The vertical pattern has essentially a cosecant-squared distribution. ▲

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THE CHIEF ENGINEER

. . . Helps Solve Your Technical Problems

Readers are invited to send their questions to the "Chief Engineer"; those of most general interest will be published.

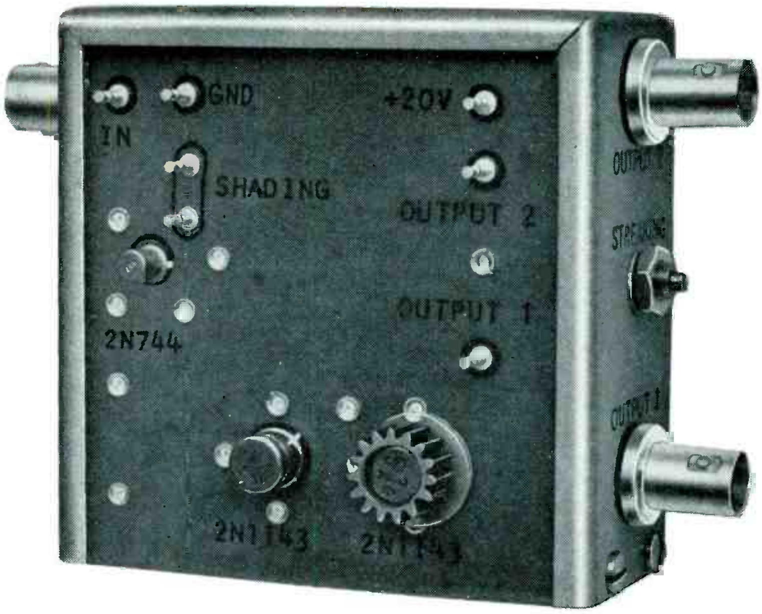
Not far from the head end of our CATV system are located fence chargers that cause a constant pulse streak on channel 4, which we receive from about 100 miles away. Are there any effective ways to go about eliminating this type of interference? We constantly check the fence lines for arcing, and we cut any weeds that might cause arcing, but we still have the problem.

I can't offer a guaranteed solution to your problem, but here are some suggestions that should prove helpful. First, try a small amount of resistive suppression in the HT side of the fence chargers that are causing the interference. A pulse-train type of "signal," almost identical to the spark pulse of auto ignition systems, is being generated, and using suppressor resistors often helps. If you can find any of the old "inductive suppressors" of the spark-plug type, they seem to work a bit better than the resistors. While this does reduce the peak voltage and duration of the pulse somewhat, it doesn't seem to interfere with the effectiveness of the charger. If the resistive type suppressor is used, not over 10,000 ohms resistance should be used.

One other method has helped in some cases: the use of LC filtering across the input AC line (in AC-powered chargers) to keep the pulses from feeding into the AC supply lines and being radiated from there. Wind a couple of air-core RF chokes (about 15-20 turns of No. 14 wire), and connect a pair of .05-mfd capacitors across the input and a pair of .005 mfd capacitors across the output, with all of the free ends tied together to a common ground. This assembly can usually be placed inside the fence-charger cabinet. Ground the cabinet well.

I am the Chief Engineer of an AM Broadcast station having a directional antenna. The station license requires that we read the base currents once daily. A chemical plant immediately adjacent to our transmitter site emits acrid fumes which under certain weather conditions settle near the ground and make it impossible to venture to the tower bases to take readings. Will the Commission allow us to skip readings of the base currents under these conditions?

There is no provision of the Commission's Rules which would permit deviation from the terms of the station license under these conditions. One possible solution to your problem is to ask the manufacturer to cooperate by not producing these fumes for a particular period of the day so that you can make the required readings. From an engineering standpoint, you must record these readings even if it is necessary to don a gas mask, and, therefore, cooperation by the manufacturer would seem to be the most satisfactory solution. ▲



TRANSISTORIZED TCA3 CAMERA AMPLIFIER

FITS ANY IMAGE ORTHICON CAMERA

This miniaturized (3¼" x 3¼" x 1¼") camera amplifier will replace vacuum tubes in ANY image orthicon camera. It's completely transistorized and is very simply mounted within the camera. Microphonics are eliminated. Operating voltage is 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 BNC type as well as 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 are included and are easily adjusted by use of standard RETMA resolution chart. TCA3's are on-the-air proven in TK10/TK30, TK11/TK31, 4PC4A1 and TA124E cameras. Instructions, necessary hardware and pre-cut cables are included.

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Circle Item 25 on Tech Data Card

TECHNIQUES FOR AUDIO TAPE MASTERING

by John D. Harmer, President and Chief Engineer, Capital City Sound Recording Co., Columbus, Ohio—Some pointers to help the sound recording engineer produce a better product.

In the recording of original tape masters for phonograph records and tape duplicating, there are some techniques that are better than others for producing a quality product. The methods to be described have been developed over a number of years in the professional recording business.

Mastering

Better high-frequency response, ease of editing, and wider dynamic range are obtained when the master recording is made full track at a tape speed of 15 ips. Master tapes should be made only with first-line professional mastering tape. This may sound extravagant at first, since almost any tape will accept a signal, but experience shows the advisability of using such tape. Absolute perfection from both a technical and artistic point of view is difficult to attain. Conscientious artists and artist and repertory (A & R) men, when listening to playback monitor speakers—usually under high-level conditions—can often sense even the most minute tape-motion flaws and other disturbances possibly not even connected with the recording equipment. Thus the engineer must do everything possible to insure highest recorded quality, and the use of unspliced professional-grade mastering tape is essential to maintaining that quality.

To provide a "protection tape," a second tape recorder may be bridged across the program buss. This machine runs at 7.5 ips and provides a full-track "copy." This second tape is recorded at the same time as the master and can be thought of, therefore, not as a copy at all, but rather as a slow-speed, low-noise original. This method has proved to be a valuable time saver in case the client wants such a "copy" of the master material for audition purposes.

Splicing

When a splice must be made, perhaps the most important single factor is maintaining the two tape ends parallel. The tape splicer should be one having superb tape holding and aligning qualities, even if it is not as fast to use as others or requires some handling of the tape for trimming. However, the best rule to apply when making original or second- or third-generation recordings is to avoid splices if at all possible. Few things short of a tape break will ruin a good recording more quickly. Even carefully trimmed, well-made splices can cause a momentary "bump" or "flutter" when going over stabilizer flywheel drums or across heads and thereby perhaps ruin an otherwise "perfect" performance.

Equipment Considerations

Each recording session may (and often does) require a different equipment arrangement; however, the following general approach can usually be applied:

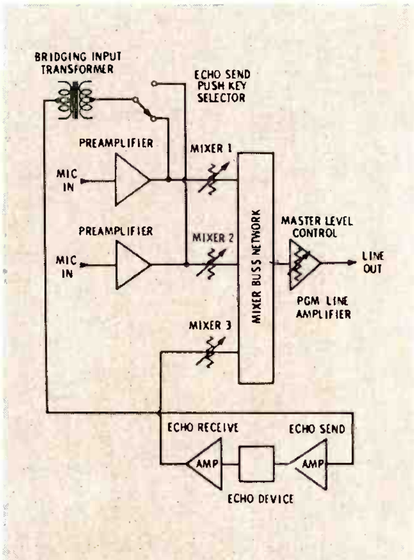

Fig. 1. A versatile arrangement for adding echo effects to the audio program.

(A) Musical instruments and vocal artists should be separated whenever possible. This may require the use of portable sound-absorbing folding screens to increase the apparent distance of separation.

(B) A different microphone should be used for each group or individual so separated.

The purpose behind this separation is to gain more flexible and individual mixer control over the various portions of the entire recording group. This allows, for example, the A & R man to call for (and the engineer to supply) increased volume level for the vocalist without a corresponding increase in the level for the orchestra.

Microphone Equalization

The use of individual microphone equalizer controls is well established in many of the major recording companies because it is an extremely versatile tool. This may cause some raised eyebrows among readers accustomed to working with broadcast transmission systems having essentially flat frequency response. Broadcast systems are designed, by and large, to transmit, unaltered, signals they receive from microphones, lines, and reproducers. On the other hand, the purpose of a recording studio is to record a performance and to alter, if necessary, the characteristics of that performance to produce a more pleasing recorded sound. In addition to adjusting the relative levels, this might mean increasing the high-frequency response of one microphone to obtain a crystal-sharp piano "ring," reducing the low-frequency response of the voice track to retain clean, understandable dialogue, or introducing vari-

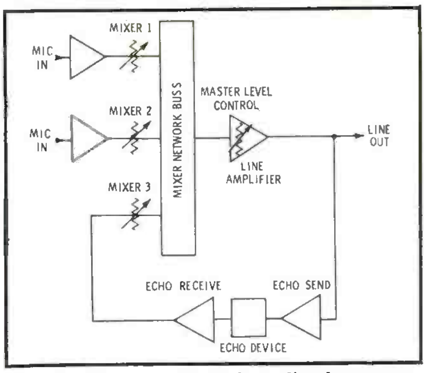

Fig. 2. Usual method has disadvantages.

ous degrees of echo into some of the microphone channels. All this results in a coloration of the original sound to produce a product in accordance with the wishes and desires of the producers, the A & R men, and the performers themselves.

Echo Devices

Most recordings made today have some amount of artificial reverberation added. Artists and A & R men demand echo effects, and the engineer must supply them.

One method of producing echo effects that has been found to work well is the following: The recording console equipment is modified so that echo send signals are derived from the channel selector keys through a transformer bridging network (Fig. 1). The output of the echo receive amplifier is brought to a mixer control on the console. This arrangement allows the recording engineer to add any amount of echo at will. In general, reverberation devices are so connected that the input of the device is isolated from its own output to prevent feedback.

A one-shot "slap echo" can be obtained by the arrangement in Fig. 1 if the echo device is a tape machine (usually running at the 7½ ips speed) set up for tape monitoring. This effect is differentiated from the normal tape reverberation in that it is a one-time echo and does not decay as the echo produced by a re-entrant system does.

The conventional method of introducing reverberation (Fig. 2) has some inherent drawbacks. In this arrangement, the program amplifier and the echo section form a closed loop. Instability due to feedback appears before a substantial echo level can be obtained. A further disadvantage is that reverberation is applied to all signals after mixing, and selective echoing of indi-

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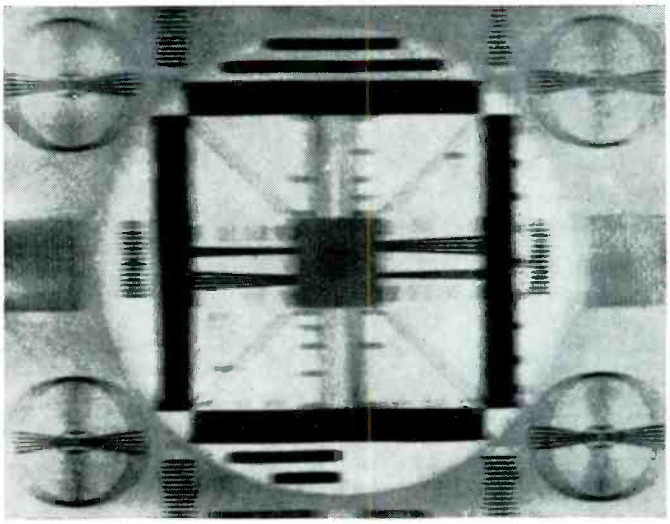
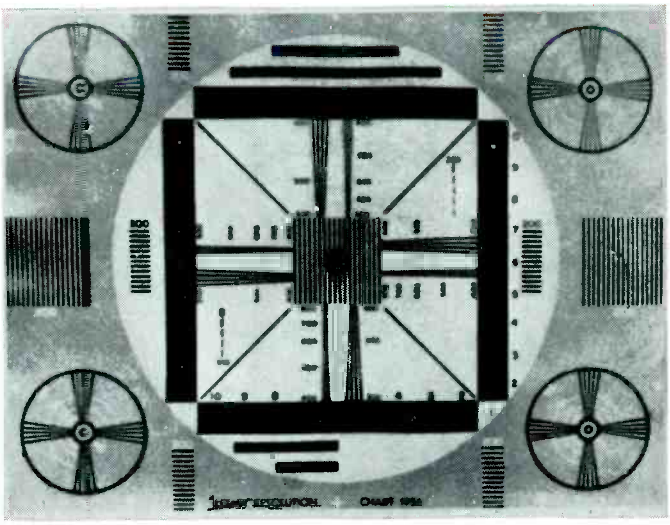
The greatest advance in image motion compensation in television history



Without Dynalens—Test pattern photographed from a monitor with I.O. camera vibrating horizontally at 25° per second.



With Dynalens—Same test pattern photographed from a monitor with I.O. camera, equipped with DYNALENS system, vibrating horizontally at 25° per second.

A unique gyro-stabilized lens system called DYNALENS has eliminated the problem of picture jumping or wobbling due to angular vibratory motions of the TV camera.

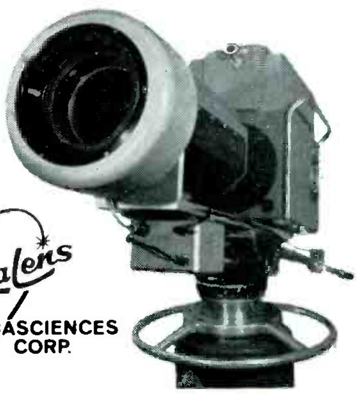
Developed by Dynasciences Corporation, in cooperation, with the Columbia Broadcasting System, DYNALENS permits vibrationless long-lens close-ups. The optical magnification of "zoom" lens or telephoto lens attachments no longer produce exaggerated motion effects.

DYNALENS has revolutionized the picture quality possible from remote locations. Cameras mounted on unsturdy or unstable platforms now transmit jitter-free pictures. Pictures shot from a moving vehicle such as a truck or car show similar steadiness.

This sophisticated lens system employs stabilizing gyros which resist any short, fast movements. For motions faster than a normal camera pan, electrical energy is produced which moves a correcting lens in exact opposition to the movement. Result: any picture unsteadiness is eliminated.

The excellent image motion compensation possible with DYNALENS has been demonstrated in tests by CBS engineers and during television coverage of the 1965 Presidential Inauguration. Similar successful results have been obtained in military aerial photography.

With the advent of DYNALENS, television broadcasting history has been made. For more information about this technological breakthrough, write:



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vidual sources is thus impossible.

Pickups

A somewhat unique, though by no means original, method of picking up electrically-operated musical instruments is shown in Fig. 3. Instruments in this class include electric guitars, bass guitars (often accompanied by huge amplifier-speaker systems), electric organs, electric pianos, and electric bass pianos. In the arrangement of Fig. 3, a connection is bridged across the voice coil of the instrument speaker. This type of pickup has been used frequently with good success.

Use of this method has generated some interesting byproducts, however, not the least of which is a general increase in background noise level. Most of the noise energy is power-frequency hum and buzz; frequently, there may be as many as four instrument amplifiers operating at the same time in the studio, and each contributes noise.

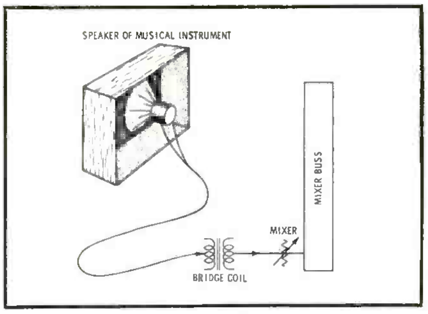

Fig. 3. A method for instrument pickup.

Unusual conditions sometimes arise. In one such instance that occurred with an electrically amplified guitar, there was an all-too-familiar ground-loop buzz, but no amount of power-cord reversing or experimentation with separate ground wires seemed to reduce the buzz. The noise persisted when the instrument was held or strapped about the musician, but it stopped when he laid the instrument down. When the engineer accidentally touched the musician while grounded, the noise was reduced. Several combinations of ground wires were then tried without totally satisfactory results. Finally, in desperation, the engineer tried having the musician stand on a large grounded sheet of metal. This reduced the noise enough to permit continuing the session.

Another form of noise is low-frequency disturbances caused by the musicians' fingers and hands on guitars or other instruments hung about the neck or otherwise in close proximity to the body. However, these are small technical difficulties that once explained and demonstrated to the A & R man can usually be cleared up with tactful instructions to the artists involved.

A further matter to consider is the relative studio sound levels from vocalists and instruments. Electrically operated and amplified instruments usually deliver better-quality sound when run below normal output, and this definitely should be encouraged by engineers and A & R men, since the direct-tap pickup allows the volume level to be restored by the mixer control. Moreover, lower instrument volume permits greater flexibility, since the sound issuing from instrument speakers in the studio is not so likely to be picked up on adjacent microphones.

The subject of piano pickup has

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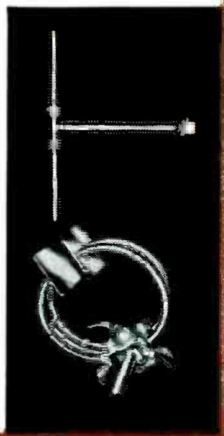

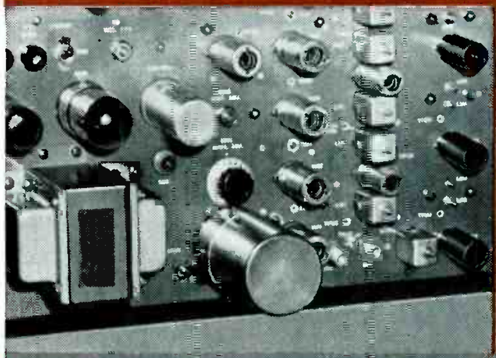

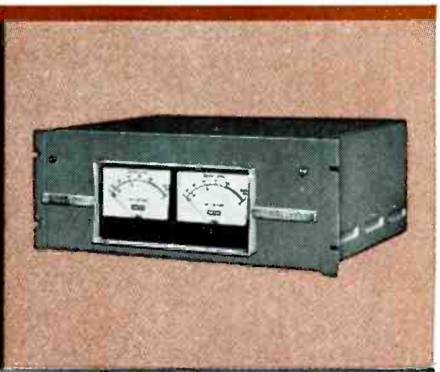

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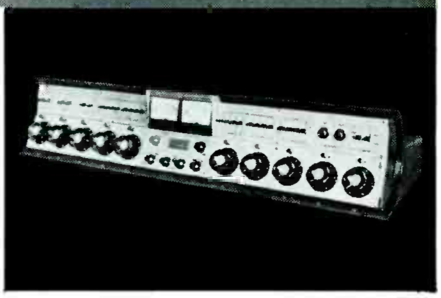

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been discussed at length elsewhere, so it will be considered only briefly here. A satisfactory and pleasingly clean pickup from a vertical grand can be obtained by using the familiar ribbon-type microphone. With individual equalization in the piano-pickup microphone channel, the character of the pickup can be changed from bright stage-front pickup to a more mellowed background sound.

Experimentation with several pickup positions has shown that two such positions give best overall results in our studio environment. In one position, the microphone is placed 2′ to 3′ in front of the instrument at a point in line with C above high C on the keyboard. The microphone faces the sounding board, and the instrument front cover is removed. In the other position, the microphone is placed 2′ to 3′ directly above the piano at a point in line with highest C. The top lid of the piano is removed, and the microphone faces directly into the instrument.

Client Relations

Some of the toughest jobs for a recording studio occur when musical talent having no previous recording experience is encountered. These people may test the microphones by blowing into them, or they may insist on playing instruments with volume levels approaching the threshold of pain. It is a good idea to try to release the studio space to the client ½ hour in advance of the scheduled session to allow time for the client to become accustomed to the premises and facilities and to permit instrument set-up time. If the engineer is on duty during this advance period, he can make the musical-instrument pickup taps, if any, determine a general microphone placement, and give what advice may be helpful.

Conclusion

The techniques for making professional tape masters depend somewhat on the individual circumstances. It is hoped, however, that the general comments given here will be helpful to those who may be called upon to assume the technical responsibility for making such recordings. ▲

A COUNTERWEIGHTED TRANSMISSION LINE

by *Len Spencer,* **Consulting Author, Montreal, Quebec, Canada**—**A basically simple, but effective, solution to the problem of sagging conductors in an open-wire transmission line.**

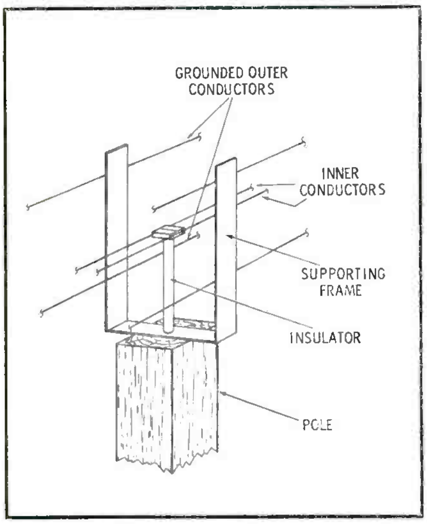


Fig. 1. Basic design of open-wire line.

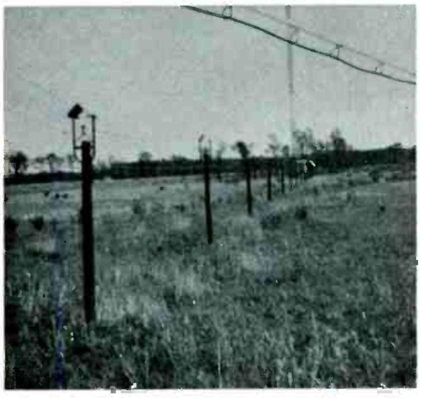


Fig. 2. One of two lines in use at CKAC.

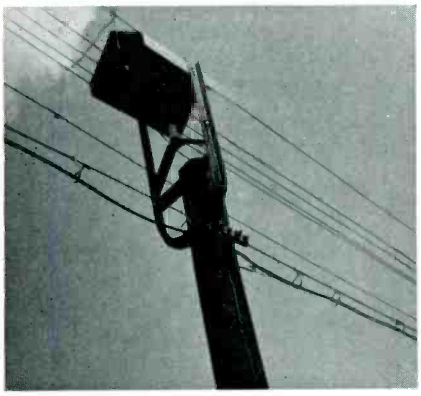


Fig. 3. View of frame atop one pole shows metal shield to keep ice off insulator.

Because of their low cost and simple maintenance requirements, unbalanced open-wire RF transmission lines for the lower broadcast frequencies were quite popular before the perfection of gas-dielectric coaxial cables. A typical open-wire unbalanced line consists of two closely spaced center conductors inside four grounded, equally spaced wires (Fig. 1). The dual center conductor is insulated from the supporting frames, each of which is mounted on a wooden pole.

At CKAC, the two-tower array is fed by two transmission lines, each about 525′ long. One of these lines is shown in Fig. 2. The supporting poles are approximately 50′ apart. Although the lines were taut when first installed, extreme seasonal changes in temperature (–32

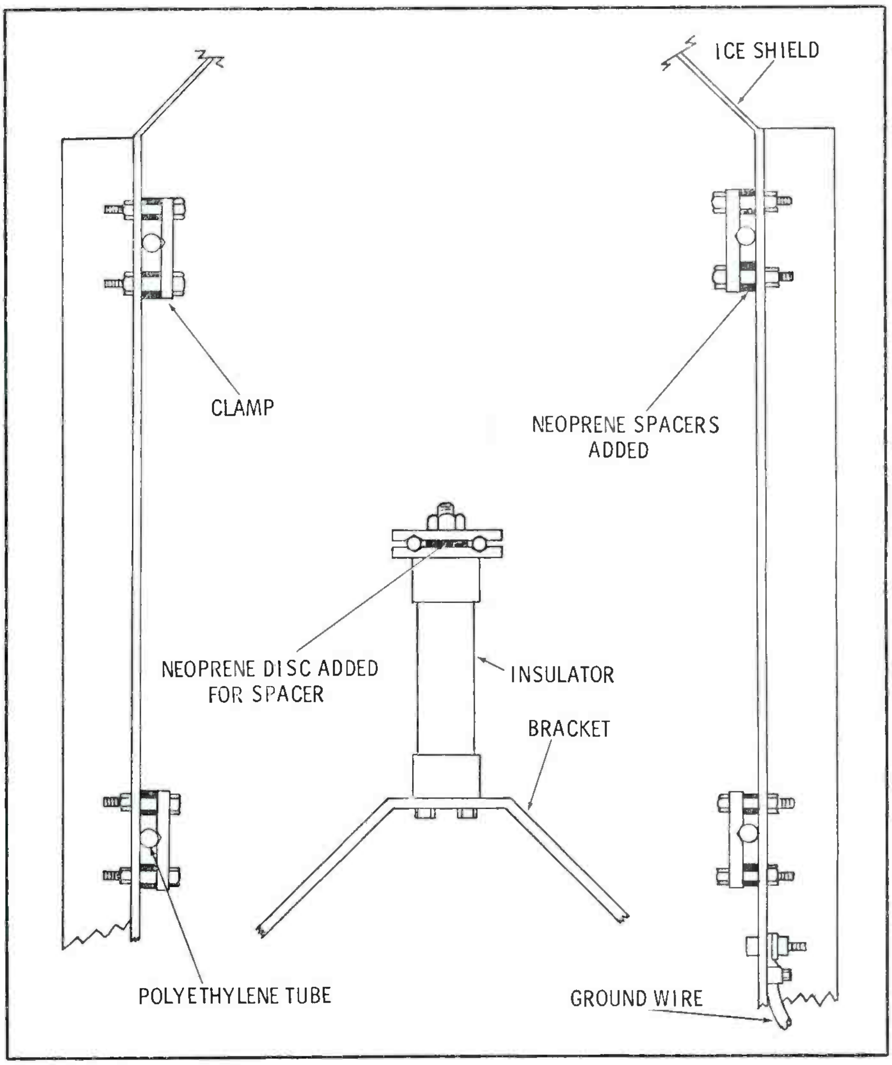
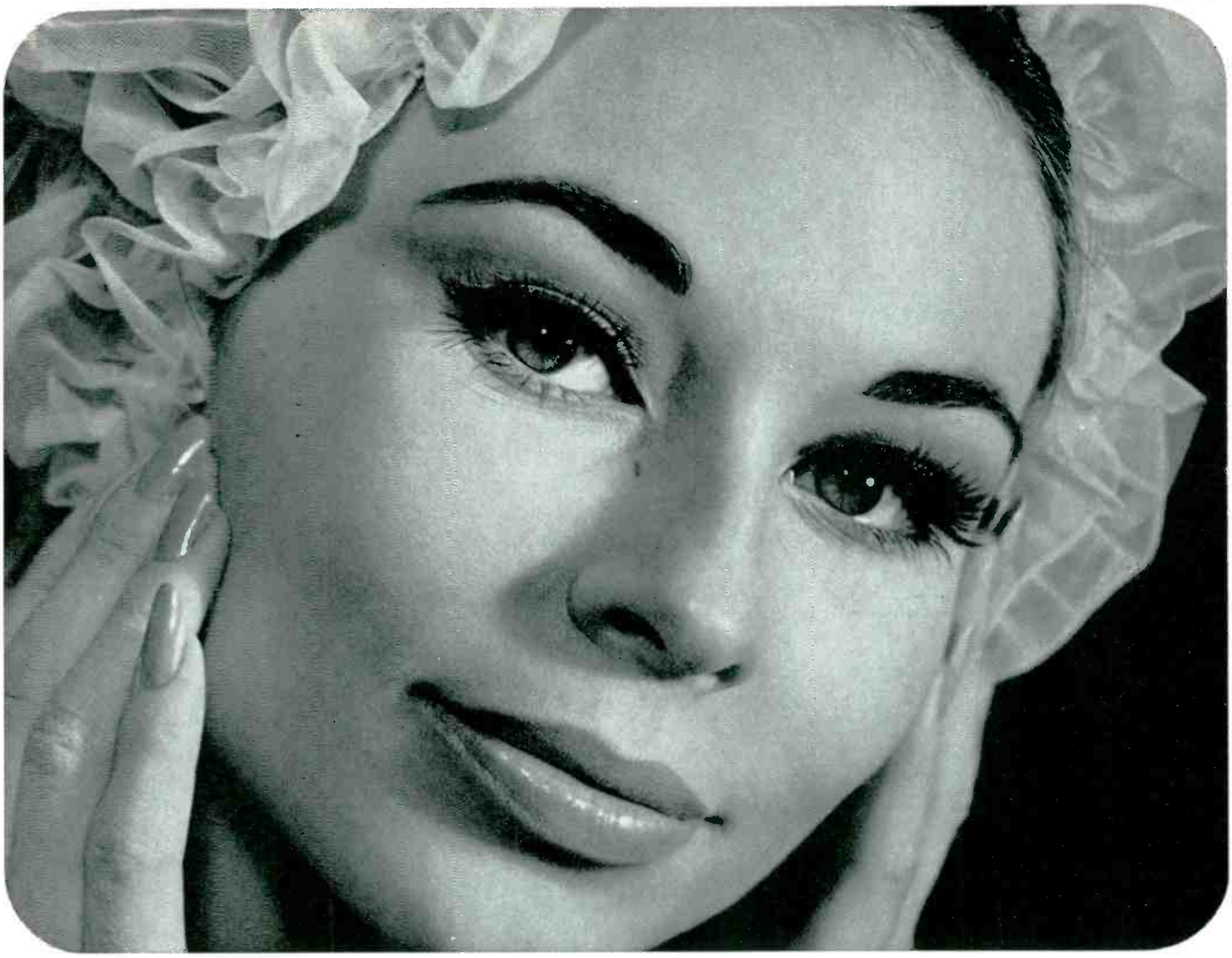


Fig. 4. Detail of support-frame changes for the counterweighted transmission line.



Film couldn't.
Scotch® Brand Video Tape did.

Kept her face soft and lovely for cosmetics spot!

KPRC-TV, Houston, will tell you: "SCOTCH" Video Tape cured "skin blemishes" in filmed TV commercials. With a demonstration that won OJ's Beauty Lotion over from film to tape. And the commercial production business over to KPRC!

Live picture quality was the big reason. Tape faithfully presents the full softness and delicacy of a woman's face—*every time*. Film, in contrast, just couldn't look live on tv, because quality gets lost in the optical-to-electronic translation. And with repeated showings, film tended to gather dirt, which appeared to be on the girl's skin, KPRC pointed out.

What's more, tape offers greater production convenience than film. You see what you've shot immediately. Most special effects are pushbutton fast. There's never a time-out for processing. Both time and money savings are usually part of the bargain.

KPRC is one of more than 200 stations actively participating in 3M's comprehensive program to help advertisers and agencies take full advantage of video tape. These stations offer helpful reference materials as well as production service. Call your local stations for details. Or write 3M Magnetic Products, Dept. MDV-35, St. Paul, Minn. 55119.

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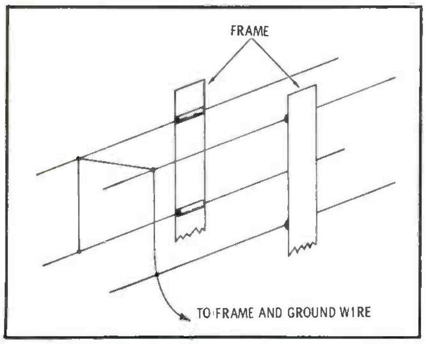


Fig. 5. Method of grounding outer wires.

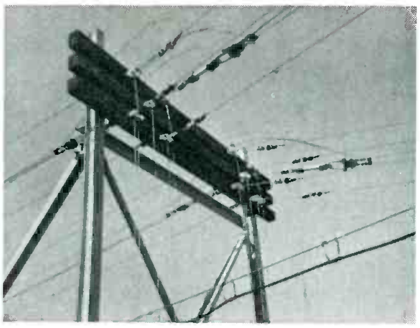


Fig. 6. Steel frame and wooden crossarms.

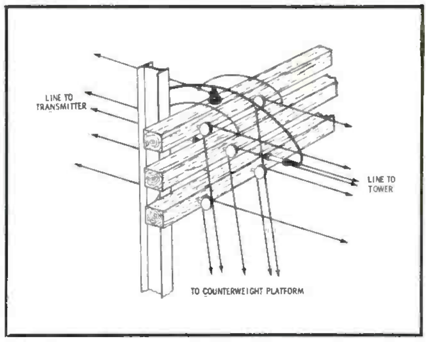


Fig. 7. Arrangement of pulleys and method of carrying "hot" wire across arms.

to 109°F) eventually resulted in considerable sag between the supporting poles. The outer wires, each firmly attached to the U-shaped metal supports (Fig. 3), expanded unevenly and would swing away from the "hot" center line whenever there was a high wind. This, of course, caused variation in the characteristic impedance of the line, which in turn caused the output power of the transmitter to vary.

It was decided to try freeing all the outside grounded wires from their individual supports and allowing them to expand and contract with their tension controlled by a suitable weight. When this proved successful, we attached the center line to the counterweight also.

To accomplish the modification, the "deadman," or pole closest to the tower, had to be extra heavily guyed. Each "U" was provided with polyethelene tubes (Fig. 4) through which the wires were passed after being securely attached by insulators to the "deadman." Near each supporting bracket a wire was soldered to the outside wires, at a distance away from the tubes (to allow for lateral movement), and ground wire on the pole as shown in Fig. 5.

At the building end of the line, cross bars are mounted on two upright steel "I" beams (Fig. 6), and the outside wires pass through pulleys attached to the top and bottom crossarms (Fig. 7). The center line, protected by a suitable insulator, has tension applied through a pulley on the center crossarm. The hinged counterweight platform (Figs. 8 and 9) keeps all the lines in tension. (The heavy cables supported by messenger cables are the phase-sampling, telephone, and power lines to the tuning huts at the bases of the towers.) The 25-lb concrete blocks in the figures were used to adjust the lines to tautness at 68°F and with the platform horizontal.

Note in Figs. 6 and 7 how the "hot" center line was carried over the top of the "H" frame but still kept under tension by the pulleys and counterweights.

The arrangement described is basically simple, but it has resulted in a more stable feed to the array and closer phasing tolerances winter and summer. ▲

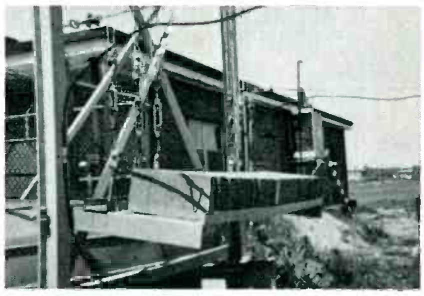


Fig. 8. Blocks on platform act as weights.

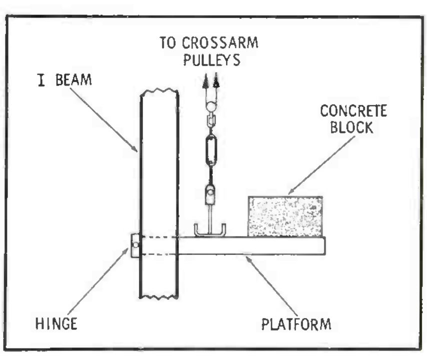
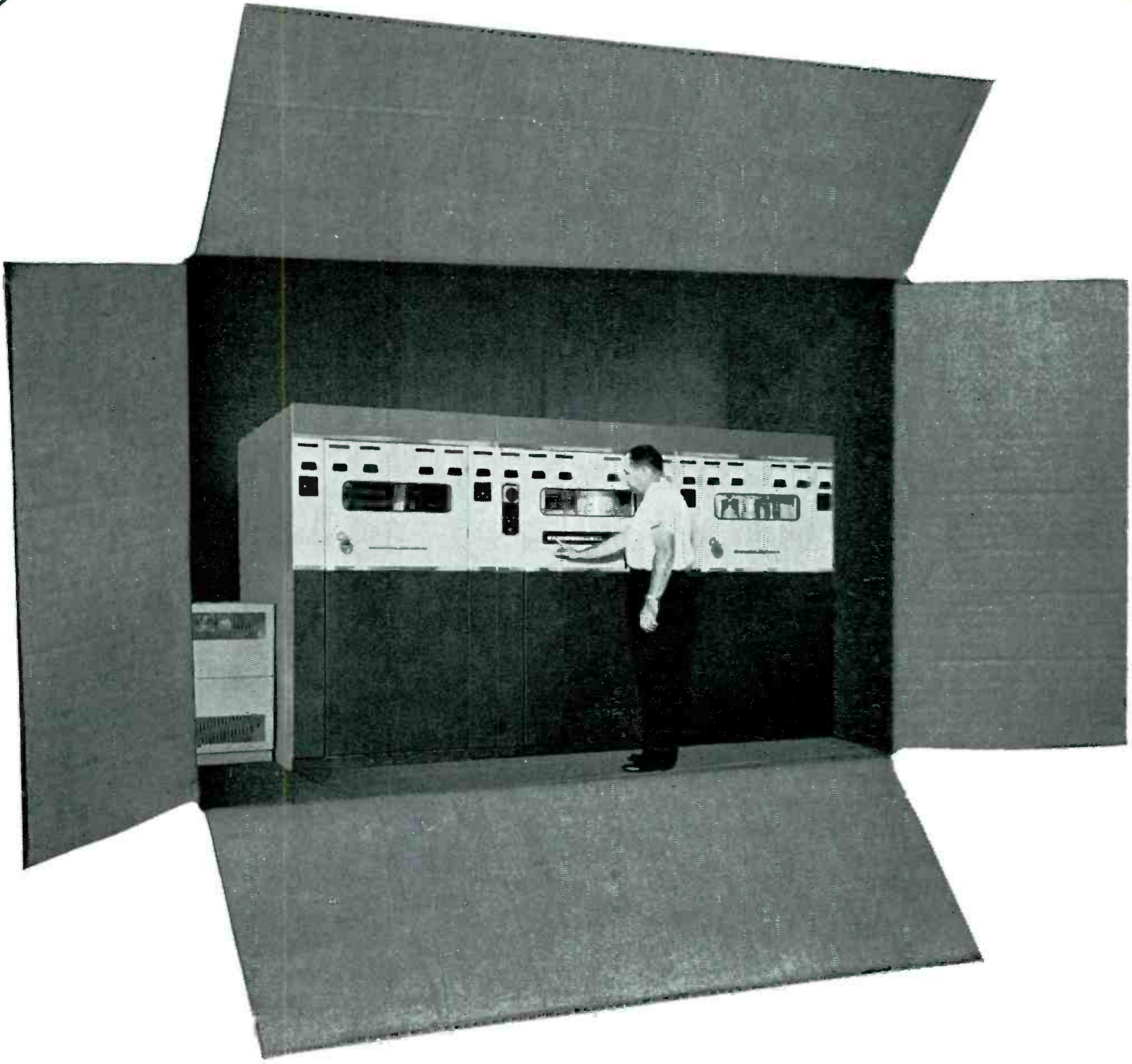


Fig. 9. Diagram shows platform fulcrum.



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- A Look at Maintenance Logs
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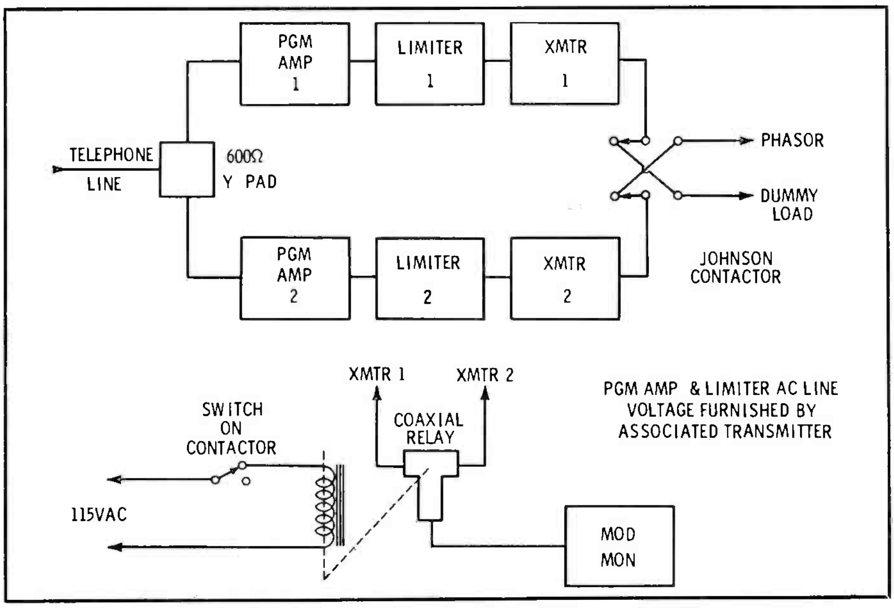


Fig. 1. Block diagram shows alternate use of the main, auxiliary transmitters at WIL.

An Automatic Transmitter Control

by Melvon G. Hart, Technical Director, WIL, St. Louis, Mo.

As more stations convert to remote-control operation of their transmitter facilities, a large number of older transmitters will be pressed into service as auxiliary transmitters to be used in the event of failure of the main transmitter. These older transmitters, while still capable of good performance, were not designed to be operated by remote control and are, in some instances, rather complicated to get on the

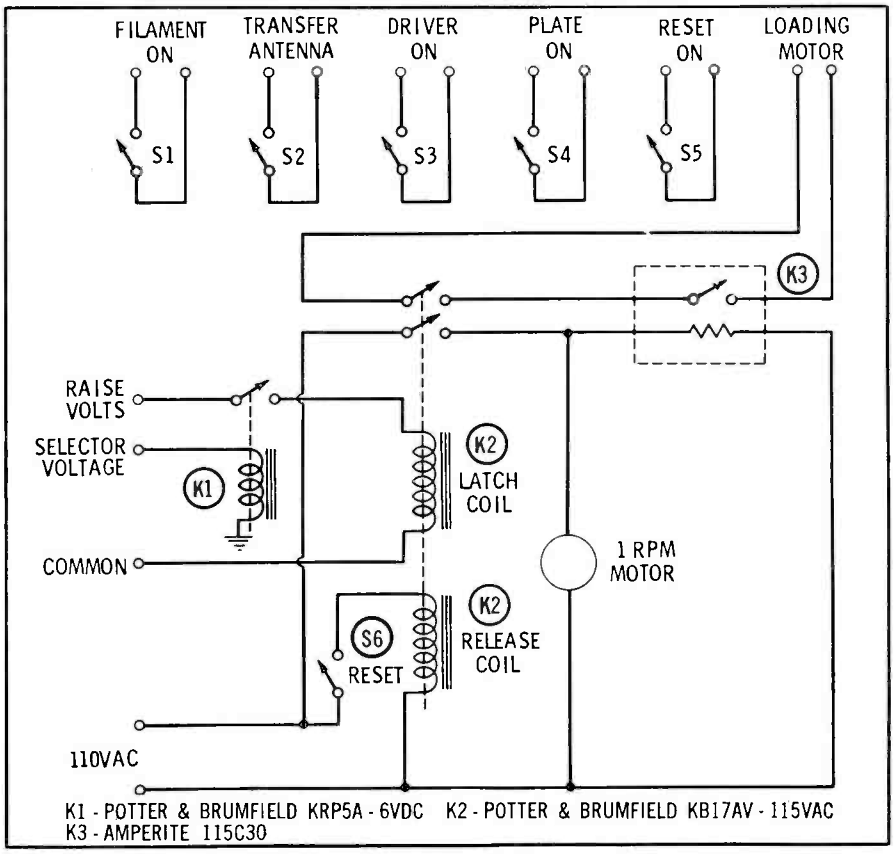


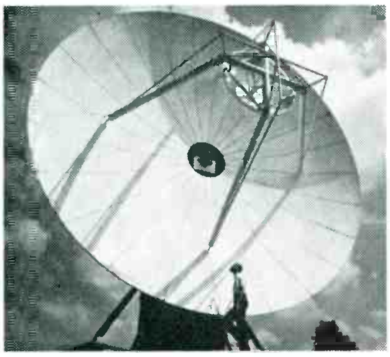
Fig. 2. Schematic diagram showing how the motor-switch arrangement functions.

air. At WIL, the standby transmitter is a Gates BC5A which was built in 1948. Putting this transmitter on the air requires that the following operations be performed in exactly the right sequence: (1) Filaments on, (2) Antenna transfer, (3) Drive plate on, (4) Final plate on, and (5) Automatic reset on. If any of these functions is forgotten or not done in proper sequence, the transmitter will not operate or, worse yet, may be operating fully modulated into the dummy load.

After several outages during which the operator on duty at the studio failed to start the standby transmitter, it was decided that a simple, automatic means of placing the auxiliary unit on the air was needed. Provision had been made for automatic switching of the audio chain and the frequency and modulation monitors in the original installation (see Fig. 1); when the new remote-controlled transmitter was installed, a new program amplifier, limiter, frequency monitor, and modulation monitor were also installed. The old units were retained as standby units. Thus each transmitter has its own set of associated audio equipment that is automatically turned on when the transmitter filaments are started. In the event of any failure a completely different set of audio and RF equipment is switched on the air.

The heart of the new system is an aluminum chassis on which are installed a one-rpm motor and cam and six lever-actuated snap-action switches. The circuit is shown in Fig. 2. To initiate the changeover, it is necessary only to dial one position on the remote-control unit and press the on or raise key. This action starts the motor, which then actuates, in proper sequence, the switches controlling the filaments, the antenna transfer, the driver, the plate voltage, and the automatic transmitter reset. At the conclusion of the sequence the motor unit resets itself. As soon as the motor starts turning, time-delay relay K3 closes the circuit to the plate-loading motor, which decreases the plate loading for 30 seconds. This allows the transmitter to start with a light load. After the transmitter is on the air, the operator adjusts the loading for the correct common-point reading. ▲

About the Cover



Truly international, transoceanic television is a reality, and in a few years it will be commonplace. The efforts of countless scientists and engineers have made this achievement possible. Symbolic of this research and development work is the antenna system shown on this month's cover.

The 30' parabolic reflector is part of a transportable space-communications terminal developed by ITT Federal Laboratories, a Division of International Telephone and Telegraph Corporation, Nutley, New Jersey. The antenna can be disassembled for transportation; semi-trailer vans contain the transmitting and receiving equipment. A servo system is provided to permit automatic tracking of the satellite with the antenna.

The system was designed for switchover from one satellite system to another with relative ease. A dual transmitter system with separate feed horns makes possible rapid shifts in frequency.

Stations of this type have been operated from a number of locations, including California, New Jersey, Brazil, and Germany. Experiments have been conducted using both the Relay and Telstar satellites.

The particular antenna shown here probably will not feed overseas programs to local TV stations, but it is one of the electronic stepping stones that will ultimately lead to this development. When that happens, significant changes in broadcasting may very well take place.

UHF-TV Station

(Continued from page 13)

of video. Standard video-cable impedance is 75 ohms. Incoming network video, which may be only 1 volt peak to peak, is fed to a distribution amplifier which brings it up to the station level and usually offers two or more outputs at that level. The camera control unit for the film island also has two or more outputs of standard composite video information. A third source of video is a mixing amplifier that furnishes .4 volts of sync, plus the station's "black" signal, about .07 volts below blanking level. Each of these video sources is fed to a three-position switcher which in turn is fed into the stabilizing amp, AGC, and then into the transmitter. Thus, the operator can select video and audio from network, from the film camera, or from black.

Q: What about some means to fade the video as the audio is faded?

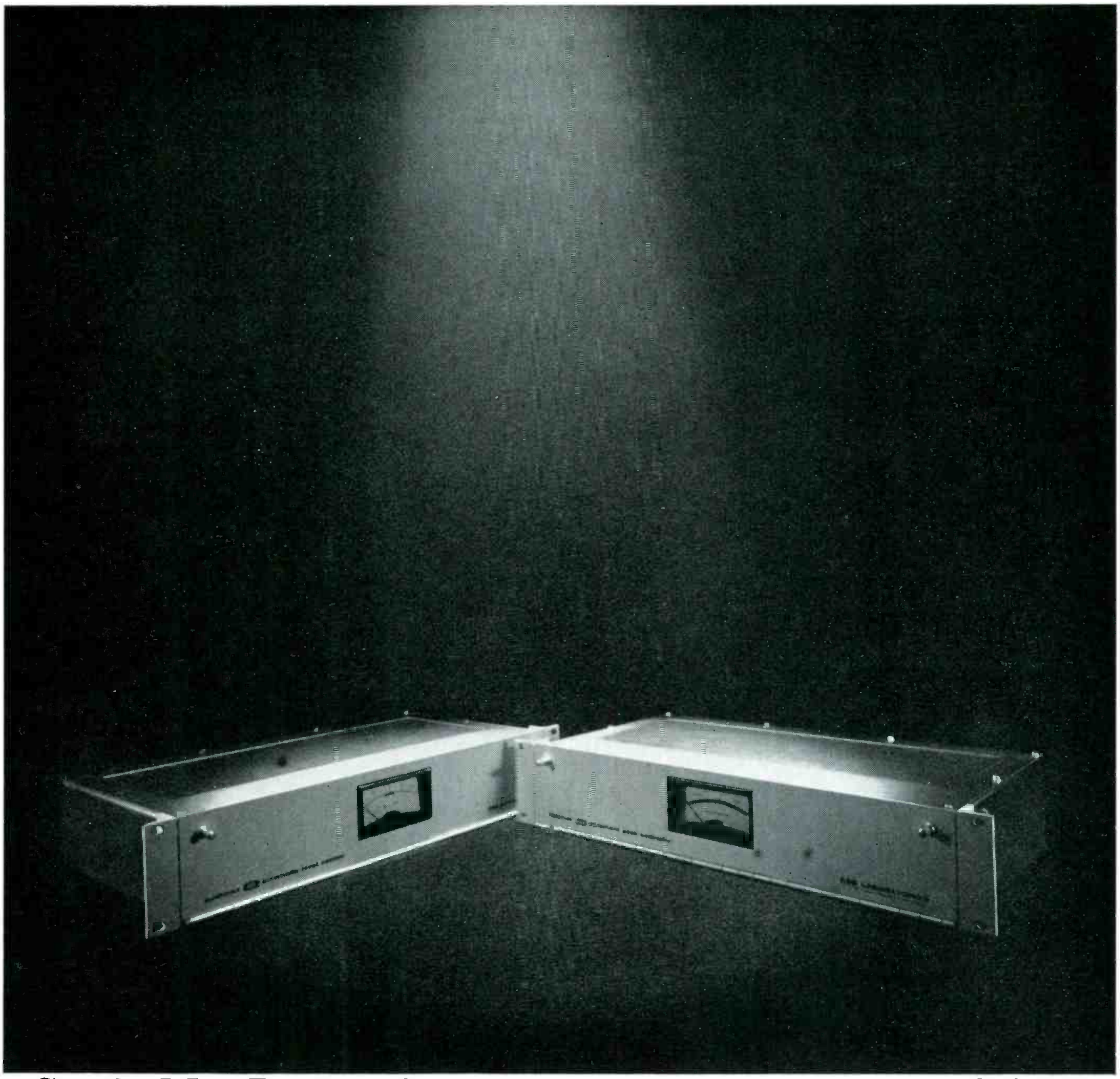
A: Fading of network video is almost never done in the smaller stations. A local video fader unit is not usually bought until local cameras are added to the facilities. Then the system works like this:

Each local camera's plain video signal (without sync added) is fed to two parallel switchers—see Fig. 3. The output of each switcher goes through a fader-pot with both pots connected through gears to a common lever which can be moved to fade out one switcher while fading in the other.

The video output of the switcher-fader unit is fed to a video-sync mixing amplifier where the sync is added. The sync is added after the fader unit to prevent loss of sync when the video is faded out. The output of the fader unit is commonly fed to a fourth position on the switcher preceding the stab-amp input.

Q: What equipment is needed for film handling?

A: Equipment for 16-mm film should include an ordinary projector, which can be a home-type unit, to preview the films and find cue lines for inserting commercials. One also needs a film rewinder, either hand-crank or motor-powered type, and a film timer. A film timer actually measures the length of the film as it is wound or rewound, but it is calibrated in hours, minutes,



See the Max Brothers increase your program power up to 8-fold!

(That's the new solid state Audimax on the left . . . and the Volumax on the right)

Hear this unique combo perform free in your studio for 30 days! Now CBS Laboratories *gives* you the famous Max Brothers (Audimax and Volumax) both solid state for the first time. They'll perform *free* in your studio for 30 days. Then, If you're not convinced that solid state Audimax can "ride" gain to increase program power up to 4-1, and solid state Volumax can control modulation peaks for as much as an additional 2-1 increase, you can cancel the Max Brothers, with no obligation.

If you decide to keep them, they cost only $665 each.

See why the Max Brothers are broadcasting's new money-making stars! Audimax is an automatic level controller that outmodes the ordinary AGC. A brilliant studio technician without human shortcomings. By automatically controlling audio levels, it frees engineers, cuts costs and boosts your signal.

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and seconds rather than in feet. A film splicer is also needed.

There is some disagreement as to what slide-making equipment is basically necessary. The traditional system uses 35-mm film, some sort of tripod, and an easel (either horizontal or vertical) where artwork, pictures, or plastic letters can be arranged to form the desired slide image. Many stations are turning from 35-mm film to Polaroid positive transparencies. Proponents of Polaroids contend they are faster and simpler, with results visible immediately. Opponents say Polaroid slides cost about three times as much as 35-mm slides.

Q: How large a staff is needed?

A: The nontechnical staff is essentially as large as a medium-size radio staff. Typically, there is a station manager who is responsible for general station business and regional and national sales. There are one or two local time salesmen, as well as a program director who is responsible for program scheduling, commercial scheduling, and network relations. A traffic manager handles the contracts and sees that they are scheduled and run as agreed. Each day's log is made up by a traffic secretary. One or two bookkeepers and a receptionist-secretary, to answer the phone and type letters, round out the staff.

The technical staff includes a chief engineer who, aside from finding and scheduling staff engineers, usually bears the responsibility for all equipment maintenance. The number of staff engineers depends on the number of hours the station will operate.

The average low-budget station, with studio, control, and transmitter housed in one facility, has three to five staff engineers. They are often radio engineers selected for their production ability. Completing this staff is the film man. He is responsible for timing film, splicing commercials in, slide making, and generally being sure each day's films are ready to air.

Q: How much does television equipment cost?

A: We'll start by approximating the new cost of a basic station's technical equipment.

Medium-gain antenna	$20,000
Transmitter monitoring equipment	2,000
Master monitor	1,700
Simple switching system	1,500
Video monitors—dual, 8"	600
Sync generator	3,000
Film camera chain	10,000
Prism-type optical multiplexer	2,000
16-mm projectors (two)	13,000
Slide projector	500
Stab amp and AGC	4,500
Film equipment, rewinder, Polaroid, etc.	1,000
Audio equipment	5,000

Thus, using new equipment, the cost is about $100,000 plus the cost of the transmitter and tower. A 1-kw transmitter will cost around $45,000, while a 12.5-kw UHF transmitter sells for near $175,000. Tower costs depend on height.

Q: Is there any way to cut this cost?

A: Most of the equipment—except the transmitter, antenna, and transmitter monitor—is common to both VHF and UHF television. The audio gear is the same as used by AM and FM radio. Thus, there is a fair availability in used equipment. The cost of used equipment varies, but as a rule seldom exceeds 50% of that of similar new equipment.

We heard several hints for buying used equipment. First, don't buy out-of-date equipment. The piece itself need not be recent, but it should either still be in production or not be out of production for more than four years. Second, stick with equipment made by a known manufacturer. It is easier to obtain parts for, and is probably more compatible. Third, talk to other engineers before buying; once they've been in the UHF field a few years, they have an idea which equipment is good.

Along with these hints, the engineers we talked to generally agreed that it is presently a buyer's market in used equipment, because many VHF stations are converting to all-transistorized equipment.

Conclusion

As we have tried to show, planning a successful low-budget UHF operation requires careful selection of location and equipment and a constant eye on costs. This article is only a check list of considerations. There was universal agreement on one fact: The actual UHF television station installation should be designed and directed by a professional consulting engineer. ▲

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10-Watt FM Station

(Continued from page 15)

mc (from a doubler), 10 kc, 100 kc, and 1 mc (all from multivibrator frequency dividers) are available. The instrument provides calibration frequencies at 100-kc intervals into the FM broadcast band.

The first step in the measurement procedure is to calibrate the reference unit. This was done by setting the selector switch for 1-mc output and comparing the fifth harmonic of this output with the 5-mc transmission of WWV. A communications receiver was used to determine when the two signals were in zero beat; the 5-mc oscillator was set within an accuracy of ±1 cps by this means.

Next the calibration unit was switched to the 100-kc output, and the difference between one of the harmonics of 100 kc and the carrier frequency was determined by comparing the difference frequency with the output of a laboratory-type audio oscillator. By this means, the carrier deviation of the transmitter as received from the factory was found to be +400 cps. The transmitter crystal control was then adjusted until the transmitter frequency was within 25 cps of the reference frequency. (The carrier-frequency tolerance for this class of station is ±3000 cps.)

This method of frequency measurement is not as accurate as some others, but it is sufficiently accurate for the purpose. Ample warmup time should be allowed for the equipment to stabilize, and care must be exercised to be **sure** the transmitter signal is being compared with the proper harmonic of 100 kc. (A calibrated receiver is usually adequate for this purpose.)

Engineering Report

It was decided that merely filing an FCC form 341 in the usual manner, while entirely proper, would not suffice completely. Therefore, a complete engineering report book was made. This book contained an affidavit of the installing engineer's qualifications, a copy of the maintenance contract, and a comprehensive engineering report describing the methods and procedures used in the installation. Also included in the report were drawings of the remote control unit, a sketch of the elevation of the transmitter-antenna installation, and a detailed description of the antenna system. The measuring techniques and equipment used to measure the frequency of the new station were described. Four photographs (showing Amen Hall, the transmitter location, the antenna installation in the cupola, and the control room) and one additional FCC form 341 (in addition to the other three engineering sections filed) completed the book. Photocopies (the original book was sent to the FCC) were made to provide the permittee and the installing engineer with a permanent record of the installation. Nine days after filing the complete FCC form 341 and the engineering report book, authority was granted for WPEA to conduct program tests.

Compliance With the Rules

Suitable program and operating logs were printed by the academy printing shop. A large notebook was purchased and marked for use as a maintenance log. WPEA maintenance is conducted according to FCC Rules and Regulations on a bimonthly basis, per the yearly contract. It will be remembered that a copy of the maintenance contract was included with the request for program-test authority. A copy of the same contract was filed with the FCC district office in Boston, as required by the Rules and Regulations. The maintenance log book provides a continuous record of the bimonthly inspections and all maintenance over a period of several years.

To ensure compliance with subpart G (the portion of the Rules dealing with the Emergency Broad-

Fig. 4. View of basement control room.

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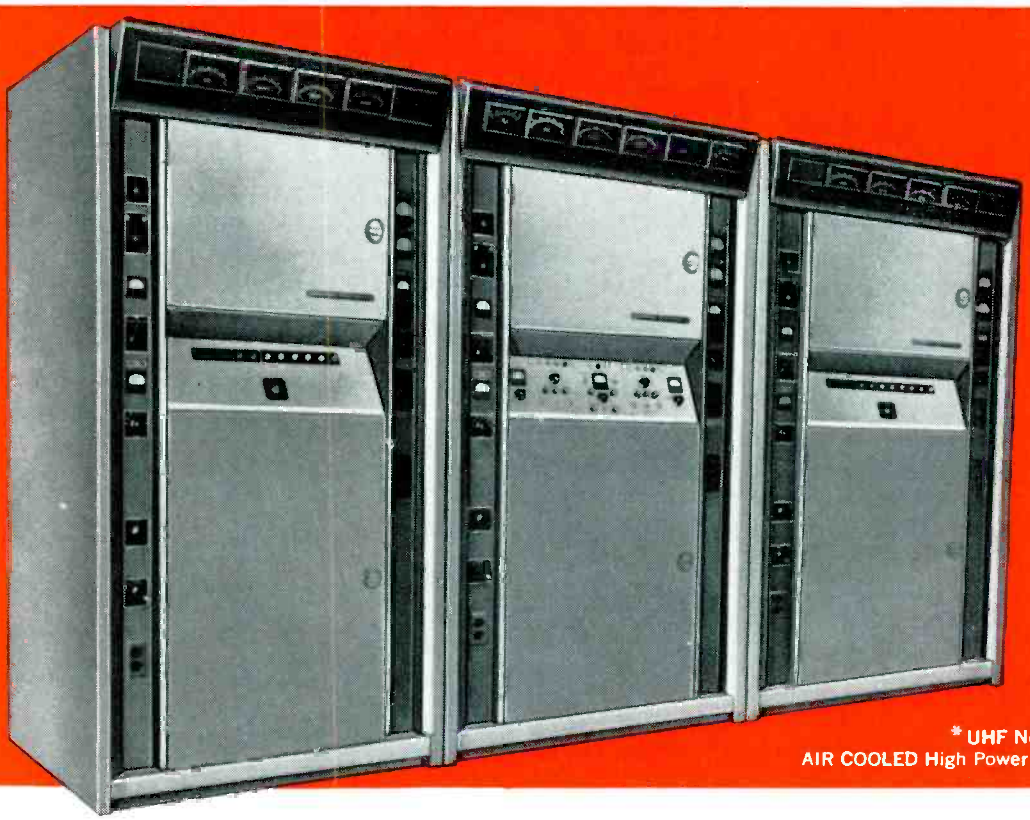

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SIMPLY ADD AMPLIFIERS TO BOOST POWER . . . Thus, whenever you wish to add to your present transmitter, regardless of make, or change your aural/visual power ratio, you simply add to or change your *amplifier* combination.

SAVINGS UP TO 50% . . . Best news of all . . . SE amplifiers are compatible with *any* driver/transmitter. Savings to you can be as much as 50% in equipment costs!
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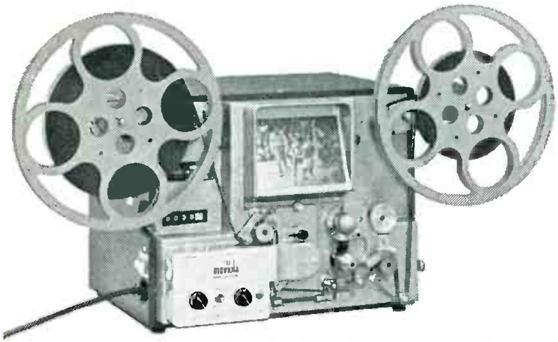
cast System), an official interpretation was obtained. According to this interpretation, WPEA is required to monitor an EBS station while on the air, just as other stations must do. However, due to the low operating power and limited operating schedule, WPEA is not required to conduct weekly test alerts. It must, of course, air the standard alerting procedure in the event of a real alert and discontinue operation. WPEA is not required to broadcast the full requirements of Section 73.921 (b), unless it voluntarily desires to do so. To provide complete compliance, a suitable receiver is used to monitor a key station while WPEA is broadcasting.

Complete step-by-step operating instructions, scope of authority of operators with third-class licenses, prohibited procedures, a copy of the maintenance contract, and all licenses are posted on a control-room bulletin board. Additional pages were inserted, where necessary, in all instruction manuals to indicate equipment modifications. A master line drawing of all external wiring connections not covered by factory manuals and drawings of special equipment constructed especially for use at WPEA were prepared. Students were given instruction in operating the console and turntables and were made aware of the normal practices and procedures used in commercial radio stations. Those operators in actual charge of the transmitter are required to have valid third-class licenses, and all students connected with the station were advised to obtain a license to provide a flexible operation.

Conclusion

By stressing proper installation and constant attention to proper operating practices, WPEA was able to attain a smooth and efficient operation. The act of incorporation of The Phillips Exeter Academy, which was signed by the Governor of New Hampshire on April 3, 1781, begins: "Whereas the education of youth has ever been considered by the wise and good as an object of the highest consequence to the safety and happiness of a people . . ." It is hoped that WPEA will, in the years to come, continue to enlarge this belief of John Phillips of nearly two centuries ago. ▲



Aeronautical Field

(Continued from page 17)

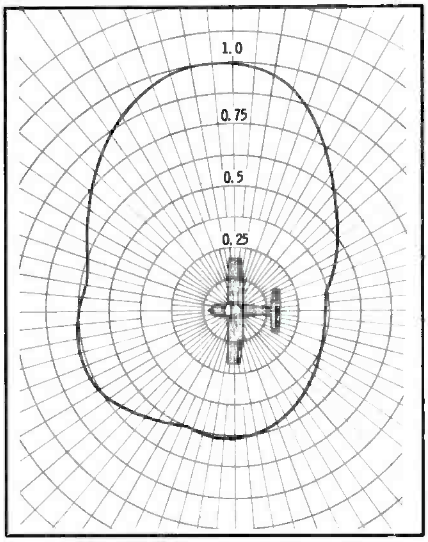


Fig. 6. Pattern of field-intensity meter antenna, distorted by metal in airplane.

It was found that the readings inside the metal airplane were strongest next to a window. With the airplane on the ground, the reading inside (with the right side of the plane toward the station) was about 1/10 the outside reading. More than one set of readings should be taken to correctly determine the correction factor.

Results

Fig. 7 shows the type of results obtained at WBBY. It is of interest to note that in the vertical plane there is still the same wide scattering of points in nulls that is observed when measuring nulls on the ground.

In the course of making these measurements, a fact became apparent that may be of help to other engineers in connection with their directional arrays. Directional patterns are determined from measurements made at a relatively few bearings, not all the way around. Thus minor variations—extra nulls or minor lobes—could exist between measured radials and never be known. But with an airplane flying at low altitude in a circular path around the array, you can for the first time see the directional pattern traced out graphically on the field-intensity meter. Nulls and minor lobes stand out precisely and can be checked quickly against landmarks to see if they fall at the correct bearings. Also, pattern distortion can be discovered and its position in terms of bearings determined for further ground-level investigation.

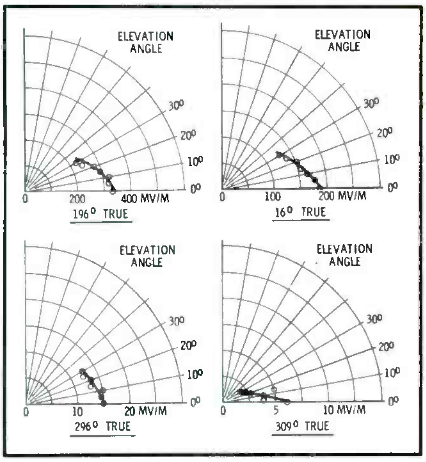


Fig. 7. Vertical-plane field intensities.

Conclusion

There are some engineering problems in connection with directional antennas that can be solved only by making airborne field-intensity measurements. In many other cases, useful information can be gained by making such measurements. ▲

NEWS OF THE INDUSTRY

NATIONAL

NAB Opposes Frequency-Sharing Plan

Opposition to the FCC proposal that television broadcasters share with the Apollo space program two frequencies assigned to auxiliary TV services has been expressed by the National Association of Broadcasters. In its comments, NAB said the proposed operation would create interference that would "greatly restrict" the broadcasters' use of the frequencies to provide public service. NAB added that ample spectrum space is available among frequencies assigned exclusively to the government to accommodate the Apollo communications channels without encroaching upon the auxiliary TV frequencies. The FCC has proposed that broadcasters share the 2106.4 and 2101.8 mc frequencies to provide earth-to-space communications for the man-on-the-moon project from four earth research stations—Goldstone, Calif.; Cape Kennedy, Fla.; Corpus Christi, Tex.; and Kauai, Hawaii. The two frequencies now are used for remote TV pickups, studio-to-transmitter links, and intercity relays. NAB also noted that while the FCC proposal is "limited to the life of the Apollo project, it is noted in the proceeding that the project life expectancy is measured in terms of a decade." Therefore, they said, it is "conceivable that this project could go on indefinitely . . ." NAB requested that if the Commission decides to go ahead and require broadcasters to share the frequencies, "a specific time limitation should be imposed on the use of these frequencies" by the Apollo project.

Antennas for Mexico

Three high-power TV antennas have been ordered for installation in Mexico. Each has an input power rating of 100 kw. These are believed to be the most powerful VHF-TV antennas in the world. The antennas, to be supplied by **Jampro Antenna Company,** are for transmitters to be located on a 4000′ mountain top about 75 miles northwest of Vera Cruz. The channel 6 antenna, ordered by **Television Regional Veracruzana, S.A.,** is for a six-bay batwing antenna. The channel 8 antenna, for **Tele-Lajas, S.A.,** has a power gain of 19.2 with an omnidirectional pattern. The channel 10 unit, for **Television de Veracruz, S.A.,** is intended to provide an ERP of 1.4 megawatts with a 100-kw input.

New TV Technique

Fifty-year-old photographs and drawings are being given "life" on the CBS News series, "World War I," by means of "still-motion" photography. In this technique the camera "eye" pans across a still picture to give an illusion of motion. These effects are produced using a "human-engineered" single-stick control for all movements and speeds. The control device, developed by **Measurement Systems, Inc.,** permits the cameraman to control speed and direction of pan by varying pressures on a single "joystick." The joystick control converts forces in any direction into electrical signals that control camera movements. In doing so, the stick does not move more than 1/16″ in any direction. This design was indicated by recent research in Human Engineering, which aims at making the most of human capabilities by designing mechanical equipment to fit the operation of the human nervous and muscular systems.

INTERNATIONAL

Firm Sold

Benco Television Associates, Ltd., Toronto, has been sold to **Neighbourhood Television Ltd.,** of Guelph, Ontario. Neighbourhood Television is acquiring a 100% interest in Benco. **Blonder-Tongue Laboratories, Inc.** held a controlling interest in Benco since the fall of 1961. Benco manufacturers translator and community antenna television products, and Neighbourhood Television owns and operates CATV systems in Canada.

A Radio Pioneer Passes

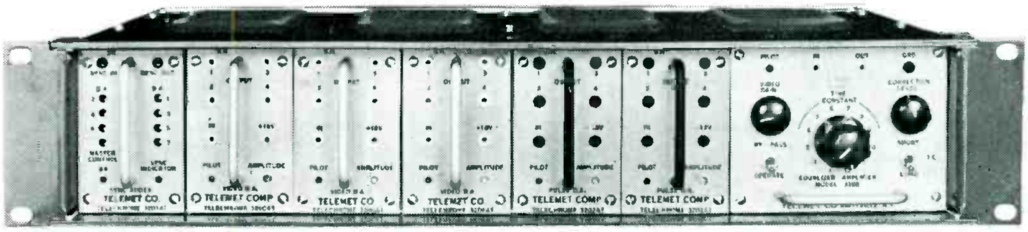
Charles Samuel Franklin, one of the early radio pioneers, died recently in London. Mr. Franklin joined the **Marconi Company** in 1899 and almost immediately left for South Africa and the Boer War to help introduce wireless to the battlefield. His first close contact with Marconi himself came in 1902 when they sailed across the Atlantic, successfully receiving transmission from Poldhu in Cornwall at ranges of up to 1550 miles.

In 1916 Franklin and Marconi started their first experiments with short-wave communications, Franklin designing a special spark transmitter that operated in compressed air. Some highly promising results were obtained from these initial experiments, and they eventually led to the first beamed short-wave system in the world. Some of Franklin's designs are still in use in HF communications.

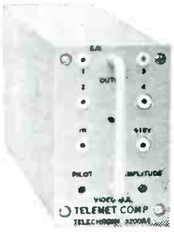
Franklin continued to work on the development of his short-wave beam system and by 1933 had even reached a stage where he was experimenting with radar. He was closely connected with broadcasting and helped in the design and installation of 2LO, London's first broadcasting station. He also designed the antenna system for the original BBC television station at Alexandra Palace. Sixty-five patents stand to Franklin's credit. These include the variable capacitor, the ganged capacitor, the reaction circuit, and the concentric feeder. ▲

SATISFY ALL DISTRIBUTION REQUIREMENTS

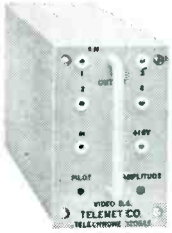
with these transistorized and completely self-contained modules



MODEL 4000 Rack Mounting Frame provides common mounting facility for any combination of modules.

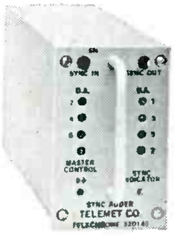


MODEL 3200

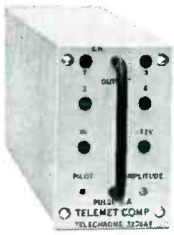


MODEL 3206

MODELS 3200 and 3206 Video Distribution Amplifiers feature high impedance bridging inputs and 4 identical isolated outputs, source terminated in 75 ohms.



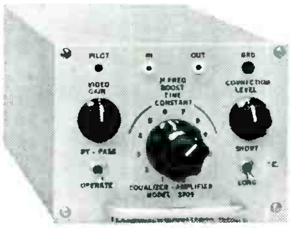
MODEL 3201



MODEL 3202

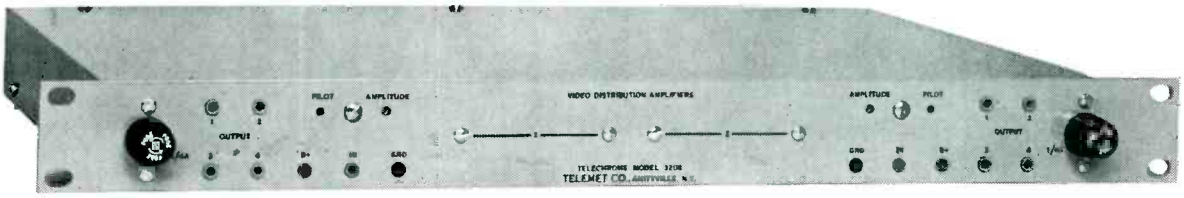
MODEL 3201 Sync Adder provides a means of mixing sync into any or all video amplifiers in the frame.

MODEL 3202 Pulse Distribution Amplifier regenerates sync, blanking or drive pulses, providing 4 identical isolated outputs.



MODEL 3205

MODEL 3205 Equalizer Amplifier now contains frequency boost circuits providing up to 10 db at 4.5 Mc. Slope adjustable to match cable. Also provides adjustable time constant correction. Ideal for Frequency Phone Correction of long coaxial lines.



NEW MODEL 3208 Dual Video Distribution Amplifier actually contains 2 separate and completely independent amplifiers and power supplies of the Model 3206 type in a space-saving configuration.

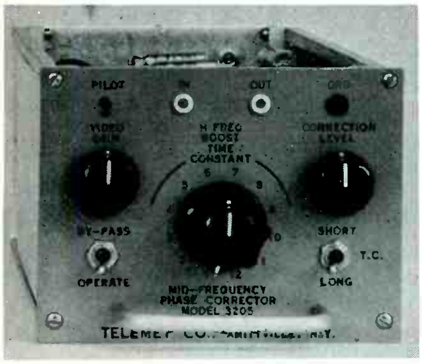
See these new items at the NAB Show

Model 3203—Clamper Amplifier with remote gain control
Model 3209—Color Stabilizing Amplifier
Model 3518—Color Bar Generator
Model 3806—Electronic Pointer
. . . and many others

TELEMET COMPANY
a division of
GIANNINI SCIENTIFIC CORPORATION
185 DIXON AVENUE, AMITYVILLE, N.Y. • PHONE (516) 541-3600

Circle Item 24 on Tech Data Card

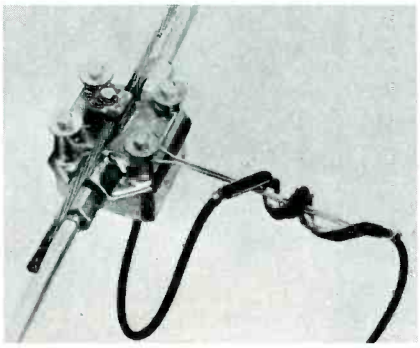
NEW PRODUCTS



Equalizer-Amplifier

Time-constant correction to reduce streaking, overshoots, and undershoots in color and monochrome TV signals is provided by the Model 3205B2 equalizer-amplifier. This **Telemet** amplifier also provides frequency boost of up to 10 db with adjustable slope. The amplifier is designed to operate with a 1-volt peak-to-peak composite or noncomposite video signal. It can be used for equalization of runs of 75-ohm coaxial cable up to 2000′ in length. Any one of a series of correction curves can be selected with a front-panel control that connects an appropriate internal capacitor in the high-frequency boost-amplifier circuit. A concentric knob is used for selecting the phase correction. A continuously variable gain control is provided. A bypass feature permits routing the video signals around the unit if no correction is required. The unit is fully transistorized and fits the company's Model 4001-A1 rack mounting frame.

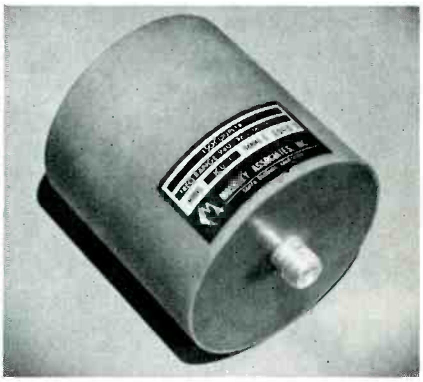
Circle Item 111 on Tech Data Card



Tapoff for CATV

The new "Multee" tapoff is engineered to accommodate four housedrop taps and still maintain excellent VSWR and low insertion loss. The fully weatherproof **Entron** unit (MT Series) has a strand-mounting clamp for easy installation. It features throughline match and backmatch for all-band color, extremely low insertion loss (.3 db average), seven attenuation values, and high isolation between tapoffs. The unit is supplied with UHF or complete aluminum flare fittings for the throughline and with threaded tapoff fittings.

Circle Item 112 on Tech Data Card



Coupler For STL Lines

When the Model ICU-1 Isocoupler is used, an STL antenna and transmission line can be mounted directly to an ungrounded standard-broadcast tower with negligible effect on the base impedance and without employing an insulated quarter-wave matching section. The coupler has less than .3 db insertion loss to signals in the 890 to 960 mc band and presents less than 10 pf of capacitance between the input and output connectors. Rated at 5000 volts peak, this coupling unit is completely sealed in a moisture-proof epoxy resin and is designed to be strapped to the base of an AM tower. Weighing less

BOOK REVIEW

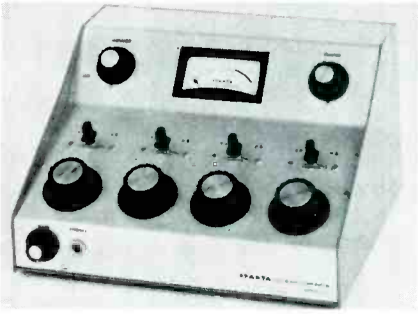
Basic Electronics: Bureau of Naval Personnel; Dower Publications, Inc., New York, New York; 459 pages, 6½ x 9¼, paperback, $2.75. This republication of Navy Training Course NavPers 10087-A has not been changed from the Navy version except for the omission of a list of training films. Nineteen chapters include fundamentals of electron tubes and transistors, tuned circuits, amplifiers, oscillators, transmission lines, transmitters, receivers, and an introduction to radar. The last two chapters serve as an introduction to computers. An appendix lists electronic color codes and symbols. An 8½-page index is also included.

The reader must already have an understanding of basic electricity if he is to comprehend this text. A knowledge of basic algebra and trigonometry is needed to thoroughly understand some sections. Line drawings, schematics, charts, graphs, and waveform drawings are used throughout to supplement the text.

The introduction urges the reader to study the book with pencil and paper and to refrain from skimming the text. This is excellent advice if the aspiring technician is to get the most from the volume.

than two pounds, the unit is 5" in overall length and 4" in diameter. Type N RF connectors are used. The price of this **Moseley Associates** product is $150.

Circle Item 113 on Tech Data Card



Compact Console

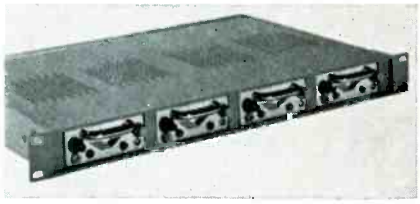
Up to eight separate audio sources can be selected through the four mixing channels of the **Sparta** A-10B console. Four plug-in preamplifiers and/or four plug-in input transformers can be supplied so that the console can handle as many as eight low-level inputs. Also included are cue facilities for all inputs, a headphone jack with gain control, and a public-address-system output. The unit has speaker muting and a self-contained monitor speaker. All preamplifiers, the program amplifier, and the monitor amplifier are of solid-state design and modular plug-in construction for ruggedness. The new console can be operated from an 18 to 22½ VDC or a 115 VAC, 50-60 cps source. It weighs 10 lbs.

Circle Item 114 on Tech Data Card

Bulk Tape Eraser

The Model 150-A Magneraser Junior, manufacturered by **Amplifier Corp. of America** and sold by **Artronics Company, Inc.**, is designed to remove from a reel of tape, in a matter of seconds, all recorded signals and to reduce background noise below that of new tape. The unit can also be used for demagnetizing record-playback and erase heads. This reduces tape distortion and background noise which is added to program material by magnetized heads. The Model 150-A can also be used to demagnetize tape guide posts, bearings, pulleys, flywheels, capstans, tools, watches, and magnetized metal. Designed for easy, hand-held operation and housed in a molded plastic case, the eraser is furnished with operating instructions and an eight-foot gray vinyl-covered line cord. List price is $18.95.

Circle Item 115 on Tech Data Card



Solid-State Amplifier

This solid-state video distribution amplifier, by **Vital Industries,** combines compact construction and many desirable features; self-contained regulated power supply, low differential gain and phase, high signal-to-noise ratio, and high-gain stability. The Model VI-10A provides four identical 75-ohm outputs from a 50K-ohm loop-through input, and gain is adjustable from −6 to +6 db, with frequency response within ¼ db to 20 mc.

Circle Item 116 on Tech Data Card

STOP You lose two turns for going too far. Turn back to page 86 for Instantaneous Selection Remote Control by Bionic Instruments.

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

59. ALTEC—Folder on line of recording and broadcast equipment.
60. AMPROBE—Full-line catalog on recorders, including information on REE-16.
61. ATC—Specification sheet on the ATC-55 solid-state multiple-cartridge unit.
62. BROADCAST ELECTRONICS—Packet contains specifications and prices for "Spotmaster" tape-cartridge systems.
63. CINE SONIC—Data sheet describes rental service which supplies background music prerecorded on 7", 10½", and 14" reels of tape or in cartridges.
64. DUOTONE—Booklet No. EL-1 describing new "Elipticon" stylus.
65. LANGEVIN—Descriptive literature covering complete line of professional sound equipment.
66. MAGNASYNC—Information on motion-picture magnetic-film sound-recording equipment and accessories.
67. McMARTIN—Data sheets covering complete line of solid-state and tube-type SCA multiplex monitors.
68. MILES REPRODUCER—Literature describes automatic logging recorder.
69. QUAM-NICHOLS—New catalog lists coaxial, extended-range, and hi-fi speakers and tweeters.
70. SCULLY—Bulletin SP-14 describing Model 280 solid-state recorder with 14" reel-size capacity.
71. SENNHEISER—Bulletin and technical information on Model MD 421 dynamic cardioid studio microphone with built-in bass control.
72. SPARTA—New product brochure describes and illustrates "Sparta-Matic" tape-cartridge systems, audio consoles, and other related studio equipment.
73. SWITCHCRAFT—New product bulletin No. 149 describes the latest molded headphone coiled cord.
74. TURNER—New four-color, 16-page microphone catalog.
75. VIKING OF MINNEAPOLIS—Specification bulletins describe Model 96 tape transport, RP120 record-playback amplifier and Model 38 cartridge handler.

COMPONENTS & MATERIALS

76. BRADY—Self-bonding signature plates for studio property identification and control.
77. TIMES WIRE—Product sheets with technical data on various flexible and semiflexible coaxial cables.

MICROWAVE DEVICES

78. LECTRONIC—Bulletin No. 83 contains a comprehensive presentation of microwave equipment, waveguide components, regulated power supplies, test equipment, and electronic components.
79. MICRO-LINK—Brochures on portable microwave link and fixed-station relay link; also planning guide for 2500-mc instructional TV systems.
80. MICROWAVE ASSOCIATES—Information on newly introduced MA-8531, a companion unit to the MA-2 microwave TV relay system.
81. SURFACE CONDUCTION—Bulletin on microwave-by-wire (G-line) for long-distance, broadband transmission.

MOBILE RADIO & COMMUNICATIONS

82. MOSELEY—New technical bulletin describes remote pickup transmitter and receiver featuring low distortion, extended frequency response, and automatic leveling and peak-limiting circuits.
83. MOSLEY—Literature describes Citizens band antennas.

POWER DEVICES

84. HEVI-DUTY—Bulletin No. 7-12 describes line-voltage regulator that uses saturable-core reactor.
85. TERADO—Brochures on line of mobile power inverters that supply instant AC power.

REFERENCE MATERIAL & SCHOOLS

86. CLEVELAND INSTITUTE OF ELECTRONICS—Brochure describes electronics slide rule with four-lesson instruction course and grading service.
87. HOWARD W. SAMS—Literature describing popular and informative technical publications; includes latest catalog of technical books.
88. JERROLD—Eight-page technical brochure describes a new bridge method of sweep-frequency impedance measurement.
89. RIKER—Brochure on how to assemble a custom video-processing amplifier with all-transistor video modules.

STUDIO & CAMERA EQUIPMENT

90. CBS LABS—Literature on Audimax III automatic level control, Volumax 400 automatic peak control.
91. CLEVELAND ELECTRONICS—Data concerns deflection yoke and alignment coil for 3" image orthicons.
92. ZOOMAR—Bulletins contain descriptions of zoom lenses and remote-control systems for television cameras.

TELEVISION EQUIPMENT

93. STANDARD ELECTRONICS—Technical data on new solid-state TV driver-amplifier combinations; detailed specs on low-cost visual/aural combinations.
94. TELEMET—Literature describing clamper amplifier, color-bar generator, and color-stabilizing amplifier.
95. VITAL INDUSTRIES—Data sheets describing video-distribution amplifier Model VI-10A, pulse-distribution amplifier VI-20, and video clamper-stabilizer VI-500.

TEST EQUIPMENT & INSTRUMENTS

96. BALLANTINE—Information on new Model 355 DC-AC digital voltmeter.
97. HICKOK—Brochure on Model 580 solid-state tube tester and general test-equipment catalog.
98. LECTROTECH—Separate bulletins detail color generator and vectorscope Model V7, color generator V6, and regulated modular power supplies.
99. SPRAGUE—Technical data and specifications on Model 500 interference locator and accessories.
100. TELONIC—Four-page brochure describes line of sweep generators, RF attenuators, RF detectors, and coaxial switches.
101. TRIPLETT—New catalog No. 46-T concerning complete line of VOM's, VTVM's, signal generators, and tube and transistor analyzers.

TOOLS

102. ENTERPRISE DEVELOPMENT—Bulletin features new desoldering-resoldering iron for use on printed circuit boards.

TRANSMITTER & ANTENNA DEVICES

103. BAUER—Data sheet concerning Model 607 FM broadcast transmitter, 1000-watt unit housed in a one-piece custom cabinet.
104. CCA—Information available on complete line of AM and FM broadcast transmitters and accessories.
105. CONTINENTAL—Brochure describes Model 317C 50-kw AM broadcast transmitter.
106. CORNELL-DUBILIER—Replacement component selector, TV-FM reception booklet, and 4-page rotor brochure.
107. GATES—Latest information concerning 5-kw AM transmitter Model BC-5P-2.
108. RUST—Data sheet on Autolog AL-100R, remote-operation version of continuous line synchronous system.
109. SCALA—Catalog sheets describe antennas for monitoring FM and TV signals.
110. WARD ELECTRONICS—Information on CDL video signal processing amplifiers and CO.-EL. UHF slot antennas.

Professional Services

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Applications and Field Engineering
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Member AFCCE

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919-PL 8-3966

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411 Phoenix Title Building 623-1121
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PRECISION FREQUENCY
MEASURING SERVICE
SPECIALISTS FOR AM-FM-TV
445 Concord Ave. Phone 876-2810
Cambridge, Mass. 02138

TAPE DUPLICATION at lowest prices in the East; we specialize in small quantities. Air Checks, Location Recording, Remote Broadcasts.
G & G RECORDING SERVICE
Lake Road RFD 1
Peekskill, N. Y. 10566
(914) PE 7-2772

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

Will buy or trade used tape and disc recording equipment—Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 295 Main St., Tuckahoe, N. Y. 1-64 tf

Ampex Head Assemblies for 300 and 400 **series recorders reconditioned.** Service includes lapping and polishing all three head stacks, cleaning entire assembly, readjusting and replacement of guides, and realignment of stacks as to azimuth and zenith. Full track assemblies—$60.00. Taber Manufacturing & Engineering Co., 2619 Lincoln Ave., Alameda, California. 5-64 tf

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

Parabolic antennas, six foot dia., new, solid surface with hardware, dipole, etc. $125.00 each. S-W Electric Cable Company, Willow & Twenty-Fourth Streets, Oakland, California. 832-3527. 10-64 tf

Everything in used broadcast equipment. Write for complete listings. Broadcast Equipment and Supply Co., Box 3141, Bristol, Tennessee. 11-64 6t

Laboratory Test Equipment, microwave components, all frequency and makes at real low prices. Write or call for information. Jericho Electronic Supplies. Sid Gordon Electronics, 80 West Jericho Turnpike, Syosset, Long Island, N. Y. (516) WA 1-7580. 12-64 6t

Four bay super-turnstile antenna, adjustable to channel 2 or 3. Fifty kilowatt rating. Used two years and in excellent condition. Write Broadcast Engineering, Dept. 121. 1-65 3t

AMPEX 350 SERIES reconditioned capstan idlers for $7.50 exchange. Send us your old ones, or order them for $10.00 and get $2.50 back after sending the old ones in. Ours have new bearings, the rubber softened and surface precision ground. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California. 1-65 12t

AMPEX 350 SERIES reconditioned capstan drive motors (BODINE NCH-33 only) $85.00 exchange. Send us your old one, or order for $100.00 and get $15.00 back after sending old one in. Ours have new bearings and rewound stator. Package motor well. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda California. 1-65 12t

Two Pultec PC 10 R1AA equalized phono amplifiers, 18 months old, $195.00 each. Neuman DST62 stereo phono cartridge 10 hours use, $45.00. Shipped prepaid with check or money order. W. R. Pletcher, 604 Thornhill Drive, Lafayette Hill, Pa. 3-65 2t

Parabolic antenna, 4-ft. diameter. New solid surface aluminum with hardware and diapole, $85 each. Empire Device heads for NF 105, half price. Jericho Electronics Supplies. Sid Gordon Electronics, 80 West Jericho Turnpike, Syosset, Long Island, N.Y. (516) WA. 1-7580. 3-65 3t

ELECTRONIC TUBES—Top Brands SOLD at substantial savings; (Minimum Order $15.00). Authorized GE, Amperex, Dumont and Eimac Distributor. Send for FREE Buyers' Guide for all your Tube Requirements. TOP CASH PAID for your excess inventory. (New Only—Commercial Quantities). Metropolitan Supply Corp., 443 Park Avenue South, New York, N.Y. 100161 (212) MU 6-2834. 3-65 5t

EQUIPMENT WANTED

A 469-B condenser manufactured by Western Electric Company for their 504 B2, 3 kw FM transmitter. Contact Bill Bratton, Chief engineer, WLAP, Lexington, Ky. 606-255-6300. 11-64-6t

Personnel

MARKETING MANAGERS (2)
Broadcast or Audio Products

Are you an engineer well grounded in either of the above product lines?

Would you prefer to report to the President?

Are you capable of selling ideas to others?

If so, you likely have the qualifications to manage the marketing of our client's expanding product lines from the conception of new products until the product is meeting the customer's needs. Technical knowledge of the products is a prime consideration. Midwest location. Send replies to:

Batten, Batten, Hudson & Swab, Inc.
Consultants to Management
4021 Fleur Drive, Des Moines, Iowa, 50315, DEPT. M.

Advertisers' Index

SEE YOU AT NAB BOOTH 215

McMartin

No other FM MONITORS can do so much!

McMartin TBM-4000

FM/SCA MULTIPLEX MONITOR FCC TYPE APPROVED #3-116

This is the most versatile instrument available for monitoring all main channel modulation and SCA Multiplex operating characteristics. Compatible with FM stereo.

Direct meter readings of:

- Total Modulation
- SCA Modulation
- SCA Frequencies
- Crosstalk
- SCA Injection

McMartin TBM-3000

McMartin TBM-3500

FREQUENCY & MODULATION MONITORS FCC TYPE APPROVED #3-113, #3-119

- The TBM-3000 is a completely self-contained frequency monitor and the TBM-3500 is a self-contained modulation monitor.
- The 3000 used in conjunction with either the 3500 or 4000 fulfills the FCC requirement for a station monitor.
- The TBM-3500 is completely compatible with FM stereo.

McMartin TBM-2500

RF AMPLIFIER FOR REMOTE MONITOR OPERATION

The TBM-2500 will drive any combination of two monitors including other brands.

- Isolated high and low level outputs.
- Excellent stability and long tube life.
- 2 watt output with 1000 μv input.
- Complete with yagi antenna and coaxial cable.

McMartin

Originality by

McMartin Industries, Inc.

605 North 13th Street Omaha, Nebraska

Code 402 — 342-2753

In Canada Sold By: Canadian Marconi Company, Montreal 16, P. Q.

Circle Item 58 on Tech Data Card

ONLY RCA's BROAD LINE OF IMAGE ORTHICONS OFFERS A CHOICE OF ALL THESE FEATURES

Now you can bring out the best in your TV pick-up equipment—even in the most critical applications—because you can select the proper RCA image orthicon specifically designed to cope with the *practical problems* of everyday broadcasting. Ask your RCA Broadcast Tube Distributor to explain this in terms of a specific, practical, everyday problem you face or might be faced with shortly. Or, write for current information: Camera Tube Booklet CAM-600.

SEE YOU AT NAB RCA BOOTH 100

IMAGE ORTHICON SELECTOR

Type	Color	Color at B/W Light Levels	Black & White	Field Mesh	Precision construction	4½" diameter	Studio Taping	Matched sets	Long Life Targets
4401V1			X(1)						
4415-4416	X	X		X	X			X	
5820A			X						
5820A/L			X						X
7293A			X	X					
7293A/L			X	X					X
7295B			X	X		X			
7389B			X	X		X	X		
7513	X			X	X		X(2)		
7513/L	X			X	X		X(2)		X
7629A			X(3)						
8092A	X		X(3)	X	X				
8093A			X	X			X		
8093A/L			X	X			X		X

(1) For exceptionally low studio light levels. (2) 7513/V1 or 7513/L/V1.
(3) Thin film semiconducting target.

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