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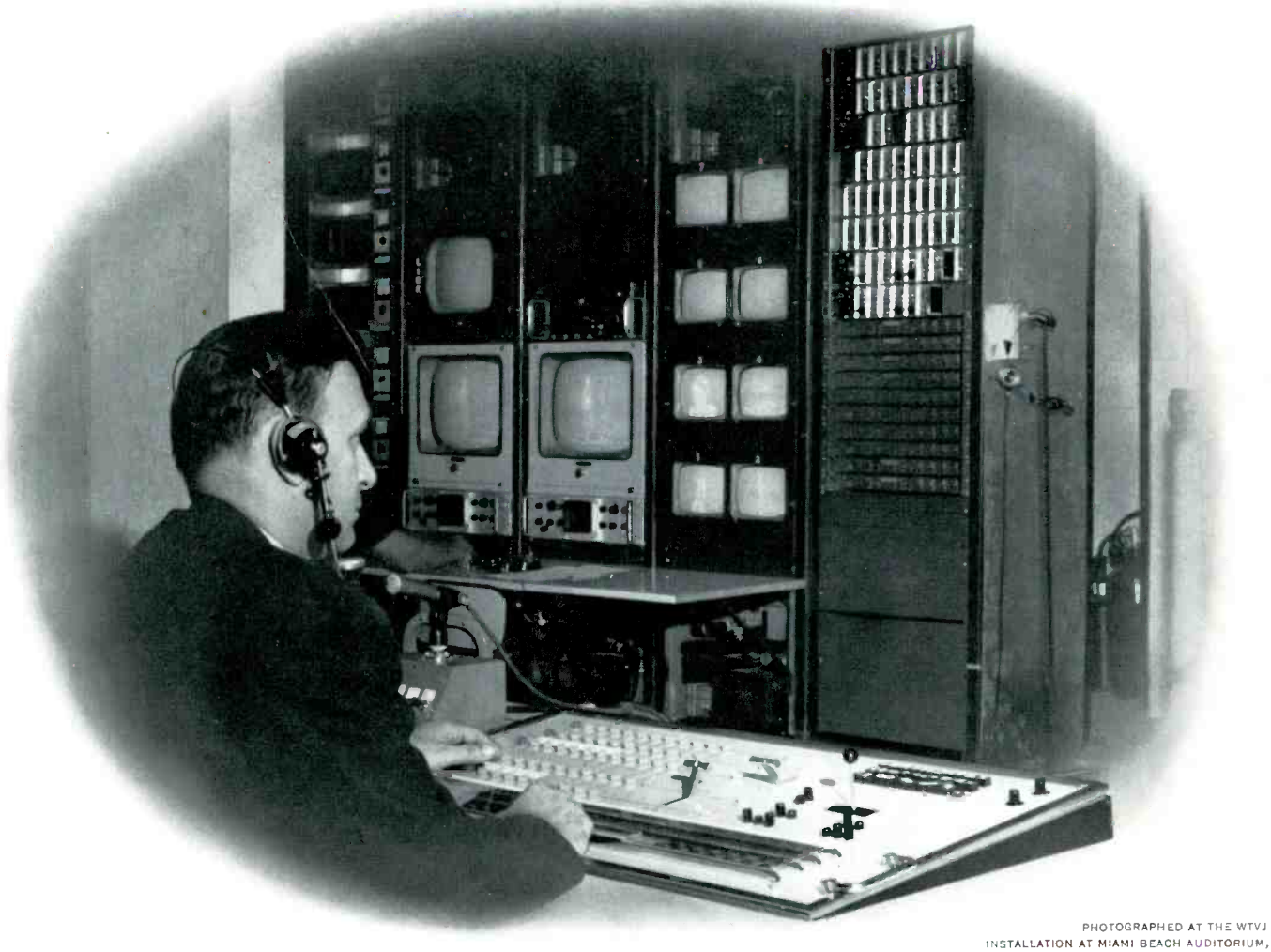
JANUARY 1965/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry

I Dreamed I was using a Riker Switcher...



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INSTALLATION AT MIAMI BEACH AUDITORIUM,
STUDIO FOR JACKIE GLEASON'S "AMERICAN SCENE"

and it's a real "Dream Switcher" because I can have all the features I need such as:

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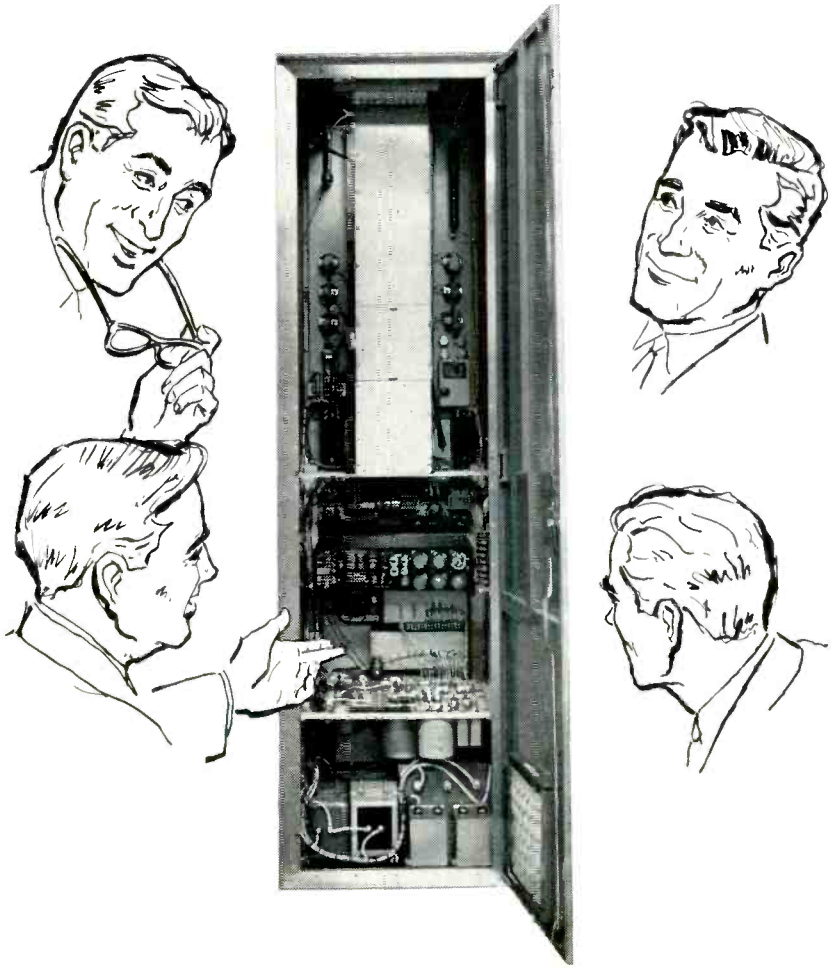
Circle Item 1 on Tech Data Card

LET'S LOOK UNDER THE HOOD AT RUST'S **NEW** 1 KW FM STEREO BROADCAST TRANSMITTER



Here's the new 1 KW FM stereo transmitter from Rust. Notice the elbow room? Space galore! (Once, we even found an employee cat-napping there.)

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RUST FM STEREO TRANSMITTERS • AUTOLOG • RUST REMOTE CONTROL

Circle Item 2 on Tech Data Card

the technical journal of the broadcast-communications industry

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CONTENTS

FEATURES

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40F	7293A	7293

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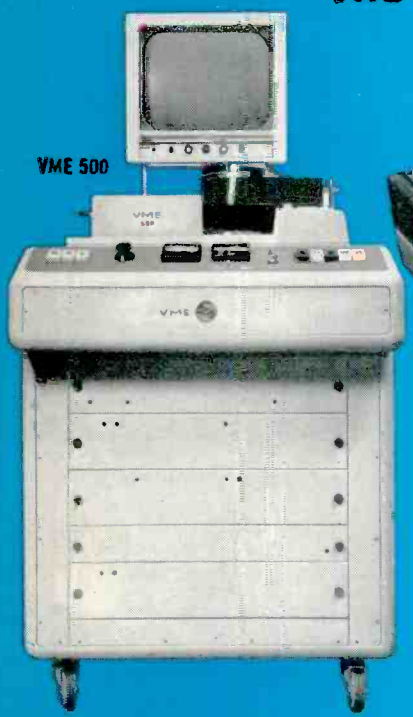

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Circle Item 4 on Tech Data Card

LETTERS to the editor

DEAR EDITOR:

After reading "'Protective' Maintenance at the Studio" in the November B-E, I'd like to say there is a lot of truth in the article. I have had to install many "protective" systems myself. Sometimes this approach must be applied even where first-phone people are involved; I once knew a first-phone operator who didn't know the difference between a capacitor and a transformer!

CLAY FREINWALD
Chief Engineer, KFHA,
Tacoma, Washington

DEAR EDITOR:

First, may I compliment your staff on their efforts in putting together the most informative publication for broadcast engineers.

However, I take issue with the philosophy expressed in "Protective Maintenance at the Studio," which appeared in your November issue. I base my comments on seven years of experience in broadcasting, both as an announcer and as a chief engineer.

Although some of the ideas presented in the article are perfectly workable, and in fact are used by many stations, it seems to me that the author is trying to replace verbal communication with "idiot-proofing." A closer relationship between the announcers and the engineer would seem to be a superior (and more economical) approach to the problem.

Obviously, the announcer who willfully and repeatedly monkeys with modulation monitors and alert receivers is in the wrong business. However, where most announcers are concerned, the application of the engineer's inventiveness to the development of something to make the announcer's tasks less burdensome would do more to promote harmony than would soldering wires over "taboo" controls.

JAMES D. ERICSON
San Luis Obispo,
California

It seems there is a difference of opinion concerning the merits of "protective" maintenance. Our November article described the measures taken at one station. Whether the individual station adopts some, all, or none of these ideas (or others of its own invention) depends, of course, on circumstances at the station and the viewpoint of station management. In varying degrees, these "announcer defeaters" do make the announcer's job easier.—Ed.

DEAR EDITOR:

I would like to call your attention to an apparent printer's error on page 12 of your November issue. In Fig. 2, the pattern labeled "over 100% modulation" is actually under 100%, and the pattern labeled "under 100% modulation" is actually well over 100%.

Nevertheless, I enjoyed this write-up by Mr. Jones. I have often used the scope as a sort of standby modulation monitor while working on the regular unit.

R. A. "DAN" DILLON
Consulting Engineer,
Woodland Hills, California

DEAR EDITOR:

I would like to call your attention to the article, "Calibration of AM and FM Modulation Monitors," in the November issue of B-E.

The sine-wave modulation patterns of Figs. 2B and 2C were reversed. The pattern shown in Fig. 2B is really under 100% modulation, and the one shown in Fig. 2C is really over 100% modulation.

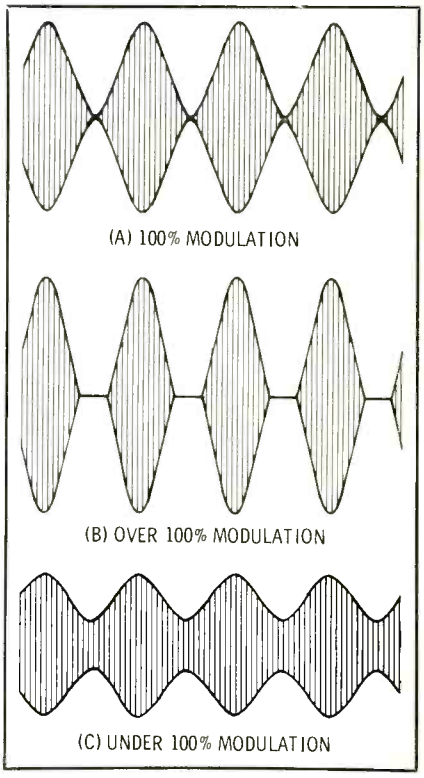
I'm sure others have noticed it, but I thought perhaps you may have overlooked it.

MARVIN BREDEMEIER
Engineering staff,
KUDL Radio,
Fairway, Kansas

Many others did, indeed, notice it, Marvin; these two letters are only a few of the many we received on this subject. You are quite right; the two illustrations are reversed. We hasten to add that the switch was one of those last-minute errors that sometimes occurs in the rush to get an issue of a magazine out; it was not author Jones's mistake.

To clear up any confusion that may exist, we are reproducing herewith a properly labeled set of waveforms. And we're keeping our fingers crossed that these will turn out right!—Ed.

Editor's Note: We're still planning a compilation of ideas concerning maintenance logs. How about it, readers? Care to send along a sample of yours? ▲



PROGRESS IN RECORDING STANDARDS

A summary of the new mechanical and electrical standards for cartridge tape systems.

Over the past ten years or so, recording methods have been devised to combine the advantages of tape with the convenience of discs. From these attempts has evolved the cartridge tape method of recording and reproduction. Until now there has been no industry-wide standard for cartridge tape systems, and compatibility between systems has been rare if not nonexistent.

The recently released NAB Magnetic Tape Cartridge Recording and Reproducing Standards are the culmination of efforts by the NAB Recording and Reproducing Standards Committee in cooperation with equipment manufacturers, broadcasters, recording companies, and international organizations. The purpose of the standards is to ". . . permit interchangeability and, at the same time, to embrace the latest technological advances of the art."

What follows is a digest of the new cartridge-tape standards. Copies of the complete standards are available from the NAB*, whose cooperation in furnishing the material which forms the basis of this article is hereby gratefully acknowledged.

Mechanical Specifications

The standards basically fall into two divisions, mechanical and electrical. The mechanical specifications deal with those aspects of tape storage and movement that affect compatibility and quality of reproduction.

Three sizes of cartridges are established. Designated NAB-A, NAB-B, and NAB-C, these cartridges have the dimensions shown in Fig. 1. All materials used in the cartridge must, of course, be nonmagnetic. The tape capacity depends on the size of the cartridge, but the amount of tape (in playing time) loaded in the cartridge must be clearly marked on the heel of the cartridge. The loaded cartridge must contain enough tape to provide the indicated playing time; any excess tape footage must be in accordance with Table 1. Precise movement of the tape is assured by guides external to the cartridge.

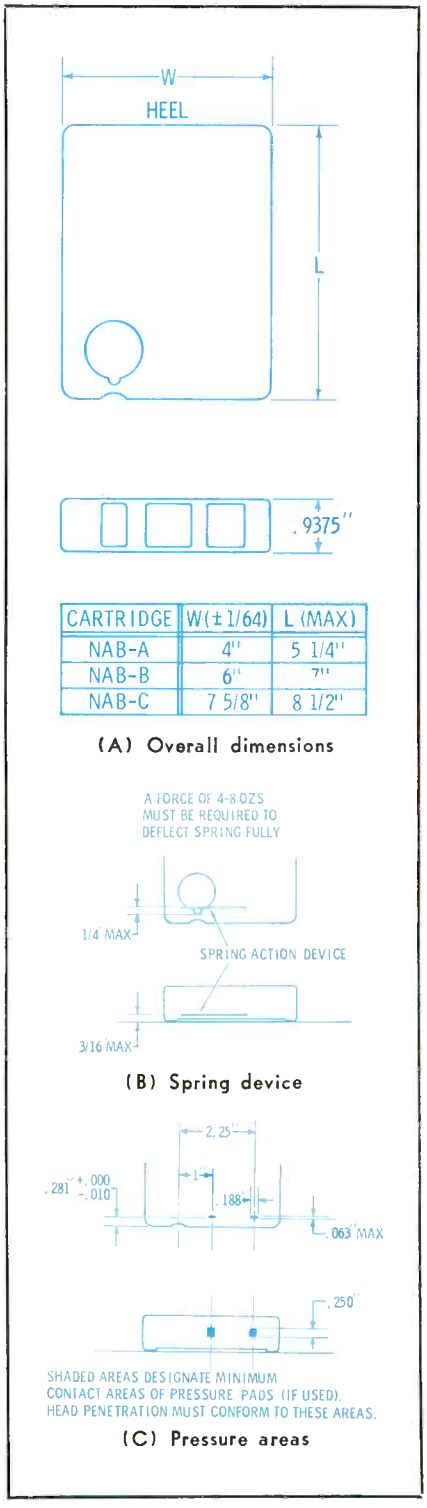


Fig. 1. Standard cartridge dimensions.

The tape itself must also meet certain dimensional requirements. Specifically, the thickness of the tape must not exceed .0016", and its width must be .246" ±.002".

The standard tape speed has been set at 7½ ips, to be maintained within an accuracy of ±.4% —measured using a 150' (±1") loop of one-mil lubricated tape loaded in an NAB-A cartridge.

Flutter must not exceed .2% rms. The following measuring technique is set forth in the standards:

> The measurement shall be made within the band from .5 to 200 cps by playing an NAB standard flutter tape containing a 3-kc recording. The flutter meter shall have no frequency weighting. The meter shall have the dynamics of the Standard Volume Indicator (ASA C16.5-1961). [It is recommended that when flutter measurements are made, the meter be read for ten seconds and that peak readings (excluding peaks which do not recur more often than three times in a ten-second period) be recorded.]

The machine must be capable of exerting a minimum pulling force of 1½ lbs on the tape. The standards state that:

> This measurement shall be made by securing a length of ¼" nonlubricated one-mil polyester recording tape to a suitable tension scale. The tape is then threaded between the capstan and pressure roller and the machine set in motion. An indication of at least 1½ lbs on the scale should then

*Persons wishing copies of the NAB Magnetic Tape Cartridge Recording and Reproducing Standards may write to the Engineering Department, National Association of Broadcasters, 1771 N Street, N.W., Washington, D.C.

Table 1. Excess Tape Footage.

LENGTH	EXCESS TAPE
Up to 63'	3 sec (22½") max
Over 63'	6 sec (45") max

be observed before tape slippage occurs.

For monophonic machines, a two-track system is used. The upper track is the program channel, and the lower track is the cue channel. In stereophonic machines, three tracks are used. The left channel is recorded on the upper track, the right channel is recorded on the center track, and the cue signals are recorded on the lower track. The standard tape-track dimensions are shown in Fig. 2.

Electrical Specifications

This portion of the standards sets forth requirements for recorded levels, frequency response, distortion, signal-to-noise ratio, crosstalk, and other characteristics.

Recorded Levels

In order to specify the recorded levels, a reference must first be defined. In this case, the NAB Standard Reference Level is "that 400-cps level which is equal to the recorded level on the NAB Primary Reference Tape." It then becomes necessary to define this tape:

> The NAB Primary Reference Tape is a tape of the normal general purpose type which has been selected for average characteristics of output, sensitivity, and distortion. The 400-cps recording on it was made at 7½ ips with bias adjusted for maximum output, at an output level 8 db below that which produced 3% third-harmonic distortion. . . . Since neither the tape nor the measurement conditions can be duplicated exactly in the field, all NAB Standard Test Tapes contain a 400-cps recording at the NAB Standard Reference Level, within ±.25 db, as a means for making this level available.

The standard recorded program level is, then, the level that produces the same reference deflection on a standard volume indicator as is produced by a 400-cps tone recorded at standard reference level.

The cue levels are defined in terms of the voltage produced by an open-circuited "ideal" head. These levels may be measured, however, by observing the output levels when the recorded cue track is reproduced through an NAB-equalized playback channel. The standard cue levels (in terms of the standard reference level) are listed in Table 2.

Frequency Response

Practical measurement of the frequency response of a reproducing system is done by playing an NAB cartridge frequency-test tape. The response must then fall within the limits shown in Fig. 3A. Regarding recording response, the standards say, "It shall be standard that the recorded response and level shall be the same as an NAB frequency test tape, within the limits shown [in Fig. 3B], when such tapes are reproduced through the same reproducing system."

Distortion and Noise

The total record-reproduce system harmonic distortion must be "less than 3% for a 400-cps tone recorded so as to produce a level 6 db above the standard NAB reference level."

The unweighted signal-to-noise ratio must be at least 45 db for monophonic systems and 42 db for stereophonic systems. Unweighted noise is to be measured over the frequency range of 20 cps to 20 kc. The measurement is made using a tape recorded with bias but without signal. The reference level is the 400-cps NAB Standard Reference Level. The indicating meter must have the dynamic characteristics of a Standard Volume Indicator, and the measuring system must "have the characteristics of a full-wave rectified average measurement law."

Crosstalk

For monophonic systems, crosstalk between the cue tone (normal level) and program channel must be not less than 50 db below the NAB Standard Reference Level at 150 cps and 8000 cps and 55 db below the reference level at 1000 cps. For stereo, the cue-tone-to-program-channel crosstalk must be at least 50 db below the NAB Standard Reference Level.

Table 2. NAB Cue-Tone Levels.

FREQUENCY (cps)	OUTPUT (db)
400	0
1000	+ .4
150	+6.1
8000	−9.4

Stereo Phasing

Stereophonic recordings are to be made with the head gaps for the two program channels in line. The phasing of the record-head coils must be such that in-phase input signals produce in-phase channel recordings. That is, when the tape is played back, the signals must have the same phase relationship as the signals obtained by playing back a full-track recording on the same machine.

Other Specifications

No erasing function is to be incorporated into the cartridge machine. Bulk erasure of the tape in a cartridge is required.

The 1000-cps "primary" cue tone is the stop cue. Its frequency is to be maintained within ±75 cps. The 150-cps "secondary" cue tone is the end-of-message cue. Its frequency is to be maintained within ±30 cps. The "tertiary" cue tone has a frequency of 8000 cps ±1 kc. It is an auxiliary tone to be used for any desired purpose. The standard cue-tone burst duration is 500 ±250 msec.

Four standard test tapes are specified. Each consists of about 150' of tape loaded into an NAB-A cartridge. The tapes are identified by number; their content follows:

Test Test No. 1 is the azimuth test tape. A 15-kc tone is recorded 10 db below the NAB Standard Reference Level (full-track) for the entire length of the tape. The recorded azimuth is maintained within

• Please turn to page 46

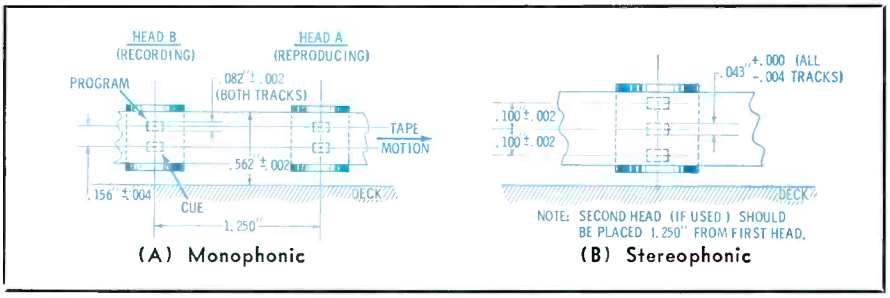


Fig. 2. Head and track configurations specified in the cartridge-tape standards.

PRESSURIZING COAX TRANSMISSION LINE

by Patrick S. Finnegan, Consulting Author, Chief Engineer, WLBC-TV, Muncie, Ind.—Discussion of the fundamental considerations in pressurizing air-dielectric coax cable.

A coaxial transmission line consists of two concentric conductors insulated from each other by one of several materials. Most smaller cables use solid or foam polyethylene, which has a high dielectric constant but exhibits greater losses at the upper frequencies than air. Higher power transmitting installations, such as those found in broadcasting stations, make use of rigid or semi-rigid air-dielectric line. The inner conductor is held in place by steatite, polyethylene, or teflon fittings (pegs or wafers) located at regular intervals throughout the line; some flexible cables employ a continuously spiraled honeycomb-like spacer.

Air, which is always present in the space between the conductors, is a less efficient insulator than any of the materials noted above, and therefore dictates the overall dielectric properties of the transmission line. A direct result of these properties is the peak power rating, a measure of the maximum voltage that can be tolerated between inner and outer conductors. This rating is constant, not depending upon frequency. (Standing waves, a result of an excessive VSWR, develop much higher than normal voltages and effectively reduce the peak power rating of the line.) Since the dielectric strength of air is proportional to the ever changing moisture content, coax lines are rated for dry air at standard pressure.

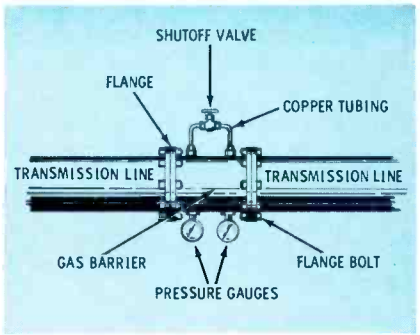


Fig. 2. Bypass and valve in gas barrier.

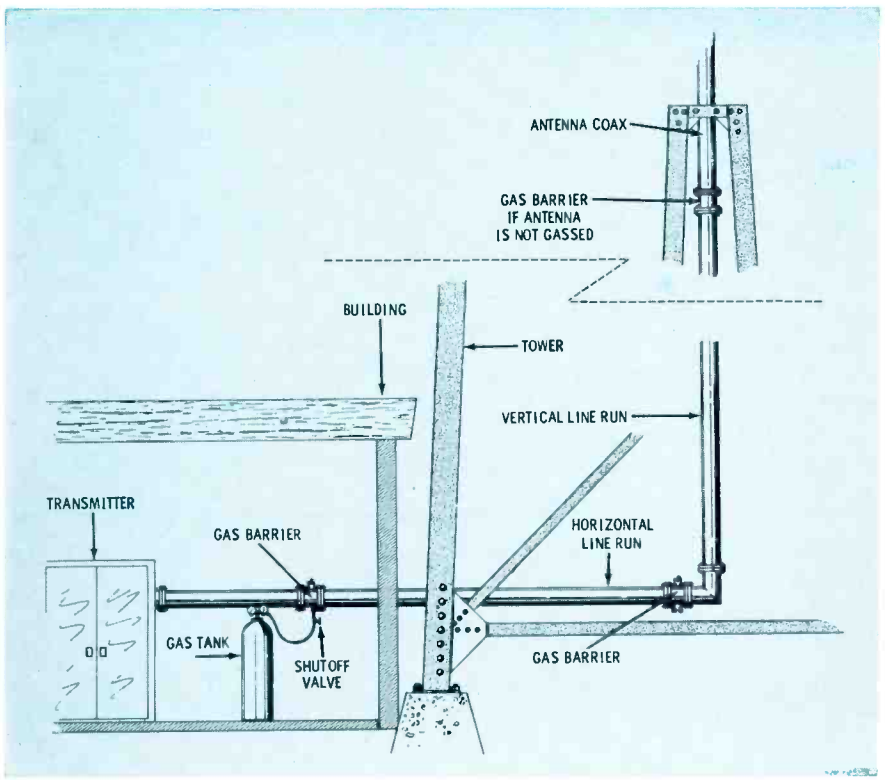


Fig. 1. Typical placement of gas barriers in a coaxial transmission-line installation.

Types of Gas

It follows from the above discussion that the rating of the line can be increased by improving the dielectric. This can be accomplished by pressurizing the air within the coax, thus increasing the air-molecule density and producing a better insulator. Naturally, there is a limit to the advantage to be gained by compressing the trapped air. If a further increase in voltage rating is desired, the air in the line can be driven out and replaced with dry nitrogen gas. Nitrogen, which has the ability to absorb moisture, offers a higher dielectric strength than compressed air. If pressurized nitrogen does not provide a high enough peak-voltage rating, sulfur-hexafluoride gas may be employed.

One other advantage of pressurizing, in addition to increased power rating, is exclusion of moisture from the interior of the line. If water vapor is allowed to enter the cable, condensation (caused by outside temperature variations) forms on the insulators and provides a short-circuit path for RF energy.

When a difference in pressure occurs between the air within the cable and the outside air, the probability of line leakage is greatest. If the outside air pressure is greater than that between the conductors, air will flow into the line through any small opening, carrying with it moisture and dirt. This changing line pressure is called "breathing."

Optimum pressure for gas in a line depends on the relative values of peak-voltage rating and operating power. A line rated to handle power in excess of that normally

applied can be operated at a relatively low pressure; the usual value is 5 psi. If a line is operated at or very near its maximum rating, higher pressure or a gas having better insulating characteristics should be used; a value of 20 psi is a common value in these cases.

Line Components

The easiest type of coaxial cable to maintain in a pressurized state is the semi-rigid or flexible type. Such line is made in one continuous piece. In many cases, these lines are fitted with gas-tight flanges at both ends and filled with gas under pressure at the factory.

Rigid coax line is normally available in 20′ sections with joining flanges on each end. During installation, the sections are bolted together with O-ring gaskets placed in matching grooves between adjoining flanges. To avoid leakage, the gaskets must be properly seated. Getting the O-ring correctly located is not always an easy matter, especially on a horizontal run where there is not enough room to hold the ring while the flanges are tightened. The procedure can be simplified by applying a few dabs of silicone grease to the gasket; this will keep it "in the groove" until the flanges are firmly joined. Be careful not to get grease on the flange surfaces—they must make metal-to-metal contact. Otherwise, since this grease is an insulator, rectification may take place at some frequencies.

To prevent leakage, both ends of the line must be gas tight. Consequently, TV and FM antennas not designed to be pressurized from the transmission line require a gas barrier, or gas block. This is a coupling device, for insertion between standard line flanges, that contains its own inner connector and a solid, sealed insulator. Each barrier has ports into which gauges or inlet pipes may be fastened; when not in use, these holes are sealed with screw-in plugs. Barriers must be installed in the system wherever two sections of line are to be isolated.

The equipment end of the line also requires a gas barrier, especially in FM and TV systems where the coax directly joins the transmitter through a flange. The usual place for the gas barrier is at the point where the line leaves the building. This location provides a convenient terminus for the gas fittings (Fig. 1).

To simplify maintenance and leak location, the total run may be broken into several sections separated by gas barriers. One of these gas barriers should be equipped with a pressure gauge and be mounted at the base of the tower. With several barriers in the system, the entire line will not have to be de-pressurized when it is necessary to open or remove a section. Each gas barrier should be by-passed with a length of small-diameter copper tubing and a shutoff valve (Fig. 2).

Some coax systems, like those used with AM directional arrays, are divided into several sections to feed various towers with end seals used on each section. The seals are gas-tight and provide openings for gauges or inlet pipes. The center conductor of the seal passes straight through the insulator and terminates in a threaded connector.

Individual system requirements will dictate the type of gas to use and whether or not it must be dried. There are several different models of dehydrators available for use in systems that demand moisture reduction. Some are completely automatic in operation—they will pump the line to the preset pressure and keep it there. If line pressure drops for any reason, the pump will run until normal conditions are restored. Automatic dehydrators use a filter that absorbs moisture from the air before it is pumped into the line. When the filter reaches its saturation point, the unit switches into a drying mode and discharges the waste water through a drain pipe. These units are designed for an intermittent duty cycle.

When nonautomatic dehydrators are used, it is a good maintenance procedure to check, at regular intervals, the filter material through the window provided for that purpose. The color of the material will change when drying is necessary.

Nitrogen and other gases require other handling methods and can be purchased in pressurized tanks (Fig. 3) through any bottled-gas distributor. The pressure inside these tanks is very high; too high, in fact, to

Fig. 3. Tank-mounted pressure gauges.

feed directly into the line—a regulator is necessary. Regulators have two gauges, one to show pressure inside the tank and another to show the pressure in the line. A control is used to preset the desired operating pressure, which will be maintained until the tank is empty.

The complexity of the gas-input connection depends upon how many lines are to be fed from one source. A single line can be connected to the system using ¼″ O.D. copper tubing or high-pressure rubber hose. In either case, a small shutoff valve should be inserted between the line and the source to maintain line pressure when it is necessary to disconnect the tank.

When several lines are fed from one source, a manifold is installed (Fig. 4). The tank feeds the manifold which, in turn, distributes gas to each line. Each outlet on the manifold has a shutoff valve so that individual lines may be isolated.

Maintenance

A normal system will always use some gas, but a higher gas consumption than normal indicates a leak. Leaks may develop for many

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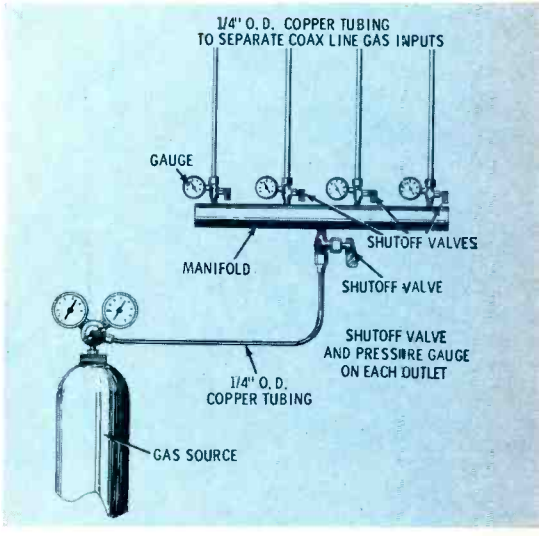

Fig. 4. Four sections fed by manifold.

A LOOK AT CATV

by James M. Moore —
An examination of what constitutes a typical CATV system.

Community antenna television (CATV) systems are becoming more numerous in all parts of the country. Many broadcasters are becoming interested in or are entering this branch of the industry. It is thus becoming increasingly likely that the broadcast engineer or technician may someday soon encounter a CATV system.

Just what constitutes a CATV system? The best way to get an idea of what such an installation is like is to visit one. The following paragraphs will give the reader an opportunity to do just that. Without going into the pros and cons of CATV, or its regulation, this look at a CATV system will give the uninitiated an overall picture of how the system works and what it does. The system to be described offers examples of most of the current techniques and design philosophy in CATV.

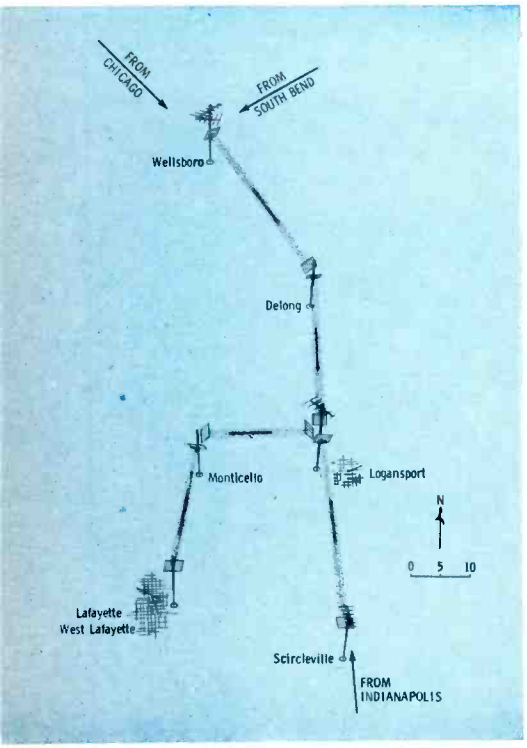

Fig. 1. Diagram of the microwave relays.

The Location

The system to be visited operates in Logansport, Indiana. This city of about 21,000 inhabitants is situated in the north-central part of the state about 70 miles from Indianapolis and 90 miles from Chicago. The city is situated on the Wabash River, and much of its area lies in the river valley. This places most of the television receivers on low ground with higher ground between them and the TV broadcast stations.

Elaborate receiving antennas mounted on towers in the 30′-to-50′ range are in evidence all over town. Even so, reception of the nearest stations at typical receiving locations is reported to be something like this: One high-band station is useable but has some snow; the other has more snow and is subject to fading. One low-band station displays some snow and co-channel interference plus considerable ignition interference; the other low-band station (farther away) is plagued by heavy snow and co-channel interference.

The purpose of this CATV system is, of course, to provide its subscribers with better reception than they could obtain with their own antennas. To do this, an extensive collection of equipment is required; the 60 miles of coaxial cable is only part of the story.

Signal Pickup

Those signals that are strong enough for reliable performance are picked up off the air at Logansport. Signals are received directly from two Indianapolis VHF TV stations, six FM stations, the two UHF channels of the Midwest Program for Airborne Television Instruction (MPATI), and one commercial UHF TV station at Lafayette, Ind.

Mast-mounted FM boosters and UHF converters help overcome line losses down the tower. All of the receiving antennas except the MPATI units are located at a height of about 275′; it was found that the MPATI receivers overloaded when fed from antennas placed at this height. Experimentation showed that satisfactory reception could be obtained with these antennas at heights near 20′.

Some of the desired stations could not be received satisfactorily at Logansport, however. To add these signals to the system, it was necessary to establish additional pickup points nearer the transmitters. The several pickup facilities for the system are shown in Fig. 1.

A receiving station at Wellsboro, Indiana, picks up signals from two Chicago VHF stations and one South Bend UHF station. The receiving antennas at this location are at a height of 190′. The video and audio from these stations are transmitted to Logansport by a two-hop microwave link.

A second pickup station near Scircleville, Indiana, receives the remaining two of the four Indianapolis-area VHF stations—the two not received directly at Logansport. A single-hop microwave link joins this station to the Logansport system. A 350′ tower is used at Scircleville. Both the southern mi-

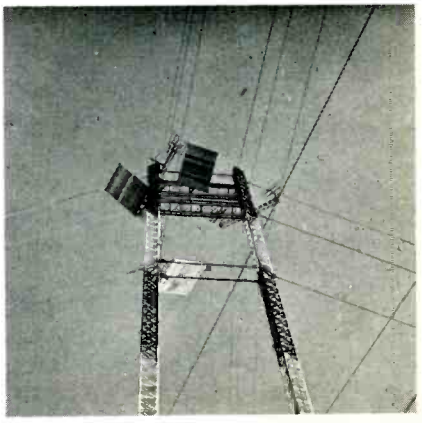

Fig. 2. Antennas atop microwave tower.

crowave link and the one from Wellsboro operate in the 6000-mc band.

Stacked, cut-to-channel yagis are used for receiving at all three locations. Some of these can be seen in Fig. 2, which is a view looking up the tower of the Logansport receiving station—the "head end" of the main cable system. (Two of the microwave reflectors are for signals arriving from Wellsboro and Scircleville; the third is part of a link to a cable distribution system now under construction at Lafayette.) The microwave receiving-antenna radomes can be seen in the ground view of Fig. 3. Note the two MPATI receiving antennas on the towers just above roof level. The site chosen for this station is on the highest terrain in the area.

The receivers for off-the-air TV pickup convert the signals to an intermediate frequency, amplify them, and reconvert them to a VHF channel. Standby oscillators generate a carrier in the event a station goes off the air. The receivers employ AGC, AFC, and limiting of the sound carrier to maintain the desired ratio between sound carrier and picture carrier.

The output of the microwave receivers contains video plus a 4.5-mc sound signal. A modulator unit is then used to replace the RF carrier. This unit is similar in function to a low-power TV transmitter.

In this particular operation, the VHF signals are put on the cable system at their original channel frequencies. The signals from UHF stations are distributed on unoccupied VHF channels.

An individual tuner is used for each FM station received. The tuner output is fed to a modulator unit which produces the signal sent out over the cable. In this system, the FM signals are distributed on frequencies in the FM broadcast band. Modulators are available, however, to supply the FM programs on the sound carrier of a vacant TV channel; and unmodulated picture carrier is also generated in this case so the programs can be heard on intercarrier-type TV receivers.

Fig. 3. Relay, UHF receiving antennas.

Distribution

After processing, the signals are transmitted to the distribution points by a trunk cable (Fig. 4). Distribution amplifiers at various points in the system serve as "hubs" to feed distribution, or feeder, lines. The individual customer taps are then taken off the feeder lines.

The system under discussion here has 12-channel capability. It uses double-shielded coaxial cable and tube-type amplifiers. (Aluminum-sheath cable and solid-state amplifiers are coming into use in the industry now.)

The head end delivers +34 dbj (0 dbj is defined as 1000 uv across 75 ohms). Down the cable 1490′, the first trunk amplifier (Fig. 5) receives +9 dbj and puts out +30 dbj on all channels. System response is held within ±¼ db for all channels; plug-in equalizers are employed to compensate for tilt in the response curve. The amplifiers in use are capable of considerably more output, but conservative operation results in longer trouble-free performance of the system. When operating levels of +9 dbj in and +30 dbj out are used, an amplifier is required for every 21 db of attenuation along the line.

Every third trunk amplifier is provided with AGC. For this purpose, a crystal-controlled, constant-level 73.5-mc signal is injected into the system at the head end. As the system attenuation varies due to tube aging, temperature variations, etc., the AGC amplifiers compensate for the variations.

Temperature changes also cause the appearance of tilt in the system response curve. Temperature compensators designed around temperature-dependent resistors are provided at every third amplifier (not necessarily the same ones with AGC) to counteract this effect.

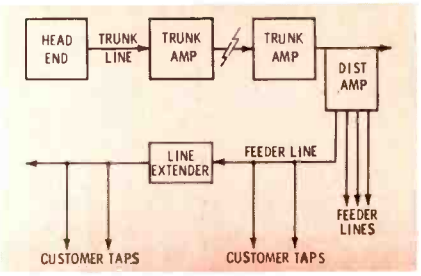

Fig. 4. Simplified system block diagram.

Distribution amplifiers feed signals from the trunk line to the distribution lines. These generally have a bridging input and an inserton loss on the order of 1 db. Up to four high-level outputs may be available to drive the distribution lines.

The lines to individual subscribers are tapped off the distribution cables. Either single- or multiple-output tap-off devices may be used. In either case, proper matching and low insertion loss are maintained to prevent degradation of system performance. Matching transformers are employed to connect the receivers to the 75-ohm drop lines from the system.

On long runs of distribution cable, amplifiers called "line extenders" are employed. In the Logansport system, solid-state units are being introduced for this purpose. These mount on the steel messenger cable, are powered through the line (tube-type amplifiers require a local AC source), and are provided with gain and tilt-compensation adjustments. On extremely long runs, additional amplifiers may be installed.

Maintenance

A CATV system, as does any electronic system, needs an adequate preventive maintenance program to maintain the best possible performance. The system under dis-

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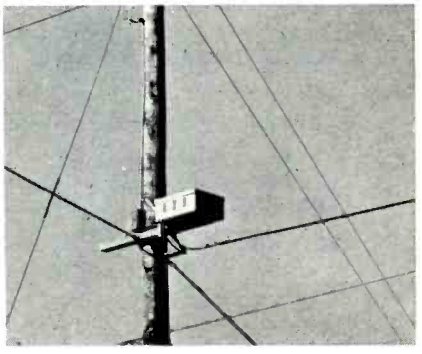


Fig. 5. Amplifier in protective enclosure.

AUDIO TAPE EQUIPMENT

by ***Thomas R. Haskett,*** Consulting Author, Haskett & Volkman, Cincinnati, Ohio—Part 2 of a thorough three-part analysis of modern sound recorders for the broadcast industry.

In our first installment, we covered studio-type and AC-operated portable recorders. In this part, we'll discuss on-the-scene portables that are self-contained, examine film-sync systems, and look closely at cartridge machines.

Battery Portables

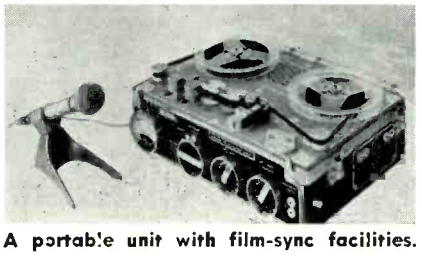
Mobility is paramount in on-the-scene news and special-events coverage. Since we don't have elastic AC lines, batteries seem the best power source for fleet - footed broadcast reporters. While music demands near-studio quality and is usually handled by AC-powered recorders, some sacrifice in frequency response, S/N, and distortion figures can be tolerated in a voice-recording machine that's self-powered, small, lightweight, and—above all—completely mobile.

Important considerations are small size and weight, batteries that are commonly-available, and simplicity of operation. The last is particularly important since engineers are seldom the prime users of news recorders—reporters and announcers are, and they usually aren't technically oriented. Also, though ordinary D cells have rather short life, their redeeming virtue is that you can buy them at any drugstore.

Most of these machines are compatible with studio recorders. Hence a busy newsman can drop off hot tape for editing or playback in the control room, meanwhile dashing off to another assignment. At least two machines, however, use non-compatible tape magazines which can't be played on studio units. There are two solutions: (1) The station may purchase several portables, the studio-based news-tape editor exchanging a recorder with a fresh load for one filled with news each time a reporter checks in. (2) One such recorder may have an AC adapter attached and be based permanently in the control or tape room.

Typical self-contained portable recorder.

Suppliers of some of these recorders furnish mikes, either as standard equipment or as accessories. While these mikes are undoubtedly matched well to their machines, some do not perform as well as commonly used broadcast dynamics. Many stations have quality mikes on hand to use with battery portables. In any case, it's well to consider whether studio mikes can be used with the recorder. The psychological effect on the public must not be overlooked, either: A rugged-looking 8″ dynamic mike with a call-letter plate on the barrel gives the newsman a professional air which can often be useful in getting a story.



A portable unit with film-sync facilities.

Lip-Sync Sound on Film

In motion-picture work for television news and commercial productions, magnetic recording practices are becoming increasingly popular. While some use is still made of both variable-area and variable-density optical recording equipment, emphasis is on magnetics in both single-system (sound recorded directly on the film in the camera) and double-system (sound recorded independently of the film on separate equipment) production. Most spot news events and interviews are recorded single-system for quick editing and because the sound is synchronized to the action by virtue of being recorded on the film itself.

For more demanding film productions, however, the double-system approach provides far greater freedom in cutting the film and in preparing visual effects such as fades, dissolves, and multiple printing for superimposed titles and transitions. In the past, double-system techniques required the use of cameras and recording equipment driven by synchronous motors to achieve exactly matched tape and film travel. The recording medium was usually 17½ mm, plastic-base film (with photographic emulsion for optical recording or with an oxide coating for magnetic) of high stretch resistance to avoid sync slippage during long film runs. The recording film was sprocket driven, which also contributed to accurate synchronization. Such film units

required good-sized trucks for portability.

Development of highly regulated, battery-driven motors for cameras and recorders led the way for compact double-system film work, but problems of tape stretch and slippage, as well as of drifting drive-motor speeds, had to be worked out. These problems have been avoided by five systems of electronic tape-film sync, all of which operate on the same general principle: A sync generator or transformer is coupled to the film-camera drive motor, sending sync pulses to the tape recorder, where they are recorded in parallel with the audio. Eventually audio is resolved, or dubbed from tape to a master film negative (the tape sync signal being used to control the speed of the master recorder to assure proper synchronism) for chemical processing, editing, printing, and release on the same print as the picture images. In some cases, audio is magnetically recorded on oxide stripes on the release print.

The four earliest sync systems were developed when full-track recording was the only reliable means of obtaining a full-fidelity signal. Therefore, these systems all employ a **phantom** or **duplex** method of recording sync along with audio on the same tape. A key point is the use of high-frequency bias with the 60-cps sync signal, in the same manner as audio is biased on tape by all recorders. Standard U. S. film-sync value is 1.2 to 1.8 volts of 60-cps sine wave, for both 16- and 35-mm systems.

Refer to Fig. 1 for the following discussions. The **Ranger** system (Fig. 1A) was the first practical U. S. method; standard on the Stellavox recorder, it's an optional alternate on Nagra and Perfectone and is compatible with the Pilote and Neo-Pilotton systems. The ¼"-long Ranger head records a 25- to 30-mil strip in the center of the tape, but at an angle of 85° to the audio head gap. Although the middle of the audio signal is erased by sync, with proper filtering in the transfer (dubbing) equipment, there are no problems.

The **Pilote** system (Fig. 1B), the European standard, is available only on the Stellavox machine, but it's compatible with Ranger and Neo-Pilotton. Head-gap length is

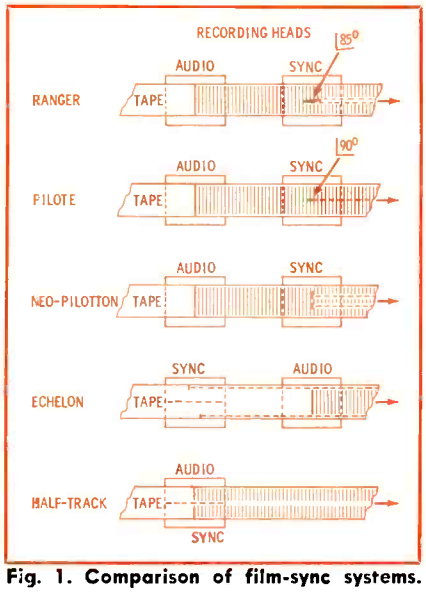
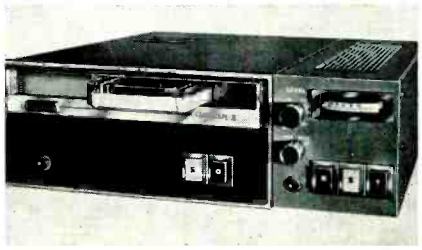


Fig. 1. Comparison of film-sync systems.

1/16" and gap width is 10 mils. The sync track is recorded at right angles to the audio gap, and the system is claimed to have less crosstalk than Ranger.

Neo-Pilotton (Fig. 1C), as the name implies, is an improvement of the Pilote system, with which (along with Ranger) it's compatible. Neo-Pilotton is available only on Nagra gear and uses a double-gap head. The gaps are 10 mils wide, spaced 10 mils apart, in line, and are parallel to the audio-head gap. Sync is again recorded at the center of the tape. However, since the two gaps are driven in push-pull, sync signals cancel out for practical purposes with respect to audio playback, but remain resolvable for sync-pickup heads.

The **Echelon** system (Fig. 1D), available only on Perfectone equipment, is neither standard nor compatible. Audio in this method is recorded by a head gap 165 mils long. Two sync heads are used, having slits of 35 mils length, spaced 185 mils apart, so as to record at the tape edges. Sync and audio head gaps are parallel. Sync heads are fed in phase, but physically are staggered 1/16"; hence the recorded sync is effectively in push-pull as far as the audio playback head is concerned. Because of track separation and push-pull sync, crosstalk is very low.



Typical single-cartridge tape machine.

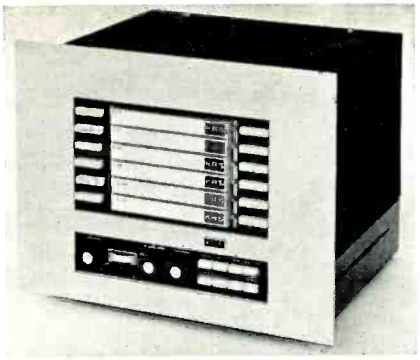
The fifth sync system has no official name, but might well be called **half-track**, since it was devised following introduction of full-fidelity split-track. Two film-sync machines are available that use two half-track heads—one for program audio, the other for sync. Crosstalk is said to be lower than with any of the phantom systems, and audio fidelity on 7½-ips half-track is adequate with present-day head design.

Support Gear for Film Sync

Any of the above film-sync gear requires additional equipment, all of which is available in one form or another from suppliers handling the sync-type recorders. Each twin segment of film and tape must have an appropriate start cue as reference for the sync pulses. The standard studio clapboard being unsuitable for much field work, a self-contained method was devised, called **blooping.** The bloop light, contained within the camera, floods the film gate at the beginning of the take, simultaneously transmitting a special bloop signal to the tape recorder. This insures accurate lineup of the picture and sound upon transfer.

Sync generators or transformers are made for almost any make and model of 35- or 16-mm camera and will work with nearly any sync recorder. While sync is often fed via wire from camera to recorder, at least one company—Magnetic Sales—has devised a method of wireless sync which uses RF to link the two units. This system frees news reporters or fast-moving performers for a wider range of action. One or more cameras may be used with one or more recorders, permitting extreme versatility. The system can be used with Perfectone, Nagra, or Stellavox.

Resolving or transfer equipment is necessary at the studio for dubbing audio onto film negatives or release prints. Special heads and amplifiers can be added to some studio recorders; there are also special units designed expressly for film-transfer work. In addition, some sync-recorder distributors will perform transfer work on a contract basis.



Multicartridge unit increases versatility.

General Features

The battery portables described here are professional, transistorized, use ¼" tape, and are available only in portable cases. All but two have VU meters; the exceptions use magic-eye tubes. All but two have battery-life indicators. Most have motor-driven shuttle; three don't. Most manufacturers offer a variety of accessories, such as mikes, telephone adapters, miniature earphones, rechargeable batteries, and chargers.

All machines handle mono, and two handle stereo. Of the popular units, five are film-sync models, while eight are not. Speeds can be had from 1⅞ through 15 ips. Frequency response averages ± 3 db from 50-10,000 cps, signal-to-noise about 50 db, flutter and wow generally .25%. From 1 to 5 heads are available, depending on function; reel capacity is from 3⅜ to 7", but 5" seems common. Weight varies from 1¾ lbs. for the Minofon 978H to 18⅔ lbs. for the Nagra III. Approximately 40% of these units use standard D cells; the rest use mercury or nickle-cadmium batteries. Several models use hand-crank rewind, and one uses a spring motor for recording. Three machines provide audio AGC. Some either use permanent-magnet erasure or have no erase head. Pricing runs from $330 to $1300.

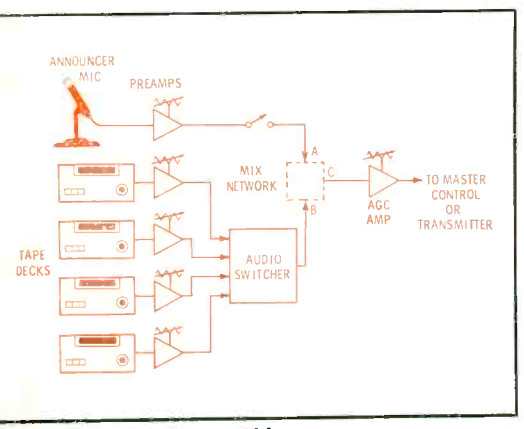


Fig. 2. All-cartridge system, announcer-run.

Cartridge Machines

Magnetic tape offers certain advantages over original disc recording: Tape is easily edited, can be erased and reused, requires little mechanical skill to handle, has greater dynamic range, and makes it possible to record lengthy segments on a single medium. However, disc playback turntables have some advantages over standard reel-to-reel tape recorders: Playback discs require even less mechanical skill than tape, and segments can be located and cued more rapidly. Short recorded announcements are difficult to handle in fast-paced programming if 20 or 30 are located on a single reel of tape on a standard recorder. To preserve tape advantages and incorporate those of the turntable, the cartridge recorder was developed. It has proven even simpler to operate than the turntable, chiefly because it's self-cueing and pushbutton-operated.

The cartridge machine's major function is to replace the disc turntable; hence a station's first ones are usually located in the control room, where board men run them. Once cartridges have been recorded and labeled, they are handled much like discs. However, since they are used chiefly for spot announcements, they are generally stored in the control room, for speed and convenience.

In addition to announcement use, cartridge recorders are becoming popular for music. Stations which program only a limited number of selections each week—so called "top forty"—find that cartridges decrease operator errors, save time, and maintain reproduction quality (since there are no fragile vinyl grooves to get scratched or dusty).

The next step is all-cartridge operation. (Some reel-to-reel programing may still be done for segments longer than 31 minutes, the current cartridge-tape limit.) In this type of operation, one or two extra cartridge recorders are often installed in a separate recording room/studio, for dubbing and makeup. All spots—live and ET—and all music, are placed on cartridges. With AGC amplifiers riding gain, the board announcer has only to load cartridges and push buttons to operate the station. The final step is full automation, which we'll discuss in our final installment.

For limited use, a combination record-playback unit is the best bet. When two or more machines are used regularly—over, say, 50% of daily air time—it's practical to acquire completely separate record and playback units. The next step is to assign a single recorder to a dubbing console in a spare control room, keeping playback units in the air control room. All machines in this class are usable in automation, in one form or another. Hence, it's possible for a station to shift from turntables . . . to manual cartridges . . . to full automation over a period of adjustment.

Standards

As an art is born and progresses, standard techniques evolve through operating practice. Features which are nonessential disappear, while innovations are added to fill specific needs. An NAB committee recently confirmed certain standards for broadcast cartridge use. They include: 7½ ips ± .4%; harmonic distortion less than 3% for a 400-cps tone recorded 6 db above NAB standard reference level, which is the 2% harmonic-distortion point of a recorded 400-cps tone; signal-to-noise ratio of 45 db for mono, 42 db for stereo, both measured at the standard reference level; and not more than .2% rms flutter. **(Editor's Note: The new NAB Standard is available from the Engineering Dept. of NAB.)**

Features to Date

Additionally, the following practices are in use. Available cartridge machines use ¼" lubricated tape in a continuous loop contained within a plastic cartridge. Half-track heads are used for mono. Program audio is placed on the first or upper track; the second track is used for cueing. Early machines, and some today, use a single 1000-cps (±75 cps) tone, called **stop cue,** approximately 500 msec in duration, which provides the basic recuing of the tape loop. When the **start** button of the machine is pressed, the transport pulls the loop around once, shutting off when the 1000-cps tone hits the cue head.

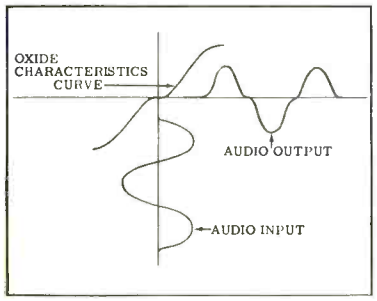
Some plain talk from Kodak about tape:

Bias transfer characteristics and dependent parameters

Kodak
TRADEMARK

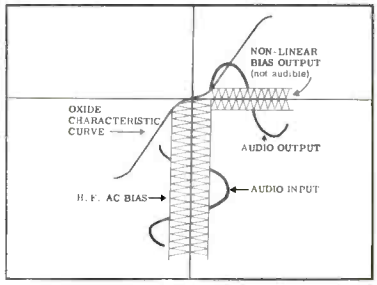
Ever heard the story about the pilot on his first solo flight? Unfortunately the engine failed. But fortunately he had a parachute. But unfortunately the chute failed to open. But fortunately he landed on a haystack. But unfortunately there was a pitchfork in the haystack. Except for the unhappy ending, this might be the story of how gamma ferric oxides respond to magnetic fields. Everything about it is fortunate with one exception. *Linearity*. The oxide needles used in the coatings have atrocious linearity characteristics. Feed in a clean, pure sine wave and out comes a non-sinusoidal complex waveform that looks something like a demented snake trying to bite its own head off. How does it sound? About as pleasant as Junior's first violin lesson.

How then is magnetic recording possible? Fret not—there's a way out. The entire problem is solved by one wonderful, mysterious phenomenon called bias. The transfer curves tell the story.

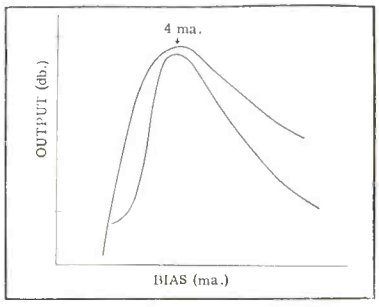


The slightly twisting curve at the upper left represents the oxide response. The lower curve is a pure, sine wave input. At the upper right we have the result of the response curve on the input . . . a mess.

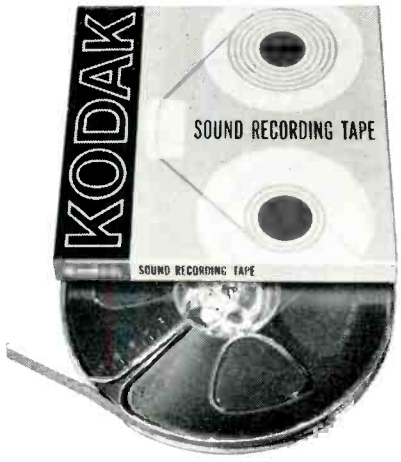
The reason it looks the way it does is because the sine wave input is affected by the non-linear characteristics of the gamma ferric oxides. But look closely. Note that while the oxide performance is non-linear when taken over its entire length, we can find linearity over selected sections. In other words, we can get rid of our distortion if we can put the signal on the linear section of the oxide's characteristic curve. And that is exactly what bias does. It "lifts" the signal away from the convoluted central area on the graph and moves it out to linear areas.



The amount of bias (that is the current in milliamperes) applied to the head is highly critical if top performance is to be achieved. Bias affects output, high and low frequency sensitivity, signal-to-noise ratio and distortion. This curve explains it.



The steep curve represents low frequency sensitivity (measured in db.) at varying bias levels for many tapes. Note that you get good performance providing you have a bias setting of about 4 milliamperes. (Curves for the other magnetic parameters are similar in shape and all peak at about the same bias level.) Vary one milliampere and you "fall off the curve" and suffer severe losses in sensitivity. Now look at the broader curve. You can vary a milliampere with hardly any change in performance at all. Here's the point. *Kodak tape has that broad curve*. It gives you top performance even though your bias settings aren't perfect. And if your tape recorder is more than a year old, then chances are enough shift has taken place to push you off the cliff. That's why we designed a broad bias curve. And that's why you need it. It's just one more way that Kodak tape gives you an extra bit of assurance of top performance.



KODAK Sound Recording Tapes are available at all normal tape outlets: electronic supply stores, specialty shops, department stores, camera stores . . . everywhere.

EASTMAN KODAK COMPANY, Rochester, N. Y.

Circle Item 7 on Tech Data Card

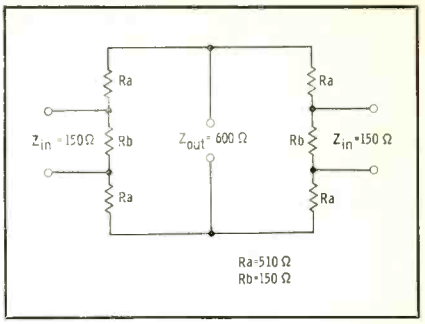


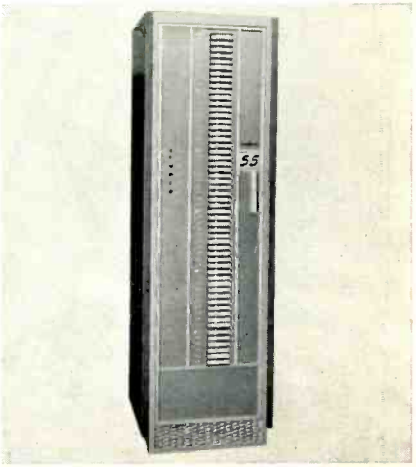
Fig. 3. Resistive pad for mixing & matching.

More recent models have retained the 1-kc stop cue, which is part of the NAB standard, and have added a second tone, called **end-of-message** or **sequencing** cue. By the new NAB standard this tone is to be 150 cps (±30 cps). Used principally in automation, it starts another machine and transfers input connections at the end of the recorded segment; recorded material often does **not** occupy the entire tape loop, and the sequencing cue obviates dead air time.

Three manufacturers offer a third tone, sometimes called **random** or **trip** cue, which is used to start theme music (on another deck) under voice during an announcement, or to switch slides or projectors in TV. Standard for random cue is 8000 cps (±1 kc).

Whatever the cue system, separate cue tracks are preserved on stereo models by employing three or four tracks. One manufacturer doesn't use any cue at all; his cartridges simply play continuously.

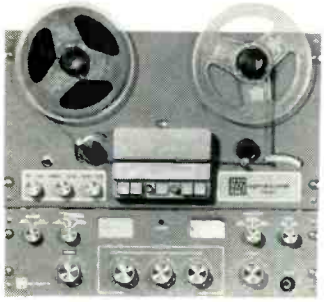
Some machines have **ready** and **run** lights; the former indicates that a cartridge is loaded and cued, while the latter shows the reproducer to be functioning. Nearly all machines have remote-control ac-



Giant unit handles fifty-five cartridges.

thank you, broadcasters!

for a record year with our 1000 SERIES



MODEL 1021 Fully transistorized with regulated power supply, the Model 1021 Recorder/Reproducer meets the exacting demands of continuous, reliable operation. A few of its many features are: broadcast standard input and output connectors, in-built cueing speaker with separate level control, mixing auxiliary input, two speed (3¾ and 7½ ips) hysteresis synchronous capstan motor.

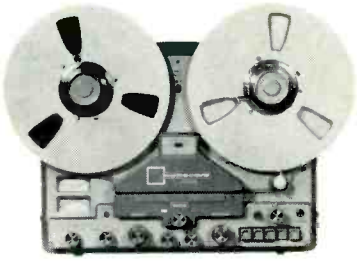
$659

MODEL 1022 The fully transistorized Model 1022 Recorder/Reproducer sets new standards for two-track stereo or half-track monaural operation. N.A.B. standard switchable equalization, in-built input and output transformers, monitoring from tape or source, capstan motor stops when tape runs out, solid die-cast transport top plate, two-speed (7½ and 15 ips) hysteresis synchronous capstan motor.

$739

MODEL 1028 The Model 1028 features 10½ inch reels and advanced circuit design utilizing the latest tube types and printed wiring. Exclusive micro-optic heads provide selectable erase and two channel simultaneous record and play. Two speed (7½ and 15 ips) hysteresis synchronous motor, precision tape guidance, die-cast main frame and other features listed with Model 1048.

$995



MODEL 1048 The Model 1048 matches the Model 1028 in excellence of design and craftsmanship. Two speed (3¾ and 7½ ips) hysteresis synchronous motor, individual channel gain controls, half-track or quarter track stereo heads, four-digit counter and many features identical to the Model 1028.

$995

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Circle Item 9 on Tech Data Card

cessories for multiple-studio use, and most have audio switchers available. These are simply relay decks which transfer tape outputs from one machine to another, triggered by sequencing cue. This means audio from two, three, or more playback decks can be fed to an audio switcher, whose output then ties up only **one** console input.

Fig. 2 illustrates a simple, convenient method for setting up an all-cartridge announce studio. Up to four cartridge reproducers are tied through an audio switcher to one half the input of a mixing pad. The other input half receives a mike preamp output. The combination feeds an AGC amplifier. For average levels on mike and tapes, the gain controls should be set with the AGC defeated. It is not necessary for the announcer to ride gain during normal operation—he has only to load cartridges, push start buttons, and operate the mike switch. Fig. 3 shows the design of a 150-150-to-600 mixing network.

Besides single-cartridge machines, four manufacturers offer multiple-cartridge units. One of these can do the work of several singles, allowing a compact and centralized cartridge operation. Of course, a multiple machine costs more than a single. Most available machines, single and multiple, use the Fidelipac-type cartridge, but two manufacturers use their own. Thus, there are three types of cartridges in broadcast use today, mutually noncompatible.

General features follow: Many models are complete playback units, needing only the addition of a recording amplifier to enable the user to make up his own spots. However, some machines are available in two versions—recording or playback only—each of which is complete in itself. In machines using the Fidelipac cartridge, single-play models can hold any of the three cartridge sizes—up to 31 minutes of tape. ATC's Model 55 (55 cartridges) and MaCarTa's Carousel (24 cartridges) are limited to 10½-minute cartridges. The KRS STACT holds six 31-minute cartridges, and RCA's RT-8 holds four 31-minute cartridges.

Most machines have a hysteresis-synchronous motor, no rewind, and output in the range of —15 to —5 VU at 600 ohms balanced. Random selectors, audio switchers, and remote-control accessories are generally available. Many units are transistorized, some with plug-in amplifier modules. KRS STACT is the only reversible model we know of, and also the only one in which it's possible to record on one cartridge while any of the other five are simultaneously playing back. Prices for cartridge tape machines in this class are from $230 through $2675.

Typical portable cartridge-tape machine.

Cartridge Portables

Just as discs require auditioning, cartridges must be monitored by station personnel. While it's possible to use studio machines, it is safer and more convenient to provide separate cartridge facilities for management, sales, and production. All machines in this class are available in portable mounting only, and handle all three sizes of cartridges, one at a time.

There are four brands on the market; two have handles and are designed as transportables, for time salesmen to use in client demonstrations, while the other two are made for table-top use. One model includes a dynamic mike and can be used for an auxiliary news/interview recorder. Another uses a silence-sensing automatic cutoff. A third is housed in an aluminum case. Still another new model is battery-operated and all-transistor. One company has recently introduced two unmounted transports (no electronics) suitable for custom installations where auditioning is required. Portable prices are $120—$295.

The End in Sight

Our next (third) and last installment will explore audio tape machines in automation systems. As we've pointed out, cartridge machines are the first step in this direction.

. . . to be continued ▲

January 1965

We interrupt this magazine to bring you...

Late Bulletin from Washington

by Howard T. Head

FCC Tightening on UHF Permits

The Commission has served notice on approximately 30 holders of construction permits for UHF television stations that they expect prompt initiation of operation; otherwise the permits must be surrendered to the Commission. In some instances, permittees have held their authorizations for periods in excess of ten years without undertaking any actual construction. These situations, the Commission says, can no longer be tolerated in view of the renewed interest in the UHF portion of the television spectrum.

Notice Now Required on Call Letters

The Commission has amended its Broadcast Rules concerning call-letter assignments. Under the new regulations, all broadcast stations within 35 miles of the applicant's station must be notified by mail of requests for new or changed call letters. If no protests are received during the prescribed 30-day waiting period, the request will receive favorable action.

TV Frequency-Monitor Requirement Eliminated

The Commission has amended its Rules to eliminate the requirement that television broadcast stations have type-approved frequency monitors in operation at all times. The new Rules result from the fact that frequency stability in modern television transmitters is often superior to that provided by the best available frequency monitors.

The new Rules require that the frequency of the visual transmitter and the frequency difference between the visual and aural transmitters be checked at least once daily. More frequent checks must be made if necessary to maintain operation within the prescribed frequency tolerance. The means of making these checks is left to the discretion of the individual licensee, but the method employed must be sufficiently accurate to reveal out-of-tolerance operation.

In addition to the daily checks, an actual measurement of the visual carrier frequency, and of the difference between the visual and aural carrier frequencies, is required at least once a month. The new Rules specifically require that the primary standard for these measurements be the Bureau of Standards transmissions from WWV, WWVB, WWVH, or WWVL.

Although not mentioned in the Commission's Rules, other VLF stations, such as NBA, Panama, have the necessary frequency and phase stability to meet the requirements. Several equipment suppliers have announced comparison equipment suitable for making the required measurements.

The new regulations relate only to frequency monitors. Television stations are still required to employ modulation monitors to assure compliance with the television Technical Standards.

Multihop Relaying for Aural Remote Pickups

The Commission now permits the use of multihop operation, employing automatic relay stations, for remote-pickup operation. This will make possible aural coverage of events which originate at locations where single-hop relaying is inadequate. The new regulations also permit communication between two licensees on the same remote-pickup frequency in order to resolve interference conflicts arising out of simultaneous operation on the same channel. The new automatic relay operation is permitted only on the channels in the 450-mc portion of the remote-pickup band.

Stereo Sound for Television

An inquiry into methods of providing stereophonic sound transmissions for television programs has been instituted. In its Notice of Inquiry, the Commission expresses interest in determining whether the incorporation of stereo sound would provide an added dimension of enjoyment and, if so, what technical measures would be needed to provide the stereo feature. Various techniques have been suggested, including systems similar to that employed by FM stations, or some form of modulation using the horizontal synchronizing pulses as a subcarrier.

Operator Requirements for DA's Unchanged

The Commission has turned down a proposal which would have relaxed the present requirement that an operator holding a first-class radiotelephone license be in actual charge of a standard broadcast station during all hours of directional operation.

This requirement, however, is still under study by various organizations, including the National Association of Broadcasters. One particularly difficult aspect is that of distinguishing between relatively simple, stable directional antennas, which require little or no attention, and more complex antenna systems which may lose adjustment easily and which require almost constant professional attention.

Howard T. Head...in Washington

HELICOPTERS IN INTERNATIONAL TELEVISION

by Elliott P. Fagerberg, Consulting Author, Geneva, Switzerland—A report on the addition of a new dimension to telecasting in Europe.

Helicopters are being used increasingly in several European countries for "live" telecasts of outdoor events. Basically, helicopters provide two important advantages: They make possible airborne, overhead camera shots, and they provide a support for equipment used to relay signals from remote cameras on the ground.

France

Success in using helicopter techniques has been reported by Radio Television Francaise (RTV) in broadcasting the "Tour de France" bicycle race. For these telecasts a helicopter is used both for direct aerial shots and as a relay for signals transmitted from video cameras mounted on motorcycles.

A transistorized image-orthicon camera is used for the airborne pickups. This camera is provided with a synthetic-resin cover for protection from the weather. Closeup pictures are obtained from cameras mounted on motorcycles that follow the racers; equipment aboard the helicopter is used to relay signals transmitted from the motorcycles. The signals are picked up with two FM receivers tuned to 492 and 532 mc and are retransmitted from the helicopter by two FM transmitters, one operating on 650 mc with an output of 5 watts and the other on 780 mc with an output of 50 watts. The video signals from the helicopter camera are also transmitted through these units. A conventional radiotelephone system is used for relaying instructions from the helicopter to the motorcycles and a truck-mounted receiving station.

Circularly polarized, printed-circuit receiving antennas are used on the helicopter and the motorcycles. The helicopter antennas are extended and retracted by electric motors.

Italy

A similar system has been used by the Radio Televisione Italiana (RAI); a helicopter makes possible coordinated pickups from two cameras mounted on automobiles (Fig. 1) and a third on a motorcycle (Fig. 2). Although RAI anticipates putting a cameraman in the helicopter, the aircraft is now used only as a relay station.

On each of the station wagons is mounted a transistorized camera using a 3″ image orthicon. A generator driven by the engine of the vehicle is used to charge batteries which in turn power the cameras.

The helicopter and auto transmitters have outputs of 6 watts each. The motorcycle transmitter power is 3 watts. Three receivers with different types of antennas operating in diversity are employed at the receiving truck (Fig. 3). A diagram of the system is shown in Fig. 4.

Belgium

A system similar to those already described has been used by the Belgian Radio and Television System. During the race, the helicopter flies over the course at an altitude of 900′ to 1000′. The video is sent from the motorcycles to the helicopter by .7-watt FM transmitters operating in the 500 mc band. Aboard the helicopter is a 50-watt FM transmitter which retransmits the video signals in the 500 mc band. Using an omnidirectional antenna (under the aircraft in the cover illustration), the helicopter relay permits constant contact with a fixed ground receiving station within a radius of about 15 miles. The ground station uses a directional antenna with a gain of about 12 db.

Microphonics due to mechanical vibrations of the helicopter proved to be a serious problem in initial tests of the equipment. This was eliminated by shock-mounting the electronic equipment in the helicopter.

Interference was another serious problem. It was produced by signals from other stations operating entirely outside the desired frequency band and by the radiotelephone system aboard the helicopter. The difficulty has been eliminated by inserting band-pass filters in the antenna transmission line.

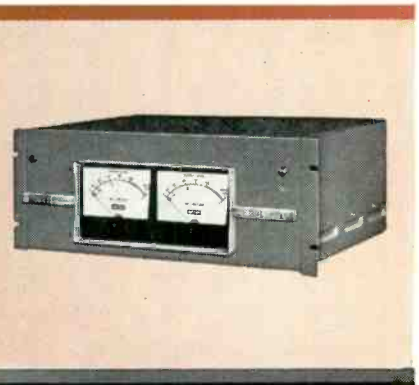
To give the helicopter pilot max-

Fig. 1. Auto-top camera used in Italy.

Fig. 2. Motorcycle camera uses vidicon.

Fig. 3. Multiple-antenna ground station.

The soundest sound in FM is the new sound of GATES



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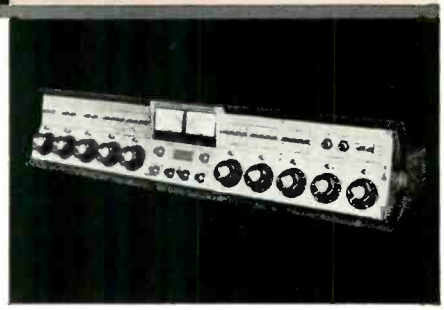

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imum freedom in maneuvering his craft while following the races, helicoidal antennas have been installed on the motorcycles and the helicopter. The use of circularly polarized antennas on the motorcycles reduces the effects of interference due to reflected waves at some relative positions of the helicopter and the motorcycles. Belgian TV engineers are convinced that ground-based stations for such telecasts should be located in rural areas to minimize the effects of industrial static.

One serious problem remains to be solved. The sync generator in the portable camera does not produce pulses that are satisfactory for good video transmission. It has been the practice to replace this information at the ground relay or the studio by pulses generated locally. The ground-based sync-pulse generator is synchronized with the signal from the helicopter by means of a "slaving" unit. This synchronization has not worked satisfactorily because of the numerous breaks in transmission from the motorcycles to the helicopter. A proposed solution is to use a return transmission channel to "enslave" the sweep of the portable camera to the sync generator at the studio.

Other Countries

The Israel Broadcasting Service has made satisfactory use of a "military-type" transceiver for live telecasts from a helicopter. While being unable for security reasons to disclose details of the cameras used, Israeli radio engineers report that a BBC-type lip microphone has been used effectively to exclude undesired noise.

Live telecasts have not yet been reported in Scandinavia, but in both Sweden and Norway helicopters have been successfully used for filming outside events for TV broadcast. The Swedish Broadcasting Corp. has obtained effective stabilization of the camera by means of a gyroscopic device. Engineers for the Norwegian Broadcasting Corp. have not yet been able to record a running commentary on the film of aerial shots because of noise within the helicopter.

Other Helicopter Uses

A number of European broadcasting organizations report successful use of helicopters for making antenna - pattern measurements. These organizations include the "Deutsch Welle" of Cologne and the Bayerischer Rundfunk of Munich in Germany, the Oesterreicher Rundfunk in Austria, and the Independent Television Authority in Great Britain.

The latter organization has used helicopters for testing new television transmitting antennas. In verifying the effective radiated power directed toward France from Dover, the Authority's engineers were able to

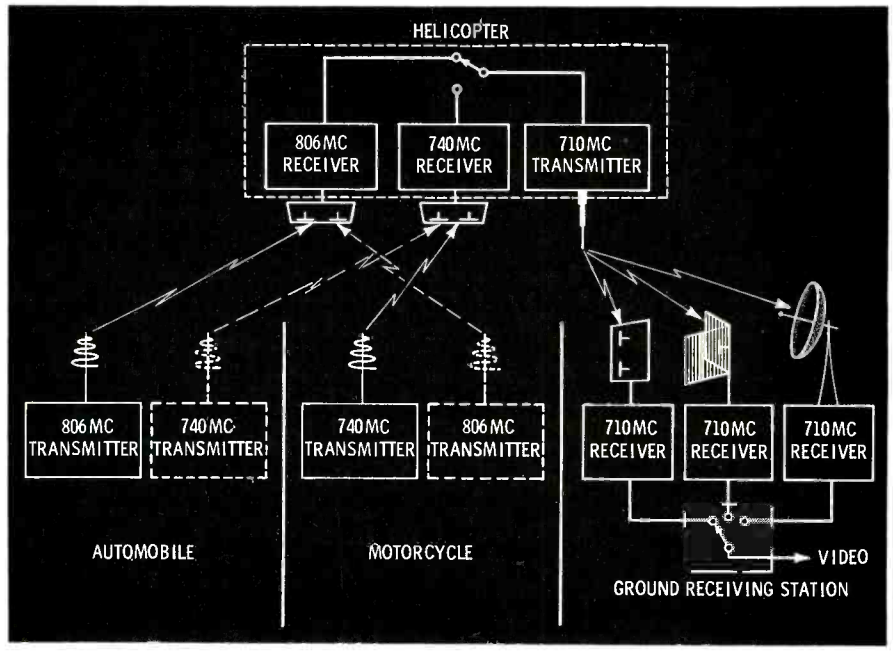
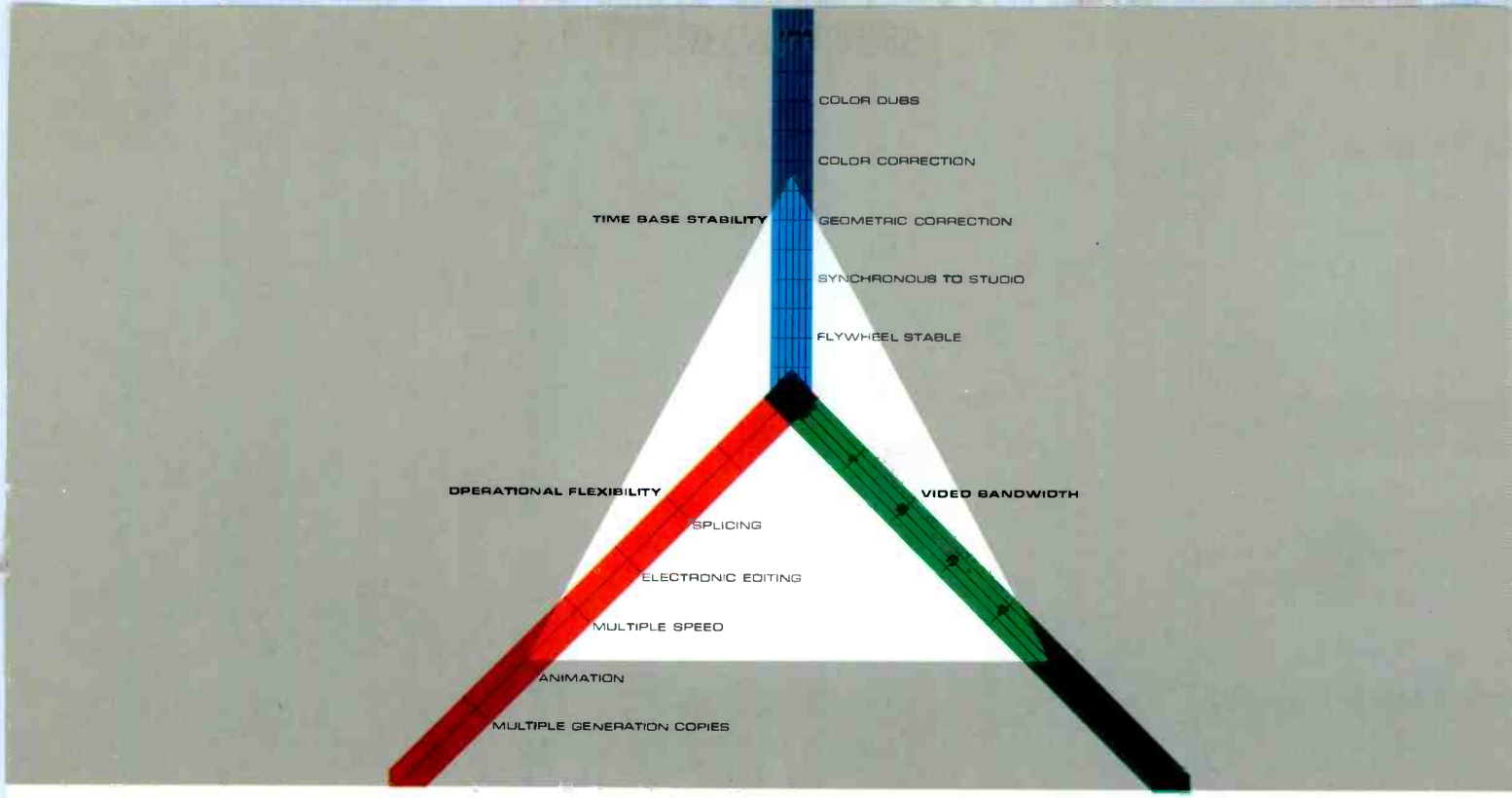


Fig. 4. Diagram illustrates the use of helicopter-borne equipment for TV relay.

determine very accurately the radiation pattern of the antenna mounted on the transmitting mast. Also, power-loss measurements over a very long radio transmission path were carried out with the transmitting equipment supported in space by a helicopter.

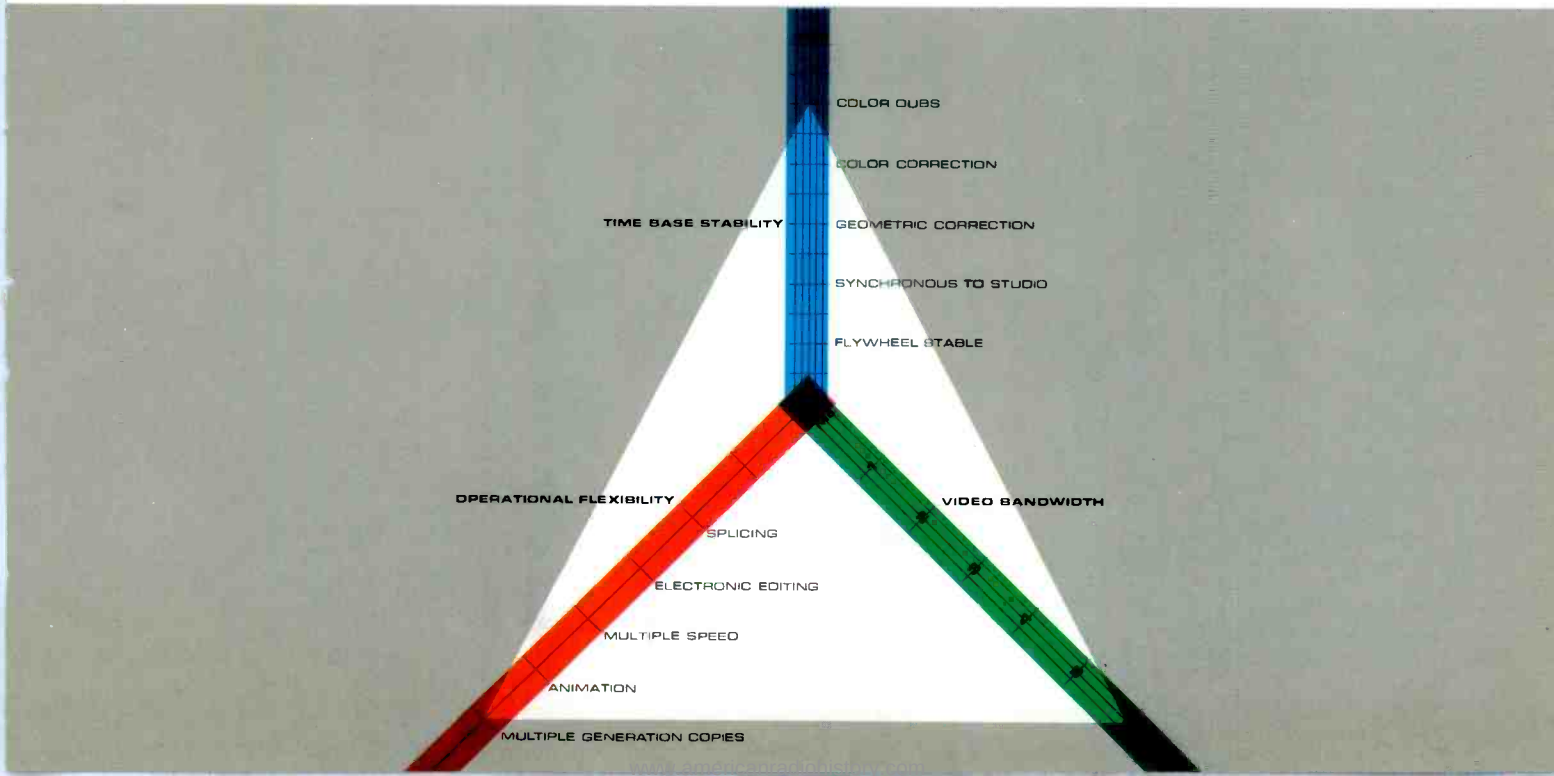
Thus it can be seen that, although the methods of usage vary from country to country, the helicopter is assuming an increasingly important role in European television broadcasting. ▲



These parameters show the best that can be expected from present-day recorders. Note the limitations on bandwidth, time base stability and production flexibility.

THIS IS THE TURNING POINT IN TELEVISION TAPE PRODUCTION

These are the parameters of an entirely new kind of recorder:
a recorder that marks the turning point in television tape technology.



THIS IS THE TURNING POINT:

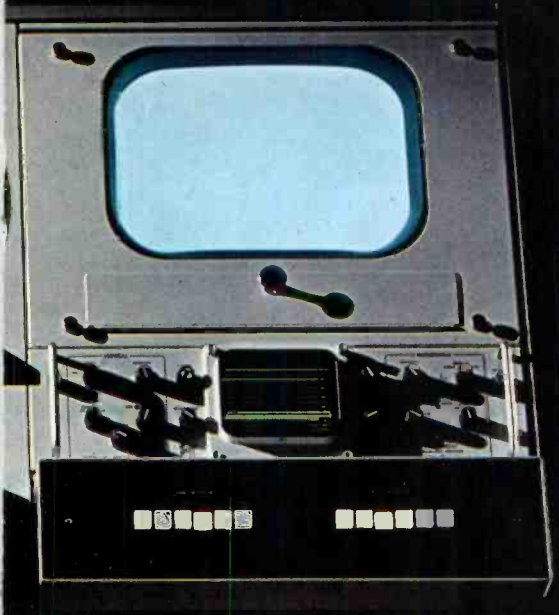
a recorder that will actually make superb, broadcast-quality third generation color copies.

The VR-2000 is the turning point that had to be made in order to make true teleproduction possible. The vector diagram—which illustrates the three principal parameters that apply to any television tape recorder—clearly demonstrates the inadequacies of previous recorders. Even the best of the recorders of the old technology just didn't have the bandwidth or time base stability to be able to maintain quality in multiple generation copies. In fact they weren't even capable of producing adequate color tapes to the second generation. The VR-2000 breaks all those previous barriers wide open. Now—for the first time—there is a recorder so advanced it can make superb, broadcast-quality fourth generation black-and-white tape copies. Now—for the first time—there is a recorder capable of producing superb, broadcast-quality third generation

THIS IS THE TURNING POINT:

a recorder that will actually make superb, broadcast-quality fourth generation black-and-white dubs.

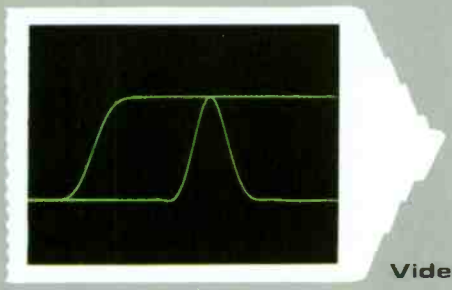
color copies. Now—for the first time since 1956—there is a recorder that is revolutionary in every sense of the word. Revolutionary in conception: the VR-2000 was designed to meet an entirely new "high-band" standard utilizing a high-band carrier/deviation frequency of 7.06 to 10.0 Mc. Revolutionary in execution: in order to meet this standard, Ampex developed a head assembly, signal electronics system, and mechanical design completely different from any television tape recorder ever made. Revolutionary in performance: the VR-2000 is the first recorder to offer the operational flexibility and multiple generation picture quality that makes true teleproduction possible. The VR-2000 marks the turning point in what can only be called a new era of television tape recording technology. The days of updating are over.



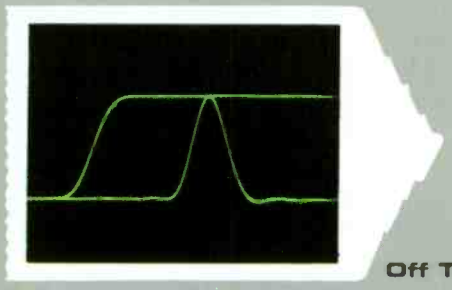
AMPEX VR-2000

TELEPRODUCTION VIDEOTAPE® RECORDER

The VR-2000 offers a quality of performance unequaled by any other recorder ever made. These are photos taken on a Tektronix Model 547 oscilloscope, with the VR-2000 operating in the 525 line high-band standard.

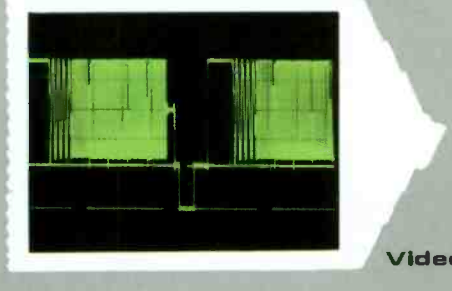


Video Input

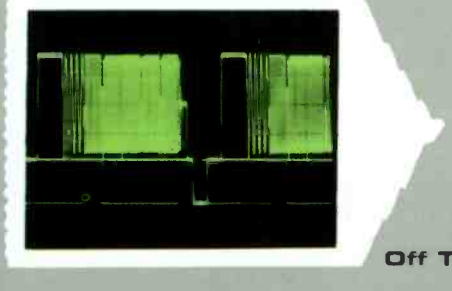


Off Tape

Transient response (K Factor): the signal is a "2T sine-squared pulse and bar" waveform for a 525 line system. Pulse H.A.D. (half-amplitude duration) was 0.25 μsec.



Video Input



Off Tape

Multiburst response: bursts are at 0.5, 1.5, 2.0, 3.0, 3.6, and 4.2 Mc.

THIS IS THE TURNING POINT:

a recorder so demonstrably superior that it can only be called revolutionary.

PRODUCTION CAPABILITIES

Editec* System: provides a precision of control over animation and editing never before attained. Makes it possible to cue each end of a scene to single frame accuracy, record animation frame-by-frame, automatically activate other studio equipment, edit sound and picture or picture only, edit precisely in sync with music, even record time lapse material.

New Intersync† System: re-designed system will actually hold synchronization to within limits of color correction ranges with the Amtec unit out of the circuit. (This, of course, is only done for short periods of time, and for demonstration purposes only.)

New Amtec† Unit: the best system of its kind, the existing Amtec was completely redesigned to match the capabilities of the VR-2000.

New Automatic Chroma Control: (optional) eliminates the last major source of variations in color recordings.

Colortec* System: maintains rigid time base stability. This, combined with the new dimension of capabilities of the VR-2000, makes possible superb quality third generation color dubs.

SIGNAL ELECTRONICS SYSTEM

New Mark IV Video Head Assembly: employs a high input impedance, low-noise Nuvistor pre-amplifier to extend frequency response beyond 10 megacycles. Features exclusive rotary transformers, optional air-cushion or ball-bearing drive. Delivers the best S-N ratio ever: up to 46 db.

New Dual Heterodyne Modulator: insures a degree of linearity never before possible.

New Automatic Frequency Control: is crystal controlled at blanking level. Actuates a warning light if frequency is in error by more than 10 kc.

New Unity Gain: keeps input and output equal and deviation correct on a pre-determined basis.

New Dropout Supression: supplies black level to replace dropout.

New One-Line Delay Accessory: (optional) replaces dropout with picture information that occurred one line earlier.

New Switching Transient Suppressor: eliminates interference to sync leading edge from front porch switching transients.

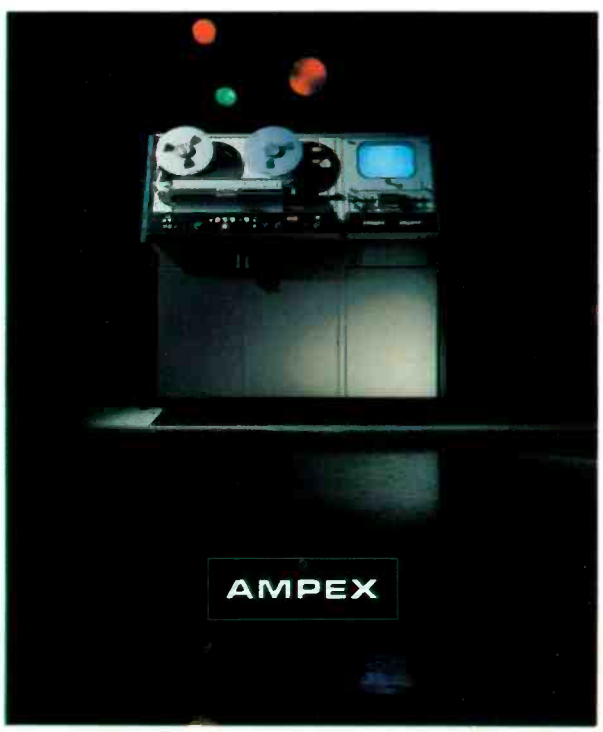
New White Level Calibration Pulse: provides continuous monitoring of video signal deviation.

New Standards Switching: the VR-2000 can switch all characteristics between broadcast standards.

MECHANICAL DESIGN

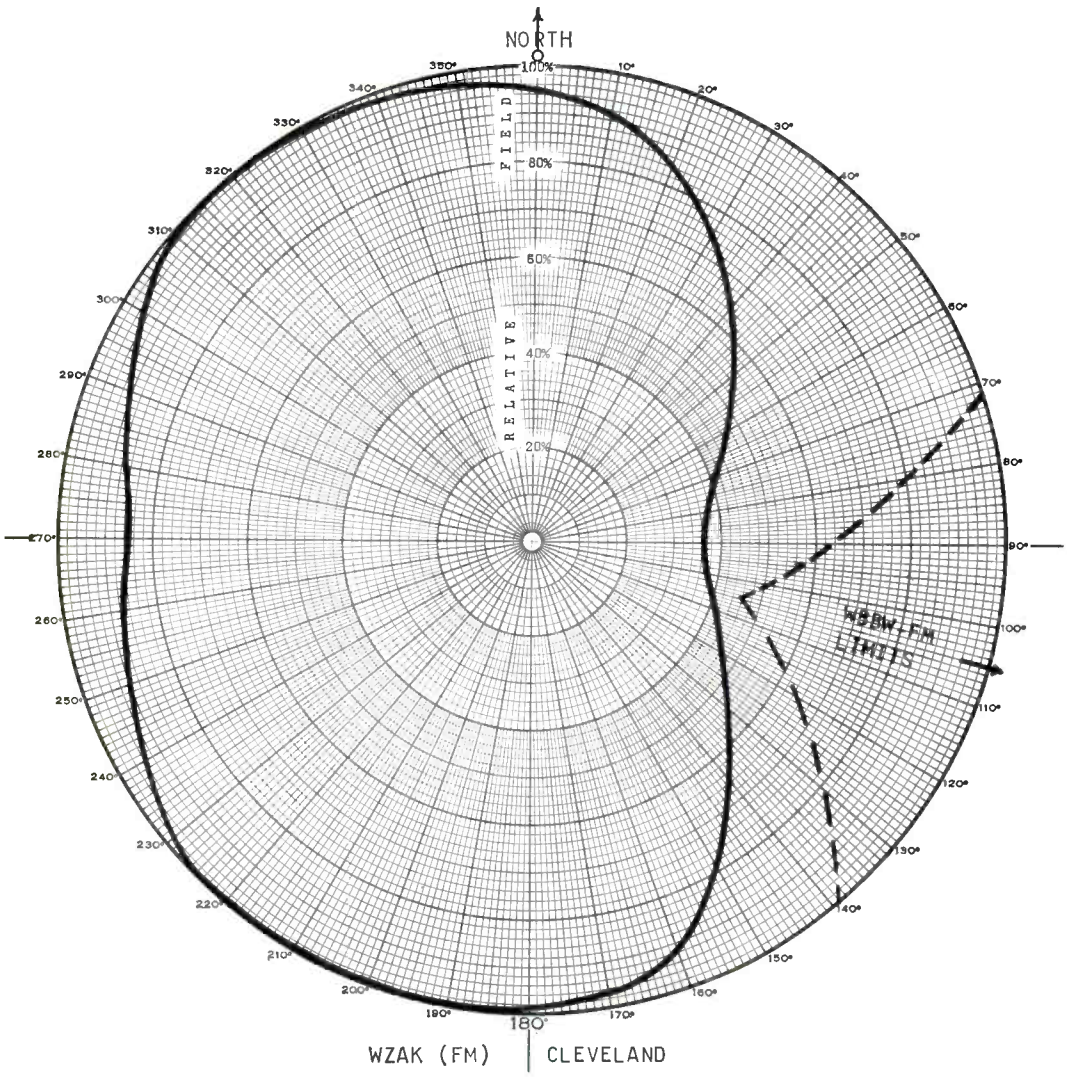
New mechanical design alone would make the VR-2000 a remarkable recorder. These are just some of the new features: "one-hand" operation; fool-proof mode selection buttons; automatic shut-off in case of malfunction; positive lock-out to prevent erasure in playback mode; digital servo circuitry eliminates MDA's, reduces once-around errors to negligible values and provides a rigid and stable 120° phase-to-phase angle. Term financing and leasing available. For complete information call your Ampex representative or write: Ampex Corporation, 401 Broadway, Redwood City, Calif.

AMPEX VR-2000
TELEPRODUCTION
VIDEOTAPE* RECORDER



LITHO IN U.S.A.—2206—1-65

NEW FROM JAMPRO
DIRECTIONAL FM ANTENNAS



The FCC's 4th Order and Report now permits the use of directional FM transmitting antennas, to provide protection of short spaced stations. If you are now short spaced, you can, in most cases, increase your ERP in all directions except towards the short spaced station. Contact your consulting engineer for full details on how the new FCC Rules may help you increase your station's coverage.

JAMPRO directionalized FM antennas are excellent for FM stereo. VSWR bandwidth is not affected. JAMPRO dual polarized antennas may also be directionalized. The antenna peak gain is nearly always increased.

The JAMPRO FM antenna may be easily directionalized. By means of parasitic reflectors behind each bay, most patterns may be achieved. Tight or multiple null patterns may require phasing and spacing of dual bays stacked side by side. JAMPRO design engineers will be pleased to work up antenna designs meeting specific pattern requirements. Antennas are pattern tested prior to shipping.

JAMPRO's complete antenna test range is used to insure pattern conformity. The supporting tower or pole affects the radiated pattern, and therefore must be included in pattern measurements.

JAMPRO

ANTENNA COMPANY

6939 POWER INN ROAD
SACRAMENTO 28, CALIFORNIA

Circle Item 17 on Tech Data Card

CA AND PAY—A Viewpoint

by ***Frederick W. Ford,*** Commissioner, Federal Communications Commission—
A discussion of the possible future relation of wired to conventional TV.*

Are the CATV industry and the television broadcasting industry today really basically divided? I submit that the answer is no; they are both a part of the same industry, and I see no reason why they should not be unified—if both are equitably and fairly regulated by the same agency.

The Problem

Television has had many problems since the first commercial television station was authorized by the Commission in 1941, and only a few of them were solved by the Sixth Report and Order of 1952. In fact, even though our television system of today stems from that Report, barely 12 years old, the problems of television seem to increase the older, more popular, and more universal it becomes.

One of these problems, which is almost as old as commercial television itself, is the impact on the broadcast-television structure of a system whereby the public pays for its television service. Such systems are known by a number of names, such as Phonevision, Toll-vision, pay-TV, Fee-V, subscription television, and community antenna television.

The first community antenna was installed on an experimental basis at Astoria, Oregon, in 1949, and the first commercial system was built at Lansford, Pennsylvania, in 1950. Today there are more than 1200 CATV systems serving an estimated 3,300,000 viewers in something over 1,000,000 homes and creating a $51,000,000 industry. Some of the systems have facilities to originate programs. Most systems receive from one to ten stations with an average of about four. The number of systems is growing rapidly.

Of these operations, about 250 use a microwave service to bring to their systems signals which cannot be received satisfactorily off the air. These microwave services are furnished by independent common carrier, by affiliated common carrier, or by private microwave. The Commission now has under consideration the question of allocating spectrum space to a CATV microwave service. These discussions are not sufficiently crystallized at this time (June 18) to warrant more than recognizing that they are in progress.

For several years CATV systems operated in many communities without any great amount of friction. Beginning in 1957, however, it appeared that a number of sharp conflicts were developing between local TV stations and the CATV systems operating in the same or nearby communities. These conflicts led to a hearing before the Senate Subcommittee on Communications and Power. The Subcommittee has not yet issued its report, and these conflicts remain basically unresolved.

Frederick W. Ford, Commissioner, FCC.

Our country is growing rapidly, and with it is growing the demand for improved television service in communities of all sizes across the land. The basic problem which the Commission and the communications industry faced in 1941, and still face today, is how that demand is to be best satisfied. In seeking to satisfy this need must we consider only the use of radio frequencies, or should we follow literally the national policy of providing an ". . . efficient, nation-wide, . . . wire and radio service"?

The radio spectrum neither can be nor should be expected to satisfy that objective. In the first place, it is not physically possible within the present state of the art to assign channels to all of the 4699 communities in the United States with a population of more than 2500. There are now 536 VHF stations and 118 UHF stations on the air in 365 communities. Even with a recent proposal to expand the assignments contained in the Sixth Report and Order to about 700 VHF stations and 1980 UHF stations in 1294 communities, the objective on its face is not attainable.

Regulation of Wire TV

It is my belief that an adequate nationwide competitive television system with an increased choice of program service can only be achieved by an integrated and Federally regulated system of both wire and radio.

The CATV industry has demonstrated that it has the capacity,

* This is a condensation, emphasizing those portions of particular interest to BROADCAST ENGINEERING readers, of a speech given by Commissioner Ford before the 13th Annual Convention of the National Community Television Association. The speech was delivered at the Bellevue Stratford Hotel, Philadelphia, on June 18, 1964.

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Circle Item 18 on Tech Data Card

desire, and ability to furnish an additional service in the public interest. It has done it and undoubtedly will continue to do it on an ever-increasing basis. But will this industry be content simply to fill in the gaps of outside television coverage, or has a new force come into existence, the ramifications of which have not yet become clearly defined? Will CATV continue only as an antenna service, or will it begin cablecasting local programs on at least one channel? Will it, in the course of events, seek interconnection among systems and finally become a multiple program service competing nationally as well as being a link between television stations and home receivers?

From the regulatory standpoint, should some provision be incorporated to require the extension of service or furnishing of service on a non-discriminatory basis to the public? If so, what regulations, if any, can or should be imposed relating to the use of telephone or power poles for wire systems? Should the consent of television stations for the use of programs be required? If so, should the regulatory authority be empowered to order consent—and on what basis, in view of the conflict over property rights in programs? Should there be authority to order a station on a system or off a system? If cablecasting becomes common on one channel of a CATV system should advertising be permitted in order to boost the local economy? Should there be authority to impose technical standards, type approval of equipment to minimize interference to the reception of signals off the air, and inspections of installations?

I am concerned also about the competitive impact which CATV could have on television broadcasting. For example, in single-station markets, which for the most part are relatively small markets, a CATV system may bring into the urban area as many as ten program choices to compete with the television station for viewers. It is contended that only about 10% of a station's listeners are involved, but it does not take much imagination to visualize this 10% growing much larger. If other communities in the station's service area are wired, and if advertisers in those communities stop buying advertising on the local station, the economic consequences to the local station are obvious.

It should be observed that wire systems are not yet ready to serve all of the people served by a television facility. Rural areas must still depend on television stations for their service. This is in large part the basis for the protection the Commission has given television stations. This position would probably be revised if technical developments should permit the delivery of a television signal to all by CATV systems on an economical basis so that the public would not suffer. The competitive factors then would not be of such concern to the Commission.

CATV and UHF

Considerable stress has been placed on the limitation or containment of CATV in order to stimulate the full development of UHF and give the all-channel receiver legislation an opportunity to develop an adequate nationwide competitive television system. It is argued that if authorizations are issued to bring outside programs to communities where UHF stations are authorized or UHF assignments made, this will prevent the development of UHF stations and frustrate the Commission's allocation and assignment policies to the detriment of the public. It is also argued that UHF needs protection from competition to survive economically. This is still an open question because it might well be argued that in some instances UHF equally well needs CATV at this point in order to reach an audience in being and thus to survive.

Conclusion

I do not pretend to know what the future of television will be. I do know that wire television is becoming increasingly important in our national scheme. I doubt that it will ever replace broadcasting, but I cannot even be sure of that. Television is perhaps the most dynamic, powerful, and influential of all the means of mass communications media in existence today. In the United States we have developed the greatest television system in the world. I think it will become greater, but it will require skill and wisdom in the years to come to keep television the servant of the people. ▲

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One year ago, BROADCAST ENGINEERING was pleased to announce the appointment of a number of Consulting Authors to its staff. The establishment of this select group has, in the ensuing year, enabled us to cover our field much more comprehensively than ever before. Most of the Consulting Authors are qualified by training, experience, or both, as experts in some technical area of broadcasting or electronics; all are capable reporters of events and developments of interest to broadcast engineers.

The members of the group represent all areas of the United States and many other parts of the world as well. Their reportorial efforts keep you, the reader, informed of events at meetings, conventions, and shows on the regional, national, and international level. In short, this staff of professionals helps BROADCAST ENGINEERING bring to its readers the most complete, up-to-date coverage of this dynamic field of technology.

Now we'd like to introduce the present members of our Consulting Author staff:

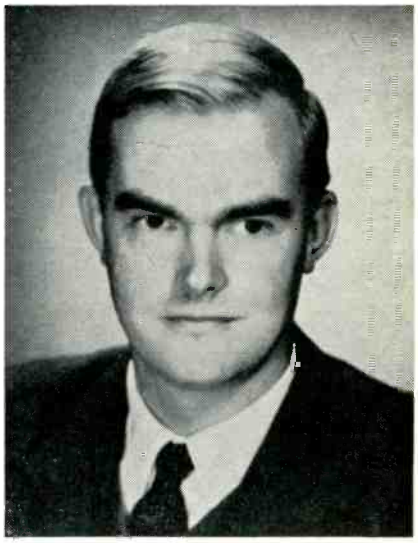
Keeping a sharp watch on the broadcast industry in the Philippine

Islands is **Warren L. Beals.** A transmitter engineer for a ten-transmitter missionary broadcasting installation, he also keeps on the lookout for news in local commercial radio and TV and the Voice of America.

Elton B. Chick is Director of Engineering for the Rounsaville radio stations. Mr. Chick's wide experience includes work in his specialty —the planning, installation, operation, and maintenance of AM broadcasting plants, including those equipped with directional antennas and remote control.

Steven A. Cisler has been in broadcasting since 1924. His area of specialization is studio and audio engineering. As president of a tape service providing foreign program material to U. S. broadcasters, he is always up-to-date on developments on the international scene.

Donald L. Coleman is Chief Engineer of WFGM, Inc. and Music Service Corporation of Worcester County, both in Fitchburg, Massachusetts. In this capacity, he has first-hand knowledge of AM and FM transmitters, SCA multiplex, and control-room installations.



J. Gordon Elder is one of our Consulting Authors in Canada. A graduate of Glasgow University, he has had experience both in industry and as a consulting engineer. In connection with the latter activity he is familiar with AM allocations, design of directional arrays, installation, and maintenance.

Elliott P. Fagerberg is our correspondent in Geneva, Switzerland. From this central location, he is able to keep informed of the many

developments that are taking place in European broadcasting.

Patrick S. Finnegan has had more than 20 years experience in broadcasting. As Vice-President and Chief Engineer of WLBC AM-TV and WMUN (FM), Muncie, Indiana, he has much practical knowledge of broadcast engineering to share with BROADCAST ENGINEERING readers.

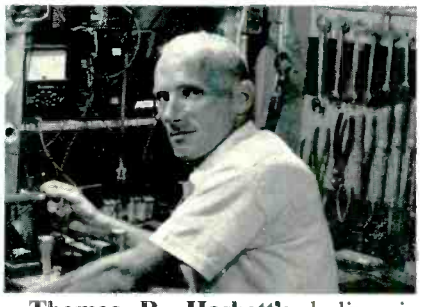
James French, Jr., has been engaged in electronics research and development, commercial television, and more recently aired and closed-circuit educational television. He has designed and built many items of transistorized equipment for TV broadcast use.

George M. Frese is a consulting engineer working out of East Wenatchee, Washington. In his practice he has worked on AM, FM, and TV broadcast stations, TV translators, CATV, and microwave and

communications links in broadcasting applications.

H. Graeme Goodall is our correspondent in the British West Indies. A native of Australia, he has had extensive experience as a broadcast engineer both in that country and in Jamaica, where he now resides.

Melvon G. Hart, Technical Director of WIL AM-FM, St. Louis, has worked in technical aspects of radio broadcasting from the microphone to the antenna. Readers will remember his article on using cartridge tape machines that appeared last year in BROADCAST ENGINEERING.



Thomas R. Haskett's byline is familiar to B-E readers because of his popular "Radio Transmitter Maintenance" and "Audio Level Devices" series. Readers can look forward to more articles of equal caliber in coming months from Mr. Haskett, who has been in the broadcasting business some 15 years.

Our Washington Correspondent, **Howard T. Head,** is a partner in the consulting engineers firm of A. D. Ring & Associates. His work has included the design of many

antennas, both directional and non-directional, for all classes of broadcast stations, extensive field work in the measurement and adjustment of broadcast antennas, and propagation studies with particular emphasis on the coverage of TV broadcast stations. He has written numerous technical and nontechnical articles for various publications.

Robert A. Jones, of LaGrange, Illinois, is another consulting engineer member of the staff. His specialties are directional antennas and transmitter troubleshooting, but he has offered B-E readers many useful suggestions concerning a variety of technical problems in broadcasting.

Bill Kessel is our Consulting Author in Fort Worth, Texas,

where he is Chief Engineer of KTVT (TV). Included in his recent experience are the installation and checking out of a new TV transmitter.

H. Eugene Larson is a new member of our Consulting Author staff. An engineer on the government's ETV project in American Samoa, he is in a position to keep us informed of developments in the Islands.

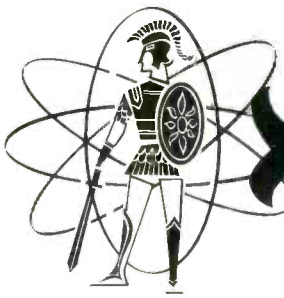
From his "listening post" in Stockholm, **Hans Richter** keeps us advised of activities in Sweden, Denmark, Finland, and Norway.

Frank B. Ridgeway, Director of Engineering of WEBR, Buffalo, N. Y., gives the benefit of his knowledge and experience to other station engineers through the pages of this magazine.

George C. Sitts, of WHEN-TV, Syracuse, N. Y., makes system planning, ETV, TV automation, and low-cost television his specialties.

Len Spencer is Technical Director of CKAC, Montreal, Quebec. His years of activity in broadcasting enable him to write with authority not only on up-to-date topics but also on topics such as "The Early Evolution of Television," which appeared in our July issue.

Broadcasting developments in India and southeast Asia are reported by **P. U. Sukhadia.** Mr. Sukhadia is engaged in radio manufacturing and engineering in Bombay.



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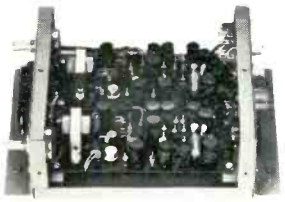

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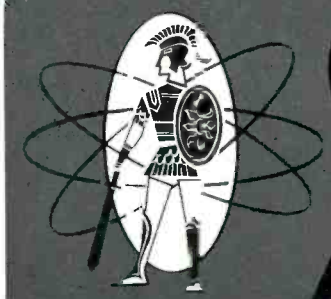

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Circle Item 21 on Tech Data Card

Edward L. Tong, assistant Chief Engineer, WDSU-TV New Orleans, has been active in radio and TV broadcasting for over 15 years. He has concentrated especially on audio and video system design and construction.

John J. Walsh is Engineering Supervisor for the LIN Broadcasting Corp. stations. His interests include studio design, construction, equipment, and maintenance. (An expert mixer of fine drinks, he is also the "official" C-A bartender.)

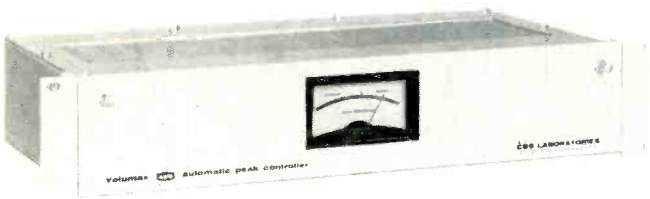
Philip Whitney is Supervisory Engineer for the Richard L. Lewis, Jr., group of seven AM and four FM stations. He also serves as General and Commercial Manager of two of the stations, WINC and WRFL (FM) in Winchester, Virginia. A veteran of 30 years in broadcasting, Mr. Whitney developed the first broadcast-transmitter remote-control system.

We take this New Year's opportunity to salute this fine staff! ▲

WOULD YOU INVEST $665 TO DOUBLE YOUR EFFECTIVE PROGRAM POWER?

New VOLUMAX™ Automatic Peak Controller From CBS Laboratories Outmodes Limiters

Expanded effective range, more reliable reception in fringe areas – both can add to your station's audience and both can be achieved by simply replacing your present peak limiter with a solid-state VOLUMAX.



A new development from CBS Laboratories, VOLUMAX is the successor to peak limiters. Unlike conventional limiters, VOLUMAX does not force you to choose between reducing program level or suffering "pumping" and other audible distortions.

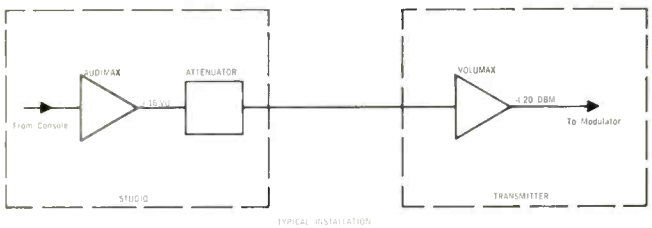
HOW IT WORKS

The secret of VOLUMAX's success is its ability to operate automatically at the most appropriate regulation speed for any program waveform.

After limiting a severe peak, conventional limiters use a long recovery time to minimize audible "pumping". Valuable modulation capability is wasted while the unit recovers from reduced gain.

VOLUMAX works in a completely different manner. Operating with dual regulation speeds, VOLUMAX analyzes the waveform and provides either microsecond or millisecond action.

The net effect is that your effective radiated program level can be doubled.



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Circle Item 23 on Tech Data Card

ENGINEERS' EXCHANGE

Starting Switcher for Cartridge Decks

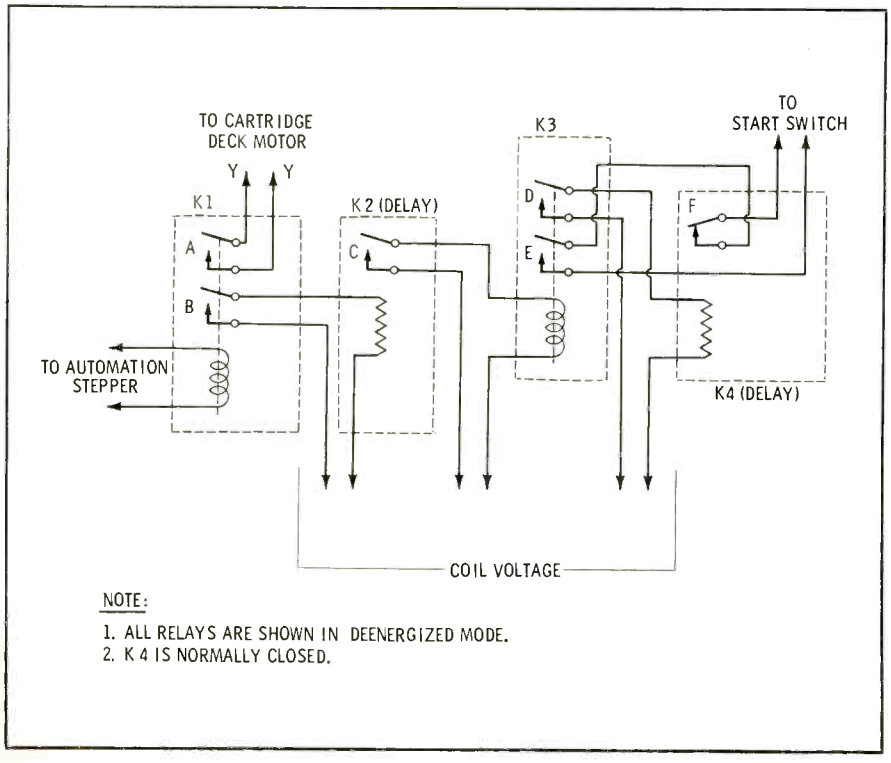
by Peter B. Wolcott, Design Engineer, Bartlesville, Oklahoma

It seems that no matter how complete a program-automation package is, there is always another tape deck or an additional back-up circuit to add. Because of each broadcaster's particular requirements, the station engineer must sometimes exercise ingenuity to devise auxiliary circuits compatible with existing automation equipment.

The first step is to carefully study the switching of **both** the automation equipment and the unit to be installed. If a terminal board is not provided for the addition of the exact device you wish to install, do not revamp or borrow a couple of unused relay terminals from the unit. The safest procedure is to design a switching-circuit that is complete in itself and not an integrated part of the automation unit.

A good example is the addition of a cartridge player to a basic system of reel-to-reel announce and music decks. In most cartridge machines, inserting the cartridge closes a switch to start the motor; then, when the start button is pressed, the play mode is activated. However, many of these players cannot undergo extended periods of continuous motor operation without suffering reduction of motor life and stability. This drawback can be overcome by modifying the motor-switching circuit so that the motor is started just before activation of the play mode. Shown in the accompanying diagram is a relay circuit for activating a cartridge deck or, with minor modifications, a reel-to-reel player. This circuit will start the motor, allow two seconds for it to reach speed, and then switch to the play mode.

In most cartridge machines, the start switch must be opened after activation, or the machine will continue to run even after the stop cue tone has been received. This problem is usually overcome by following the recorded segment with the automation control tone (or interval of silence) and an extra several seconds to allow for definite switching by the automation unit. The additional running time allows the cartridge start switch to open before the stop cue tone on the cartridge-tape cue track reaches the head. In the circuit to be described, no additional running time is necessary, because the cartridge start switch is opened two seconds after it has been activated. Thus, positive activation of the automation unit may be accomplished by switching the cartridge machine.



NOTE:
1. ALL RELAYS ARE SHOWN IN DEENERGIZED MODE.
2. K4 IS NORMALLY CLOSED.

The sequence of operation is as follows. When the automation stepper closes K1, the cartridge-deck motor starts through contacts A, and heater voltage for delay relay K2 is applied through contacts B. After a delay of two seconds, contacts C of K2 pull in and energize K3. Contacts E of K3 complete the start circuit of the cartridge deck through normally closed contacts F of K4. Also, contacts D of K3 apply heater voltage to delay relay K4. Two seconds after K4 is energized, contacts F open the start circuit of the cartridge player to prevent recycling. When the automation stepper is activated at the end of the recorded segment, the circuit returns to normal.

The combination of K1 and K2 starts the deck motor two seconds before starting the play operation. Relays K3 and K4 open the start switch to prevent the machine from restarting at the end of the cycle. If you plan to record your cartridges with a long silence or automation control tone in the manner described previously, K3 and K4 may be omitted. Simply wire the start switch across contacts C of K2.

Construction is no problem. Relays K1 and K3 are shown as DPST types, but 3PDT units are far more plentiful and provide an extra set of contacts for indicator lights. Both K2 and K4 are Amperite delay relay tubes with a delay time of two seconds; K4 has normally closed contacts. Voltage ratings for the relays depend on the available power supply; 6.3 volts seems to be the most easily found source. However, if you're really short on spare AC, you can use units that operate from line voltage—but be careful to keep the relay leads away from amplifiers and preamps. Also be sure to use a liberal number of capacitors to eliminate switching noise. A little imagination can adapt this circuit to many automation applications. ▲

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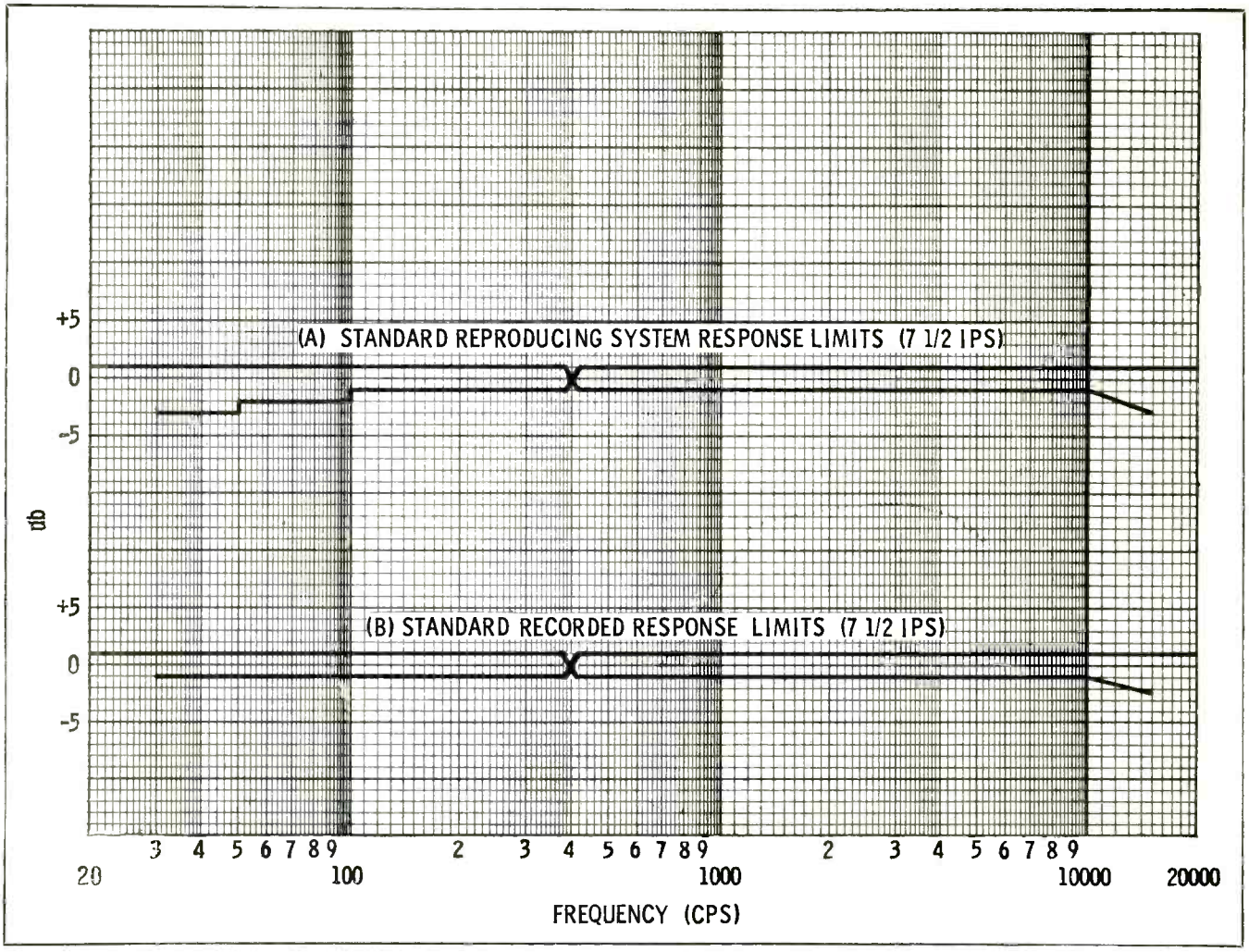


Fig. 3. These curves show the permissible limits between which the recording and reproducing responses may be allowed to vary.

±1′ of 90° with respect to the longitudinal axis of the tape.

Test Tape No. 2 is used for making flutter measurements. A 3-kc tone is recorded at the NAB Standard Reference Level for the full length of the tape. The flutter content of the tape is kept at or below .05%, measured as described previously.

Tape No. 3 is the monophonic frequency-response test tape, and No. 4 is the stereophonic frequency-response test tape. The tones recorded on the tape are listed in Table 3. Each tone is identified by an announcement preceding it. In addition, the tones on the

BOOK REVIEW

Two-Way Mobile Radio Handbook; Jack Helmi; Howard W. Sams & Co., Inc., Indianapolis, Ind.; 224 pages, paperbound, $3.95. This newly revised book (published first in 1960) updates information presented in the early version.

The first chapter acquaints the reader with an overall picture of the field of two-way radiocommunication, elaborating on uses for two-way radio and introducing equipment used in modern systems.

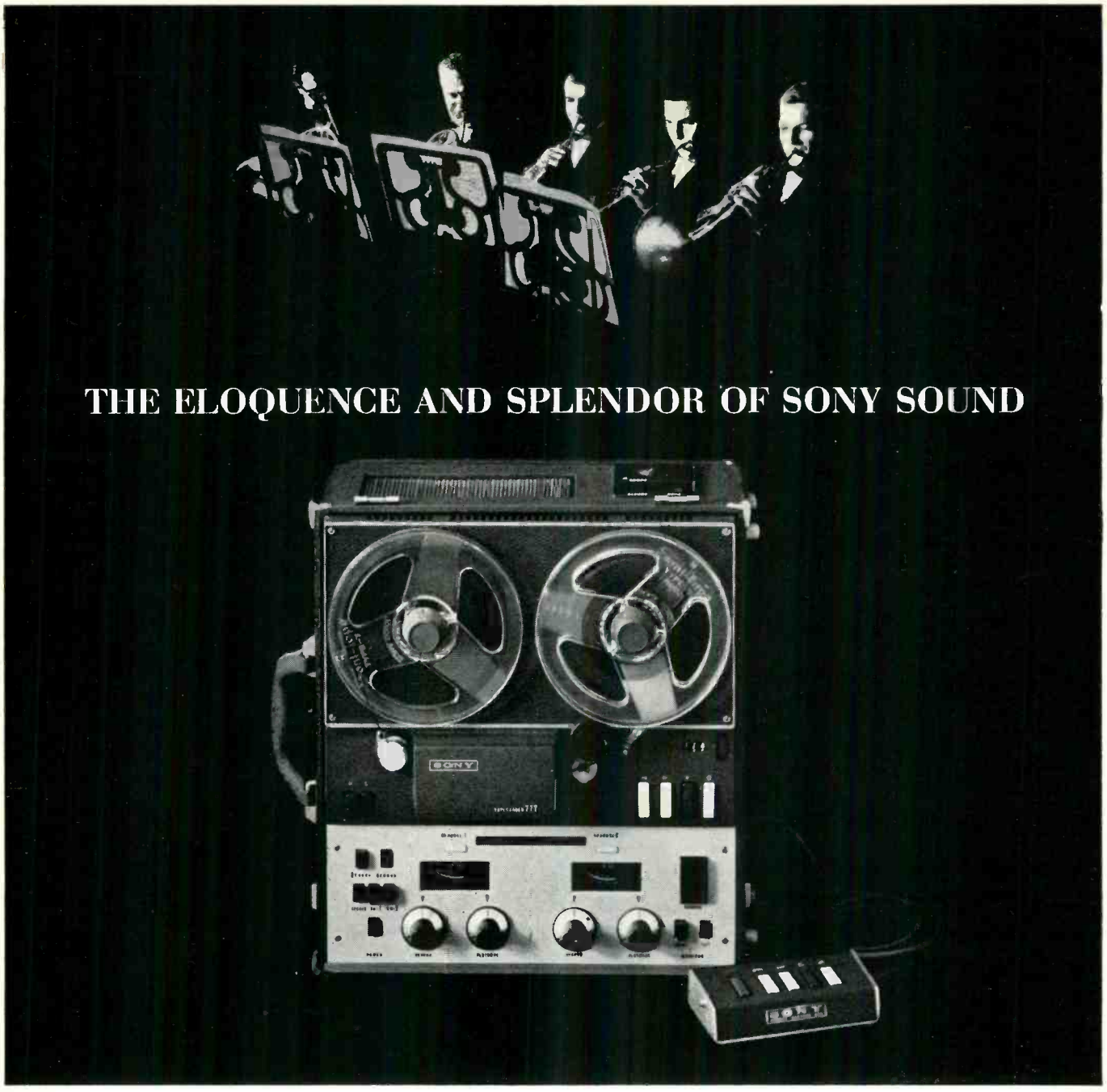
The next three chapters are devoted to analyzing receiver circuits. Starting with the RF, crystal oscillator, and mixer stages, these chapters show circuits used in different equipments and explain their operation. A comprehensive study of IF stages leads logically to FM detectors, audio amplifiers, squelch systems, noise limiters, and AFC circuits. In one chapter, dual- and triple-conversion sets are analyzed, and a simple means is shown for computing frequencies in this seemingly complex heterodyning process. The matter of receiver alignment is also introduced.

A separate chapter on transmitters treats them in much the same manner as receivers were treated—explaining oscillator, multiplier, RF amplifier, and speech circuits. Alignment is also discussed, since this is the most popular way to troubleshoot transmitters.

Control systems—remote and local—are covered in Chapter 6, and Chapter 7 is devoted to antennas, transmission lines, and antenna supports. Special-purpose antennas are described for unusual applications. Chapter 8 details power supplies for almost any imaginable two-way radio system—fixed, mobile (in many vehicle types), and portable.

Troubleshooting hints are included in almost every chapter, but there is also a special chapter on servicing. This is accompanied by a chapter on setting up a shop for servicing two-way gear. These chapters list what equipment is needed, suggest shop layouts for expeditious servicing, and tell the reader how to apply his knowledge of communications.

An entirely new chapter on selling, and on the business end of running a communications shop, tells the reader how to use his knowledge profitably. The final chapter—also new—is devoted to the Common Carrier Service, companies that are licensed to provide communications services and equipment for public use. These latter systems are explained in detail, and include mobile telephone systems, radio paging services, and miscellaneous common carriers.



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A revolutionary development from Sony, patented "TRAC-STAN" drive introduces a new traction treaded capstan that provides a solid coupling between pinch roller and capstan, eliminating flutter, wow and tape timing error.

The perfect integration of superior performance specifications and operational ease. For home or studio use, the new Sony Sterecorder 777S-4 is the finest 4 track professional tape recorder value on the market today. An outstanding array of features includes solid-state modular-type circuitry, 3 motors, exclusive electro bi-lateral head, tape & source monitoring, sound on sound, 3" V.U. meters. Sony's solenoid controls (feather touch switching of tape motion in the instrument and the remote control unit) provide an unsurpassed ease of operation. Also available: Model 777S-2 (2 track stereo recording, with 4 & 2 track electro bi-lateral playback). **Complete with remote control unit . . . . . less than $695.**

*A Sony exclusive, the patented Electric Bi-lateral Head enables 2 track stereo and monophonic playback as well as 4 track playback.

SONY® SUPERSCOPE® *The Tapeway to Stereo*

For literature or name of nearest dealer write Superscope, Inc., Dept. 52, Sun Valley, California.

Selected by House of Good Taste, New York World's Fair.
All Sony Sterecorders are Multiplex Ready!

Circle Item 26 on Tech Data Card

Table 3. Test Tones on Response Tape.

Frequency (cps)	Duration (sec)	Level
400	10	Standard reference ± .25 db
400	10	Calibration level (10 db below standard reference)
15,000	20	See Text
12,000	5	" "
10,000	5	" "
8000	5	" "
5000	5	" "
2500	5	" "
1000	5	" "
600	5	" "
300	5	" "
150	5	" "
75	5	" "
50	5	" "
30	5	" "

stereo test tape are identified "left" or "right," as appropriate. The stereo channel signals are recorded in a phase-additive manner. The tones are recorded so as to produce a response uniform within ±½ db when the tape is reproduced through an ideal reproducing system. (The "ideal" reproducing system is explained in detail in the standards. The method of using the tape for practical frequency-response measurements was described earlier in this article.)

Test tones are recorded on the cue track as follows:

> . . . 1000 cps to coincide with the beginning of the program-track test tones, 1000-cps stop cue between the first and second 400-cps tones, 150 cps at the end of the program-track test tones followed by 8000 cps, with additional 150-, 1000-, and 8000-cps tones of 4 seconds duration each added for calibration of cue circuitry.

Unless otherwise specified, the levels and durations of the cue test tones are as related earlier.

Conclusion

The significant (to the station engineer) points of the NAB standards for cartridge tape recording have been extracted and presented here. The complete Standards also contain other information that could not be included in the limited space available here.

A standard has now been adopted that can be used to bring about industry-wide compatibility and uniformity of performance in cartridge tape equipment. Adoption of the standard will not mean, however, that advancement of the art will cease. Rather, developments can be expected to proceed now in an orderly manner. ▲

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.

I do "contract" engineering for a daytime-only AM station that is contemplating the addition of an FM antenna on the tower. I have several questions concerning this matter and on other subjects concerning the Commission's Rules and policies.

1. I find nothing in the FCC Rules allowing (or prohibiting) the use of an auxiliary antenna during the period of construction when the FM antenna is being installed on the main AM radiator. What is the necessary procedure insofar as the FCC is concerned?

2. I am not a registered professional engineer. Will a consultant have to be engaged to submit data concerning the use of a temporary antenna during the construction period?

3. What position does the Commission take regarding signs, etc., attached to the AM radiator?

These questions are not specifically covered by the Rules; the Commission makes determinations of such matters on a case-by-case basis. I will answer your questions in the same order in which you asked them.

1. You must request, by a letter to the Secretary of the Commission, authority to operate the AM station with the proposed temporary radiator. You should clearly state the facilities of the AM station and give the appropriate file number and details of the FM construction permit. A rough sketch showing the height and elevation details of the temporary antenna should be attached to the letter. You should also state the period of time for which temporary authority is requested. The Commission will require that the power into the temporary radiator be determined by the indirect method.

All this is based on the assumption that the temporary radiator will be less efficient than the main radiator; authority will not be granted if the radiation is increased above the licensed value.

2. You need not be a registered professional engineer to submit these data to the Commission so long as you are qualified to do the work. Should questions arise (such as interference to other stations, etc.), your qualifications might be questioned. However, in a case such as you describe, no questions should arise, since the temporary radiator would in almost all cases be less efficient than the main radiator and the operating power can be easily maintained by the indirect method.

3. The Commission will permit the erection of signs attached to the AM tower so long as the electrical characteristics of the tower are unaltered and certain other requirements are met.

If the sign is constructed of wood, no problem is presented so long as there is no wiring to alter the electrical characteristics of the tower. An informal request must be made by letter to the Secretary of the Commission. Details of the construction must be given in the letter.

The requirements applicable to the use of electric signs or lighting decorations on the tower are a little more complicated. A rough sketch of the arrangement of light bulbs must be submitted to show that the decorative lighting will not interfere with the existing obstruction lighting and will not extend higher than the tower itself. The color of the light bulbs must be stated; the use of green lights is prohibited, and the preferred colors are red and white. The method of crossing the base insulator with the lighting wires must be explained and a circuit diagram supplied. Lighting chokes should be used so that these wires will have a minimum effect on the base impedance of the tower.

The Broadcast Bureau will usually grant temporary authority to operate such lighting for a stated short period of time if the above data is supplied. During this period, the power must be determined by the indirect method. When permanent authority of this nature is desired, new base-impedance measurements will be necessary, and an application for a modified license will be required. ▲

CATV

(Continued from page 13)

cussion has its own local maintenance staff and a shop in its downtown headquarters. The maintenance program calls for this staff to visit at least three amplifiers each working day; in this way the entire system is covered every four or five months.

Each microwave station is visited weekly; levels are checked and other routine maintenance is performed. More involved maintenance is performed monthly. Those maintenance activities that require shutting down the microwave equipment are done late at night so that no interruptions to program service are caused.

Cable of the type used in this one-year-old system has an average life expectancy of five years, so the maintenance problem of cable deterioration has not yet arisen.

Reception Problems

A few reception problems have been encountered with the off-the-air pickups. Cochannel-interference bars occur on one of the VHF channels; careful selection and orientation of the receiving antenna has minimized this problem.

Another problem is peculiar to the MPATI transmissions. FAA regulations require the use of 400-cps AC power aboard the aircraft carrying the MPATI transmitters. As a result, 400-cps hum bars are in evidence on the pictures relayed and received by 60-cps powered equipment. No solution has been found so far for this problem. Fortunately it is not so serious that it cannot be lived with.

Conclusion

In essence, a CATV system receives signals from a TV (or FM) broadcast station, amplifies them, and delivers them to its subscribers. The medium of distribution is a cable, and the various amplifiers, microwave links, etc., are accessories required to do the job. The basic operation of the units that make up the system is the same as for similar units in any other system. The difference lies in the way these building blocks are put together and in the details of design required to make them compatible with each other. ▲

Pressurizing Coax

(Continued from page 11)

reasons; a pinched "O" ring may crack, bolts may become loose at the flanges, or solder joints may break due to thermal flexing of the line. Unless there has been some physical damage, leaks usually develop at flange joints and end seals.

Detecting the small leak is a difficult task. One technique for locating small leaks in low-pressure lines is to gradually increase line pressure; a leak which is small under low pressure can become more identifiable under high pressure. If this technique fails to uncover the leak, the next method—soapy water and a brush—can be used. With a brush, apply a strong solution of soapy water to each coax joint; leaking air or gas will cause bubbles to form (Fig. 5). You can be misled, because the solution can bubble due to the brushing operation. If you're unsure, wipe the soap off and make a second application, trying not to make too many bubbles with the brush. To dispel any doubts, watch the area for a minute or so; the foam caused by application of the solution will dissipate, while leaking gas will continuously form new bubbles. There is a commercial product, used primarily by the gas pipeline companies, for detecting leaks. This liquid, supplied in a plastic bottle, doesn't foam as easily as a soap solution (thus gives few false alarms), but detects even the smallest leaks.

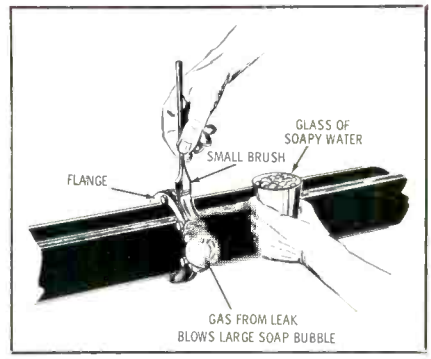


Fig. 5. Soap solution used to find leaks.

Once the leak is found, tighten the flange bolts; these sometimes work loose. If this fails, the line will have to be taken apart to install new gaskets. This is often necessary in lines that have been in use for a number of years.

When a line run has been broken up into sections with gauge-equipped gas barriers, it is easy to isolate the section where the leak is located. Shut off the valves at each gas barrier. The section with the leak can then be identified by the drop in pressure as indicated by its gauge.

UHF television stations make use of a combination sideband-suppressor/diplexer unit made up of tuned line sections. The tuned sections are of very high Q and are quite sensitive to temperature and gas-pressure changes. Whenever there is a reason to bleed the gas from a suppressor/diplexer, always do so gradually. Don't just pull the exhaust plugs and let the gas go. Because the gas is under high pressure, its sudden outward rush can disturb the inner coax elements and cause detuning and a high VSWR. To bleed a suppressor/diplexer, unscrew the plugs a few threads at a time until the gas starts to leak with an easy "hiss." Leave the plugs in that position until the unit is empty.

Whenever it becomes necessary to change any of the brass plugs or gauges in the line barriers, use a pipe-thread sealer to prevent leakage from around the threads. ▲

NEWS OF THE INDUSTRY

INTERNATIONAL

Austrian TV Station

On October 10, the **Bayerischer Rundfunk** (Austrian Broadcasting Network) began operation of a TV station at Walberg. The station operates on channel 11 and broadcasts the schedule of the **Deutschen Fernsehens** (German TV Network). The station is being operated on a test basis, and the schedule is somewhat intermittent.

US Color TV Shown in Europe

A color television studio on wheels has been sent on a six-month European tour by the **Radio Corporation of America** to demonstrate the United States color-television system to governmental authorities who are considering adoption of color broadcasting standards. The mobile unit includes two color-TV cameras for live pickup, a color film chain, a color video tape recorder, and associated monitors and control equipment. The traveling demonstration was built by RCA's Broadcasting and Communications Equipment Division at Camden, N. J., and is being shown in Europe by the RCA International Division. It arrived in England in October and was first demonstrated to members of the European Broadcasting Union during the EBU meeting in London. A number of major European cities will be visited over a period of several months.

New TV Headquarters

A major expansion of the **Marconi** Broadcasting and Closed-Circuit Television Development Groups has recently been completed with the move of these groups from Marconi's Pottery Lane establishment to a new building at Waterhouse Lane, Chelmsford. The total floor space occupied by television development work has been increased more than 1½ times to 37,500 sq. ft. Laboratory facilities include a central apparatus room which provides "piped" synchronizing signals of all the currently used television standards, VHF radio signals, and other standard reference signals to all parts of the building. This system eliminates the need for a large amount of duplicated test equipment in each laboratory. A complete television studio is included in the building for equipment demonstrations.

NATIONAL

Solid-State TV Relay

A number of tests of their new all-solid-state 2-gc relay equipment have been conducted by **Microwave Associates, Inc.,** in cooperation with broadcasters. The

equipment has been used successfully in helicopter and blimp relay applications; the system can be used directly with a television camera in the aircraft or to relay signals transmitted from pickup points on the ground. Omnidirectional antennas on the helicopter and directional dish antennas at the receiving site have permitted transmission ranges of 15 miles. The system involves no klystron or other tuning device. The solid-state equipment is operational immediately when turned on, and there is no noticeable drift. For helicopter operation, frequencies are selected by a channel selector that can be operated from the pilot's compartment. A TWT booster is available; it requires no tuning adjustments and provides a full 20-watt power output when used with the 1-watt solid-state transmitter.

Manufacturer Becomes CATV Owner

Entron, Inc. has become a partner in the Jacksonville Cable Television Company, in Jacksonville, North Carolina. The Jacksonville company recently signed with Entron for the construction of a community antenna television system in the Jacksonville area. Cost of this construction is estimated at $300,000. Fred Stegner, president of the Jacksonville company, said that the system will carry programs of six VHF stations.

Film Depicts Climbing Safety

An 11-minute motion picture shows safety measures recommended for workers whose jobs require climbing to unusual heights. The film, available for free showing from **Air Space Devices, Inc.,** covers hazards in climbing such structures as water towers, oil derricks, microwave towers, etc.

PROPERTY TRANSACTIONS

The assets of radio station KVOX, Moorhead, Minnesota, have been transferred from **KVOX Broadcasting Company,** whose largest stockholder is E. J. McKellar, of Fargo, North Dakota, to **Central Minnesota Television Company,** of Alexandria, Minnesota, whose largest stockholder is Tom Barnes, of Fargo. Mr. Barnes also is a principal in KSOO-AM-TV, Sioux Falls, South Dakota, and Managing Director of KTHI-TV, Fargo. The sale price was $165,000.

The sale of Radio Station **WOKZ-AM and FM,** Alton, Ill., has been announced by Edward N. Palen, president of **Palen Broadcasting Corp.** The purchaser is **Morell Broadcasting Corp.,** the stockholders of which consist of Mr. A. R. Ellman, a Chicago accountant; Mr. A. C. Morici, a California business man; and Mr. Frank M. Levy, president of Acme Corp., commercial printers in Chicago. Both Messrs. Morici and Ellman have had previous ownership in various radio stations. The total consideration was $210,000.00. WOKZ-AM operates with 1000 watts daytime on 1570 kc; the FM, on 100.3 mc, operates with 3.2 kw.

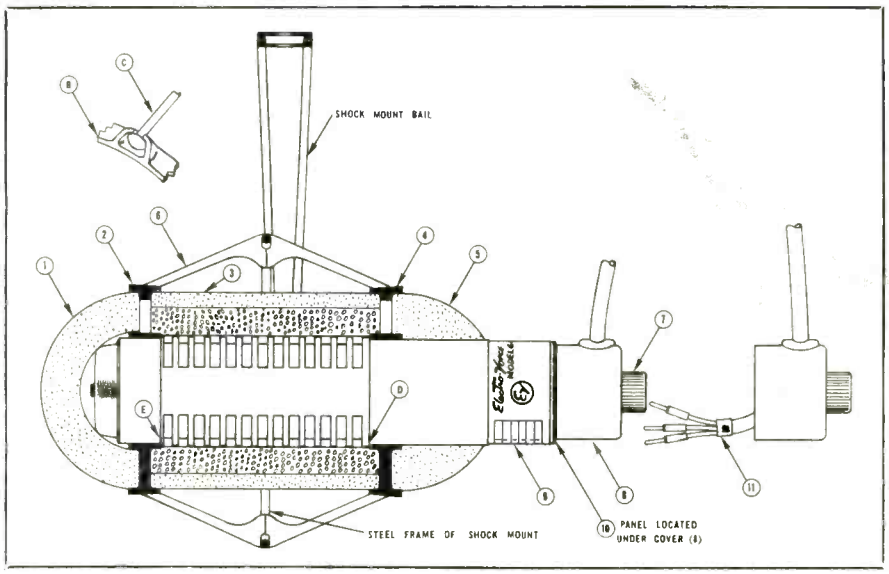
PERSONALITIES

William L. Walker, Assistant Treasurer of the **National Association of Broadcasters** and a veteran NAB staff member, has been named Director of Broadcast Management for the association. He succeeds James H. Hulbert, who earlier this year was named assistant to the NAB President. **David L. Doughty,** a member of the Department staff, has been appointed Labor Counsel in the Department, reporting to Mr. Walker. The Broadcast Management Department advises NAB members on station business, personnel, and financial matters; conducts surveys on wages and other operating costs; and develops yardsticks and other suggested procedures to permit more efficient and economical operations. It also provides labor-relations and Wage-Hour-Act services.

David J. Rosenthal has been transferred to the post of Assistant Manager, TV and Photographic Lighting Department, from the **Century Lighting** Rental Department. Mr. Rosenthal received his BS in drama from New York University and his MFA in drama from Carnegie Institute of Technology. He has had experience as a stage manager, lighting designer, stage electrician, and technical director for educational and community theater organizations. He was a visiting instructor for stage lighting and technical director at Indiana State College in 1961. He served as lighting designer, TV Division, USA Southeastern Signal Corps School, Fort Gordon, Georgia, for two years.

William Vito "Bill" Genova, collegiate all-star fullback and a draft choice earlier this year of the Toronto Argonauts, today was named Assistant Radio-Television Promotion Manager of **CKLW,** Windsor, Ontario. Genova will assume his new position immediately as assistant to George A. Sperry, Advertising-Promotion Director of CKLW.

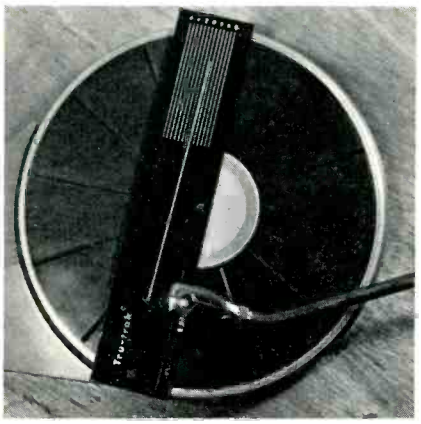
NEW PRODUCTS



Dynamic Cardioid Mike

Requests for a microphone with a wide acceptance angle for working close to the subject in tight sets resulted in the development of this Model 668 by **Electro-Voice, Inc.** Tested by a number of stations and sound studios, performance of the 668 was approved by them as an excellent, durable production mike. The element is dynamic, employing the "Variable-D" principle of directivity (U.S. Pat. #3,115,207). The unit is similar in construction to the older Model 666 except that, instead of three discrete rear apertures, two slotted tubes are used to produce a continuous opening that will increase front-to-back ratio. A special built-in equalizer makes possible a total of 36 variations of response. The variable-response program panel is located inside the rear of the microphone case.

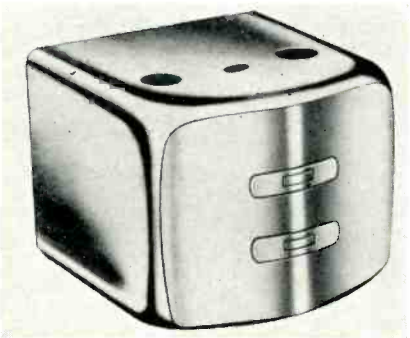
Circle Item 41 on Tech Data Card



Measure Tracking Error

Tru-Trak, a device that shows visually the amount of "tracking error" in record players, and positions the tone arm for optimum performance, has been developed by **Alard Products** of Somerset, Calif. The new tool eliminates the necessity of working with complicated calculations and difficult hairline measurements in determining proper mounting position for the tone arm. Tru-Trak consists of a pointer assembly that attaches to the cartridge and a calibrated scale that fits over the turntable spindle. As the tone arm is moved across the turntable, the pointer visually indicates the tracking variations of the tone arm. By changing the mounting center of the tone arm, the increase or decrease in tracking error is readily apparent. The mounting position that produces the minimum amount of movement on the scale is the proper positioning for greatest fidelity with the particular tone arm and cartridge being tested. Tru-Trak is made from Lucite, fits standard cartridge mounting, and can be installed in minutes. Price is $6.95 Postpaid.

Circle Item 42 on Tech Data Card



8-Track Stereo Head

The **Nortronics** Model B2L, an 8-track stereo head for ¼" tape, offers twice as much playing time as the standard 4-track stereo tape system operating at the same tape speed. A 100-microinch gap assures excellent performance at 3.75 ips. The head is available in either solid- or laminated-core versions. It has a hyperbolic, all-metal face with special, close-fitting mu-metal shielding to eliminate external noise. The unit can be used as a record/play head and is available in various impedances to accommodate all types of circuitry.

Circle Item 43 on Tech Data Card

Moisture Alarm

The Aquadex (TM) moisture indicator is a simple and inexpensive desiccant type indicator, but **Pall Trinity Micro** has incorporated new design features. The sight-glass is held in place by a screw-on knob rather than conventional snap-on rings which can be blown off. This same screw-on feature makes a simple task of recharging the moisture indicator when necessary. The "glass" is also of clear, polycarbonate plastic which will not craze or shatter. Another feature of this moisture indicator is its porous disc filter between the desiccant bed and the downstream outlet. The relatively large filter area eliminates one major cause of clogging in this type of indicator. The indicator is simple to install at virtually any point in the system downstream of a dryer. It can be recharged without shutting down the system, is rated for service up to 300 psi, and requires almost no maintenance. Two models are available; one signals when moisture exceeds 4% relative humidity, the other at 40% relative humidity.

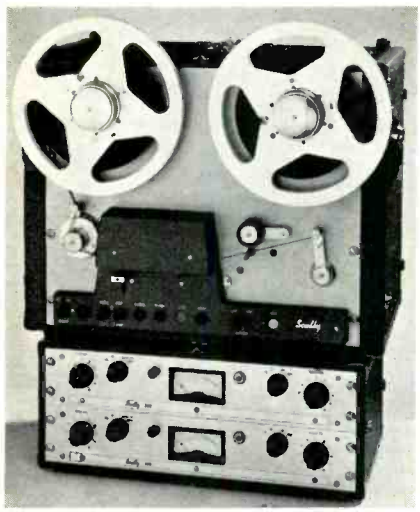
Circle Item 44 on Tech Data Card

Wireless TV Camera

The Fernseh wireless TV camera, distributed in the United States by **Video-Medical Electronics, Inc.,** found use during the political conventions last sum-

mer. This camera features the ability to be locked in synchronism both vertically and horizontally with the master sync generator. The complete unit weighs 26 pounds and has a battery life of about 4 hours.

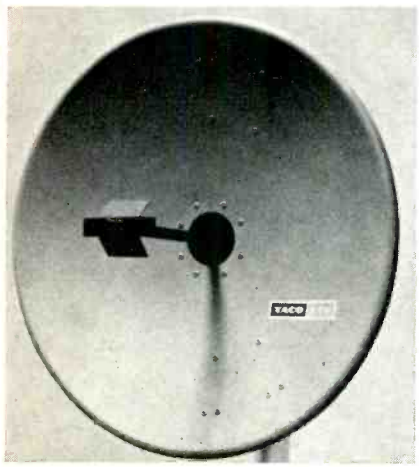
Circle Item 45 on Tech Data Card



New Recorder

A new solid-state professional tape recorder/reproducer has been built by **Scully Recording Instruments Corp.,** makers of the renowned Scully Lathe. Design features include plug-in heads, plug-in relays, and separate plug-in circuit cards for the play amplifier, record amplifier, and bias/erase oscillator. Patented disc brakes provide smooth handling of tape in all modes. Standard models handle reel sizes up to 10½" and are available in rack, console, or portable mount. Tape widths are quarter-inch, half-inch, and one inch, and 14" reel-size is available on special order.

Circle Item 46 on Tech Data Card



Receiving Antenna For ETV

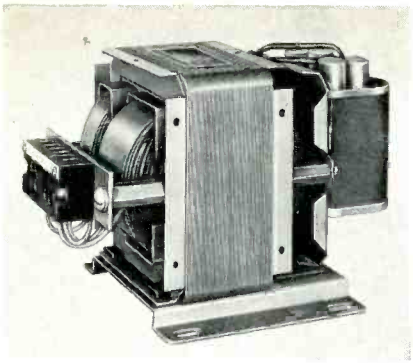
A 24" parabolic receiving antenna covering the frequencies between 2500 and 2690 mc has been added to **Technical Appliance Corp.'s** line for the band recently assigned to educational television use. The EPA-2 antenna uses a dipole element to achieve low VSWR (1.3:1 max) across the entire band. Gain of the antenna is 21 db relative to a linear isotropic radiator; polarization may be either vertical or horizontal.

Circle Item 47 on Tech Data Card

Monitor Speaker

A new wall-type monitor and playback speaker system designed specifically for professional studio applications is now being produced by **Altec Lansing Corporation,** a subsidiary of Ling-Temco-Vought, Inc. Designated the Altec 844A Monitor-Playback Speaker System, the compact cabinet contains two special Altec 414-type low-frequency speakers which produce a uniform response from 30 cps to the crossover frequency of 800 cps. Reproduction from the crossover frequency to 22.000 cps is provided by an Altec 806A HF Compression Driver coupled to an 811B cast aluminum Sectoral Horn. The assembly measures 31" × 24" × 16" and has a dual full-section frequency-dividing network. A rotary control mounted on the front of the cabinet permits adjusting the high-frequency attenuation from 0 to −10 db. Price is $327.

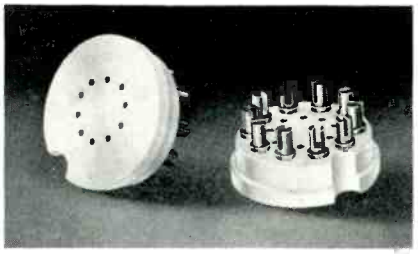
Circle Item 48 on Tech Data Card



Voltage Stabilizer

New "Voltrol" stabilizer designs, by **Acme Electric Corp.,** Cuba, N. Y., incorporate new core techniques and improved insulation materials. The ferroresonant transformer employs a capacitor-terminated control winding that induces flux saturation which is confined by a magnetic shunt to the secondary portion of the core. A 5% line-voltage variation is recovered within one cycle; wider variations are corrected in proportionate times. The manufacturer indicates that these new stabilizers have a semi-square-wave output, which lends itself to more effective filtering, especially when used as a regulated supply source for solid-state rectifiers. To provide for correcting a below-normal DC voltage, Voltrol stabilizers have a special rectifier output tap. They include standard enclosed designs, open designs for OEM applications, and cord and plug adapter receptacle. The units are now available in ratings from 30 through 5000 volt-amps, all standard input-voltage ranges, and stabilized output voltages of 120, 240, and 480 volts rms.

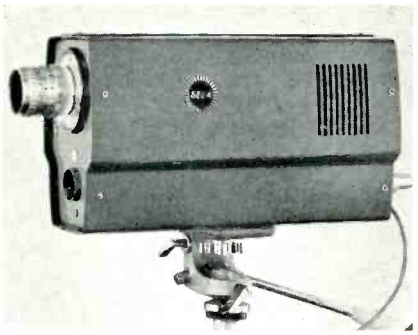
Circle Item 49 on Tech Data Card



Ten-Pin Transistor Socket

The RTC-1019-SL is a ten-pin transistor holder for the "Signetics" package offered by **Sealectro Corp.**

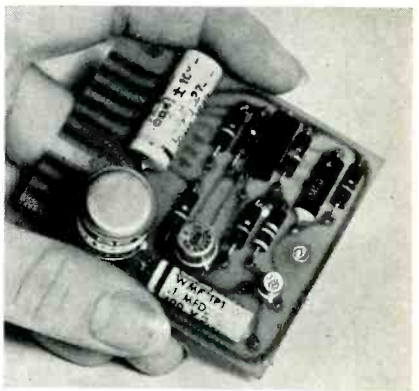
Circle Item 97 on Tech Data Card



Solid-State CCTV Camera

The D-24 is a new CCTV solid-state camera from **Sela Electronics Co.,** New York. The D-24 is designed for use in industry, commerce, or at home. Small in size, light in weight, it can be placed where it is needed most for maximum security or efficiency. Complete with lens, mounting facilities, and cable, the unit is priced at $395.

Circle Item 98 on Tech Data Card



Modular PA Systems

The new **Langevin** 4000 series Sound Reinforcing Modules are basic solid-state products designed for simplicity of assembly and operation combined with improved quality and reliability. The units in the series include preamplifiers, amplifiers, power supplies, equalizers, gain and tone controls, and "building-block" hardware for assembling public-address systems.

Circle Item 99 on Tech Data Card

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

50. AKG—Technical specifications, applications notes, and other information on microphones and microphone accessories are provided in brochure.
51. ATC—Brochure on solid-state cartridge tape unit; conforms to NAB standards—either desk-top or rack models available.
52. ATLAS—Illustrated data sheet describing C-46 and C-66 sound columns, two-way wall speaker system, and bidirectional baffle speaker combinations.
53. BROADCAST ELECTRONICS—Packet contains specifications and prices for "Spotmaster" cartridge-tape systems.
54. CINE SONIC—Data sheet describes rental service which supplies background music prerecorded on 7", 10½", and 14" reels of tape or in cartridges.
55. EASTMAN KODAK—Folder S1-4 gives information on high-speed sound-film system. Brochures on recording film and magnetic tape are also available.
56. MAGNASYNC—Technical information on 10-channel magnetic communications recorder/reproducer and time-injector unit.
57. NORTRONICS—Engineering bulletin CEB No. 2 explains factors which should be considered when designing a 3.75-ips tape system; bulletin CEB No. 9 gives engineering data on silicon-transistor recording amplifier.
58. QUAM-NICHOLS—New high-fidelity catalog lists coaxial, extended-range, and hi-fi speakers and tweeters.
59. SHURE—Technical data sheet on Model 571 miniature dynamic microphone.
60. SPARTA—Data sheet describes Model AS-100 stereo audio console with all-solid-state construction.
61. STANCIL-HOFFMAN—Catalog sheets describing a new line of miniature plug-in amplifiers, line and monitor amplifiers, and bias oscillators.
62. VIKING—Specification bulletins describe Model 96 tape transport system, Model 38 cartridge handler, and Model 88 Stereo Compact.
63. VISUAL—Latest information on KRS audio automation system; incorporates the KRS Stact cartridge-tape equipment.

COMPONENTS & MATERIALS

64. AMPEREX—Condensed semiconductor catalog with listings and specifications on full line of germanium and silicon transistors.
56. BRADY—Product data sheet No. 600-A describes line of wire markers.
66. EICO—1965 catalog includes listings of kits and wired test and Citizens band equipment.
67. METALAB—Condensed catalog SD 5 shows complete line of stock-delivery and laboratory equipment.
68. PHELPS DODGE—Brochure gives electrical and mechanical characteristics of coaxial cable for CATV.
69. SWITCHCRAFT—Product bulletin No. 147 describing new slim-line and compact 4-pin connectors.

MICROWAVE DEVICES

70. MICRO-LINK—Brochures on Model 420A portable microwave relay link and Model 600 fixed-station relay link; also planning guide for 2500-mc instructional TV systems.
71. SURFACE CONDUCTION — Bulletin on microwave-by-wire (G-line) for long distance, broadband transmission.

MOBILE RADIO & COMMUNICATIONS

72. CALVERT—Information on Model TT21 linear amplifier for the HF bands (3.5 to 28 mc).
73. GENERAL ELECTRIC—Bulletin ECR 1162 describes hand-carried portable VHF-FM two-way radio.

74. MOSELEY—Technical data sheet on new 160-mc remote-pickup transmitter and receiver.

75. MOSLEY—Literature describes Citizens band antennas.

POWER DEVICES

76. HEVI-DUTY—Bulletin No. 7-12 describes line-voltage regulator that uses saturable-core reactor.

77. LECTROTECH—Separate bulletins detail solid-state modular power supplies and meter-protective devices.

78. STACO—Catalog sheet on Adjust-A-Volt type T1520U variable transformers.

REFERENCE MATERIAL & SCHOOLS

79. CLEVELAND INSTITUTE—Booklet describes courses in electronics, including those for broadcast engineering and FCC license preparation.

80. HOWARD W. SAMS—Literature describing popular and informative technical publications; includes latest catalog of technical books.

81. RIKER—Brochure on how to assemble a custom video-processing amplifier with all transistor video modules.

STUDIO & CAMERA EQUIPMENT

82. CLEVELAND ELECTRONICS—Data concerns deflection yoke and alignment coil for 3" image orthicons.

83. DENSON—Literature on low-cost broadcast equipment.

84. ZOOMAR—Bulletins contain descriptions of zoom lenses and remote-control systems for television cameras.

TELEVISION EQUIPMENT

85. WARD ELECTRONIC—Catalog on solid-state vertical-interval video-switching systems.

86. VITAL INDUSTRIES—Data sheets describing video-distribution amplifier Model VI-10A and pulse-distribution amplifier VI-20.

TEST EQUIPMENT & INSTRUMENTS

87. BALLANTINE—Catalog on latest instrument, Model 345 DC-AC voltmeter/ohmmeter.

88. SECO—Data sheets on caddy-pack tube tester that holds over 200 tubes.

89. SENNHEISER—Bulletin on Model KB 2 tubeless distortion-analyzer bridge.

90. TEKTRONIX—Literature describing TV waveform monitors and oscilloscopes.

91. TRIPLETT—New catalog No. 46-T concerning complete line of VOM's, VTVM's, signal generators, and tube and transistor analyzers.

TRANSMITTER & ANTENNA DEVICES

92. BAUER—Data sheet concerning Model 607 FM broadcast transmitter, 1000-watt unit housed in a one-piece custom cabinet.

93. ENTRON—Literature on directional coupler designed to provide one tap-off outlet from trunk lines of CATV systems for feeding distribution amplifiers.

94. RUST — Descriptive literature gives details of transmitter automatic logging system.

95. SCALA RADIO—Information, complete with drawings and graphs, on how to eliminate cochannel interference.

96. TELETRONIX—Specification sheets for 250- and 3000-watt FM broadcast transmitters and power amplifiers.

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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.

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