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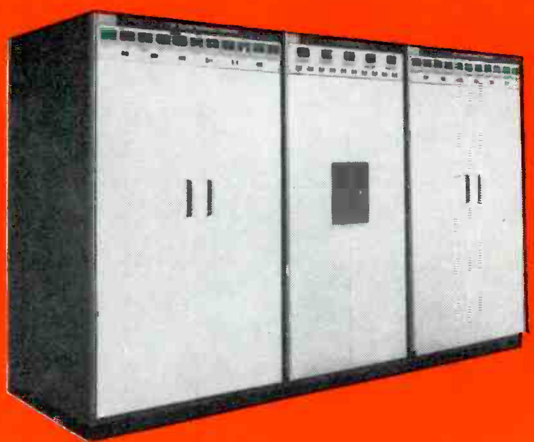
FEATURING

Broadcast Engineering

the technical journal of the broadcast-communications industry



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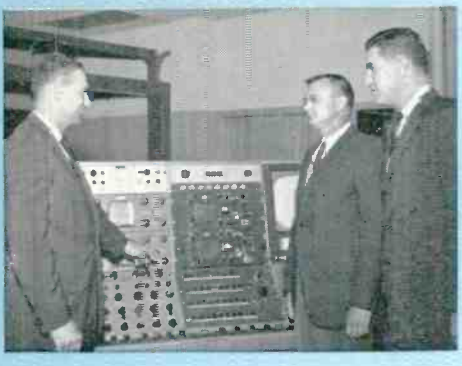

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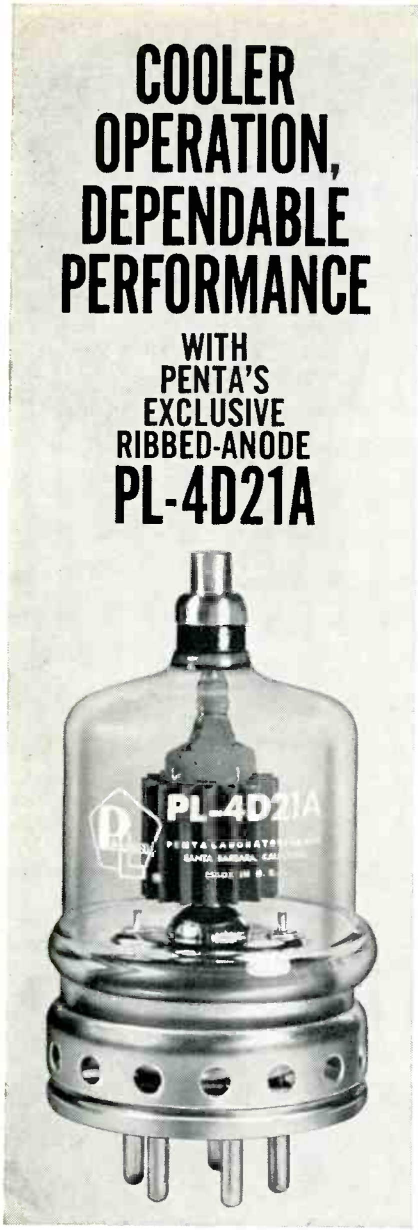

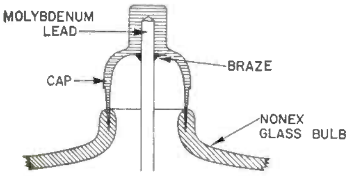

the technical journal of the broadcast-communications industry

Broadcast Engineering

Volume 5, No. 4 **April, 1963**

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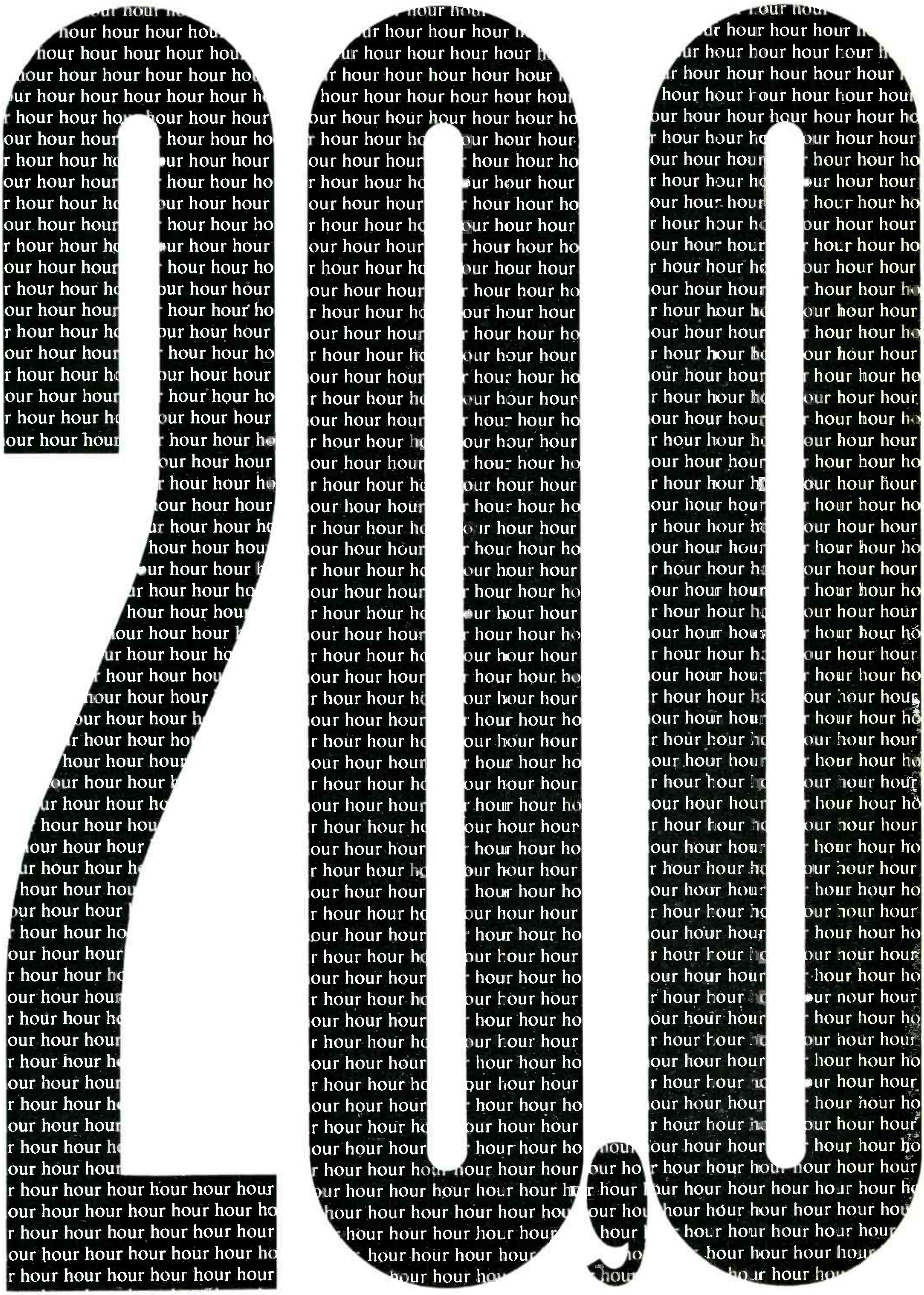
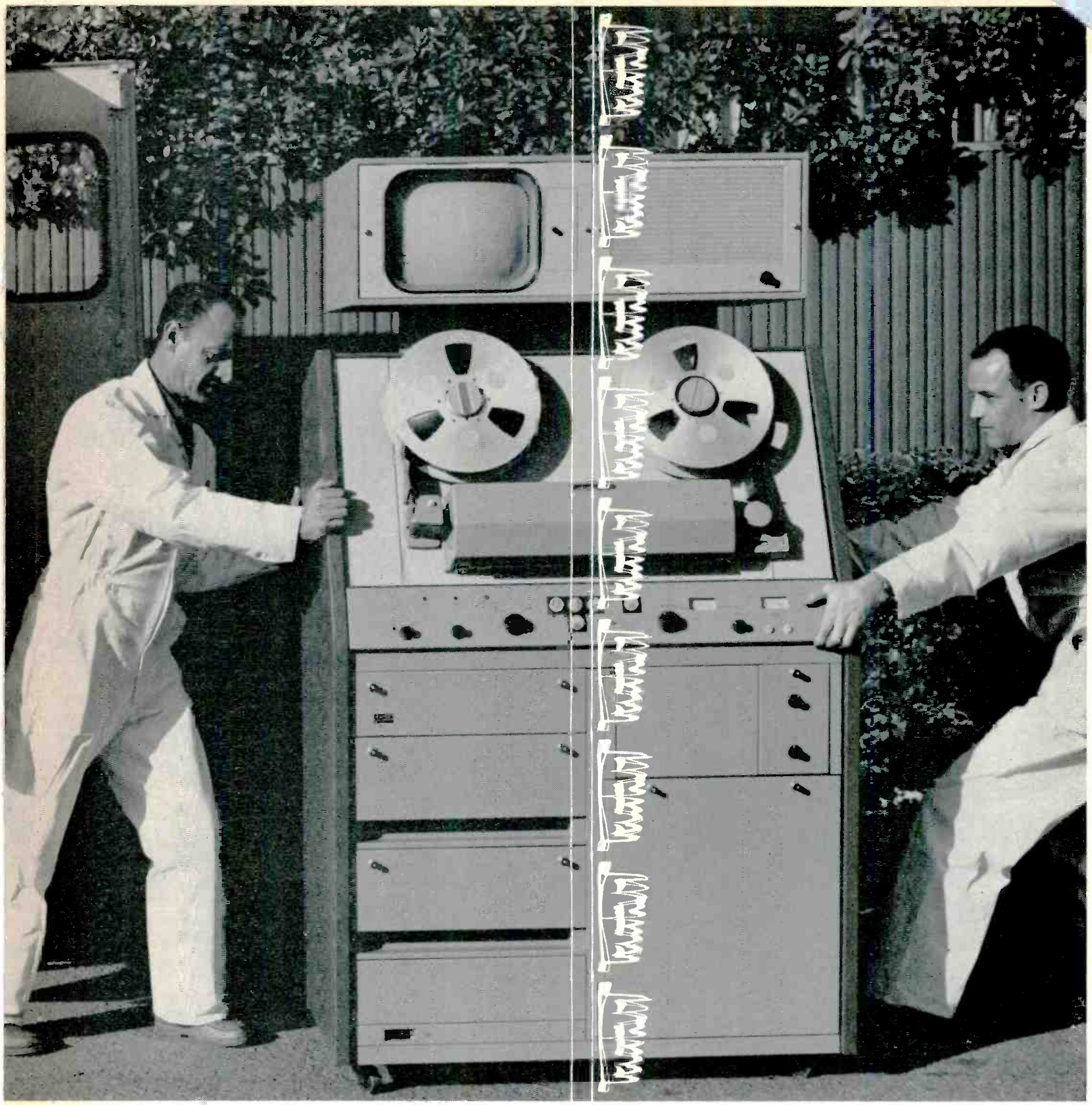


Who can deliver a fully transistorized broadcast VTR for less than $35,000?



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*TM Ampex Corp.

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LETTERS to the editor

DEAR EDITOR:

In the December, 1962, issue of BROADCAST ENGINEERING there is a reference to Pacific Transducer Corp. Sweep-Frequency Test Record. Can you furnish the address of this company?

FRANK TEFT

Chief Engineer
TV Dept.
Central Michigan University
Mt. Pleasant, Mich.

The address is:
11836 W. Pico Blvd.
Los Angeles 64, Calif.
—Ed.

DEAR EDITOR:

Starting with the April, 1961, issue of BROADCAST ENGINEERING, you ran a series of articles on television system maintenance. Would you kindly advise us if these articles are available complete in reprint, and our cost on a quantity of 50?

A. L. HAMES

Manager, Broadcast Service
Canadian General Electric Co., Ltd.
Toronto, Ontario

Although reprints are not available, all the maintenance series articles will shortly be available in a 56-page booklet, as a subscription premium.—Ed.

DEAR EDITOR:

I was pleased to see my article "Automatic Music System" published in the February issue of BE. There are, however, a couple of errors. The relay designated "6" in Figs. 3 and 4 should be "G" and the smoothing resistor between the 100-mfd capacitors in the full-wave power supply should be 200 ohms.

I have received several letters from persons interested in the system, and as a result have found that I made the following omission: It is necessary to install 0.1-mfd capacitors or 10K 2-watt resistors across each of the ready lights. The changers contain .05-mfd capacitors across their switches to prevent sparking. Enough current can flow through these capacitors to light the neon lamps, even when the switches are open. The parallel capacitor or resistor will form a voltage divider to reduce the voltage across the neons to a point below firing threshold, until the switches are closed. It may also be necessary to put a .05-mfd capacitor across various relay contacts where the 110-volt line is broken, to prevent on-air "popping."

ARTHUR J. SMITH

Chief Engineer
WCNB AM-FM
Connersville, Ind.

G's and 6's are kind'a similar, aren't they Art? Seriously though, sorry for the goof, and thanks much for the additional information.—Ed.

What compact can do everything a console recorder can? **AMPEX PR-10**

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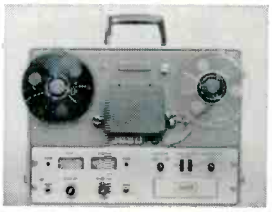

AMPEX

See the PR-10 at NAB.

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SUPPRESSION PRACTICES FOR BROADCAST STATIONS

*by James B. Hatfield** — A review of the techniques employed to suppress harmonic radiation in compliance with FCC Rules and Regulations.

In recent years in the problem of controlling RF harmonic radiation from standard broadcast stations, in compliance with FCC Rules governing harmful interference to other radio services, has become increasingly more difficult to overcome. This article reviews most of the general approaches to the problem, with due consideration to the present FCC Rules on RF harmonics.

Rules 3.40 and 3.317 require that AM and FM stations having a transmitter type-approved since January 1, 1960, attenuate RF harmonics at least 80 db below the unmodulated carrier for powers greater than 5 kw. For lower powers the Rules specify a formula which requires minimum attenuation value of 73 db for 1 kw, and 67 db for 0.25 kw.

The above Rules do not apply to transmitters type-approved before January 1, 1960 [(3.317 (e) (2), 3.46 (C) and as no values are given for these transmitters, it is generally considered that the attenuation is satisfactory if the harmonics are down 60 db, providing no harmful interference is being created to any radio service. It can be seen that January 1, 1960 is a significant date in considering compliance with the FCC Rules relating to harmonics. The equipment manufacturer can generally advise the broadcaster of the type approval date on his transmitter, or this information can be obtained from the FCC. (Many broadcast transmitters being sold today were type approved before January 1, 1960.)

For TV stations the FCC Rules [3.687(i)] require that harmonics must be attenuated at least 60 db below the visual transmitter power, but point out that this is a temporary value. The rules also state that due to the utilization of high power by most TV stations, consideration should be given to providing more than 60 db of harmonic attenuation.

It is anticipated that broadcasters will experience little harmonic trouble with standard broadcast transmitters type-approved by the FCC after January 1, 1960, due to the higher standards required for this equipment. The harmonic suppression ideas set forth in this article should be helpful in regard to older transmitters, but the techniques can be applied to any equipment to achieve further harmonic suppression.

The design of a modern transmitter incorporates features that result in low harmonic radiation. It is generally difficult, if not impossible due to type approval requirements of the FCC, to modify an existing transmitter to take advantage of all of these features.

Special attention is paid to the low power RF stages in a modern transmitter, and the design procedures incorporated will not generate serious harmonic products. This is achieved through proper selection of the operating constants of vacuum tubes (or transistors) and is outside the scope of this article. If harmonics can be prevented through circuitry in the low-power stages, then they do not have to be suppressed at high power levels by means of special filters.

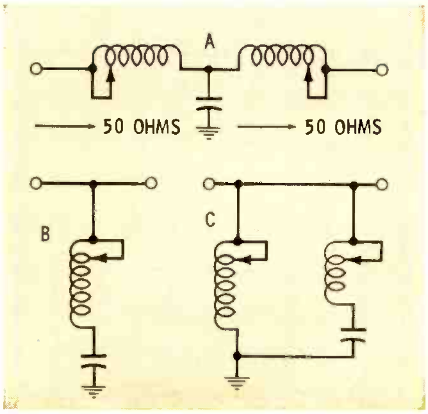

Fig. 1. Filters for harmonic suppression:

The modern transmitter has double shielded construction with all access openings having radiation leak-proof seals. With all power and controls leads entering the transmitter protected by means of RF filters, and with the shielding provisions mentioned above, the harmonic radiation from the transmitter cabinet is reduced to a minimum.

It is standard practice in modern transmitters to incorporate specially designed harmonic filters in the output circuit. These circuits can be added to most existing transmitters, and the technique utilized will be generally reviewed here.

Filter Circuits

If an AM transmitter is radiating objectionable harmonics (such as the 2nd, 3rd and 4th), it may be neccessary to install a filter that will reduce the amplitude of the entire harmonic band. Some older type transmitters working into shunt fed towers may require this treatment. A good filter for this purpose is the T-F network shown in Fig. 1A. It is easily designed for 90° phase shift, because all three arms will have the same reactance as the transmitter output load. For a 50-ohm transmission line, for example, all three arms are also 50 ohms at the operating frequency of the station. This filter is generally installed in the output circuit of the transmitter and shielded by locating it either in the transmitter enclosure or in a well shielded metal box. Although higher order phase shift networks with larger series arm inductors will in most cases provide

*Consulting Radio Engineer, Seattle, Washington

superior harmonic attenuation, the equipment is more expensive due to the larger inductors and the higher capacitor current. If the 90° network is not used for impedance matching, the current flowing in the capacitor is about 1.4 times the current flowing in each series arm.

Fig. 2 shows the reactance and current relations to phase shift in a T-network for the special case of 50-ohms input and output. The current ratio can be utilized to determine the capacitor current if the phase shift and current in either series arm are known. If the currents are known, the ratio will provide information on the phase shift. If properly adjusted and terminated, the input current to the T-network will equal the output current.

The most bothersome harmonic from a transmitter is almost always the 2nd. This can be reduced satisfactorily by installing a series circuit (Fig. 1B), tuned to the 2nd harmonic, across the output of the transmitter (center of coax to ground). At the operating frequency of the station this circuit will look like a capacitor and may create serious detuning of the output stage if the reactive values of this circuit are too low. As this circuit accomplishes its attenuation by shorting out the harmonic, the quality of the filter decreases as the reactance values are increased. An approximate rule to follow is to employ reactance values which are twice the load across which they are placed. If connected across a 50-ohm load, the capacitor and inductor should each have a reactive value of 100 ohms at the 2nd harmonic frequency. There is normally room in the transmitter enclosure to place this equipment.

The impedance of the series filter circuit at the harmonic frequency must be very low, in comparison with the impedance across which it is placed, in order to obtain good harmonic attenuation. Both impedances are referred to the 2nd harmonic, at which frequency large standing waves with large variations in impedance are bound to exist on the transmission line connected to the transmitter. The impedance at the point of filter connection, and at the harmonic frequency, is generally unknown unless measured with an RF bridge; under some conditions it can be very low. If such a condition is encountered, it will be found that the series-type filter is inefficient, and the only solution may be a new location or a different type filter. Where a transmission line is utilized between the transmitter and the antenna coupling unit, it is normally possible to overcome the above mentioned trouble by moving the filter to the other end of the line.

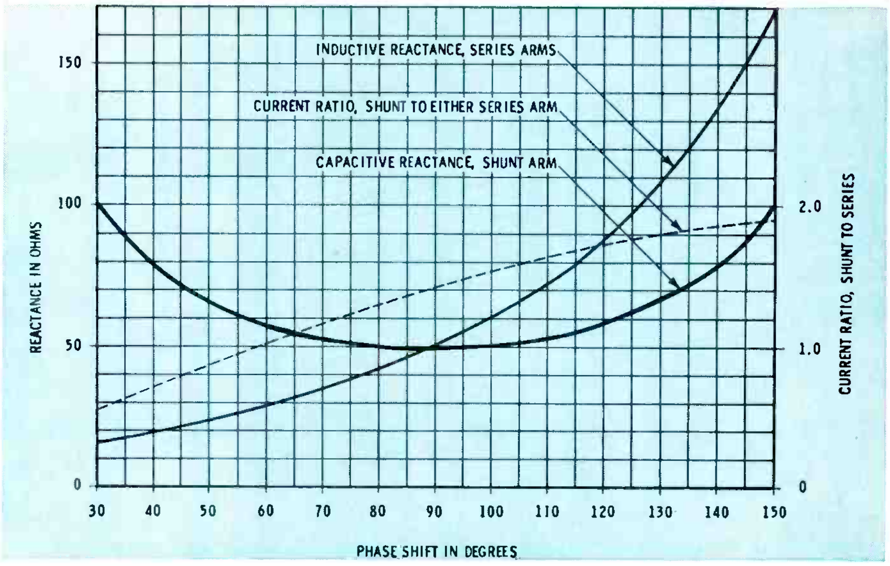

Fig. 2. Reactance and current relations to phase shift in a T network for 50-ohm input and output.

If transmitter detuning by the series circuit in Fig. 1B is too severe, the circuit in Fig. 1C can be utilized without any noticeable detuning. The added inductor is adjusted so that the entire circuit is parallel resonant at the operating frequency, thereby presenting a very high impedance. The series circuit must be precisely adjusted for maximum 2nd harmonic attenuation before the parallel inductor is adjusted.

The circuit just described can be simplified as shown in Fig. 3A; here only one inductor and one capacitor are required. The adjustment must be performed in reverse. First adjust the bottom part of the inductor and the capacitor to parallel resonance at the station operating frequency; then adjust the top part of the inductor for maximum attenuation at the 2nd harmonic. As these filters contain parallel resonant circuits, the components must be sufficiently large to handle the circulating currents. If they are installed across a low impedance circuit, such as a properly terminated coaxial cable, the circulating currents will not be severe.

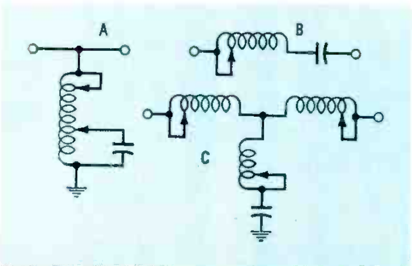

Fig. 3. Filters for harmonic suppression:

A series circuit is occasionally installed in series with a broadcast transmitter output bus or transmission line center conductor to further attenuate harmonics, as shown in Fig. 3B. But as this filter does not provide very much harmonic attenuation by itself, it is not utilized extensively.

The antenna coupling unit found at most broadcast stations takes on the configuration of the T-network shown in Fig. 1A, which offers further attenuation to the RF harmonics. Some coupling units, at stations operating with nondirectional antennas, contain large inductors which were initially adjusted to utilize only a few of the available turns in the series arms. Usually, large increases in harmonic attenuation can be realized in these coupling units by returning them for a higher phase shift, utilizing more turns in the inductors. If the unit was originally tuned for a low phase shift, say 45°, it can be properly retuned to 135° by utilizing more turns in the inductors and the same capacitor.

If the antenna coupling unit takes on the configuration of Fig. 3C, it is possible, to retune this circuit for

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LIGHTING FOR YOUR TV STUDIO

by ***Nathan J. Sonnenfeld**** — How to plan the lighting system for a new or modernized television studio.

TV is a visual art. It is also a highly competitive business; and lighting is probably the most important phase of television production. Fine set design and costuming will be wasted unless they are properly lighted. With proper planning, your results will be good and your costs will stay in line. Improper planning results in poor picture quality and generally higher operating costs.

Lighting can be divided into two considerations: quantity and quality. The correct quantity is that amount of light necessary for proper exposure at a desired lens opening. Quality is the additional finesse and illumination added to the correct quantity of light to produce an interesting picture.

In planning new or modernized studios, you would be well advised to call in a TV lighting expert at the beginning. He can insure maximum results for the minimum expenditure.

What should your TV lighting system produce for you? A better picture at a moderate operating expenditure. Sometimes you also want it to provide a competitive advantage by being, "The Best in the Area" — your time salesmen know how to sell this.

How does a properly designed lighting system meet these requirements?

1. By providing a safe and rapid means of energizing the lights.
2. By including an adequate lighting control center for switching and dimming lights.
3. By consisting of the right number, types, and quality of lighting instruments.
4. By providing devices for efficient movement and positioning of the lights.

The best way to provide power to the lights is through square ducts from the lighting control center to and along the studio ceiling. The next link is flexible multi-conductor cables to connector strips with pigtails on 4′ or 5′ centers. The connector strips should be about 4′ to 6′ apart. This system will provide one outlet for every 20 or 25 square feet of studio floor (Fig. 1).

The lighting control center should provide for the connecting of any light individually or with any other light or lights on any dimmer or group of dimmers. The dimming system should be operable from the lighting control center and/or remotely from the control room. The lighting control center (Fig. 2) should be located on the studio floor against the least valuable wall. In the case of electronic dimmer boards (Fig. 3), the dimmer bank is located out of the studio, while the patch panel is on the studio floor. A typical dimmer bank is shown in Fig. 4.

The right wattage, type, and combination of scoops, fresnels, backliters, pattern projectors, etc., must be determined. Factors entering into the decision include mounting height, personnel available, type of programming to be covered, and of course the most important single factor, the type and make of camera and tube employed. Scoops are used for base and fill light, and fresnels for key, accent, and back light.

The highly flexible pipe-rail system of mounting lighting instruments is the most widely used. Each light is provided with a "C" clamp so that it can be readily moved along a pipe, or from pipe to pipe. Each light has a pigtail and connector which plugs into a pigtail from the connector strips mounted onto and above the light pipe. These light pipes are spaced on 4′ to 6′ centers.

*Vice-President, Lighting & Electronics, Inc., Brooklyn, New York

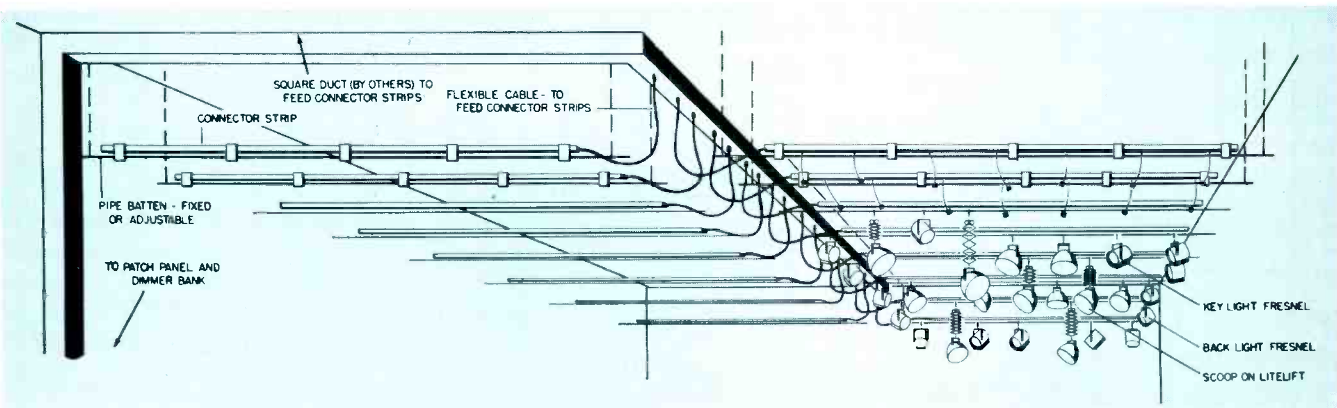

Fig. 1. Layout diagram of power ducts and connector strips for studio lighting system.

Pipes should be hung by chain and "S" hooks so that they can, if necessary, be raised or lowered. Where the budget permits, counterweights are an excellent investment. Twenty to forty per cent of the lights should have pantograph lite lifts. Another successful system is Flex-rail, in which pairs of parallel rails are mounted about 8 feet apart. Through the use of double carriers, floating rails may be moved along the fixed parallel rails. Each light is mounted to a single carrier and may be easily moved along the floating rail.

Technical sheets describing the characteristics, distribution, efficiency, and use of each light are available from lighting equipment manufacturers. The lighting expert should spend enough time with studio personnel during the design, construction, and early operating days of the studio to thoroughly acquaint them with the equipment.

Requirements

What are your electrical requirements? For black and white, you should have 25 watts per square foot for I.O. cameras, and 30 to 35 for vidicon cameras. When designing for color, provide 70 to 100 watts per square foot. You can plan air conditioning for one half the above values because not all the studio lights are on at one time.

Here are a few guides for budgeting studio lighting facilities. The cost for connector strips is approximately $1.50 per square foot, lights $3.50 per square foot, patch panel $1.50, dimmers $1.50 (for electronic dimmers add $4.50). For color telecasting, add 25 to 40%. These prices are for equipment only; installation and light bulbs are additional.

Fig. 3. Two-scene remote control console.

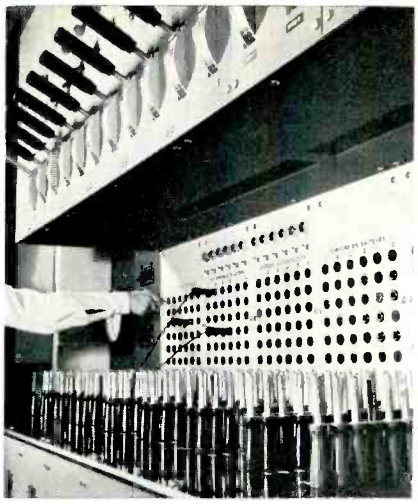

Fig. 2. Studio patch panel and dimmer bank.

A 25' x 40' studio should be equipped with:

- 8—20' connector strips, each with seven 20-amp pigtails.
- 4—wall receptacles, each with one 50-amp and one 20-amp pigtail.
- 1—patch panel with 72 load cords and plugs.
- 8—control groups, each with 8 female receptacles on a 100-amp contactor.
- 1—dimmer bank with six 6000-watt interlocking autotransformer dimmers, and 2 nondim circuits.
- 2—3" fresnels with barn doors (4 way).
- 10—6" fresnels, 9 with barn doors (4 way).
- 6—8" fresnels, 3 with barn doors (4 way).
- 8—500-watt par 64 backliters.
- 16—18" scoops.
- 3—6" pattern projecting ellipsoidals.
- 1—1500-watt follow spot.
- 12—lite lifts with jumpers.
- 3—castered stands with jumpers.

A 40' x 60' studio should be equipped with:

- 22—18' connector strips, each with five 20-amp pigtails.
- 6—wall receptacles, each with one 20-amp and one 50-amp pigtail.
- 1—patch panel with 136 load cords and plugs and 16 controls groups, each with 8 female receptacles on a 100-amp contactor.
- 1—dimmer bank with twelve 6000-watt interlocking autotransformer dimmers, and 4 nondim circuits.
- 1—remote control panel for location in control room.
- 3—3" fresnels with barn doors (4 way).
- 20—6" fresnels, 15 with barn doors (4 way).
- 12—8" fresnels, 6 with barn doors (4 way)
- 30—16" scoops.
- 10—500-watt par 64 backliters.
- 3—6" pattern projecting ellipsoidals.
- 1—8" pattern projecting ellipsoidals.
- 1—2100-watt 60-volt follow spot.
- 24—lite lifts with jumpers.
- 3—castered stands with jumpers.

Procedure For Lighting the Show

Generally the lighting director is familiar with the studio, the show, and the personnel. It is assumed that because of the physical limits of the studio, most of the equipment is hanging in the correct places. A script review with the producer, director, and scene designer sets the limits of the production. Notes are made as to mood, backgrounds, special effects, etc. Camera angles, mike boom locations, action, etc., are plotted. Working with the floor plans, the lighting director will lay out his light plot, keeping in mind the availability and location of equipment (Fig. 5).

As soon as the studio space is free, the lights are arranged as plotted. After the set is dressed, final focusing is accomplished. In line with today's techniques, key lights are set first, then back light and fill light are added. After this the

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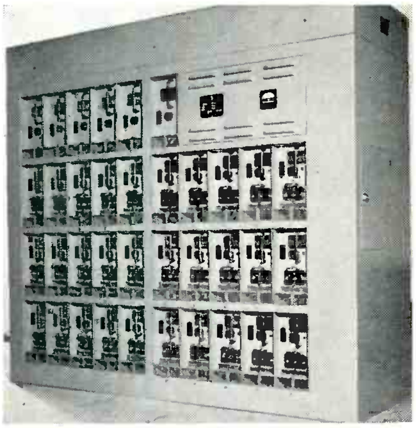


Fig. 4. Solid-state remotely controlled dimmer bank containing 36 6-kw electronic dimmers.

SPECTRUM DISPLAY IN BROADCAST MONITORING

by Granville Klink* — How a system similar to FCC surveillance equipment is used in a station to monitor broadcast signals.

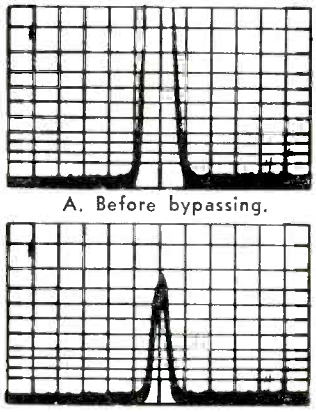

A. Before bypassing.
B. After bypassing.

Fig. 1. Spurious radiation at 193.25 mc.

The use of spectrum display as a device to monitor broadcast signals has been a part of the surveillance procedure of the FCC for a number of years. Eleven monitoring stations incorporate this type of equipment as do the mobile TV monitoring units which the FCC has had in service since 1955.

We had an experience, some four or five years ago, with spurious radiation from an old AM transmitter. At that time we made a trip to the FCC Laurel Monitoring Station to view the signal on their equipment. The spurious radiation happened to be a second harmonic which was suppressed, in this case, without too much difficulty. The possibility of purchasing panoramic display equipment similar to that used by the FCC was investigated. We found this system to be very expensive and not directly applicable for our use.

WTOP-TV, which operates on Channel 9 in Washington, D. C., received its first Advisory Notice resulting directly from spectrum monitoring in May, 1962. The notice specified a spurious radiation at 193.25 mc, and described it as being a potential source of interference to Channel 10.

The Laurel Monitoring Station, which is about 15 miles from Washington, was contacted via telephone and we were advised that spectrum monitoring had been used in discovering the spurious signal. While we held the telephone line open, several tests and adjustments were made on the television and FM transmitters in an effort to find a possible clue to the source of the spurious signal radiation, but the attempt was to no avail.

With the knowledge that Nems-Clarke, in Silver Spring, Maryland, had been working on spectrum display equipment, we called on them to assist us in locating and identifying the trouble. We borrowed from them two pieces of equipment which they had developed for use in the field of telemetry. These were the Model 1674 general purpose FM receiver, which tunes continuously from 54 to 260 mc, and the Model 200 spectrum display unit which was designed to operate from the IF output of the 1674 receiver. This system was installed in our transmitter room and the receiver was tuned to 193.25 mc; the offending signal appeared as in Fig. 1A.

Using this display as a guide for systematic troubleshooting, the spurious signal was found to be

Fig. 3. Nems-Clarke Model SDU-520 combination receiver/spectrum display unit.

*Chief Engineer, WTOP-AM-FM-TV Washington, D. C.

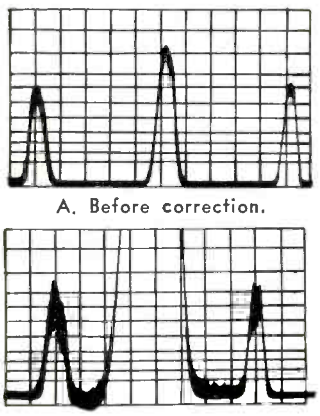

A. Before correction.
B. After correction.

Fig. 2. Sideband 20 kc from aural carrier.

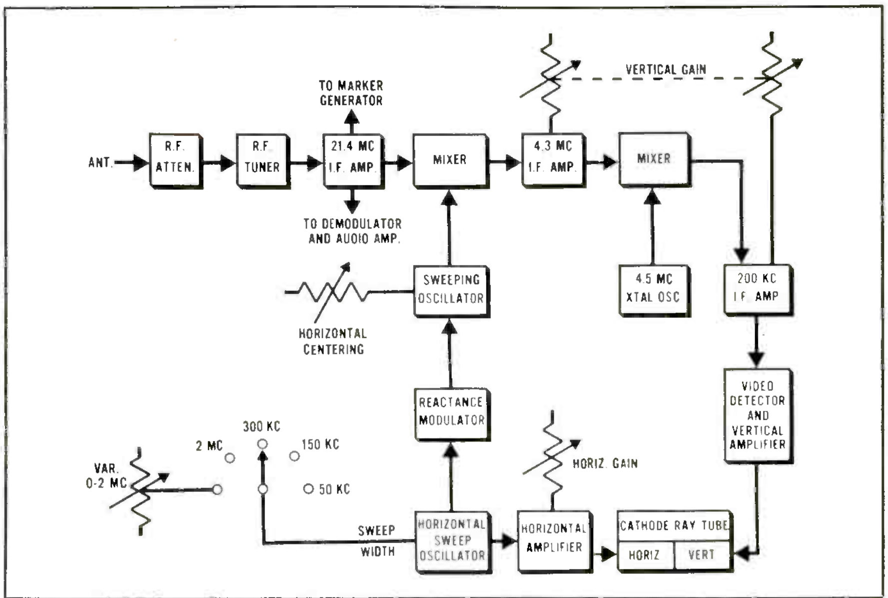


Fig. 4. Block diagram of broadcast station spectrum display unit for in-plant use.

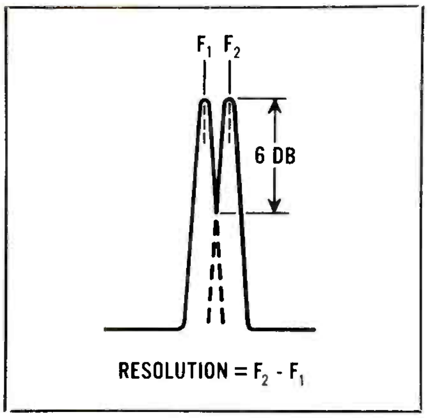
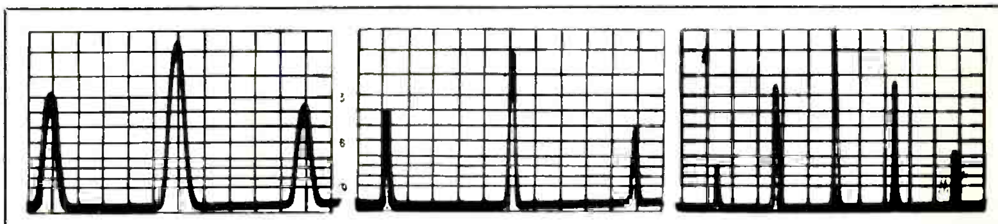


Fig. 5. Resolution of spectrum display unit.



A. 25-kc at 50-kc sweep. B. 75-kc at 150-kc sweep. C. 75-kc at 300-kc sweep.

Fig. 7. Markers across the CRT screen.

generated in the screen circuit of a tripler stage in both aural and visual transmitters. Additional bypassing in these circuits resulted in a reduction of approximately 80 db, as indicated in Fig. 1B. The next day, a telephone call to the monitoring station confirmed our elimination of the spurious signal.

Further checking of the TV signal with the spectrum display system revealed small spurious sidebands 20 kc from the aural carrier (Fig. 2A). (The kc marker pips shown in Fig. 2B aid in determining the exact location of the sidebands.) This fault was found to be caused by one of the crystals in the aural exciter crystal oscillator. The sidebands disappeared when some of the grounds in the oscillator stage were resoldered.

Additional experimentation with the system indicated its potential value as a modulation or deviation monitor for both the TV aural transmitter and the FM transmitter.

However, the spectrum display unit lacked adequate calibration facilities for the accurate determination of deviation, as well as sufficient resolution to use practical modulation frequencies. Consequently, we approached Nems-Clarke with the idea of developing a unit specifically designed for broadcast use, with calibration features to enable precise measurement of deviation and amplitude. Their SDU-520 is shown in Fig. 3.

Before looking at some of the measurements that can be made with this unit, it would be useful to become familiar with its circuitry. A block diagram of the device is shown in Fig. 4.

Output of the RF tuner is at the IF frequency of 21.4 mc; the passband at this point is 2 mc wide. This IF signal is fed into a mixer stage where it is mixed with the output of a sweeping oscillator having a center frequency of 25.7 mc, thus producing a second IF signal of 4.3 mc. The sweeping oscillator frequency swings from 24.7 to 26.7 mc. Since this sweep width matches the bandpass of the tuner, signals out to 1 mc from the frequency at which the dial is set will be heterodyned with the sweeping oscillator for a 4.3-mc IF.

The sweep width selector varies the amplitude of the sawtooth wave applied to the reactance modulator, which in turn varies the frequency excursion of the sweeping oscillator. Fixed sweep widths of 50 kc, 150 kc, 300 kc, and 2 mc are available. The fifth position of the switch provides a variable sweep width from zero to 2 mc, adjustable by means of a front panel control. The purpose of the 2 megacycle width is to assist in locating a desired signal.

One of the most important specifications of a spectrum display unit is its resolution. Resolution is defined as the separation in kilocycles between two signals of equal amplitude whose point of intersection on the screen is 6 db down from their peaks. This is illustrated in Fig. 5. Resolution is a function of the pip width. This width on the screen is determined directly by the bandwidth of the last IF amplifier. At 4.3 mc, the best bandwidth that can be obtained is about 20 kc. Since a pip of this width would make it impossible to separate sidebands of frequencies less than 20 kc, it is necessary to perform another conversion to a lower IF frequency. At 200 kc, a bandwidth of 3 kc is easily obtainable. A crystal oscillator (Fig. 4) at 4.5 mc is mixed with the 4.3 mc IF signal to obtain an IF frequency of 200 kc.

The marker frequencies, ± 25 kc and ± 75 kc, and their harmonics are obtained by injecting the proper signals into the 21.4-mc IF circuit. Since crystals for 25 and 75 kc are quite costly, these frequencies are obtained by mixing crystal controlled frequencies of 4.525 megacycles and 4.575 megacycles with the existing 4.5 megacycle oscillator, as shown in Fig. 6. Either the 25 or 75 kc signal is then mixed with a 21.4-mc oscillator, producing the center frequency of 21.4 mc, as well as sum and difference frequencies of 21.375 and 21.425 mc or 21.325 and 21.475 mc. Since harmonics of the mixing frequencies also appear in the output, the result is a spectrum of 25-kc or 75-kc markers across the CRT screen. Fig. 7A shows the 25-kc markers with sweep width set at 50 kc. In Fig. 7B the 75-kc markers are displayed on a sweep width of 150 kc. Note that there are six vertical scale division lines on each side of center so that when the

• Please turn to page 42

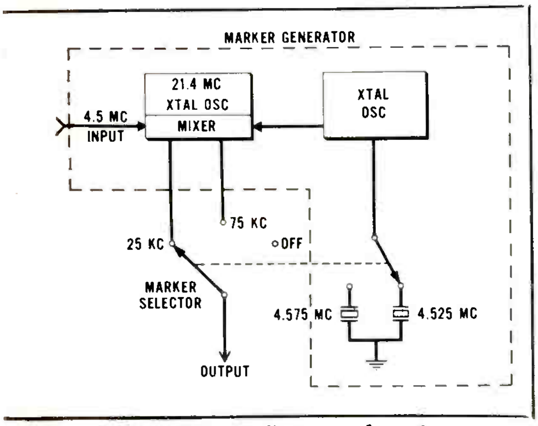
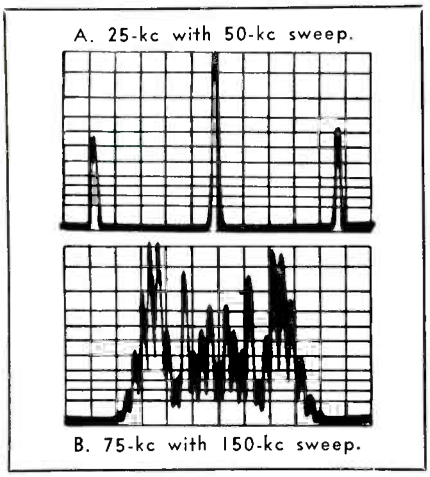


Fig. 6. Block diagram of marker system.



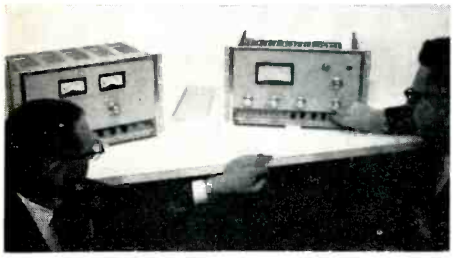
A. 25-kc with 50-kc sweep.

B. 75-kc with 150-kc sweep.

Fig. 8. Trace of 25- and 75-kc markers.

TOURING THE NAB EXHIBITS

by Stuart N. Soll — On-the-spot interviews with exhibitors, plus reports on products displayed at the National Association of Broadcasters Convention



FM Stereo Monitor and Limiter

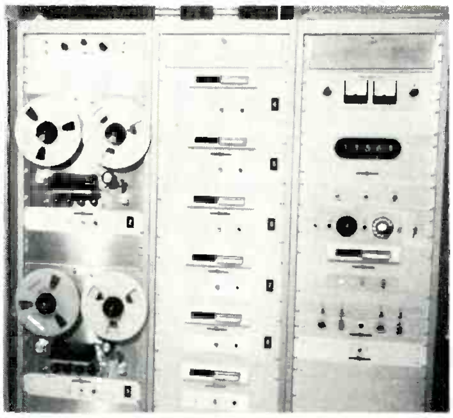
At the **Collins Radio** booth we spoke with Mr. Carl R. Rollert and Mr. K. E. Vaughn about the company's new stereo monitor model 900 C-1. The equipment allows measurements of all parameters serving as a complete proof-of-performance package. With this monitor, the engineer can measure L—R, L+R, pilot carrier phase, and main channel modulation of the entire wideband stereo signal. Functionally styled, the equipment is built on plug-in cards which carry wired, rather than printed, circuits. The components are mounted on one side of the card and the circuit is wired on the other side in the manner of chassis layout. Mr. Rollert went on to say the monitor is completely self contained for noise measurements with its built-in voltmeter that permits measurements to —70 dbm. For distortion readings, an external distortion analyzer is required. The functions of the monitor are selected on one master switch. All monitor test points are brought to the front panel and also to the rear for permanent connections. The 26-U-2 limiter consists of two 26-U-1 limiters cross-connected for stereo measurements in one package. the levels of the readings are thereby stabilized.

Circle Item 50 on Tech Data Card

Miniature Transistorized Television Tape Recorder

Highlighting the **Sony Corp. of America** booth was a small transistorized closed-circuit television tape recorder. As he demonstrated the machine, Mr. Bruce L. Birchard explained some of its features to us. Designated the PV-100, the recorder operates at 5¾ ips with helical scan at 3600 rpm. According to Mr. Birchard, head life is about 1000 hours, and when one has to be replaced the cost is approximately $300. An important feature of this machine is the ability to stop a single field to analyze an action. The machine is suited for mobile applications in news services, and is also useful in previews of video commercials so that sponsors can see them before they are aired. In keeping with portability, the machine weighs 145 lbs. and requires 300 volt amps of power for operation, which can be supplied by a motor-generator set (Sony has one under development). Capable of taking input from any camera, video tape recorder, or other video signal source, the device is simple to operate and records tapes that are interchangeable between machines. The cost, Mr. Birchard said, is $10,900.

Circle Item 51 on Tech Data Card



Automation System

Automatic Tape Control displayed and demonstrated a complete program automation setup employing their systems programmer. In a conversation with Mr. Lee Sharp we learned about the functions of some of the component parts of the equipment. Serving as the central brain of the system, the digital programmer operates with a telephone-type dial, a memory unit, and a tape cartridge for recording the control tones. When a source is dialed the appropriate code is recorded on the programmer tape—in just two seconds. It is possible to store several days of program information on a 300′ reel, Mr. Sharp said. Each program cartridge, then, represents a particular sequence of sources. When the control tape is played in the programmer, the sources are selected in the prescribed sequence and as each ends, a 3200-cps tone from the source causes the program unit to select the next source. Thus the system allows a great variety of program inputs ranging from reel tape to off-air pickups, from discs to prerecorded cartridge tape, and others. According to Mr. Sharp, most stations choose a simple system first, consisting of the programmer and two or three sources, then progress, as the effectiveness is recognized, to larger and more versatile systems. The system shown, we were told, is typical of those installed in medium-sized stations, and permits the use of a wide variety of program material.

Check Item 52 on Tech Data Card

50-kw Transmitter uses Ceramic Tetrodes

At **ITA Electronics Corp.** this year the big news was the new 50-kw transmitter, the AM 60000-A. We spoke with engineer Juan Chiabrando who told us that this transmitter is designed around the 4CX15000-A and 4CX35000-A ceramic tetrodes which provide high output with low driving power. A pair of the former is used in the modulator in a class AB_1 circuit. The exciter uses a 4-400A in its last stage driving the final 4CX35000. For full output, only 150 to 200 watts of driving power is required. Mr. Chiabrando showed us a portion of the feedback loop which covers the entire circuit, from the modulator plates to the audio input transformer. Distortion is approximately 2% maximum at any point across the frequency spectrum. The built-in harmonic suppression measures reduce all harmonics to at least —80 db and some to —90 or more. Designed for high frequency operation with only minor component changes, the transmitter boasts low cabinet radiation. It has been reduced so far, we were told, that no signal could be detected at a point 300 feet from the transmitter. This is achieved with vhf techniques. The parts are accessible from removable and swing-down panels at the front and rear of the transmitter. Long component life is assured by extreme derating of the components. As an added precaution, the transmitter final plate power and the power to the modulator are removed in the event the air pressure from the blowers should drop below the prescribed values.

Check Item 53 on Tech Data Card

Color Film Camera Channel

When we visited the **General Electric Technical Products Operation** Booth, we were fortunate in talking with Mr. Jim Wall, Manager, Sales, Broadcast Equipment, who advised us of some of the highlights in his company's exhibit. Of major importance is the new 4-vidicon color film camera channel Model PE-24-A-4. This system is transistorized and designed for ease of operation, adjustment, and maintenance, Mr. Wall said. We were further informed of several features incorporated in the unit to insure sharp, detailed pictures. The camera circuits are regulated, the vidicons are provided with vernier controls for precise adjustment, and the fourth vidicon provides detail and luminance. Also featured at the booth is the PE-23 transistorized studio vidicon camera which has recently been introduced. The camera allows about 50% lower initial cost, lower power requirements, and economy inherent in transistorized circuits. The power supply and video channel amplifier are included in the camera itself. The horizontal resolution at the center is 700 lines, and at the corners 500 lines; bandwidth is flat to 10 mc. G.E. also revealed details of a line of UHF transmitters and "zig-zag" panel directional antennas. "Frequency drift in the new transmitter series," according to H. E. Smith, TPO marketing manager, "is no more than five parts in 10 million. . . ." The heart of the series is the TT-55-A transmitter which serves as driver for 12.5-kw and 25-kw amplifiers. In further comments Smith said the antennas make possible an almost limitless variety of directional patterns.

Check Item 54 on Tech Data Card

NEW PRODUCTS AT THE NAB SHOW

Wide Range Zoom Lens

Television Zoomer introduced a new 10-2-1 wide angle ZOOMAR lens which resulted from a collaboration between ETS, Pierre Angenieux of Paris, Evershed Power Optics of London, and Dr. Frank G. Back of ZOOMAR, U.S.A. The lens zooms from 35 to 350 mm, or 1⅜ to 14 inches, and has a speed of F/4.5. A convertor extends the range from 56 to 560 mm, or 2¼ to 22½ inches. This lens is interchangeable on all image orthicon cameras, is color corrected, and has resolution and contrast equal to any fixed focus lens. For TV commercials requiring tight zoom shots the 3-foot minimum working distance permits zooming from a wide angle shot of 40 inches to an extreme close-up of 4 inches.

Check Item 55 on Tech Data Card

Camera Chains and Equipment

An extensive line of television camera chains and associated equipment was on display at the **EMI/US** booth. Included in the demonstration was the type 201 Vidicon Camera Chain. This setup consists of a camera, camera control unit, and an optional remote-control panel. One of the advantages of the system is the small size (10" x 9" x 16") and light weight of the camera—it weighs only 30 lbs. Available with a four-lens turret (201), a manual zoom lens mounting (201/1), and a mounting for a remotely-controlled zoom lens (201/2), the basic camera is equipped with a built-in 7" rectangular CRT viewfinder which is fed with composite signal output of the chain. The CCU, available for rack mounting or in a portable case, includes a variable boost stage that compensates for camera tube resolution loss. The type 203 4½" Image Orthicon Camera Chain was also demonstrated. The camera in this system is also compact and lightweight (108 lbs.), and is equipped with a 5-position turret — the camera tube may be removed through the fifth position. Also shown was a color camera chain, a pan and tilt camera mounting, color encoder, distribution amplifier, picture monitor, waveform monitor, switcher, intercommunications system, sound mixing equipment, and the company's Emitape for video recording. Two image orthicons and a multiple-camera film chain were also on display.

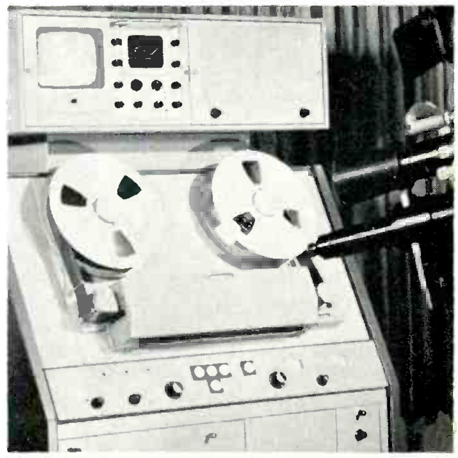
Check Item 56 on Tech Data Card

Wires and Cables

A complete line of television wires and cables were on display at the **Boston Insulated Wire & Cable Co., NAB booth.** These included camera cables, connectors, and assemblies for Marconi, EMI, RCA, GE, Grundig, and Dage commercial broadcast and special application cameras and microwave relay equipment; audio and coaxial cables for network color television. Also on hand were U.S. manufactured cables and connectors for use with British cameras employing stranded, color-coded,

Nylon-jacketed conductors, with Neoprene or Plastic outer jacket. Watertight repairable connector terminations were introduced.

Check Item 57 on Tech Data Card



Television Tape Equipment

Ampex Corp. introduced the first fully transistorized broadcast television tape recorder priced at less than $35,000 at the show. Designed to bring the benefits of video recording to many small and medium market stations the VR-1100 is approximately half the cost of other transistorized television recorders. The machine is equipped for operation at either 7½ ips or 15 ips and is self contained. Employing modular construction, the recorder enables ease of maintenance. One of the accessories available for the recorder is the Editec, a

system for automatic editing and animation on television tape. Combined with another accessory, the Electronic Editor, the device permits the VR-1100 to perform editing operations at costs lower than film. Through push-button operation, the Editec will turn several scenes into a completed program. The "splice" may be viewed before the actual editing is done, enabling engineers and editors to see that continuity will be proper. The system electronically marks the tape with tone bursts on a cue track. These gate the monitoring and recording circuits. By using the device, music may be prerecorded on the audio track and electronic video

A PLAN FOR MAKING ANTENNA PROOFS

Technical Talks by John Battison
— How to carry out a directional antenna proof-of-performance.

There comes a time in the life of every chief engineer when he is confronted with a directional antenna for the first time. When this happens don't let it upset you. On the contrary, accept it as a valuable experience — it will add a lot to your professional worth! In most cases the consulting engineer who fathered the design will be present to tune up the system and prove out the array. However, the day may come when, for reasons beyond your control, you have to do the work yourself. You may have to act as midwife until the consultant arrives, or after a siege of bad weather you may be faced with the job of getting back on the air, or of staying on the air after adjustments. Thus, for those who may be about to face their first DA, here is some helpful advice.

Equipment

Before proceeding with any tests or adjustments, make sure your field intensity measuring set is in proper working order and has been calibrated within the last 2 years. If it hasn't, don't waste time doing the proof—the FCC will not accept it if the meter is not properly calibrated. And do remember to send a copy of the calibration certificate with the proof material!

If you can borrow a second meter, do so; then set them up together and make simultaneous readings. They should agree within very close limits—take readings on four or five scales and attenuator settings to double check; if there is a very big difference try to find a known signal that you can check for calibration purposes. In any case, if one has recently been calibrated and the other is at the end of its grace period, use the meter with the later calibration. This is based on the theory that the later the calibration, the more accurate the meter . . . unless, of course, you know the readings are inaccurate. (It may seem that this subject has been over-emphasized; it has not! There is no point in wasting two or three weeks if the FCC won't accept your work because the meter is suspect.)

Next, obtain a two-way radio, CB unit, or any other communications gear licensed for your purpose. Arrange to have a receiver as close as possible to your assistant's post at the phasing equipment. Obtain a copy of the engineering report from the engineer who designed the array. Generally, there is one at the station, especially if it is a new installation. If it is an older station, and there has been a procession of engineers, it is quite possible that the report has gone the way of most old paper work. (In any case, when you arrived as chief you should have requested one from "the Boss," or the consulting engineer. After all, how can you know what is going on if you don't know how it should work?)

Get the necessary maps, with largest scale possible; up-to-date street maps, compass, pencils, ruler, slide rule, and dividers are essential. Check your auto odometer to prepare a calibration curve for locating points that are not easily identified on the maps due to lack of landmarks. Make up a recording sheet as shown in Fig. 1.

LOCATION POINT #	MILES	FIELD INTEN.	WEATHER	DA/NDA REMARKS (landmarks, etc.)	DATE
2	2.1	105 mv/m	clear	nondirectional; intersection highways 26 & 9; clear of all wires	2/15/63

Fig 1. Antenna proof data recording sheet for field intensity measurements.

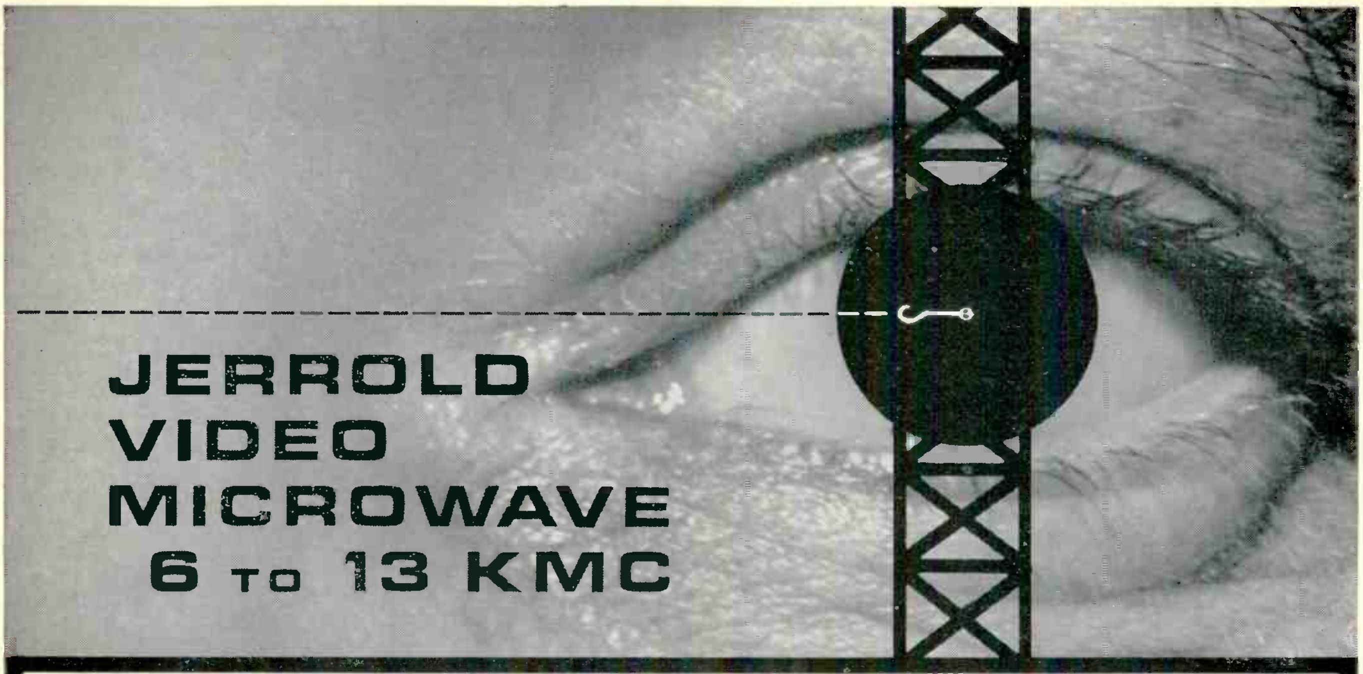
Place a number of these prepared sheets on a clipboard, and be sure of your facts regarding dates and directional/nondirectional operation. Remember, don't take measurements before 2 hours after sunrise, or after 2 hours before sunset, unless they are those taken in close where the field intensity is very high.

If the proof is on an older station, check very carefully to make sure no uncooperative power companies or factories have built towers or other large structures that could distort the pattern. If something of this sort has happened, and you feel it might upset your pattern, you should get in touch with your consulting engineer right away.[1]

In a new operation there should be nothing abnormal about the antenna site, and you can expect the pattern to behave as planned. But just to be sure, inspect the site and find out **before** you start that there is a brand new 300-foot steel tower just 350 feet from your center tower!

Assuming that the site is clear—and in the case of our new station this is most important—make a final double check for obstructions. Buildings, signs, etc., going up any-

[1] The Hot Water Tank at WJIL, Robert A. Jones, BROADCAST ENGINEERING, January, 1963.



. . . BEST FOR CATV, CCTV, ETV, AND STL USE

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- Most dependable in performance
- Easiest and most economical to operate and maintain
- Widest baseband—IF bandwidth 30 mc, video bandwidth 8 mc
- Greatest stability—±0.005%
- Individual power supplies–can't lose all channels at once

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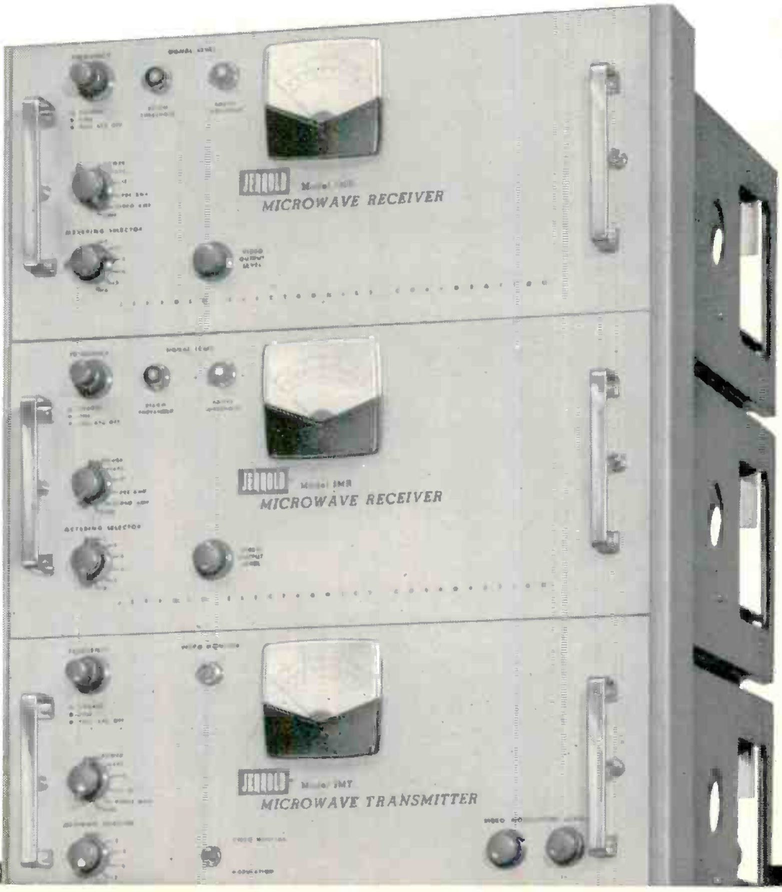
Take advantage of Jerrold's wide experience not only in supplying equipment but in helping you plan any hop from 20 to hundreds of miles. For complete information, write or call Jerrold Electronics, Philadelphia 32, Pa.



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Circle Item 10 on Tech Data Card

where near the tower site could cause trouble. In other words be sure that construction is completed **before** starting work. Be sure that this precaution includes the protective fence around the tower base.

Preliminary Setup

Before you actually start making measurements, make sure that all the purely mechanical things are taken care of, including paperwork. Get a looseleaf notebook and keep copious notes. These will help you not only during the measuring, but also when making up the report, and also later if you have the occasion to repeat the measurements or make further checks.

Orient yourself on the local map and lay out your radials. Normally eight will be required, unless for some good reason fewer will suffice. In addition to these radials, the FCC will specify some monitor points. Locate and mark these on the map at this time. Then mark your expected measuring points on the map, in accordance with the requirements of Section 3.186 of the Rules, starting with not less than 10 times the spacing between elements of the DA. Be very sure to observe the Rules regarding spacing—it is far better to make too many measurements than not enough.

Have the construction engineer's surveyor confirm that the towers are oriented properly, and located at the correct place. This is not as silly as it sounds—there are cases on record of DA's being built in the wrong place or pointing in the wrong direction. If possible, also verify the base height. List the limits on critical azimuths for quick reference purposes.

Inspections

Now make a mechanical inspection of the complete installation. Look at the transmission lines as well as the sampling loops and the coaxial lines running back to the transmitter buildings. Be sure the loops are about 14′ up the tower and that the line is insulated from the tower; then set the coupling at around 75%. A point to watch is that all loops are on the same sides of the towers. If they are not you may get unmatched current distribution readings.

If the coaxial transmission line is used, check pressure, and if pos-

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sible examine the route of the cable. If it is suspended on poles, ground the line at every support by means of 3″ copper strap. When the transmitter is fired up, check the lines for hot spots by walking along with the field intensity meter (Fig. 2). If hot spots are found, they can be brought under control by additional grounding at those points.

By now you should have checked all the connections in the antenna system and tuning units as well as the transmitter and phasing cubicles. Don't forget to check relay operation for two conditions:

1. Proper operation when power is applied.
2. Operation in the proper direction. It is not uncommon to find relays operating in the wrong direction when night or day patterns are called for.

Be sure that your electric service is supplying the proper voltage with the transmitter operating on full power. Check at this time for hot points in the wiring, especially those points connected to the transmitter. As time passes and the equipment heats up, poor connections (high-resistance-points) in the electrical wiring may cause voltage drops that could affect operation.

While on the electrical inspection tours be sure to inspect the tower lighting system for leakage, with a VTVM; if more than 15 volts is measured, find out why. Often the junction boxes are at fault. Be sure that any neutral wires in the lighting system are properly bonded. Make a final check across the base insulator and lighting transformer, or choke, to be absolutely sure that there are no grounds caused by bits of wire or construction metal hanging from the base of the tower.

Tune Up the Transmitter

If the installation is new, the manufacturer's field engineer will probably be present to tune up the transmitter before handing it over to you. If he is not, you must go through it with the instruction book and satisfy yourself that the transmitter is correctly wired, installed, and ready for use. Tune it first with a dummy antenna. (If you don't have a dummy a reasonable substitute for this purpose can be constructed from 100-watt light bulbs or elements out of electric radiators. While not exactly correct, these devices will absorb enough power for the necessary tests, and provide some operating leeway.) Be sure you are on correct frequency; have your measuring service make four or five checks during the testing period.

Finally, check the Construction Permit to be sure that you are familiar with the conditions of operation. Be sure, also, that the necessary OK's have been obtained from the FCC for equipment test.

Measurements

Identify the nondirectional tower and measure its impedance. Follow standard practice, measuring from 25 to 30 kc on each side of the operating frequency. The other towers should be floating unless they are approximately 180° in which case they must be detuned.

Check the effect of connecting the lighting transformer or lighting chokes. If there is any appreciable change in impedance, detune them by adding or removing some capacity. The following operations must be performed in a new installation: Measure phase shift and impedance (nominal) of sampling and transmission lines; then check the reactance of the coupling units and the mutual and self impedances of the towers. From the data obtained thus far, the impedances of the various drive points can be worked out. The system can then be set up on the phasor. (This assumes that the networks have been measured and checked.)

At this point the calibration of all the RF meters used in the antenna system should be checked by connecting them in series with the line to the nondirectional tower. It it important to bear in mind the FCC Rules regarding scales when making this test.

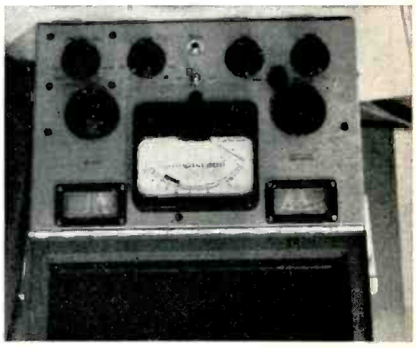

Fig. 2. A typical field-intensity set.

Tubes designed from the user's viewpoint

...use them wherever reliability is essential

When reliability really counts—as it does in industrial control applications—be sure with tubes custom-designed and tested for the job.

Sylvania engineers traveled the country—met with engineers and maintenance groups in broadcasting, public service radio, industry, the airlines—listened to their problems and studied them. From this came GB Gold Brand, a superior line of new and upgraded tubes, each tailor-made to a specific job. A given tube may have, for example, low noise, exceptional stability or vibration resistance. Or a critical parameter may be as much as three times the usual value. In each case, performance and reliability have been verified by actual user experience as well as laboratory testing.

This extra effort has paid off. "Excellent results," says an airline official. "No failures," reports a highway patrol department. "Hundreds of dollars saved in program interruptions," reports a TV station. "Less costly in the long run," discovered a county government. Similar results can be yours with a truly reliable, genuinely interchangeable GB Gold Brand Tube.

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GENERAL SYSTEM

Circle Item 14 on Tech Data Card

The transmitter should be fired up and all the necessary checks for proper operation made. When you are satisfied that the transmitter is operating properly, the phase monitor can be calibrated according to the manufacturer's instructions. The sampling currents can now be adjusted, and any required phase corrections made.

From here on it will be a case of checking phase shifts, currents, and power in the various antennas. If the initial phasor settings did not produce the required pattern as shown by the phase monitor, it will be necessary to initiate a series of corrections.

Measurements of Radiation

The nondirectional measurements can now be made. Check the monitor points and make directional antenna measurements on the previously plotted radials.

When checking your DA system, you should remember that although you may be primarily interested in obtaining the proper shape as described in the CP or license, you must also consider efficiency. To check this you must consider the size, or RMS, of the array. The expected RMS was calculated in the application; when the antenna measurements are completed the actual RMS can be calculated.

If the apparent RMS is higher than anticipated on the basis of the application, several points should be checked. First, the calculations could be at fault. Be sure the power division between one or more towers and the current ratios are correct. Possibly the engineer who designed the array made a mistake and came up with a tower gain in excess of that which the array actually provides. If this is the trouble, you can easily reduce the power to reasonable limits by readjusting the tuning and phasing networks, thus increasing effective resistance in the system.

If your RMS is too low (this is somewhat more frequently the case, especially when complicated tower arrangements are used), there may be unexpected losses in the system. Sometimes, of course, the original calculations were wrong, and it will thus be necessary to recompute the system efficiency. However, in the case of new DA's this very seldom happens. The FCC's engineers check the figure very carefully before the CP is issued. The trouble usually is found to be improper adjustment of the phasing equipment, or extra losses in the transmission lines because of improper terminations.

In case of trouble with a directional array, it is best to contact the station's consulting engineer before disturbing the adjustments. If you are installing a new station, some very valuable experience can be gained by working closely with the consulting engineer right from the first operation in the DA check. Actually there is no FCC requirement stating a consulting engineer **must** make the directional antenna proof. There is, however, a well enforced requirement that the engineer who makes the measurements must be properly qualified by experience and training. If there is any doubt at all, the Commission will require the engineer to substantiate his results, and occasionally a station engineer will perform a proof only to have it rejected. This then indicates the importance of accuracy to save time and money. ▲

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Circle Item 16 on Tech Data Card

CARTRIDGE TAPE AT WORK

by Patrick S. Finnegan* — How one station developed an efficient cartridge tape system which includes automatic switching.

WLBC Radio and Television has almost completely converted to the use of cartridge tape. Reel-to-reel tape had been used extensively for many years, so the switch to cartridges has been primarily a change in methods. Cartridges have added many new operational advantages, but also some new problems.

Our station management wished to create a new sound for WLBC radio best described by the slogan, "music you can sing, hum, or tap your toe to" — the type of music most of our listeners buy and play in their homes. The need for better music control, preservation of LP records, singing station breaks, music bridges, and tight, smooth flow of air presentation — all without undue material preparation problems — led us to the adoption of a cartridge tape system. The setup can most aptly be described as a "manually operated, automatic system."

Music selected from LP albums is dubbed onto tape, **one number** to each cartridge; our music library now consists of about 1800 selections on individual cartridges. Disc jockey "chatter" and song introductions are on one cartridge for each show. Openings, closings, announcements, station breaks, etc., are also on cartridges. All commercial announcements, even though they come in on disc, are dubbed onto tape.

System

Eight playback decks are employed in our radio control room (Fig. 1). Two are used with our Automatic Time Injector, and one is used for recording (with an appropriate amplifier).[1] The decks are the dual-F tone type, so that sequencing from one to another is automatic, providing a tight, even flow of program material.

Fig. 1. Radio control room equipment.

An automatic switcher handles four decks, with its output appearing on one fader of the console. The outputs of the other two decks each appear on a fader (Fig. 2). This arrangement enables us to fade a theme under voice announcements, and also to use one deck as a recorder.

Problems

The first problem was maintaining compatibility among machines (we have a total of 13 machines for both radio and television). While it is comparatively easy to record and playback on the same machine with a fairly good system response, it is quite another thing to use three recorders for supplying 13 machines with tapes.

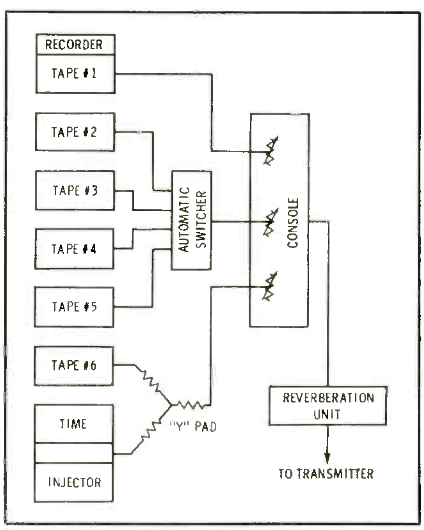


Fig. 2. Block diagram of cartridge tape system with automatic switcher and reverberation unit.

Shortly after changing to a cartridge tape system, we acquired a sophisticated reverberation unit. This brought about the most difficult problem, one which almost defied solution, even though the answer turned out to be simple. Each solution, however, seemed to present another difficulty.

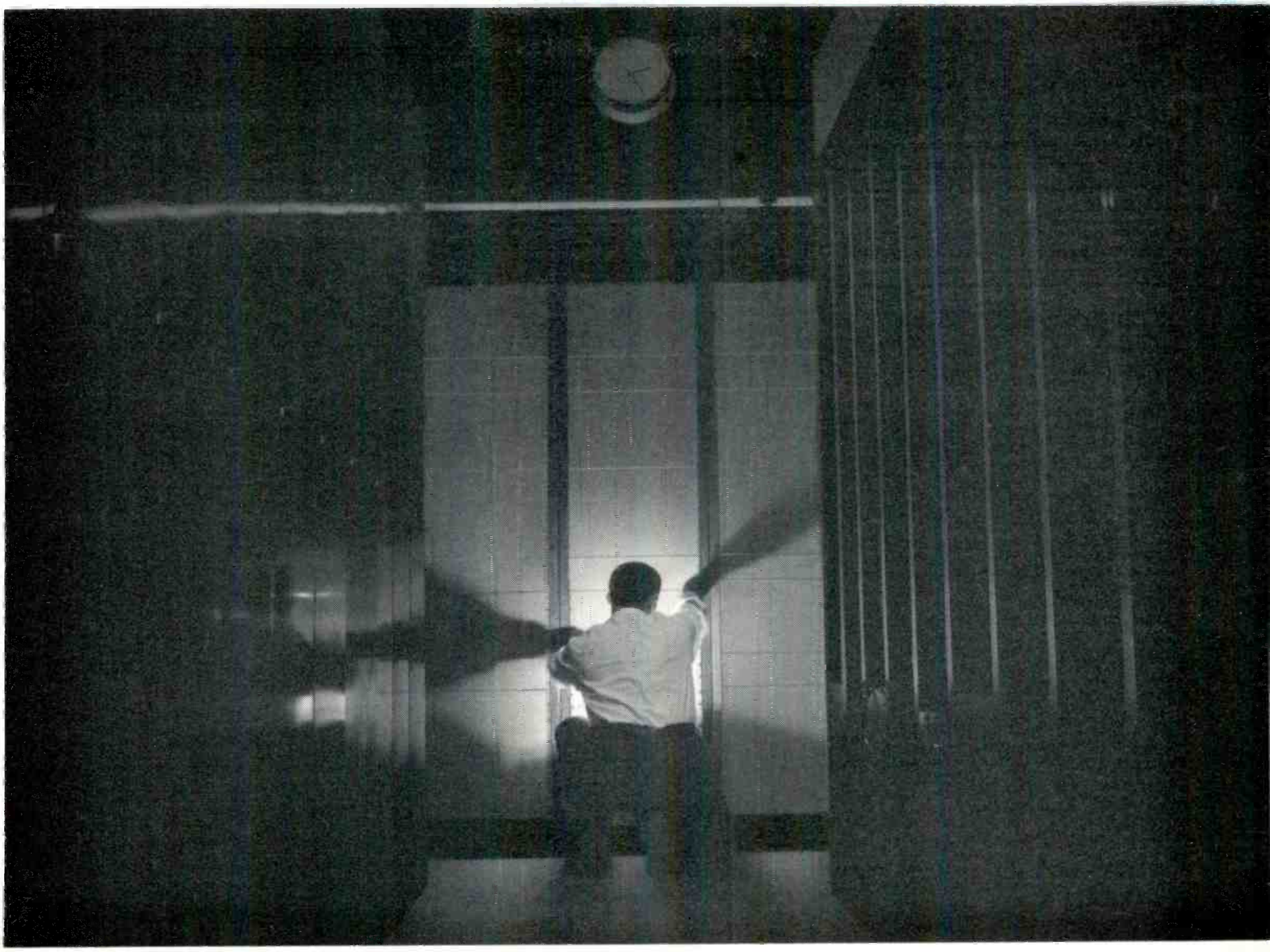
The compatibility problem was attacked at the master recorder first. This unit was sent back to the manufacturer for as nearly perfect alignment of heads, equalizers, and guides as was possible. We then made alignment and multitone tapes on this machine. All other machines, in addition the two other recorders, were adjusted to give essentially the same results as the master.

As one might expect, this took a lot of time and patience. One trick we learned to help speed up the process was to make a 20-second tape of a few pertinent tones. We make the initial adjustment with this tape, and then run the master multitone tape through each machine for fine alignment.

Maintaining compatibility is quite a chore. The heads on the master recorder for example, had to be replaced three times the first year due to wear. The new heads must be very carefully aligned, or the newly recorded material will not be compatible with the old. Head wear on the master is indicated when the switches also provided flexibility,

*Chief Engineer/VP, WLBC, Muncie, Indiana.

[1]Automatic Time Injector, Patrick S. Finnegan, BROADCAST ENGINEERING, October, 1962.



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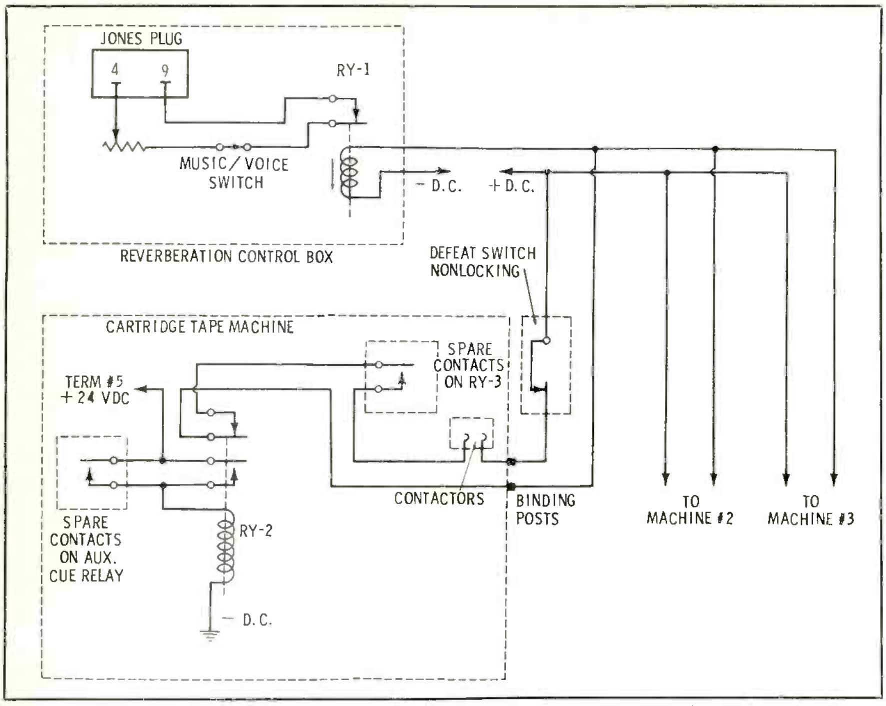

Fig. 3. Equipment modifications to operate the voice/music switching of the reverberation unit.

program level at the beginning is normal, but gets weaker as recording progresses (it is especially low with longer tapes). This was evident on the discjockey "chatter" tapes, which are about 5 minutes in length. The worn spots on the head fill up with oxide and lift the tape away from the head causing lower levels.

When the master cue head is worn trouble develops in the control room; tapes fail to trigger other decks, machines won't stop, or two units may go at the same time. This behavior is erratic, depending upon the sensitivity of the cue amplifiers. We permanently solved the problem of two machines starting at the same time, by wiring the trip circuit, through contacts on the auxiliary-start relay of the tape machines.[2] This relay is open during the first few seconds, disabling the automatic-stop circuit until the tone portion of the tape has passed the playback head. We found it necessary to replace the original device with a relay having more contacts. Worn heads on playback decks exhibit similar symptoms, but these are usually associated with the individual unit, making it easier to trace down.

Switching

At first, we tried simple toggle switches for the sequencing path, but this became both a limitation and a problem. Should a machine be out for any reason, starting had to be done manually. We eliminated this by installing a 10-position rotary switch for each machine. These

[2]The author's equipment consists of ATC Model 190 units in which the auxiliary start relay is designated K202.

since we can sequence any deck to any other except itself. The rotary switches couldn't be used directly, however, without some method of preventing the DC from one deck from effecting the control circuits of another. The simpliest solution was the use of silicon diodes in series with the lead to each machine to act as one-way current gates.

The reverberation unit was a real headache because it was placed in the system between the AGC amplifier and limiter, and applied reverberation on all program signals. The amount of reverberation was correct for music, but entirely too much for voice. Although the unit has a provision for selecting either music or voice modes, manual switching is impractical. The ideal arrangement is to have the music cartridge control the switching.

We first altered the operation of the manual switch in the control unit so the cartridge could take over control. We added a small strip of sensing foil to each music cartridge, on the tape-opening side. Contactors were a real problem; because there was nothing available on the market which would do the job. We decided to build our own. To make each switch, we glued two plastic 300-ohm TV twinlead connectors (female) together and drilled a hole in the center for mounting to the tape deck. Two contacts were then cut from Eimac finger stock, and drilled to match the holes in the connectors. To hold the contacts in place, rivets slightly larger than the holes were seated tightly in the plastic with a hot soldering iron. Wires are connected to these switches at the normal twinlead entrance. When these devices are properly placed on the decks, the foil on the music cartridge completes the circuit across the two fingers. (These switches have been in operation for 10 months without any trouble.)

Each playback deck was modified to operate with one of these switches (Fig. 3). A relay (RY-1) was mounted in the reverberation control box to complete the music/voice circuit. A pair of normally-open contacts of the auxiliary tone relay (RY-2) were wired as shown in Fig. 3, as was a set of normally open contacts of the main run relay (RY-3) of each deck.[3]

Operation

The modification works like this: With the deck idle, RY-3 contacts are open, so relay RY-1 in the control box is relaxed, and the reverberation unit is in the voice mode. When a deck is started RY-3 closes and remains so while machine is running. This completes the circuit through RY-2 normally closed contacts, through the contractors (providing cartridge with foil is across contacts), applying voltage to RY-1. This puts the reverberation unit in music mode. If a voice tape was to run simultaneosuly with music faded into the background the "defeat" switch is operated, causing the reverberation unit to switch back to the voice mode. At the end of a musical number when an auxiliary tone comes on, the cue relay operates causing relay RY-2 to pull in and remain energized with its holding contacts. This breaks the other contacts and puts the reverberation unit into voice mode during runout time. When the deck stops running, voltage is removed from terminal No. 5 and RY-2 drops out, restoring the system to normal.

Conclusion

WLBC Television has found cartridge tapes to be quite useful. All audio announcements (when announcer is off camera), station breaks, openings and closings of shows, etc., are recorded. We use no standby announcer at all, everything is on audio tape. Two playback decks are used with simple toggle switch sequencing, which was found to be adequate in most cases.

Two recording booths are kept

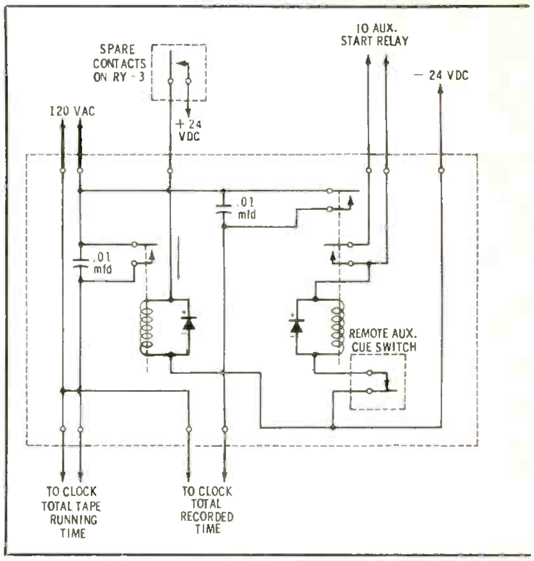

Fig. 4. Modifications to recording booth equipment, and clock unit for running and recorded time.

busy. Each has a recorder, AGC amplifier, turntables, monitors, and console. The booth recorders are modified to perform other tasks also. For example, each recorder has two timers; one shows total tape running time, while the other shows only the recorded time (Fig. 4). We found this to be quite helpful, especially when making long tapes.

To facilitate cleaning and general maintenance we installed pull-out shelves for each deck, and a large Jones plug to handle all connections for quick disconnects. We can pull a machine out of the rack and send it on its way to the shop in about 10 seconds.

We buy blank cartridges, and lubricated tape in bulk and "roll our own." We decided the pre-packaged lengths of tape were inadequate for our needs. The tape lengths of our 3,000 cartridges are tailored to suit individual applications, and thereby allow a savings in cost. ▲

[3]The main run/solenoid relay in the ATC 190 is designated K201.

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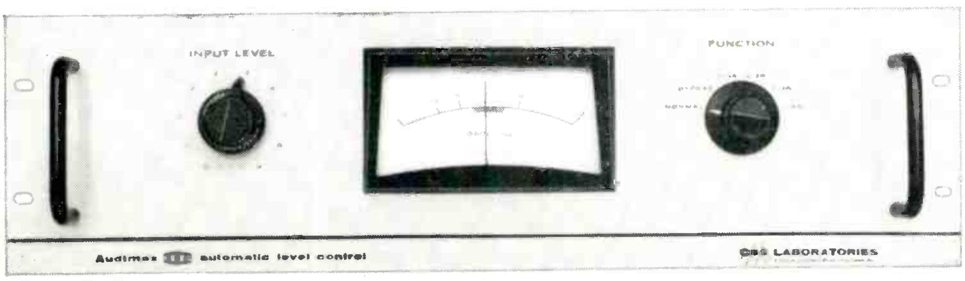

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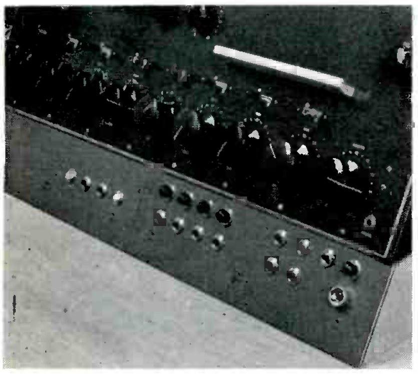
Circle Item 21 on Tech Data Card

ENGINEERS' EXCHANGE

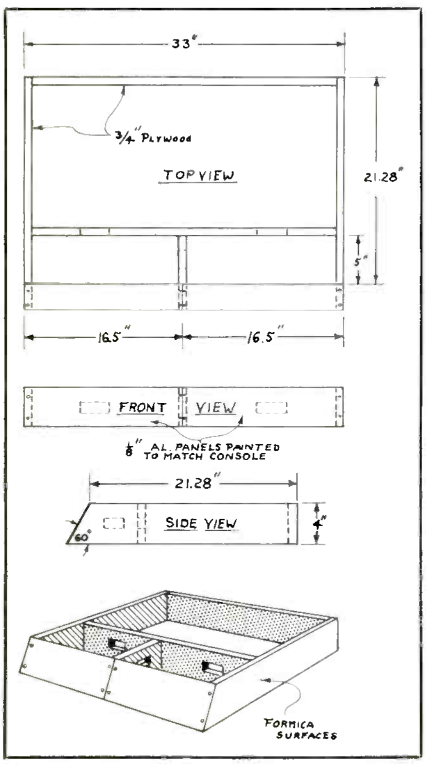


Console Accessory Panel

by Elton B. Chick, Rounsaville Radio Stations, Atlanta, Georgia

Present day radio, with its wide variety of sound effects and special equipment, requires numerous switches, indicators, and other control components at the audio console position. Convenient mounting space must be provided for these devices. A system which has proven quite effective in our radio operation is shown in the accompanying photo.

Here the console is elevated four inches on a pedestal made of plywood covered with Formica (to match the console desk). Two panels are mounted on the front surface and are wired so that either may be removed, independently of the other, for service or modification. The panels carry controls for echo, filter, tone and bell effects, as well as for tape cartridge players and a tape recorder. Space for additional controls is provided on the left panel.



Limiter Preamp

by Lyell Gunderson, Chief Engineer, KENN Radio, Farmington, New Mexico.

In the past three months I have become familiar with one of the problems confronting engineers in remote transmitter operation. The difficulty concerns working spot checks on the transmitter and other equipment at the transmitter site. Since our remote equipment is in use most of the time, a new amplifier or a modification of an existing device was necessary for voice announcements originating at the transmitter location.

Several unused preamps in our console are bypassed to provide high level inputs. So the answer was simple — install one of these units in the limiter, along with a microphone connector and change-over switch.

The first step is mounting the preamp. We located ours just behind the front drop-down panel for easy access to the internal wiring, and to keep the additional audio lines short. Then we mounted the connector and lever switch on the front panel of the limiter to provide convenient operation.

The switch is connected between the input pad and the input transformer,and is arranged to load the preamp during normal operation. Electrical location of this switch depends, of course, on the circuit of the individual equipment. We chose this arrangement because the preamp has just 40-db gain, possibly not enough to overcome the insertion loss of an input attenuator. There is an additional advantage to connecting the switch here—none of the limiter controls need to be changed for voice announcements and hence, there is no chance of forgetting to return them to normal settings once the job is finished.

A word of caution seems to be in order at this point. Check the

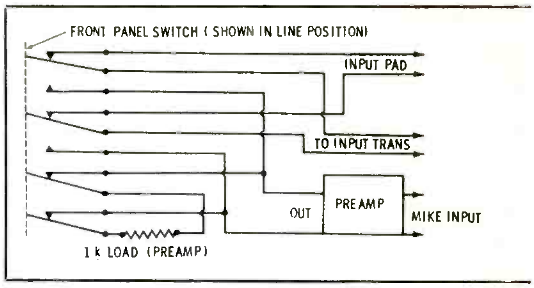


plate voltage of the preamp immediately after installation. The voltage in our limiter is so high that it was necessary to install a 22K resistor in the B+line.

Without changing any settings, the limiter indicates 10 db of compression on voice operation, resulting in good balance.

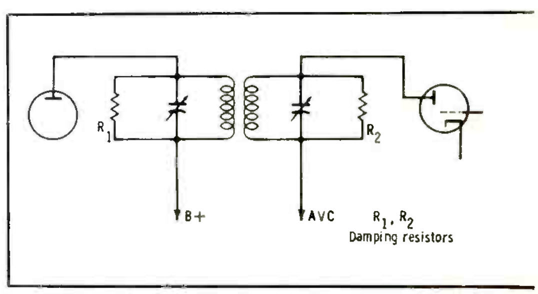
On-Air Monitor

by Sim S. Eagleson, Sr., Chief Engineer, WSBB Radio, New Smyrna Beach, Florida

At WSBB Radio, our console has no provision for supplying the monitor amplifier with on-air only audio which is desirable for the reception room, or lobby, speakers. As it was, all the necessary cueing and other auditioning procedures would constantly interrupt the monitor signal. After considering various simplified circuits which were possible within the console, we decided to make use of an old console-type broadcast radio receiver.

Actually, the conversion was simple. The IF amplifier strip was detuned, and both the input and output of each transformer was damped by shunting each with appropriate resistors. We used from 5 to 10k, but the value may vary depending on the amount of damping desired. The front end of the set was also detuned; this was necessary to prevent overloading of the detector and thereby avoid blasting.

This minor conversion also boosted overall audio quality since the IF amplifier curve was substantially broadened. Now everyone is happy with the on-air monitor, since the annoying cueing interruptions have been eliminated.



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Circle Item 22 on Tech Data Card

NEWS OF THE INDUSTRY

BBC Orders UHF Stations

Orders placed by the **British Broadcasting Corp.** for high power UHF television transmitters are resulting in requirements for American klystron tubes. Ordered were stations having 12 transmitters worth $1,820,000 from **Marconi Wireless Telegraph Co., Ltd.; Pye TVT, Ltd.,** received a $1,680,000 contract for 12 additional transmitters. The equipment of both English companies use klystrons built by **Eitel-McCullough, Inc.,** San Carlos, Calif., in aural and visual channels.

New Members of Gold Microphone Club

Frank Sinatra, Dean Martin, and **Sammy Davis, Jr.,** are the most recent members of the **Shure** Gold Microphone Club. Each received an inscribed gold-plated Shure Unidyne III microphone during their recent appearance in a night club near Chicago. The awards were made as part of the program sponsored by **Shure Brothers, Inc.,** Evanston, Ill., in appreciation for outstanding showmanship and recognition of the microphones critical importance to successful night club entertaining.

Exhibit Features Studio and Editing Equipment

The 93rd SMPTE Convention Equipment Exhibit, to be held April 22-25, has received such response from the motion picture and television industry that it has been necessary to reserve more space at The Traymore, Atlantic City, according to Dennis E. Kealey, Reevesound Co., Inc., Exhibit Chairman. An optical FX unit with rotator lens and prism attachments for television cameras and 16mm and 35mm motion picture cameras is to be shown by The Camera Mart, Inc., New York. It reproduces images upside down, sideways, or tilted at any angle, and enables a scene to be rotated 360° in both clockwise and counterclockwise directions. Used with the prisms, the unit can produce multiple identical images from a single object, the number of images dependent on the number of prism faces. Measures taken by the industry to expedite sound and film editing will be much in evidence at the show. Two examples, also in the Camera Mart display, are a dual sound reader and an extension plate for attaching additional soundheads to a standard Moviola. Two editing devices from Hollywood Film Co. are a film slitter for 35/32mm, and a film repair and splicing machine that uses Mylar tape. The latter perforates the tape and shears off the excess in one operation. Among the many other items that will be shown are television cameras, film and tape recording equipment, film processors, laboratory test equipment, zoom optics, high-speed cameras, and lighting equipment.

General Radio Opens Dallas Office

General Radio Co., West Concord, Mass., announces the opening of a new sales engineering office in Dallas, Tex. The new office, headed by Edward F. Sutherland, will cover Colorado, Oklahoma, Arkansas, Louisiana, and all of Texas except El Paso. Dallas is the tenth district sales office for General Radio, and the third opened in the past 15 months, expanding the direct field sales policy begun when GR opened its New York office almost 30 years ago.

Intercity Microwave System Uses Three Frequencies

A unique microwave system which uses a different frequency for each of its three hops has begun relaying network television programs over a 137-mile path from **KRCA,** Los Angeles, to **KOGO-TV,** San Diego. A single system using frequencies in the 2,000, 7,000, and 13,000 megacycle bands demonstrates the versatility of microwave for TV relay, according to E. C. Tracy, Manager, Broadcast Sales Dept., **RCA Broadcast and Communications Products Div.**

LeRoy A. Bellwood, KOGO-TV Director of Engineering, said the frequencies were chosen to offset adverse signal conditions in the inter-city path. Outbound from Los Angeles, the TV signal is beamed at 13 kmc for a distance of 17 miles to Mt. Wilson in the first leg of the relay. The 13-kmc band was selected to avoid the congestion at 7 kmc in the Los Angeles area. Near the summit of the 5,600′ mountain, a repeater station relays the signal on its longest hop of 108 miles, 40 miles of which is over Pacific Ocean waters. The second leg uses a 2-kmc frequency to overcome signal propagation characteristics created by the distance and by surface reflections from the water.

At Mt. Soledad, 12 miles from KOGO-TV's San Diego studio, the incoming signal is reinforced through space diversity, a method of employing two receiving antennas and switching their outputs to provide the best signal-to-noise ratio. The Mt. Soledad station uses a 19′ dish, one of the largest ever built for TV relay service, and a companion 10-foot dish. The final leg in the system takes the signal at 7 kmc to the studio. Microwave transmitters and receivers are multiplexed into common parabola antennas at the studio and at Mt. Soledad, the transmitter site, to provide simultaneous sending and receiving service between the two points.

Lighting for Studios

(Continued from page 15)

finesse of pattern projectors, eye lights, etc., are added. The lighting director uses his light meter while making adjustments, and continuously checks the monitor. In fact the monitor checking is what counts—the lighting is set for the monitor effect and not exactly by light-meter or eye. Since the audience sees what is on the monitor, tube response, not eye response, is what counts.

For a simple show (e.g., a panel show) a light plot may not even be prepared. In this case the director simply moves a few lights to obtain the desired results. However, he should always check out the result with people on set and with a camera and monitor.

Here are some lighting pointers:

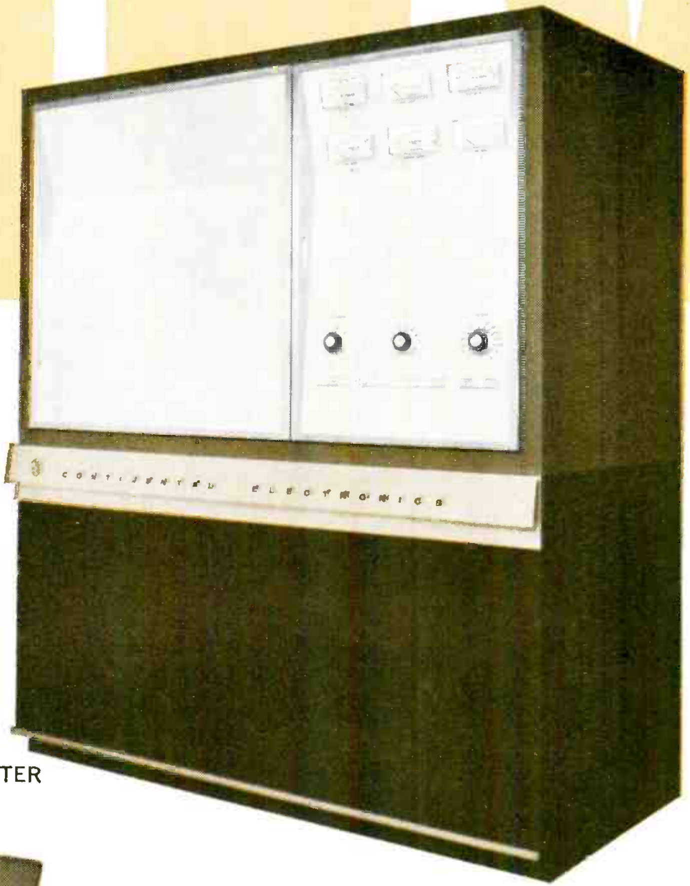
1. When foot-candle levels are mentioned, they are for incident light; that is, with the light meter turned directly toward the TV camera.
2. The practical brightness/contrast ratio for operational use is 30 or 40 to 1, even though "the book" says 20 to 1—stops between f-8 and f-16 are generally used to provide good depth of focus.
3. As the f-stop is decreased, depth of focus decreases and the background loses sharpness. As the f-stop is decreased, lower light levels should be used. Stated differently, for operational use where light levels are low, reduce the f-stop, but remember depth of focus will be reduced.
4. When more light is required on the actors' faces and none is available, reduce the light intensity on the background. This will increase the brightness/contrast ratio between the actors' faces and the background, and create the same effect as more light on the actors' faces.
5. Always let your video control operator know what you are doing—he can nullify an effect that you worked hard to create.
6. Try to keep actors as far in front of the scenery as possible to give proper angle for your back lights and also reduce actors' shadows on scenery.
7. Use barn doors on backlites to prevent glare into camera lenses.
8. Use lens hoods to increase camera mobility.
9. Pattern projecting ellipsoidals can be used to break up a shadow that can't be eliminated.
10. Specific personnel must be responsible for lighting, lighting equipment, and lighting equipment maintenance. ▲

Fig. 5. Checking lighting plans during a technical rehearsal in the studio.

About The Cover

The cover, this month, shows one portion of the exhibit area at the **41st Annual Convention** of the **National Association** of **Broadcasters.** This important event, with its **Engineering Conference,** was held at the **Conrad Hilton Hotel** in **Chicago, Illinois, March 31** to **April 3.** More than 70 manufacturers, representatives, and associations manned booths on the display floor—the largest lineup of exhibits and demonstrations in the history of the Convention. Countless new products were introduced, and several innovations in equipment, systems, and techniques were discussed and demonstrated. A number of special events took place during the four days. In addition to the sessions of the Engineering Conference covering all technical aspects of broadcasting, numerous meetings, luncheons, and receptions were held in and around the convention hotel. The registration during the four day period totaled well over 3400 persons. As a wrap-up for the show, the 41st Annual Banquet was held on the evening of Wednesday, April 3rd.

NEW



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AM BROADCAST TRANSMITTER

SERIES 1100 TAPE TRANSPORTS AND
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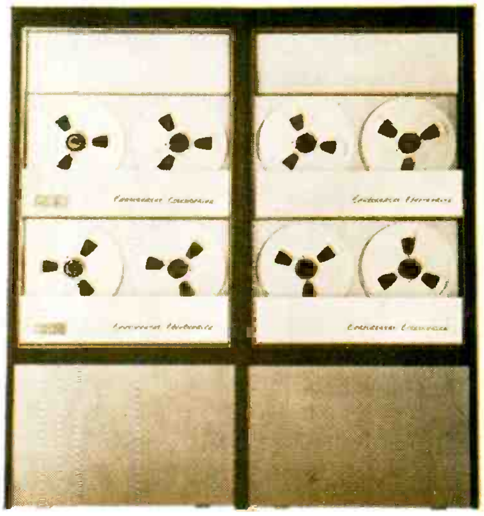

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Circle Item 38 on Tech Data Card

Spectrum Display

(Continued from page 17)

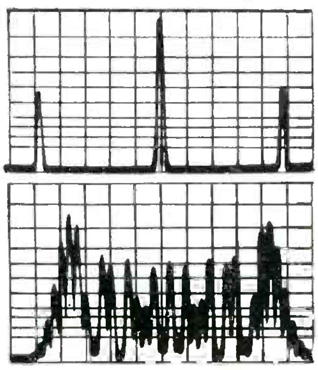
markers are set on the fifth line, an extra division is available for measuring overmodulation. In Fig. 7C, the sweep width has been increased to 300 kc, with markers at 75 kc and marker harmonics at 150 kc.

Modulation Monitor

The use of the markers when the spectrum display unit is functioning as a frequency deviation monitor is shown in Figs. 8 and 9. Theoretically, the spectrum of a frequency modulated wave consists of a carrier and an infinite number of side frequencies above and below the carrier; the frequency distance between adjacent components is equal to the modulating audio frequency. Fortunately, in practice, the amplitude of the side components dies off quite rapidly beyond the maximum frequency deviation. At low audio frequencies, up to about 5 kc, the bandwidth is very closely equal to twice the frequency deviation. At the highest audio frequencies, the bandwidth may exceed the total deviation by as much as 40%. However, in spite of preemphasis, the energy at these frequencies in a complex voice or music wave is usually too low to cause overmodulation.

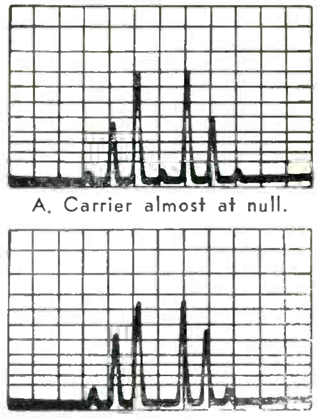
The modulation monitor for the TV or FM station may be accurately calibrated by the Bessel null technique, which makes use of the fact that the carrier goes to zero at certain deviation ratios, such as 2.4, 5.52, 8.65 and 11.8. (Deviation ratio is the ratio of the frequency deviation in kilocycles to the modulating frequency in kilocycles.) Considering that the sidebands should be separated by at least 5 kc for good resolution and that the upper

A. 75-kc markers.



B. 100% modulation at 5-kc.

Fig. 9. Spectrum of 75-kc markers.



A. Carrier almost at null.

B. Carrier nulled out.

Fig. 10. Bessell null measurements.

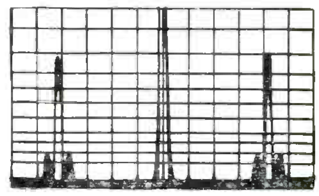


Fig. 11. FM signal with 67-kc subcarrier.

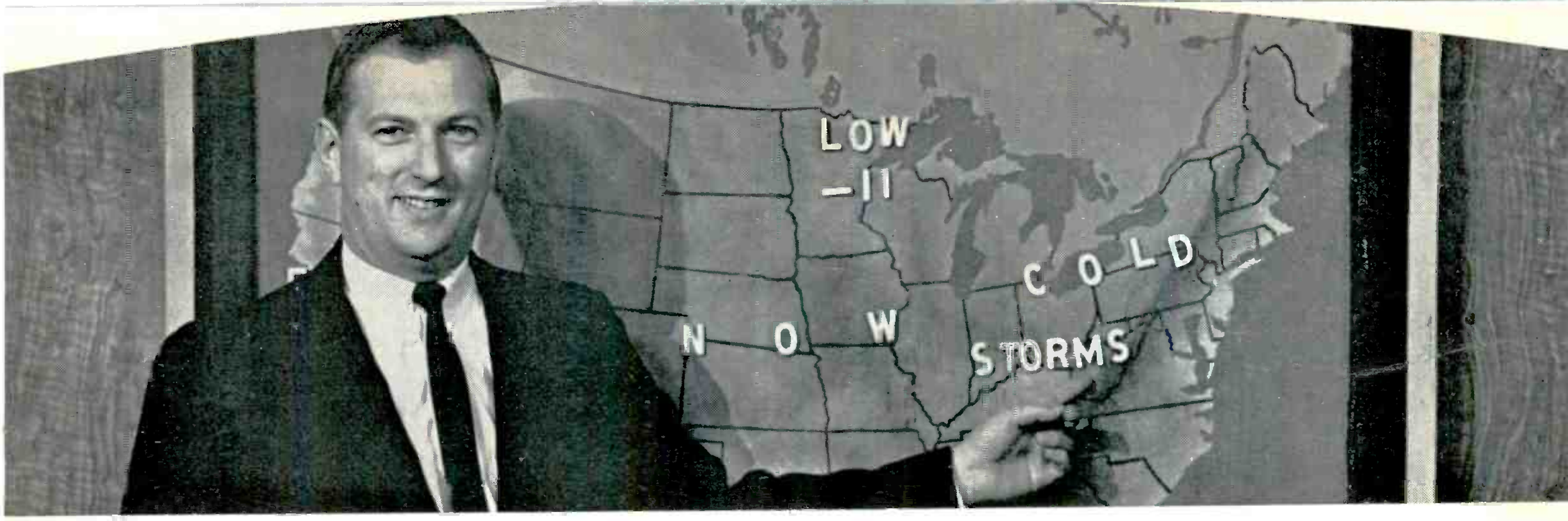
limit of most audio oscillators is 20 kc, the optimum ratios for measuring 75-kc deviation are 5.52 and 8.65. This requires modulation frequencies of 13.6 and 8.7 kc, respectively. For 25-kc deviation, a modulating frequency of 10.4 kc would produce a ratio of 2.4.

Fig. 10A shows the carrier approaching a null as the amplitude of the 13.6-kc modulating signal is increased; in Fig. 10B, the null has been obtained.

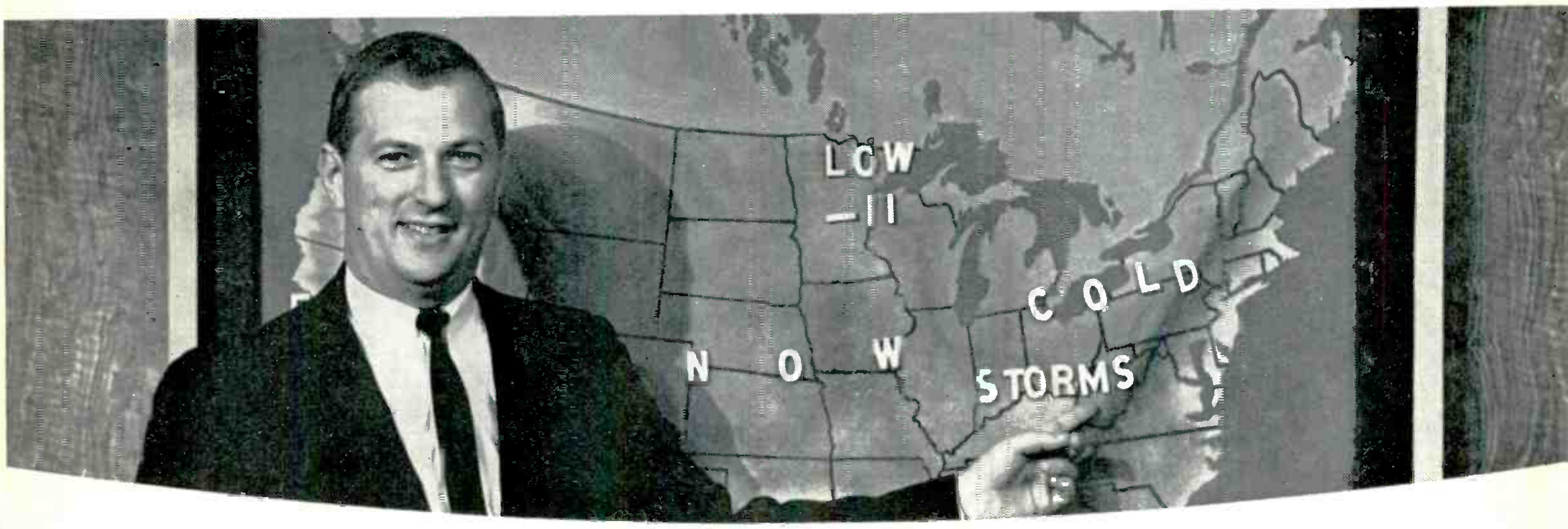
Fig. 11 illustrates the appearance of an FM carrier on which is multiplexed a 67-kc SCA subcarrier. There is no modulation on the main carrier; the subcarrier is modulated to 5-kc deviation. Percent of subcarrier injection, symmetry of modulation, and frequency deviation of the subcarrier can be measured.

In closing, it should be mentioned that all of the pictures which were taken of the SDU screen were done with a Polaroid camera mounted on a standard scope mount. The film used was Polaroid No. 146-L, which produces a film positive mountable in a 3¼ x 4-inch lantern slide mount. The exposure time required is two seconds. Much sharper pictures are obtainable with the standard fast speed No. 146 film, where the use for slides is not required. ▲

Editor's Note: The material in this article was presented at the 17th annual NAB Engineering Conference, Chicago, Ill., April 1, 1963.



WHY SHOULD THIS PICTURE...
COST TWICE AS MUCH AS THIS ONE?



Obviously it shouldn't. Yet most TV stations are still paying twice as much as necessary to transmit news broadcasts, panel shows, live audience shows, live spots...in fact about 80 per cent of all studio work. Significant new technological advances in Vidicons now make it possible for you to put quality pictures on the air in these scenes at ½ the price.

A lot of people are still nursing the idea (once true) that a Vidicon Camera won't give good picture quality. Take a close look at the two pictures here. One is **EMI** Vidicon quality; the other is Image Orthicon quality. Can you tell the difference? Well, the viewers can't either.

Contact Electra Megadyne, Inc. for the full story on how you can save money using Vidicon Cameras in your studio.

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Circle Item 29 on Tech Data Card

Image Orthicon & Vidicon Camera Chains • Video & Audio Switching & Distribution Systems • Monitors • Recording Tape • Complete Custom Studio Equipment

Harmonic Suppression

(Continued from page 13)

additional harmonic attenuation. Generally, the inductor located in series with the capacitor in the shunt arm is employed to adjust the value of the capacitor. In most cases, this series circuit can be resonated at the 2nd harmonic by adjusting the inductor. The two other inductors, in the series arms, are then adjusted with an RF bridge so that the input to the T-network matches the transmission line from the transmitter (normally 50 ohms).

Any change that is made in an existing antenna coupling unit must take into consideration a possible higher circulating current in the capacitor. The capacitor current is almost proportional to the phase shift in a T-network, and if any doubt exists regarding this current, it can be determined by means of a series RF ammeter. The current, as indicated by the meter, should not exceed the rating of the capacitor when the transmitter is undergoing 100% tone modulation.

The configuration of Fig. 3C can be modified to resemble that of Fig. 4, which provides additional circuits for harmonic attenuation. The series circuit in the shunt arm can be tuned to the 2nd harmonic, and the parallel circuit in each of the series arms can be tuned to any combination of harmonic frequencies. In tuning each parallel circuit, the variable tap on the inductor associated with the capacitor is first adjusted for parallel resonance at the desired harmonic frequency. This operation must be performed on both parallel circuits before the complete network is adjusted for a proper input impedance at the operating frequency, by adjusting the remaining turns on the inductor associated with each series arm. Since each series-arm parallel circuit is resonant at the harmonic frequency, it appears like an inductive reactance at the operating frequency and the current through the capacitor is low compared to the current through the inductance. Normally, this type of T-network must be adjusted for a high value of phase shift, due to the high residual inductive reactance in the parallel circuits of the series arms. Other more complicated circuits have been devised to overcome this shortcoming, but are beyond the scope of this article.

Adjustment and Measurement

As a starting point, the most practical way to adjust a harmonic filter is by means of an RF Bridge. For preliminary measurements, a grid dip meter may also be used.

Series-type filter circuits are disconnected from the transmitter circuit, and the RF bridge is connected to the filter at that point. With measurements being made at the desired harmonic frequency, the circuit is adjusted for zero reactance as indicated on the dial of the bridge. If heavy components are employed, the value of the resistive component as measured on the bridge should be very low. In adjusting parallel circuits by means of a bridge, the components can be connected in series and adjusted by the above procedure, or the branches can be adjusted separately with one end of each grounded. In the latter method, the capacitive reactance (this may comprise a capacitor and inductance in series) must be adjusted to equal the inductive reactance at the desired frequency. Better accuracy can be obtained on the RF bridge if the initial balance is set inductive at 100 or 200 ohms (or even higher). This way both inductive reactance (additive) and capacitive reactance (subtractive) can be read on the low part of the reactance dial.

For adjusting series-type filters with a grid dip meter, the circuit can be disconnected from the transmitter equipment and the capacitor and inductor connected in parallel. An alternate method is to run a good ground connection to the top of the filter circuit where it connects to the transmitting equipment, resulting in a parallel circuit. After making either of these changes in the filter (without changing location), it is tuned to resonance at

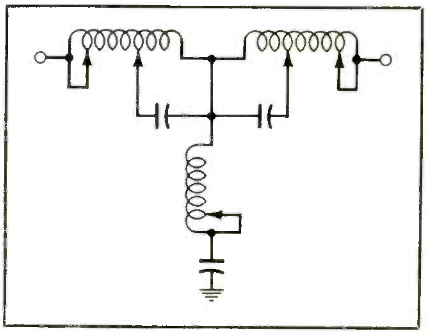


Fig. 4. Series/parallel tuned T-network.

the harmonic frequency by means of the grid dip meter.

A filter cannot be adjusted for maximum harmonic attenuation with an RF bridge or a grid dip meter because this measuring equipment disturbs the proper resonance of the circuit. For maximum harmonic attenuation, the filter should be adjusted under normal operating connections and with measurements or observations being made at or beyond the output of all equipment.

The most widely used method of precisely adjusting a harmonic filter, after making preliminary adjustments with a bridge or dip meter, is by means of the S meter on a communications receiver located remotely from the station. By means of telephone communication the filter can be adjusted for minimum deflection on the S meter at the harmonic frequency, thereby obtaining ultimate efficiency.

If a harmonic filter is installed by a station, in compliance with FCC Rules, it is sometimes necessary to determine the db improvement in harmonic attenuation. A measuring site, clear of buildings and power lines, should be selected approximately one mile from the station. Field intensity measurements should be made at the station operating frequency and at the required harmonic frequencies. It may be necessary to move closer to the station if the harmonics are of very low amplitude; but the possibility of spurious signals being generated in the measuring equipment (from high signal levels at the operating frequency) should not be overlooked. It is recommended that measurements be made at the same location before and after the installation, or returning, of a harmonic filter. If interference to a critical communications service is produced, it may be necessary to select a number of measuring sites and average the measurements before and after suppressing the harmonic radiation.

In calculating the db factor for harmonics the following formula is used: $db = 20 \log_{10} \frac{eo}{eh}$ where,

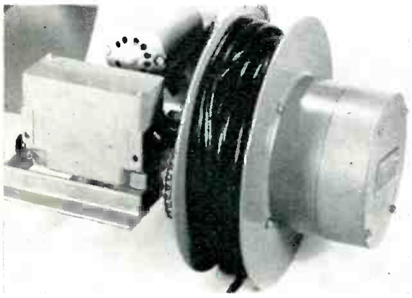
eo is the signal strength in mv/m at the operating frequency,

eh is the signal strength in mv/m at the harmonic frequency.

This is the standard formula for voltage ratios and many engineers find it more convenient to consult the db tables in reference books. Based on this formula, if the signal at the station operating frequency measure 100 mv/m and at the same measuring site the 2nd harmonic measures .01 mv/m, the harmonic is attenuated 80 db.

In performing RF harmonic measurements on transmitters, in connection with type-approval applications filed with the FCC, the present FCC Rule 2.524 requires that harmonics and other spurious frequencies be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. For the average standard broadcast station, this measurement procedure is not very practical in running down harmonics, due to the special measuring equipment and dummy RF load required. This method does not take advantage of the extra harmonic attenuation available in the antenna coupling units, and therefore does not produce results that reflect a more favorable normal operating condition. ▲

NEW PRODUCTS



Motor-Controlled Microphone Reel

Raising and lowering multi-microphone installations in auditorium ceilings or sports arenas is simplified with this newly-developed motor-controlled microphone cable reel by **Industrial Electric Reels, Inc.,** Omaha, Nebraska. Operated from a remote control push-button station, the reel is powered by a reversing-type 115-volt AC single-phase motor with a switch that will not permit overtravel up or down. The spool accommodates more than 100 feet of five-conductor microphone cable, and the unit can be furnished with from one to eight conductor collector rings.

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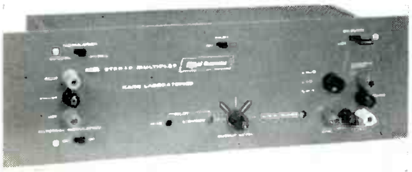

Stereo Signal Generator

A generator which produces the FCC specified composite signal for FM stereo broadcasting, has been announced by **Karg Laboratories,** Norwalk, Conn. Designated the MX-1G, the device has an internal audio oscillator and front-panel switching to generate stereo modulation of right, left, or both channels simultaneously, as well as monophonic modulation of both channels with the pilot signal on or off. The unit thus permits rapid checking of stereo demodulator circuitry. Channel separation, sync pull-in and hold-in range, and channel balance can be measured and adjusted. The device has a separation of 40 db min., carrier suppression of 40 db min., output level variable from 0 to 15 volts p-p, output impedance of 600 ohms, and frequency response of 40 to 15,000 cps ±1 db. The generator, which boasts distortion of less than 1%, provides modulation frequency sync and pilot frequency sync for an oscilloscope, and a carrier freq. test jack. Price is $250 for cabinet model wired, $150 for kit, and $255 for rack model.

Circle Item 40 on Tech Data Card

Mono/Stereo Test Record

The first test record specifically designed to check and calibrate both monophonic and stereophonic audio broadcast equipment was announced today by **CBS Laboratories,** div. of Columbia Broadcasting System, Inc. The BTR 150 is capable of checking the dynamic accuracy of VU meters, providing a ballistic calibration signal as specified by the ASA Standard C 16.5-1954. It also provides signals for adjusting level controls and limiters, and has bands for checking the frequency response of monophonic and stereo phono pickups; turntable rumble, flutter, and wow; and channel phasing. The record is priced at $10 including instructions, and is available postpaid from the manufacturer.

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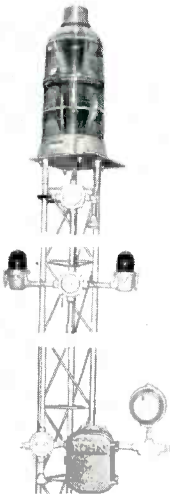

Tower Lighting Equipment

Rohn Manufacturing Co., Peoria, Ill., now offers a line of obstruction lights and beacons for installation on towers, or other structures. The B-1 MM Code Beacon, designed to meet FAA and FCC specs, is intended for use on TV, microwave, and transmission-line towers; water tanks; and other lofty structures for aircraft warning purposes. Obstruction lights are available in either single or double models, and meet regulations for use as warning lights on towers. Also included in the line are beacon flasher units and junction boxes.

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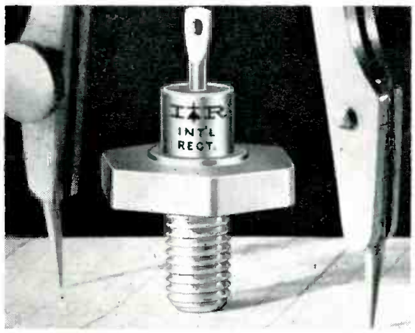

50-Watt Zener Voltage Regulators

A series of stud-mounted, 50-watt, silicon zener diodes (JEDEC types 1N3305-1N3340), spanning the voltage range from 6.8 to 100 volts in 5, 10, and 20% voltage tolerances types were displayed by **International Rectifier Corp.,** El Segundo, Calif., at the IEEE show. These rugged devices are designed to provide very high stability over a wide temperature range (−65 to + 175° C) in such applications as DC voltage regulating, clipping and clamping circuits, and limiting and surge protection. Also on hand at the booths was a series of 70- to 250-amp silicon rectifiers, subminiature light-activated silicon **PNPN** switches, zener-diode lab kits, and integrated, silicon-controlled, rectifier power stacks.

Circle Item 43 on Tech Data Card

Light-Weight Cinema Light

General Electric's new light-weight, portable Cinema Light, which weighs 8½ pounds including its sealed beam lamp and nickel-cadmium battery pack, is proving a boon to photographers on news coverage assignments and other on-the-spot jobs. It is capable of being fully recharged (giving 10 to 12 minutes of light in 60 minutes) by either plugging it into a household current or by means of an inverter and a car battery. The lights come equipped with a wide-angle, 3400 K, 6500 candlepower light source.

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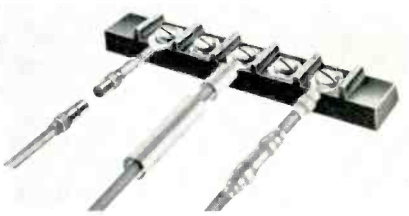

Semi-Rigid Shrinkable Tubing

A semi-rigid, irradiated, heat shrinkage tubing that provides maximum strength at stress or connection points has been introduced by **Alpha Wire Corp.,** New York, N. Y. Of extremely strong, heavy-wall, and abrasion-resistant extruded material, the tubings are supplied in expanded form and slip easily over the object to be covered. When a temperature of approximately 275° F (135° C) is applied the tubings immediately return (within seven seconds) to their predetermined diameter, approximately 50% smaller, forming a permanent mechanical bond. Applications include coaxial cable build-up termination and connector insulation, splicing, and encapsulation. FIT-290, clear tubing is especially useful for protecting and encapsulating wire or components so that printed data is clearly visible, and inspection simplified. The shrinking process may be accomplished by use of an Alpha hot air gun (HG-1), an oven, radiant heat, or hot liquid dip.

Circle Item 45 on Tech Data Card

High-Current Mercury Vapor Rectifier

Amperex Electronic Corp., Power Tube Department, Hicksville, L. I., N. Y., has announced a grid-controlled mercury vapor half-wave rectifier tube, featuring an anode current rating of 3 amps at a PIV below 15 kv. Ideally suited for use with the type 6693 for controlling high-voltage power supplies such as in broadcast equipment, the 8270 is a long life tube with a voltage drop of 12 volts. Three type 8270 tubes used in conjunction with three Amperex 6693's can deliver 12 kv at 9 amps in a three-phase full-wave power supply. The tube operates at 150 cps maximum. Its ionization time is 10 usec maximum; deionization time is 500 usec maximum. Price is $48.00.

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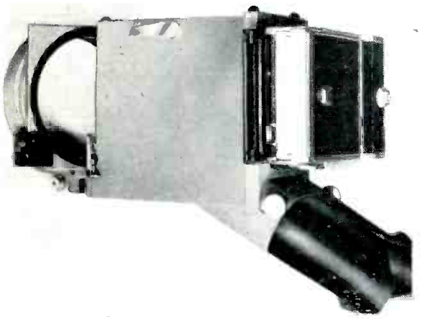


Die-Cast Oscilloscope Cameras

A new versatile oscilloscope camera has been announced by **Du Mont Laboratories, Divisions of Fairchild Camera and Instrument Corp.**, Clifton, N. J. The new cameras feature vibration-free mounting, light-tight rubber viewing hoods, "non-jam" lever-actuated shutters, and capability to fit any 5" oscilloscope. The 453 series also has the advantage of object-to-image ratios from 1:1 to 1:0.7 with one lens and without use of tools, spacers, or gauges. Though the basic cameras utilize 3½" x 4½" polaroid backs, other backs may be interchanged for records from 4" x 5" to 35-mm. Prices range from $350.00 to $425.00.

Circle Item 47 on Tech Data Card

Tape Eraser

A bulk tape eraser, Model 55-03, has been introduced by **Roberts Electronics** for use with reels up to 10 inches in diameter. Efficient and easy to use, the device quickly erases an entire reel of tape, reducing background noise levels below that left by most normal tape recorder erase heads. The units are priced at $24.50.

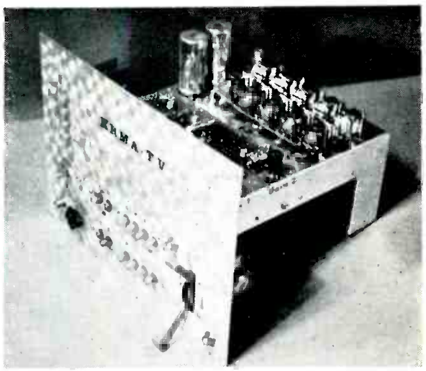
Circle Item 48 on Tech Data Card

Dynamic Microphone Assembly

A microphone assembly designed specifically to meet critical needs for high speech intelligibility from telephone handsets is now in production and distribution by **Altec Lansing Corp.**, Anaheim, Calif. The 690A Microphone assembly is a combination of a miniature dynamic microphone and a transistorized amplifier (both encapsulated in a single unit), and directly replaces the conventional carbon transmitter used in handsets. With a frequency range of 200-10,000 cps, the device obtains its operating voltage from the leads formerly connected to the carbon transmitter; a bridge circuit permits operation without regard to supply voltage polarity. The 690 employs a sintered bronze filter and Mylar polyester diaphragm proving protection for the element from voice moisture, humidity, shock, blast, and corrosive fumes. Among the uses of the assembly are radio and TV participation programs, mobile news and special events communications systems, and other broadcast applications.

Circle Item 49 on Tech Data Card

• Please turn to page 50



Here's A Preview of Next Month's issue

THE ECONOMY VIDEO SWITCHER

How to construct a transistorized, relay-operated, video switcher for standby use.

•

THEORY OF DIRECTIONAL ANTENNA SYSTEMS — PART 1

An explanation of the theory behind directional arrays and their characteristics.

•

TRANSMISSION LINES — A Practical Approach

Technical Talks — The principles of transmission lines, in theory and practice.

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WHAT TO DO WHEN THE PROOF OF PERFORMANCE FLOPS — PART 1

The first of five parts tells how to begin checking out a broadcast system in preparation for, or following the failure of, a proof.

•

A NEW METHOD OF STEREO BROADCASTING

From a paper presented at the NAB Engineering Conference on a new system for broadcasting stereo.

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ENGINEERS' TECH DATA SECTION

AUDIO & RECORDING EQUIPMENT

64. ALTEC LANSING—Planning guide includes sound system information and wiring layouts.
65. AUTOMATIC TAPE CONTROL—Booklet entitled "Planning for Automated Radio Programming."
66. BROADCAST ELECTRONICS—Spec sheets on cartridge tape recorders, players, and winders; plus cartridge racks and turntable preamp.
67. KUDELSKI—Brochure describes miniature portable tape recorder with wire frequency range and lip-sync.
68. NORTON ASSOCIATES—Specs on miniature tape-recording heads.
69. RCA VICTOR RECORD DIV.—Brochure lists properties of company's magnetic recording tape.
70. STANCIL-HOFFMAN—Bulletins on battery-operated portable recorder, magnetic recorder/reproducer, and high-speed tape duplicators.
71. TUNER CO.—Spec sheet describes dynamic lavalier microphone.

COMPONENTS & MATERIALS

72. ALPHA WIRE CORP.—Catalogs list electronic tubing, wire, and cable.
73. CENTRALAB—Data sheet covers high-alumina ceramic material with high dielectric constant and low loss.
74. COLUMBIA TECHNICAL CORP.—Index describes family of coatings, potting compounds, dopes, encapsulants, adhesives and cements.
75. DIALIGHT CORP. — Subminiature illuminated push-button switches and matching indicator lights are listed in illustrated catalog.
76. KURMAN ELECTRIC CO.—Bulletin shows relays, and lists stocking sales offices and engineering offices.
77. J. W. MILLER—Catalog covers milspec chokes, I.F. transformers, and special windings.
78. PENNSYLVANIA FLOUROCARBON CO. — Four-page product selector chart gives physical characteristics of tube products.
79. ROTRON MANUFACTURING CO. — Data sheet provides specs on lightweight fan for cooling electronic equipment.
80. SYLVANIA ELECTRIC PRODUCTS—Traveling-wave tubes, backward-wave oscillators, microwave phototubes, and continuous-wave gas lasers are covered in brochures.
81. TECH LABORATORIES—Bulletins cover miniature molded tap switch, rotary switch, and thumbwheel switch.
82. WESTON INSTRUMENTS DIV.—Data sheet on subminiature trimming potentiometers.

RADIO & CONTROL ROOM EQUIPMENT

83. FAIRCHILD—Catalog of speech input equipment including attentuators, preamps, line amps, equalizers, compressors, and noise reduction units.
84. McMARTIN INDUSTRIES—Brochure details SCA multiplex receivers for background music and in-store broadcasting.
85. MOSELEY ASSOCIATES—Bulletin presents sub-carrier generator for use with FM stereophonic broadcasting.
86. SPARTA ELECTRONIC CORP.—Spec sheets on cartridge tape equipment including stereo, monaural, and audio cue units.

STUDIO & CAMERA EQUIPMENT

87. CUMMINS—Bulletins describe film marking perforators.
88. ELECTRA MEGADYNE—Tech sheets on video equipment include camera chains, switches, intercoms, distribution amplifiers, monitors, and remote vidicon systems.
89. HOUSTON FEARLESS—Brochure gives complete specs on company's film processor for television stations.

90. S.O.S. PHOTO-CINE-OPTICS—Product sheets list items for television and motion picture production including camera, tape, film, audio, and lab equipment.

91. TELEVISION ZOOMAR CO.—Bulletins show several zoom lenses for TV cameras, and a servo remote control.

TELEVISION EQUIPMENT

92. ADLER ELECTRONICS—Literature describes educational television systems.

93. BLONDER-TONGUE — CCTV guide for planning business and industrial systems.

94. INTERNATIONAL NUCLEAR CORP.—High-gain video amplifier which is completely transistorized, is described in bulletin.

95. RIKER INDUSTRIES—Brochure shows line of sync generators and how to assemble them from basic modules.

96. TELEMET CO.—Catalog of video equipment line including monitors, distribution amplifiers, and transmission test sets.

97. TELEQUIP CORP.—Brochures on image orthicon cameras, film processors, and other television devices.

98. TROMPETER ELECTRONICS—Bulletin on RF video patching systems.

100. VIDEO ELECTRONICS—Brochures cover spectrum display unit with optional plug-in AM tuner.

TEST EQUIPMENT & INSTRUMENTS

101. DAVEN—Catalog presents line of electronic test equipment including transmission and noise measuring sets, power output meter, and syncronous switch.

102. KAY ELECTRIC CO.—100-page catalog presents line of precision electronics test equipment and measuring instruments.

103. SECO—Data sheet gives specs on transistor tunnel-diode analyzer, and SCR tester.

104. TEKTRONIX—Tech bulletins cover television oscilloscope, color vectorscope, and waveform monitor.

TRANSMITTER & ANTENNA DEVICES

105. CO. EL.—Catalogs describe broadband dipole antennas, FM antennas, UHF slot antennas, filters, and diplexers.

106. DORNE & MARGOLIN — Sheet covers characteristics of helical resonator band-pass filter for VHF and UHF.

107. ITA ELECTRONICS—AM, FM, and TV transmitters; audio consoles, monitors, and logging equipment are covered in bulletins.

108. JAMPRO ANTENNA CO.—Article on the effects of antenna VSWR on stereo separation.

109. MECA ELECTRONICS—Bulletin describes line of reactive coaxial power splitters.

110. PHELPS DODGE ELECTRONICS—Brochure describes line of communications products including transmission line, waveguide, and hardware.

111. SARKES TARZAN—Booklet on vertical interval switching, and microwave-system design handbook.

112. TACO—Line of microwave antennas accessories is covered in catalog.

113. TECHNICRAFT DIV., ELECTRONIC SPECIALTY — Catalog lists waveguide and other microwave components.

MISCELLANEOUS

114. CLEVELAND INSTITUTE OF ELECTRONICS — Pocket electronics data guide of conversion factors, formulas, tables, and color codes.

115. GRANTHAM SCHOOL OF ELECTRONICS—Booklet details courses offered in communications which lead to FCC licensing.

116. ONAN DIV., STUDEBAKER-PACKARD CORP. — Brochures describe portable and fixed gasoline-driven electric power plants.

117. PERMA-POWER—Technical catalog lists specs and other information on line of radio control equipment.

118. RADIO SHACK—Spring sale catalog shows large selection of electronics devices, hi-fi equipment, records, and tapes.

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GOVERNMENT SURPLUS, NEW 10 CM. WEATHER RADAR SYSTEM—Raytheon, 275 KW peak output S band. Rotating yoke P.P.I. Weather Band 4, 20 and 80 mi. range. Price $975 complete. Has picked up clouds at 50 mi. Wt. 488 lbs. Radio Research Inst. Co., 550 5th Ave., New York, New York. 1-63 6t

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We will buy used tape equipment—Ampex or Concertone. Radio Broadcast Services, 131 Adams Street, N.E., Albuquerque, New Mexico. 4-63-1t

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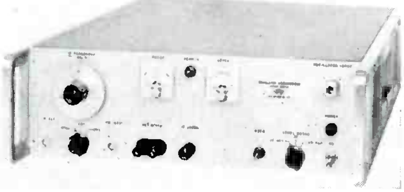
New Products

(Continued from page 47)



Oscillator Synchronizer

Stabilization of VHF and microwave signals to 1 part in 10^8 per second and 1 part in 10^6 per week is provided by a new instrument from **Dymec Div.** of **Hewlett-Packard Co.,** Palo Alto, Cal. The DY-2650A Oscillator Synchronizer phase locks a reflex klystron oscillator to an internal crystal reference to provide extremely stable signals, required in such areas as doppler systems, microwave frequency standards labs and parametric amplifier pump applications. Temperature stability is 1 part in 10^6 through the range 0-50° C. The device will synchronize most reflex klystrons, 1 to 12.4 gc, to eliminate drift and minimize incidental FM caused by noise, power supply ripple, and mechanical shock. The synchronizer permits FM to be applied to a klystron oscillator with deviations to 500 kc at rates to 50 kc.

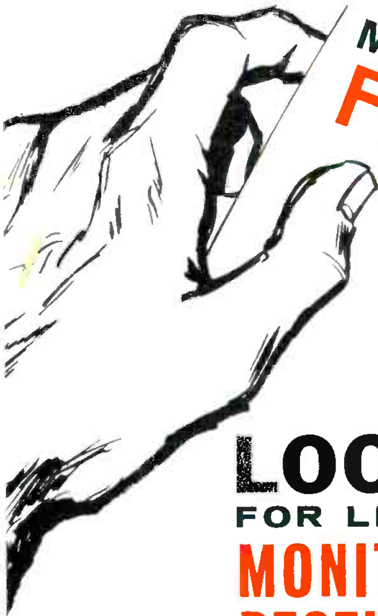
Circle Item 120 on Tech Data Card

Tube Tester

A portable tube tester featuring a replaceable socket panel to guard against obsolescence was introduced recently by **The Hickok Electrical Instrument Company,** Cleveland, Ohio. Model 6000A will test all the latest tubes, compactrons, novars, nuvistors, and 10-pin types including entertainment types and some industrial tubes. Tube set up information is shown on the roll chart located in the panel. Gm Ranges, 0-15,000 umhos, are read directly on the meter, and inter-element leakage with a sensitivity of more than 3 megohms, is registered instantly on 5 neon lamps, identifying elements involved. The suggested price of the unit furnished in a red leatherette carrying case is $239.50.

Circle Item 121 on Tech Data Card

Advertisers' Index



Memo To:

FM: *Station Managers*
Station Owners
Chief Engineers

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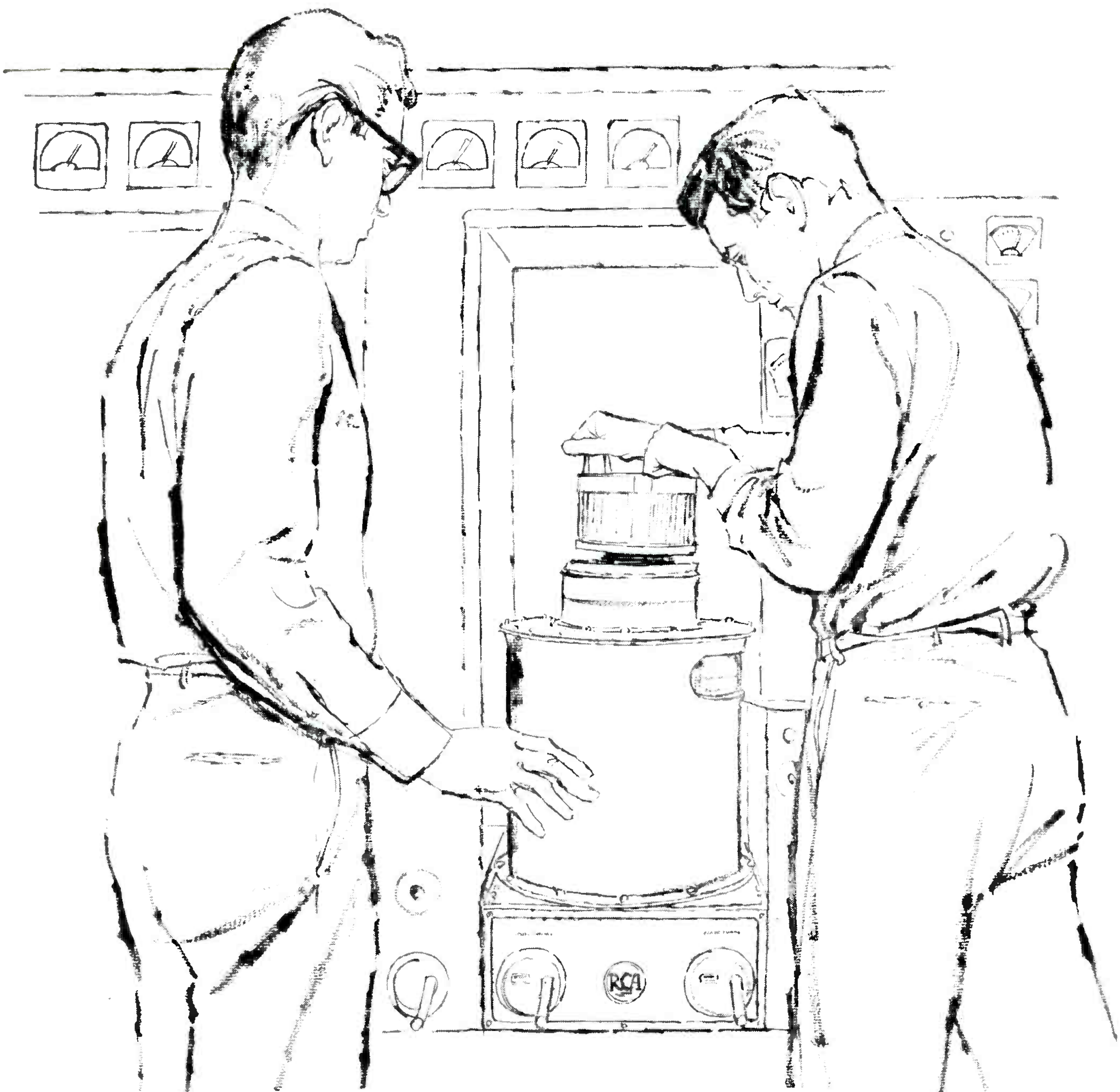

RCA-6166A/7007

New Design...New Performance

Improvements in RCA-6166A/7007 practically make it a new tube. This is the result of thorough evaluation of design, materials, and techniques—a continuing process at RCA. This relentless search to improve tubes has increased the life expectancy and provided new performance capability for this grooved ceramic tetrode—outstanding for medium and high power VHF-TV.

RCA-6166A/7007 includes significant improvements in exhaust vacuum firing, screen support structure, and filament processing. The tube is easier to drive. Moreover, with less load on the driver, you can expect better-than-ever performance and longer tube life.

Designed by tube engineers working with transmitter designers, RCA-6166A/7007 operates on all channels, fits into the driver stage without modifications in the transmitter. Try it next time you have need of tubes for radio or TV.

RCA ELECTRON TUBE DIVISION, HARRISON, N.J.

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