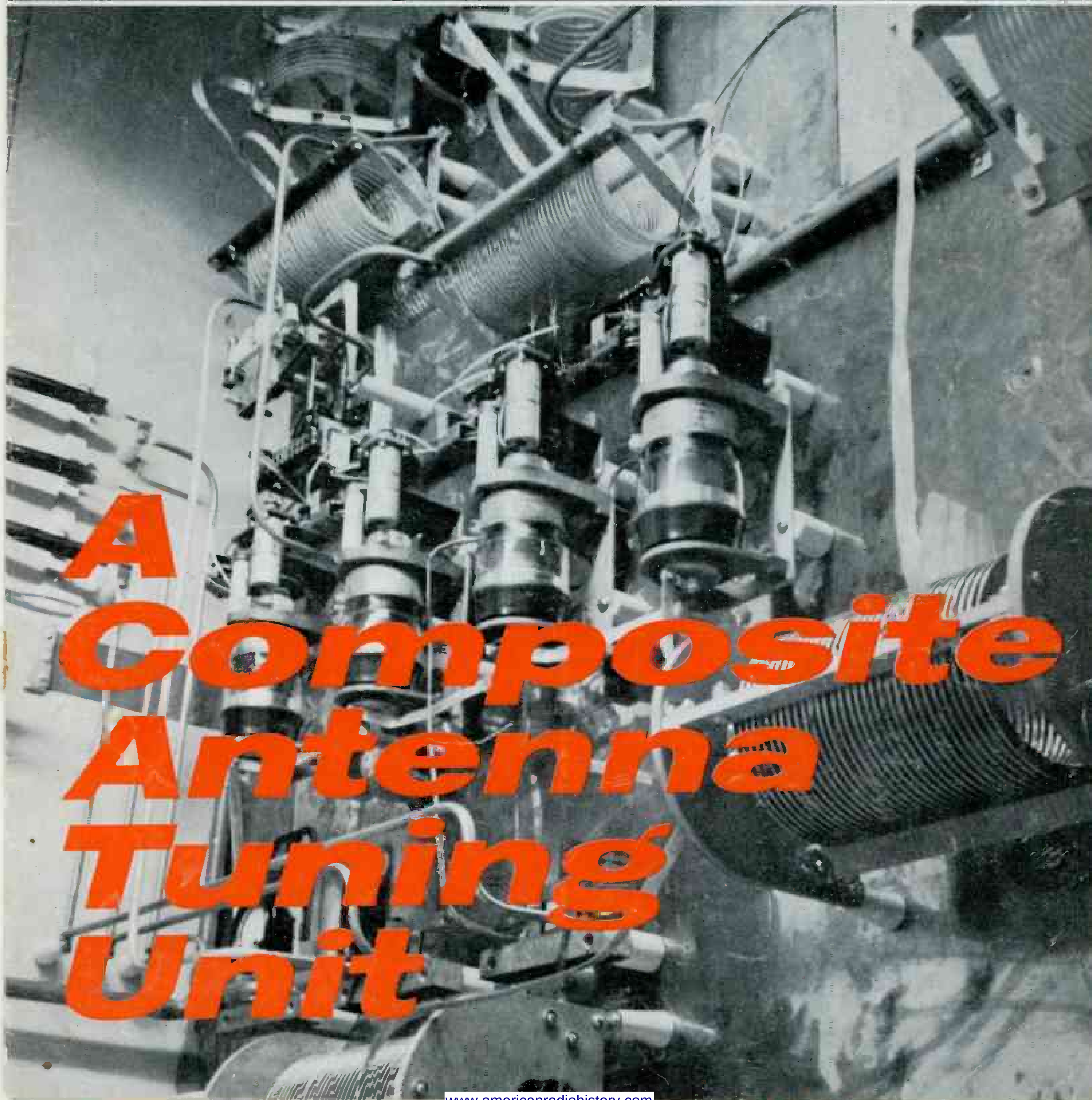
SEPTEMBER, 1962

BROADCAST ENGINEERING®

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY



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Designed for stereo and multiplex operation, ITA FM transmitters in 5, 7.5 and 10 kw power levels are the most compact, fully accessible transmitters sold. Their single cabinet construction requires less than 6 square feet of floor space and vertical arrangement of components virtually eliminates blind spots. Automatic recycling assures continuity of operation and extra long-life ceramic tetrode PA tubes greatly reduce operating costs! They're your *best* buy in medium power FM transmitters.

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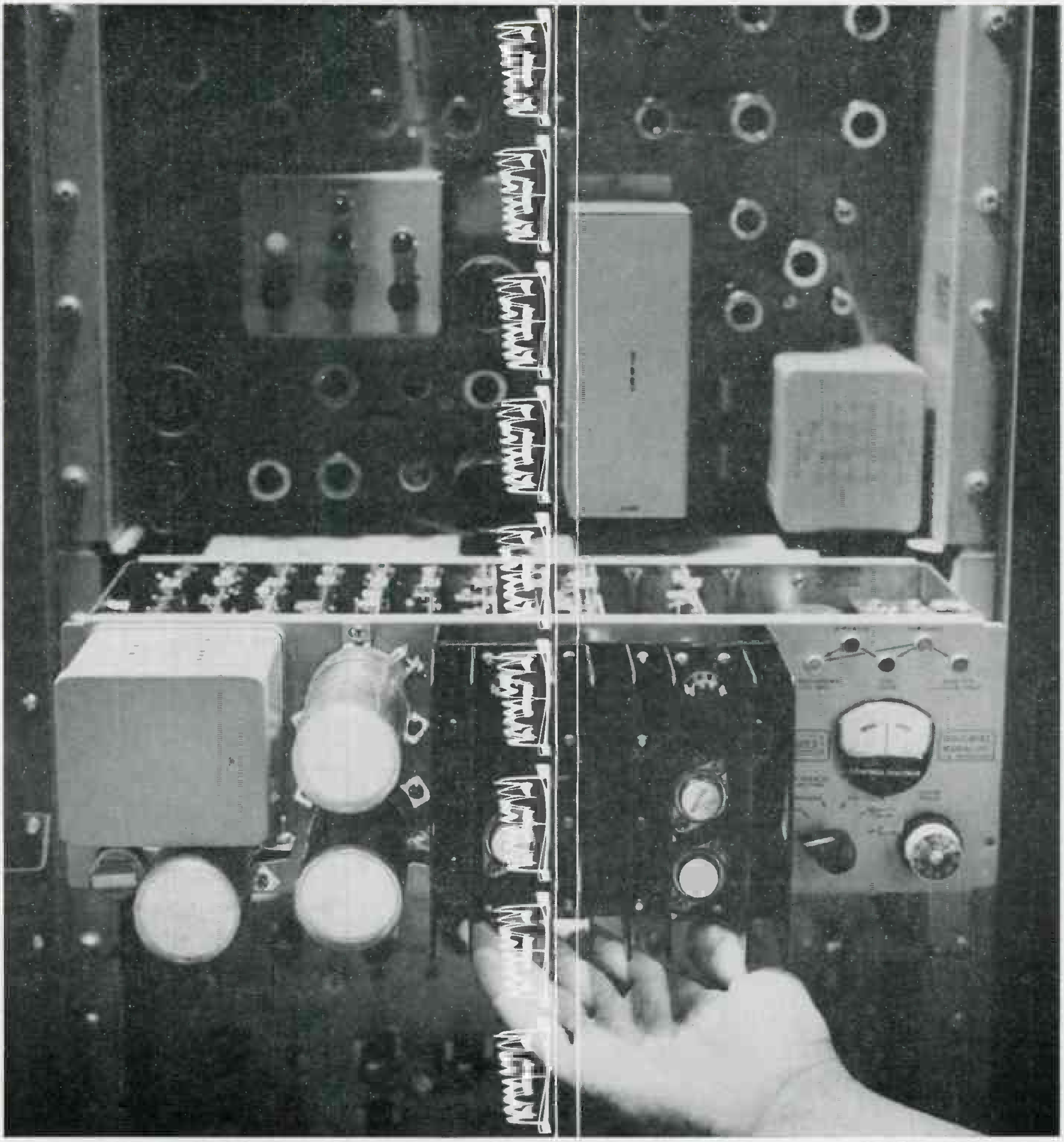
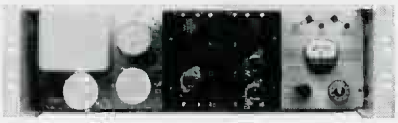


What color tape playback system takes up only 5¼" of rack space? **AMPEX Colortec.**

Ampex Colortec* color adapter eliminates a complete extra rack of electronics: it fits into a 5¼" panel on your Videotape* recorder. It gives you color. Bright, beautiful color—with full bandwidth luminance and chrominance signals. Sharp black and white, too. And it's accurate to 3 parts per billion. The luminance and chroma are never separated but are processed together so that the picture is synchronous to 3.58 mc subcarrier to within ± 3 nano-seconds. Furthermore, it's the only



color recovery system that meets N.T.S.C. standards. Operation? Extremely simple with only two principal controls. What do these facts indicate? Simply this: even if you aren't contemplating color transmission yet, Colortec color tape playback system should figure in long-range plans. For details write the only company providing recorders and tape for every application: Ampex Corporation, 934 Charter St., Redwood City, Calif. Sales, service engineers throughout the world.

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RADIO TRANSMITTER MAINTENANCE

By Thomas R. Haskett
Broadcast Consultant
Michigan City, Ind.

PART I of III

Maintenance plays a very important part in the daily operation of a station, as well as providing "bread and butter" insurance. It is also a tremendous help in complying with FCC rules. This series has been requested by a number of readers.

THIS ARTICLE describes a systematic plan of preventive maintenance as applied to the transmitter plant of a typical radio station. A previous series of articles (Audio Studio Maintenance, June, July and August B/E) covered the studio setup; the transmitter work—only additional techniques peculiar to the transmitter plant will be described here. All of the items mentioned previously—tools, test gear, spare tubes, capacitors, resistors, cleaning supplies, and technical manuals for all equipment—should be on hand at the transmitter.

This article will deal with the basic units to be found at most AM or FM transmitter plants: Audio equipment associated with the transmitter, the transmitter, phasing equipment, transmission line, line-to-antenna tuning assembly, antenna(s), tower(s), ground system, frequency, modulation, phase, CONELRAD monitors, remote-control system, and field-intensity meter. FM multiplex equipment is also discussed briefly. The engineering staff should be familiar with the theory and function of all this equipment before attempting any form of service.

The maintenance program is divided into two groups: Electronic and mechanical. We shall examine the electronic aspect first. All tubes used at the transmitter plant can be divided into two categories—small, receiving-type tubes, and large, transmitting types. Small tubes can be tested in a tube checker. There is also some difference in the average cost of a transmitting tube as compared with that of a receiving tube; as a consequence the large tubes are treated with greater care and more specialized techniques.

All major transmitting tubes are furnished with serial numbers. These numbers should be made a matter of record at the time of purchase; indeed, a "biography" of each tube should be made up—for instance, in the form of a 3 x 5 file card (see Figure 1). The card shows what socket the tube was installed in, how long it was there, and what the meter readings were—thus indicating its performance. The high cost of transmitting tubes makes it worthwhile to keep such a record to get the most life out of each "bottle."

These big tubes should be test-operated in the transmitter as soon as possible after purchase. This assures the staff that the spares on hand are reliable; if found to be "sick" they should be returned to the supplier for replacement. It is also a good idea to run shelf spares for a day or so every few months; at the same time a workhorse tube can be given a "shelf vacation." (Perhaps in theory this is unnecessary, but in practice it *seems* to make the tubes last longer.) Some stations prefer to rotate their big tubes, rather than just checking the spares. This may be compared with rotating tires on an automobile. It also has the advantage of reducing the amount of time spent in changing tubes. Most engineers are familiar with another practice which has proved its worth through the years: The keeping of one or two "precooked" mercury-vapor rectifiers stored vertically in a rack near the transmitter. This obviates the necessity of "cooking" a spare following the breakdown of an operating tube, which could keep the station off the air longer than necessary.

At this point the reader should refer to the previous article and review the section which discusses the mutual-conductance tube tester. Next, the portions describing the use of an audio oscillator and a distortion meter for dynamic testing of audio gear should be re-read. Finally, the techniques of checking power supplies should be re-read.

Audio Tests

The technique of dynamic testing of audio equipment described earlier should be used for peak limiters, standby consoles, turntable and microphone preamps, and tape recorders, as well as the audio portion of the transmitter. (See Figure 2.) The annual, so-called "FCC audio proof" will cover all normally-used equipment in the system; a "complete unit proof" should also be run on each audio unit—both operating and standby—and it should also be done on an annual basis, although at a different time than when the FCC proof is done. At such time each piece of gear should be subjected to a close visual inspection, cleaning, and checking of *all* socket voltages with a VTVM. With the relatively complete data provided by these yearly inspections, it will be a simple job to run quarterly "spot proofs" on each unit, again including the close visual inspection, chassis cleaning, but measuring *only* the power supply voltages. It is only necessary to run three spot proofs per year, per unit;

NEW "CYCLOID" FM RING ANTENNA DESIGNED FOR FM STEREO AND MULTIPLEX BROADCASTING

Patent Pending on Unique Binary Tuning Feature

A new FM antenna featuring a major technological advance in ring type radiating elements has been introduced by the Gates Radio Company, Quincy, Ill., subsidiary of Harris-Intertype Corporation. It is available from single to sixteen element arrays and is factory pretuned.

"Cycloid" is the first ring antenna to offer binary adjustment, an exclusive tuning arrangement (patent pending) whereby the inductance of the ring is changed at the same time the antenna is adjusted for capacitive tuning. The advantage is uniform L/C for adjustment over the FM frequency range.

Binary adjustment permits tuning to an extremely low standing wave ratio. Fine tuning is achieved by moving the feed strap up or down the middle semi-circular element. Since this adjustment is incorporated in the antenna, it is not necessary to buy costly extras such as transformers or field tuning kits to achieve the optimum low standing wave ratio.

Where the antenna is mounted on a supporting pole and pretuned at the factory, a voltage standing wave ratio of 1.2 to 1 or better at the one megacycle bandwidth points should be expected. A side mounted antenna, pretuned at the factory, should also provide an excellent voltage standing wave ratio. The one megacycle bandwidth of the antenna is superb for stereo and multiplexing. (See Fig. 1)

The most important determining factor for a good horizontal pattern is the circularity of the antenna element in free space. The Gates "Cycloid" FM antenna is circular within ±1 db in free space to provide the best possible starting point for an optimum horizontal pattern.

Mounting brackets tailored to each installation are furnished for pole, side or inside tower mounting. The antenna's windload design will reflect a direct savings in maintenance costs.

Literature describing the technical characteristics of the "Cycloid" antenna is now available. Write Gates Radio Company, Quincy, Illinois, for Brochure No. 111.

CYCLOID ANTENNA BANDWIDTH

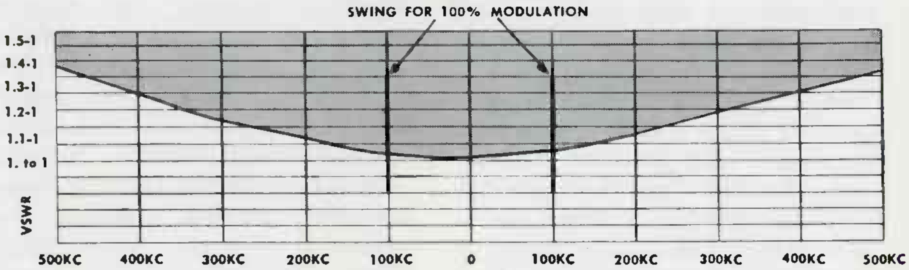


Fig. 1

the annual unit proof counts as the fourth.

A word about the audio-proof method of checking the transmitter: It is simply the standard FCC-required audio proof-of-performance, minus all audio equipment preceding the transmitter proper. In other words, the audio oscillator is fed directly to the transmitter AF input, while the distortion meter is driven either from the modulation monitor or a separate detector, whichever is normally used. The technique gives an accurate picture of the operation of the modulator and driver stages. (Refer again to Figure 2.)

We have covered the audio and power-supply sections of the transmitter. (A further note on transmitter power supplies: In some of the newer transmitters which utilize solid-state rectifiers, it is advisable to check the diodes with an ohmmeter quarterly and replace the bad ones before too many go out.)[1] There remain the RF sections—oscillators, buffer amplifiers, AFC tubes, frequency multipliers, modulators, and power amplifiers. The tubes in these various stages must invariably be tested in the transmitter by using the panel meters to compare operating parameters with manufacturer's recommended values and previously recorded figures. Naturally, the readings of *all* transmitter meters must be taken, at least weekly, and kept on file. A meter log should be made out which will show the performance of each stage. (See Figure 3. This is in addition to the minimal requirements of the daily operating log.) Any deviations from the normal readings should be thoroughly investigated. Many operators also prefer to log the control settings of tuning adjustments along with meter readings, for the same reason. Since it is usually possible to check all RF stages by means of the panel meters, it is seldom difficult to track down an ailing tube, at least in AM transmitters. The failure of a tube, or of any other component, can be localized to a particular stage by this method, after which conventional trouble-shooting techniques can be employed to determine the faulty part.

[1] Editor's note: It is not likely that many faulty diodes will be found.

4-400A	Penta No. 19124
6-15-60	Purchased new from Ajax Radio, Chicago.
6-17-60	Tested as L modulator; ran at 30 ma, which is OK, and sounded fine on air.
12-21-60	Installed as R modulator, drawing 30 ma.
7- 5-61	Returned to shelf, though still OK.
10-13-61	Installed as L modulator, drawing 31 ma.

Fig. 1. Typical card entries on tube history, showing tube type, manufacturer, serial number and date. Space is left on the card for additional remarks.

Trouble Indications

An example of a common technique employed to check transmitting tubes by means of panel meters is as follows: While observing the plate-current meter of a particular tube, that stage's plate circuit should be carefully detuned. Away from resonance, the current will rise, and the rate of increase will vary according to the condition of the tube. A new tube will show a sharp increase, but since emission decreases with age, an older tube will show a slower rise. Once the operator is familiar with normal circuit action, as observed on the panel meters, doubtful tubes can be spotted and replaced.

Mention should be made of the normal AM modulation monitor, which can indicate certain types of trouble. Not only does it show the continuous depth of modulation, its carrier-shift meter provides a warning, should excessive non-symmet-

(Continued on page 17)

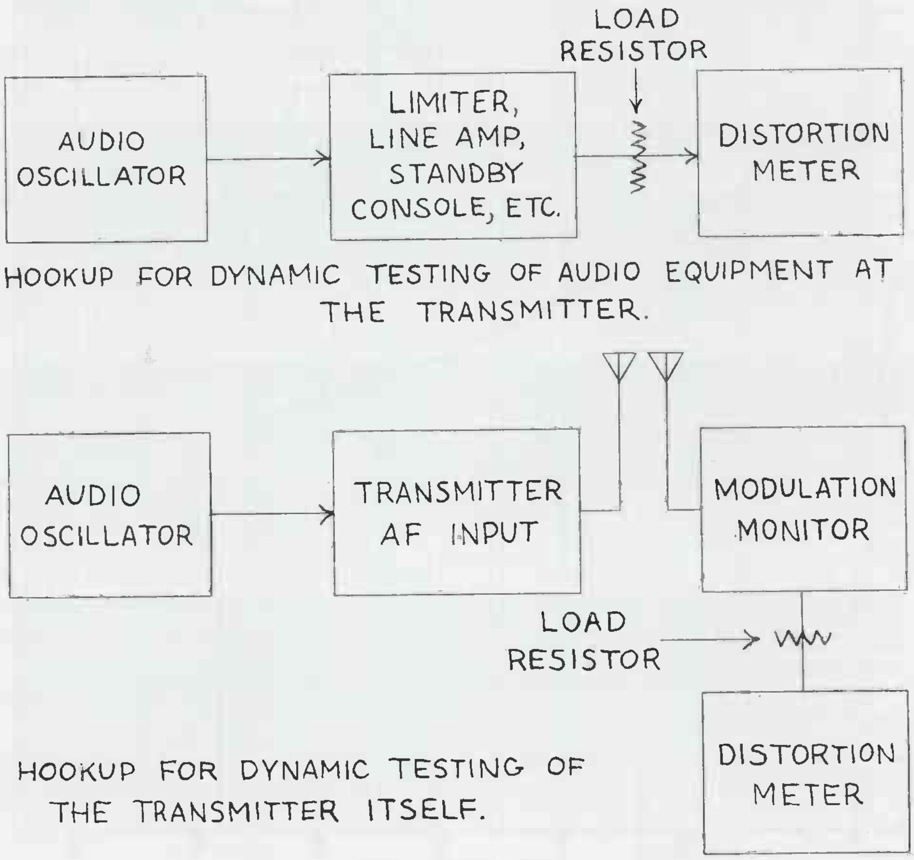


Fig. 2. Dynamic testing block diagram for transmitter and audio equipment.

TRANSISTOR AUDIO AMPLIFIER CIRCUITS

Part II

This series on transistors is based on a Solid State Short Course given at University of Nebraska and gives basic transistor circuit design data.

By Donald K. Haahr
Engineering Department
Collins Radio Co.
Cedar Rapids, Iowa

Part II concludes basis transistor design data, and shows how feed-back is not a cure-all.

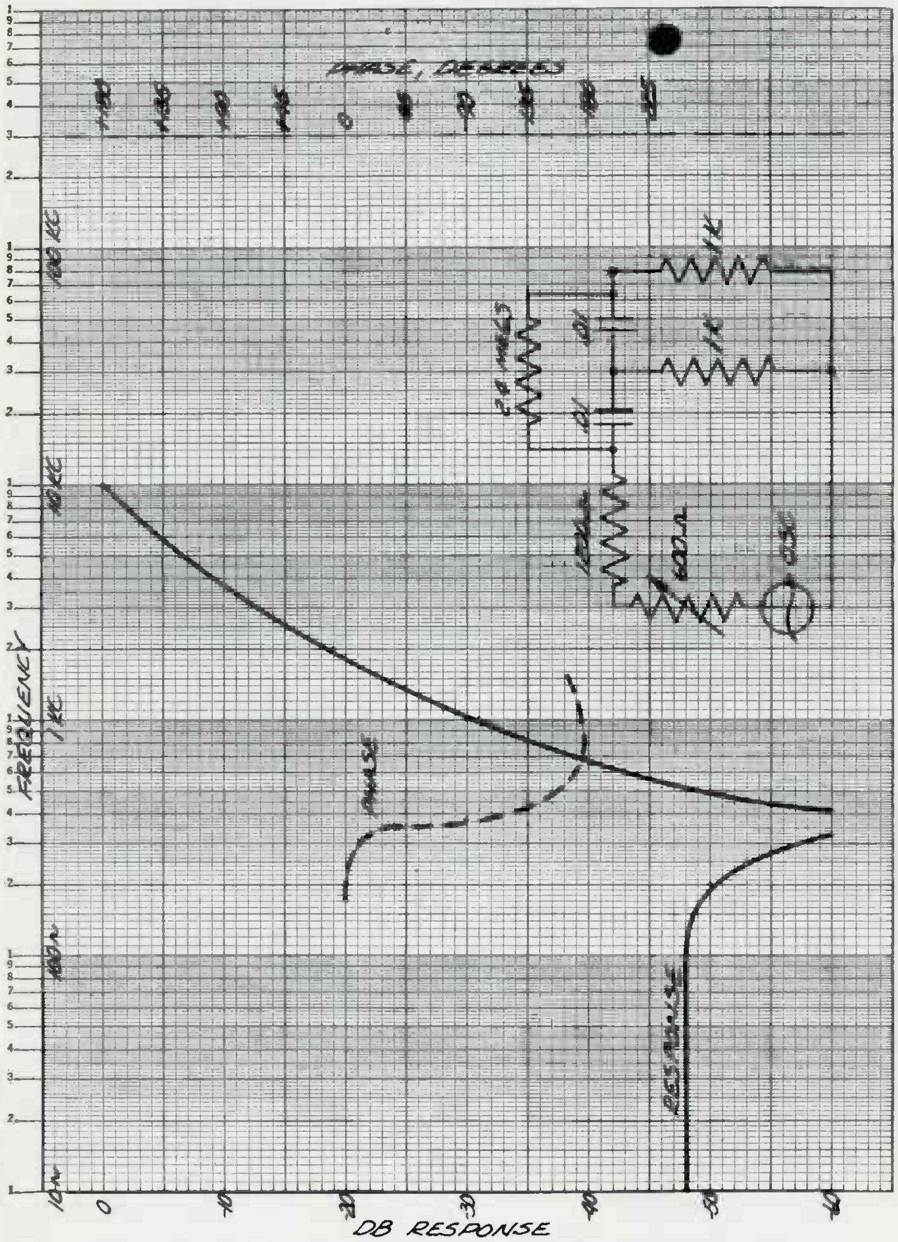


Fig. 3. Response-phase versus frequency (of a single bridge T network).

YOU WILL recall that the 180° phase shift point is about 50 kc, and consider the input stage has a response of 2 db out to 200 kc. With an over-all gain of about 80 db, it doesn't take much leakage to achieve a loop gain greater than one. In fact, to emphasize this further, the preamp feeding this amplifier is —1 db out to 600 kc. Meanwhile, there is still a 3-stage amplifier to be improved with over-all feedback. Now it is evident why a little time spent at parts placement in design layout is worthwhile, and the right kind of shielding in the right place can make or break a design or revision.

The amplifier of Figure 1, as an example, with no feedback is stable and has distortion of about 3% at 50 cycles, 2.6% at the 1 kc reference and 4% at 15 kc. The rule of thumb would have 6 db of feedback cut distortion to about 1.5%, 1.3% and 2%, but this is what happens: at 1 kc it dropped to 1.3% as expected; at 50 cycles it helped somewhat but did not cut it in half; but at 15 kc there is trouble with a 30 kc parasite (second harmonic of 15 kc), which has approximately 180° phase difference from mid-frequency reference or actually a positive feedback. The answer to this problem is inexpensive, practical and simple.

Here again, it is something that is not new. As shown here (Fig. 3), the bridge T consists of two resistors and two condensers. Notice there is about 150° phase shift before there is a gain increase. This can be graphically applied to the response and phase curves of the amplifier by sliding the corrected feedback response curve horizontally so that an additive phase results in a curve that does not go beyond 180°, and ideally not beyond 150°. The additive gain and phase result in a plot as shown in Figure 4. Note there is a response dip, but note also the 180° phase point has moved from 50 kc out to 150 kc where the response allows 35 db feedback instead of 6 db. The notch is not desirable because it indicates no feedback at 54 kc, which is the 3rd harmonic of 18 kc. This is why certain frequencies have higher distortion than the remaining bandpass.

The prospects of a bridge T look very good, and another section just like it is added (Fig. 5). The result is a compensated feedback signal that does not reach 180° until beyond 200 kc, and the response is relatively smooth to 90 kc where 26 db of feedback would be possible. As a result (Fig. 6), the limiting factor is the 24 db allowable feedback at 17 cycles before 180° phase shift is reached there. As can be seen, the improvements make the complexity of the feedback compensating network worthwhile.

Then comes the problem of deciding how much safety factor should be allowed. One suggestion is to use 10 db less feedback than 180° phase shift or feedback stability will allow, another method is to design for the 150° phase shift point. The first method establishes 14 db of stable feedback, and the second method 20 db. Both are determined at the lower frequencies because of the compensated network. Without the compensated feedback, the first, or 10 db method, would allow no feedback, and the second, or 150° point, would allow 4 db. This time both are limited at the high frequencies.

It *is* important at this stage of development to more than just assume adequate isolation and shielding. A 2,000 ohm resistor termination on the shielded lead of a VTVM works well as a test probe. This is approximately the input impedance of the first stage, and a 1.3 millivolt undesired pickup in a critical area would equal the signal to the input stage and only 0.1 millivolt pickup would be required at the preamp input for rated output. Higher frequencies will be the most troublesome!

The normal phase shift from grid to plate or base to collector is 180° until cut off frequencies are approached. For tubes this is around 100 kc, which presents no particular problem. However, for transistors this is close to the audio bandpass, and an additional 45° phase shift may be present.

One more thing that should be discussed — maintenance. This is probably the major contact with semi-conductors, so here are some hints that may help in realizing that this complex field can be separated into simple elements.

As mentioned earlier, a little care and interpolation with these small voltage readings will pay off in time saved. Resistance checks may be deceptive if the transistors are not removed. There is more interconnection between stages than is often realized. If the transistors are not removed from the circuit, it is not advisable to use a scale less than R X 10. However, be sure the power is off before removing or inserting a transistor, otherwise transient pulses are produced that can be harmful to the transistors. The resistance between the emitter and collector is high in both directions. Emitter to base, and collector to base, are both low.

A word of caution when servicing a printed circuit board: too much heat or pressure can lift the copper from the board. To avoid this, use a minimum amount of heat and pressure, and do the job quickly. A small iron that is well tinned helps in this respect. If a lead on the board is broken to the extent that solder cannot bridge the gap easily, just add a fine piece of buss wire.

The problem of unsoldering several connections at one time, as on can type capacitors, is always a strain on the printed circuit board. Special, inexpensive kits are available which facilitate removing printed circuit components.

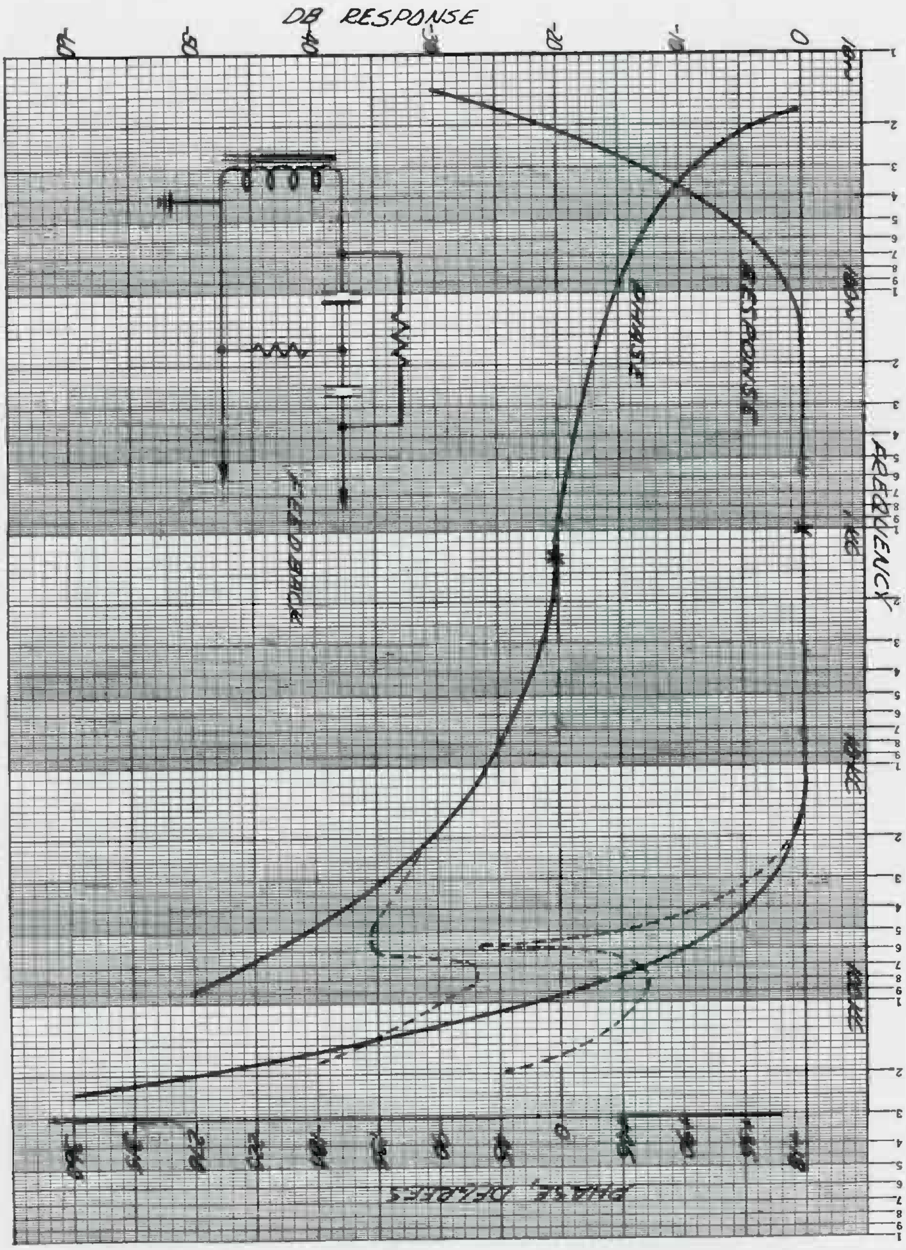


Fig. 4. Response-phase versus frequency (of a single bridge T network as applied to the line amplifier feedback).

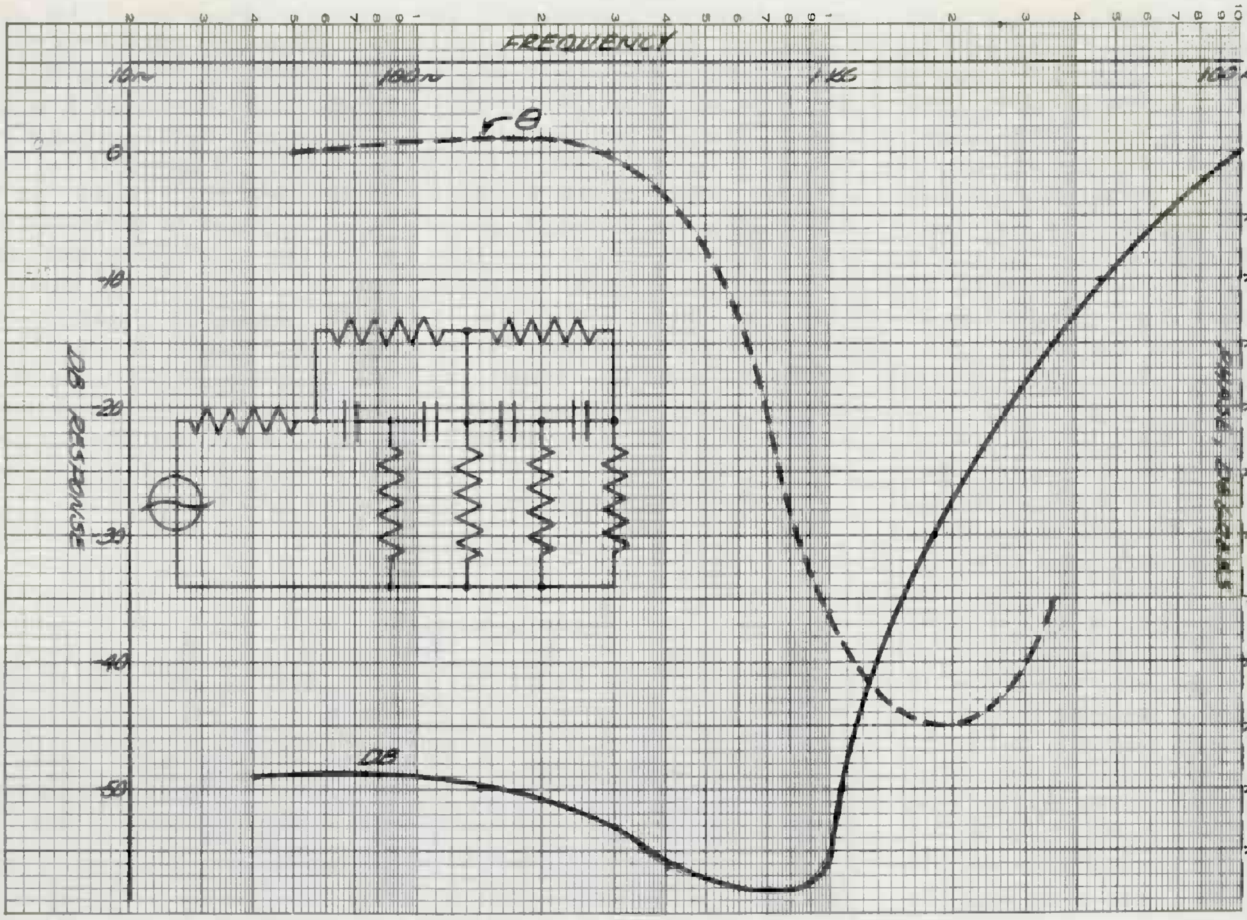


Fig. 5. Response-phase versus frequency (of a double bridge T network).

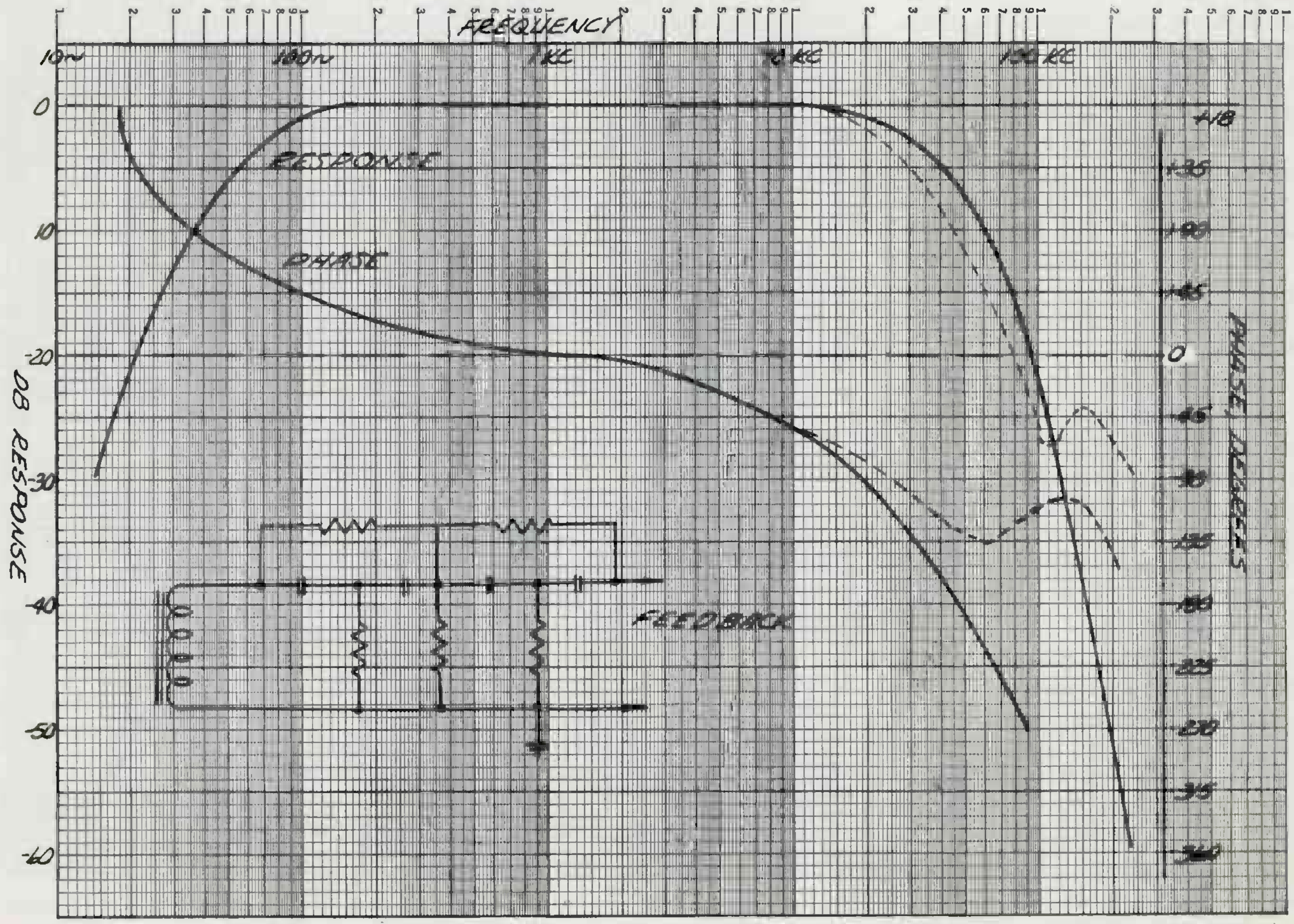
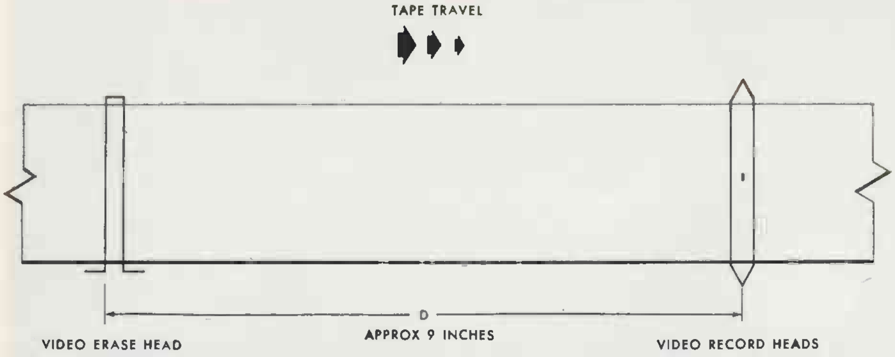


Fig. 6. Response-phase versus frequency (of a double bridge T network as applied to the line amplifier feedback.)



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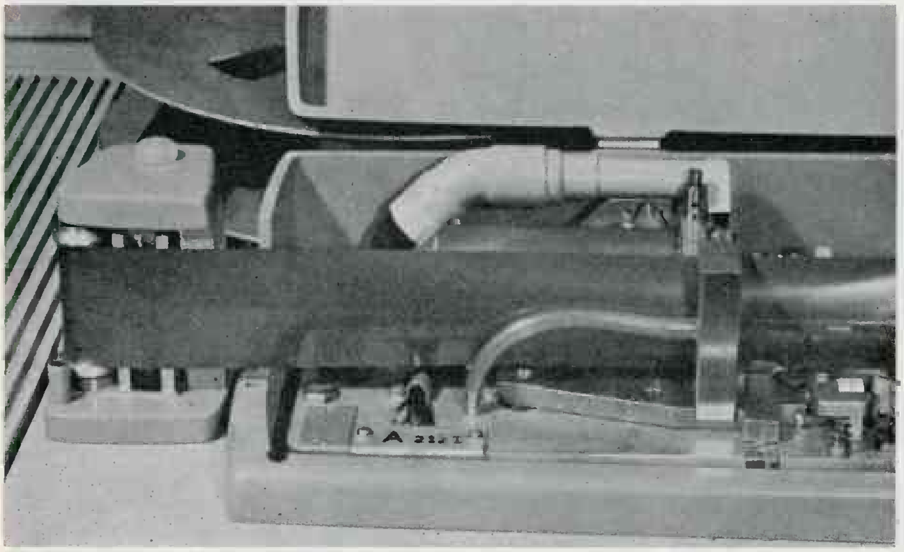


Fig. 1. Head separation. Video Erase-Video Record.

ELECTRONIC VIDEO TAPE EDITING

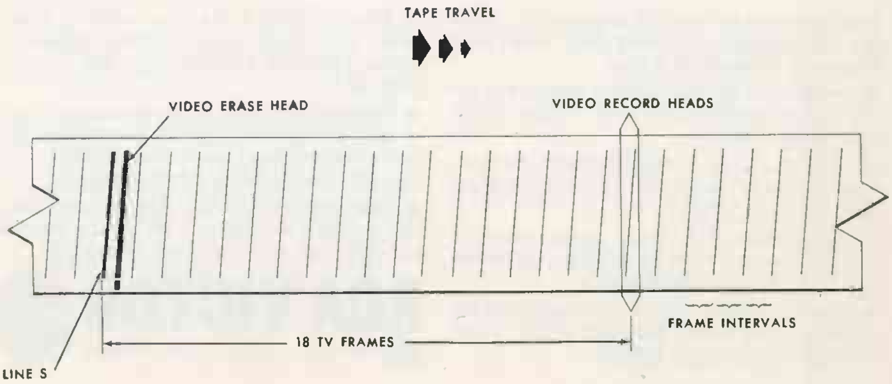
An ingenious tape device enables TV tape to be handled and interspersed with effects in exactly the same manner as film.

SINCE the time that magnetic tape was first used for recording television signals, it has been the ambition of producers and engineers alike to be able to edit taped programs with the same precision and flexibility as is possible with motion picture film.

The main obstacle to precision editing of tape has been the fact that pictures recorded on magnetic tape, unlike those photographed on film, are not visible when the medium is stationary and difficulty is, therefore, experienced in selecting appropriate editing points. At present, tape editing techniques revolve around physically cutting and splicing the tape. Editing points are usually identified with the aid of a diluent containing iron oxide particles which is spread on the tape surface and allowed to dry. The diluent evaporates, leaving a collection of particles outlining the edit pulses. Another technique is a means of transferring individual pictures to single frame storage devices for leisurely study. Much engineering effort, both in Europe and the U. S., has been directed toward such a device; but all such apparatus has, so far, proved expensive to manufacture and cumbersome and inflexible in use.

A completely different approach has been adopted in the design philosophies of the new electronic

Fig. 2. Method of measuring head separation.



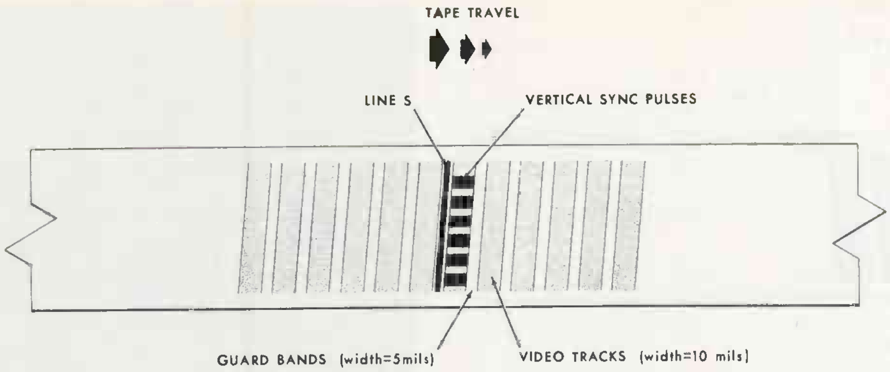


Fig. 3. Detail of "splicing" point.

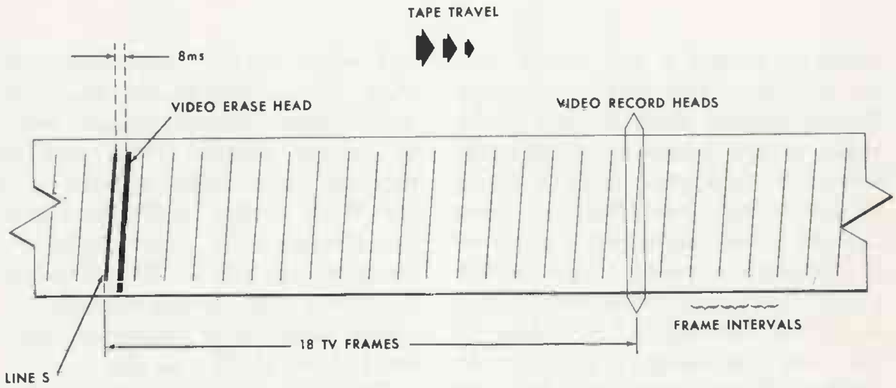


Fig. 4. Initial position of "splicing" point.

editing system. In this system, no attempt is made to stop the tape or to store individual frames. Rather, splices are made while the tape is running at normal speed. These splices do not involve physically cutting and splicing the tape, but are accomplished by activating record circuits while the tape is running so as to record new footage at any point in an existing scene or program. Scenes in the original recording may be transferred to other tapes or spot erased. The splices thus made are splices in the recorded information, but not in the recording media.

The new Electronic Editor may be easily installed in an existing Videotape television recorder and has as its heart a small chassis containing solid state circuitry. This unit alters the operation of the standard recorder enabling it to be stopped and started between recordings without any loss of synchronism in the final tape.

One television recorder, fitted with an Electronic Editor, may be used to assemble a first generation, completely edited, master tape, by using motion picture type shooting techniques with only one camera. Scenery changes, costume changes and other effects, not possible with the continuous action usually employed in television recording, now become readily achievable on tape. Additionally, the recorder may be used to insert new scenes into the middle of an existing program at any time after the original recording was prepared. In this mode of operation commercial or spot announcements may be added to a tape or a new scene may be inserted to replace one not required or correct one containing a production "fluff."

In order to appreciate the technical functions of the Electronic Editor, consider the situation that would exist on an unmodified recorder, if a tape bearing recorded program information were threaded onto the machine, and, at some point during the replay of this tape, the record button were operated in

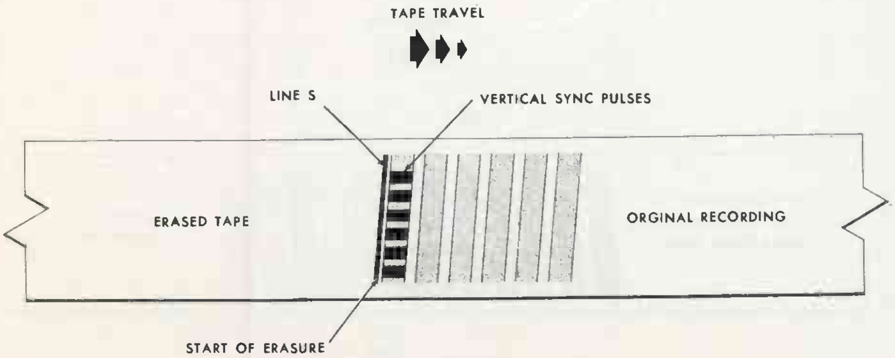
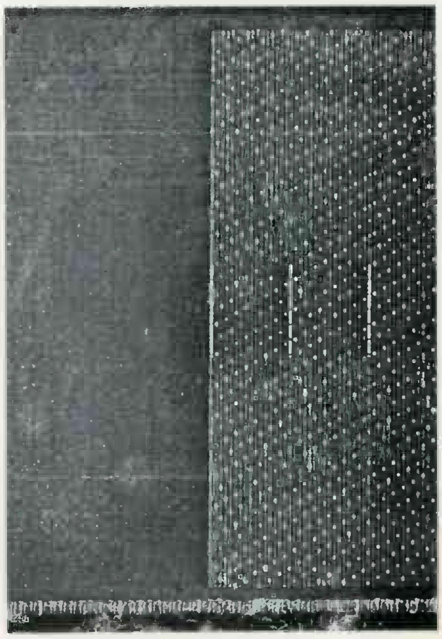


Fig. 5. Start of video erasure.



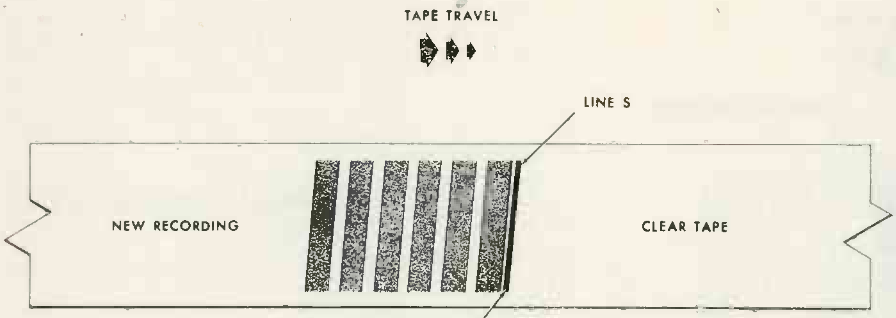


Fig. 6. Start of video recording.

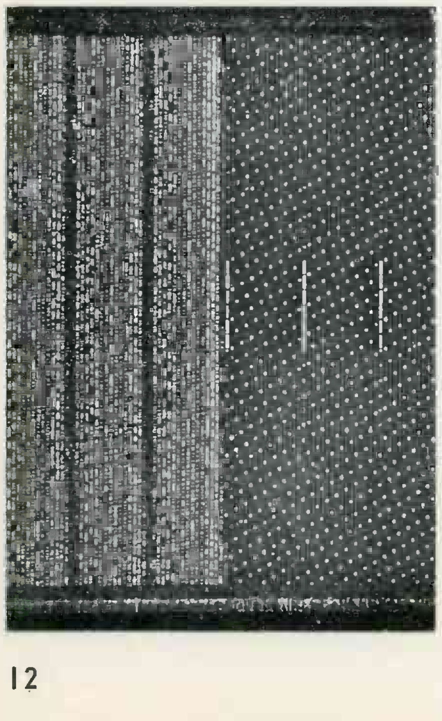
order to record a new scene into the middle of the existing program. Record current would be fed to the video record heads to record the new scene, and erase current would be fed to the erase head to erase the old scene. However, a number of problems would arise which would make the attempted transition from the original recording to the new recording impossible to achieve. These problems may be conveniently grouped as follows:

(a) Disturbances in the drum and capstan servo-mechanism.

(b) Incorrect phasing of the reproduced tape signal and incoming video signal.

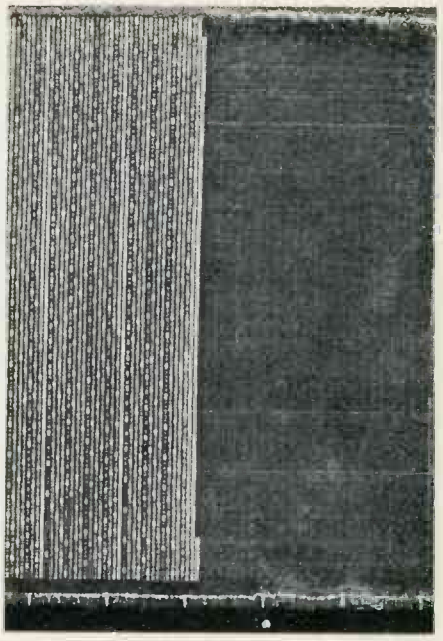
(c) The distance between video record and erase heads causing an overlap of recordings.

Fortunately there are straightforward solutions to each of these problems. It is possible to arrange the servo system so that it uses the same sources of drum and capstan drive signals upon entering the record mode that it uses during the Play mode. Specifically the drum drive signal remains phase locked to system vertical sync, and the capstan drive source remains a 60 cps Wien bridge oscillator. During the Record mode this oscillator is free-running, but no difficulty from long-term drift occurs because any minor variation in frequency will be tracked-out during re-play.



The correct phasing of the reproduced tape signal to the incoming video may be obtained by using an Intersync television signal synchronizer. This unit is a precision servo control mechanism that guarantees that synchronizing pulses recovered from tape are in very close time relationship with the studio synchronizing pulse generator.

Remaining is the matter of distance between the video record and erase heads. This distance (see Figure 1) would cause a double recording to exist for some nine inches of the tape which, in turn, would cause both the sync processing and servo mechanism circuits to malfunction. To deal with this problem, the distance must, first of all, be translated into units precisely and readily measurable by electronic means. It has been found convenient



to do this by considering it as a time interval corresponding, at the linear tape speed of 15 ips, to something slightly less than 18 television frames. Figure 2 shows how a line S on the tape that is exactly 18 frames ahead of the video record head would be, in fact, slightly ahead of the video erase head. The line S marks the location of the "splice" that it is intended to make, and it is further defined as existing in the guard band following a video track bearing vertical synchronizing pulses as shown in Figure 3.

In the operation of the Electronic Editor, the location of the line S is determined after a random cue by means of a vertical gating circuit which detects the first frame synchronizing pulse following the cue. At this instant in time, the tape lies under the heads as shown in Figure 4. The time taken for line S to travel to the video erase head would be 9.3 milli-seconds and the time taken to travel to the video record

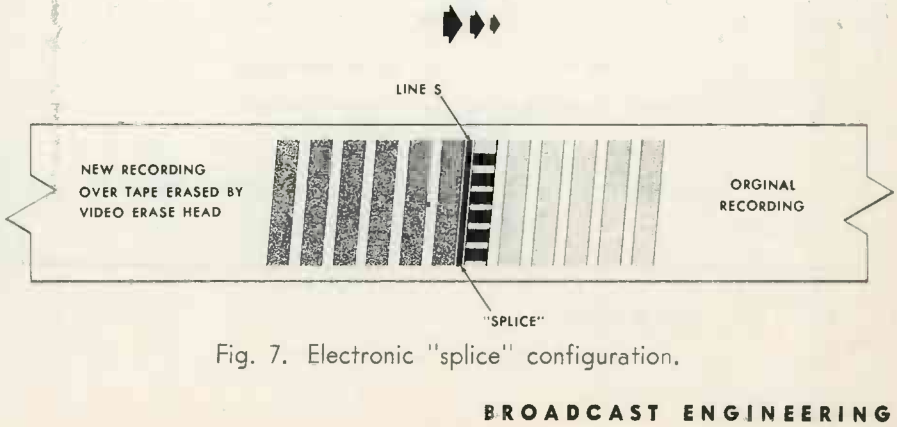
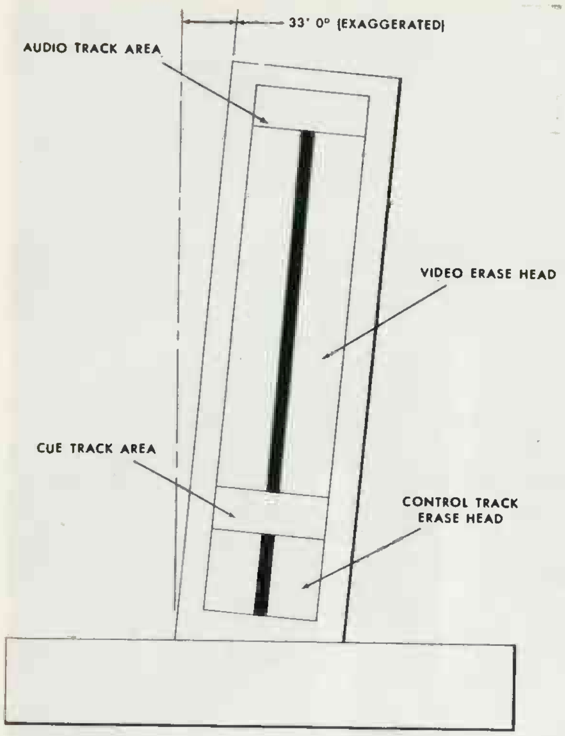


Fig. 7. Electronic "splice" configuration.



DETAIL OF ERASE HEAD ASSEMBLY

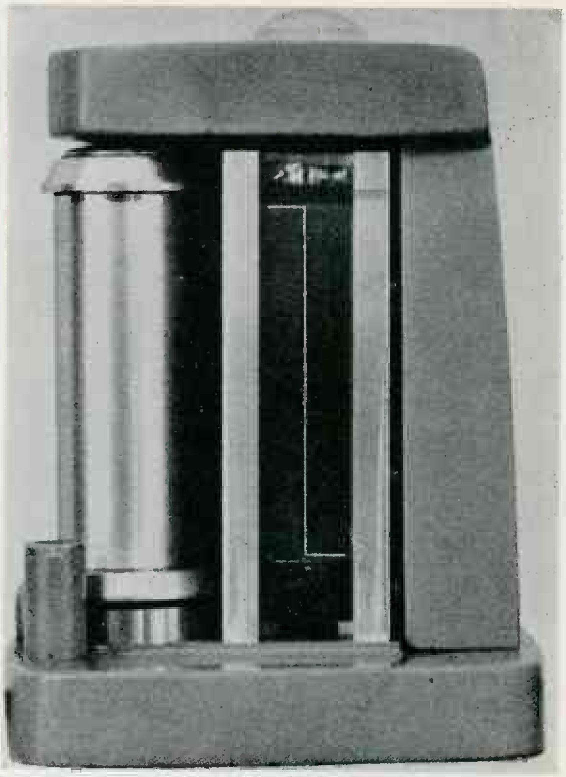


Fig. 8.

head would be 600 milli-seconds or 18 television frames.

The 9.3 milli-seconds delay is obtained from a delay multivibrator, and, at the end of this period, the erase head is energized by an electronic gating circuit. Turn-on time is 30 usec, and erasure starts exactly on line S (Figure 5). The 18 frame delay is computed by a binary counter system. At the end of this period, the record current is gated on electronically. Turn-on time in this case is 2 usec, and the new recording starts immediately following the line S (Figure 6).

The accuracy obtained from the foregoing system is in the order of 0.05%, thus enabling the operator to make perfect "butt splices" by merely pressing the record button. The preservation of all video information at the "splice" and the accuracy of tracking is evident from an examination of Figure 7.

The Editor has two modes of operation, referred to as INSERT and ASSEMBLE. In the latter mode, the unit may be used to add further program material to the end of an existing program, and, in this way, assemble a complete program from individual short scenes. In fact, a completely edited tape may be prepared using only one camera and one television recorder.

The INSERT mode, on the other hand, is used to insert new material into the middle of an existing tape. In this mode, commercials (for example), may be added to a recorded program at any time following its original preparation. Because any information "behind" the inserted material is erased, and there is no loss of sync, it becomes possible to correct errors that accidentally occurred in the original production. If the action is repeated and the Record button is pressed, the scene containing the production error is replaced with a new scene.

In the INSERT mode, it is obviously necessary to make two "splices" per operation and still maintain synchronism. The operation of making the first (or ingoing) "splice" was described above. The second (or out-going) "splice" is made in a similar manner except that at the end of the measured time intervals, the erase and record currents are turned OFF instead of ON. This is performed with the same precision as that of the first "splice."

However, during the recording of the insert, the capstan oscillator frequency is not controlled and it may drift slightly if the inserted material is of considerable length. This in turn may cause a variation in the wavelength of the recorded control track signal which would cause an abrupt shift in the phase of the reproduced control track signal at the out-going "splice."

A possible solution to this problem would be to employ a phase correction system in the capstan oscillator output circuit during Record. This, however, would be extremely complex. The solution adopted utilizes the fact that, in the INSERT mode, a control track signal already exists on the tape. This information would normally be erased by the full width video erase head when entering the RECORD mode. However, a new head has been developed (Figure 8) which has a separate section for erasure of the control track. This section is disconnected when the INSERT mode is selected. This means that although the machine is placed in the RECORD mode, reproduction of the control track continues, and it may be used to retain normal control of the capstan oscillator, thus avoiding any possibility of control track phase shift.

The video erase head is of entirely new design and uses only a half-turn in contact with the tape. It has been found that improved erase efficiency results. The electrical gap width is 5 mils, which is

How Much Have YOU Heard About co el Custom Coverage Antennas?

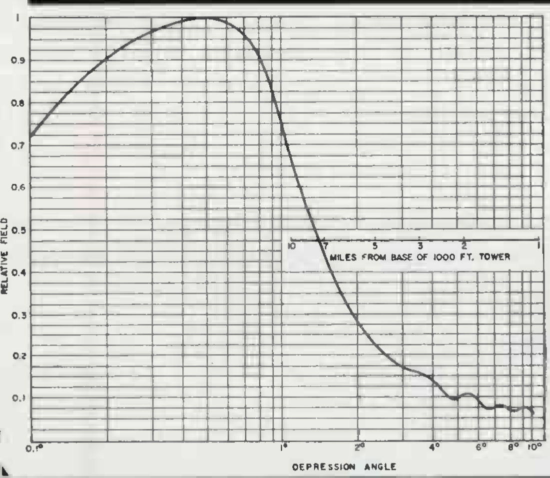
. . . probably very little, because we've been so busy trying to satisfy the demand for our antennas in Europe, Australia, South America, Africa and Asia. Now that our expanded production and development facilities are completed, we'd like to tell you about our achievements in custom coverage antenna systems . . . that provide a greater variety of horizontal and vertical patterns, with greater ERP and greater economies. CO.EL. manufactures a full line of low band, high band and UHF antennas. Described below is one of the many CO.EL. antenna systems.

UHF BROADBAND DIPOLE ANTENNAS

CO.EL. UHF Antenna — mounted in self-supporting polyester cylinder, with internal ladder.

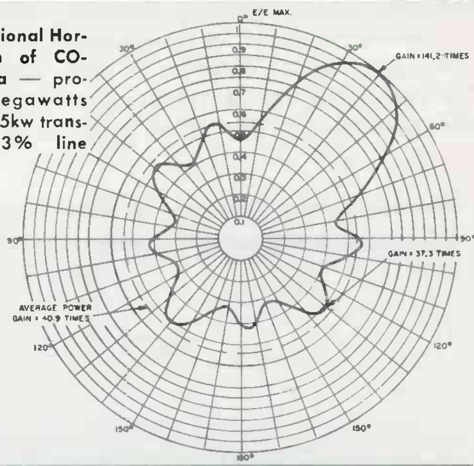
FEATURES — Custom Patterns to meet your station's coverage requirements, with either directional or circular horizontal patterns and shaped vertical patterns ■ Directional Patterns providing megawatts of peak ERP with existing transmitters ■ Increased signal strength without increased operating expense ■ Very low VSWR — guaranteed 1.04 or better ■ No De-icers required ■ Can diplex two stations into common antenna, eliminating need for costly side-by-side mounting ■ Rugged heavy duty construction ■ Expert checkout service by qualified antenna engineers.

Write for details on this and other CO.EL. TV antennas, towers, 10mc FM antennas; and all antenna accessory equipment including filterplexers, notch diplexers, sideband filters, harmonic filters and rigid transmission line.



Vertical Pattern in Main Beam of CO-108UD Antenna — Smooth pattern provides uniform signal strength. Beam tilt is optional.

A Sample Directional Horizontal Pattern of CO-108UD Antenna — providing 3.1 megawatts Peak ERP with 25kw transmitter and 13% line losses.



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24 CAROL ROAD, WESTFIELD, N. J. / AD 2-0250 / Cable: COELTENNA WESTFIELD

Specialists in Advanced Antenna Systems

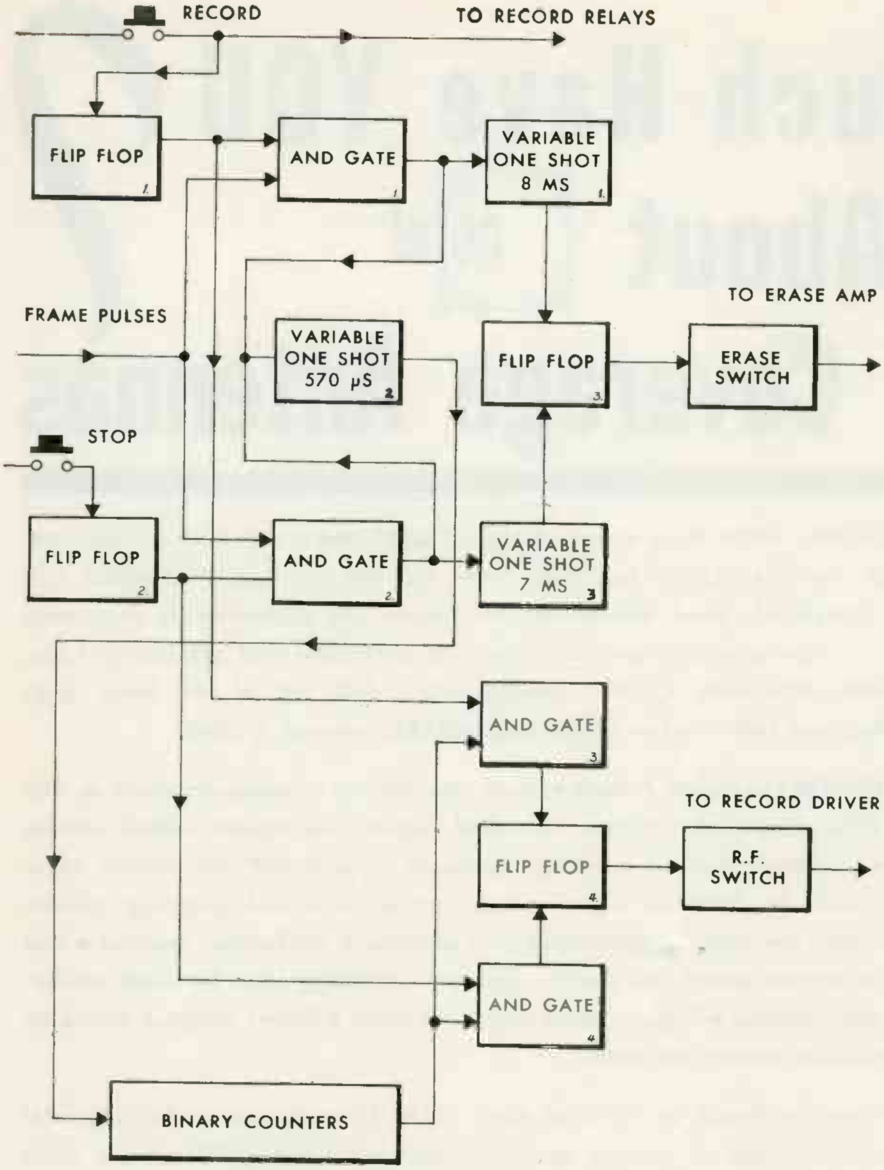


Fig. 9. Block diagram of logic type circuit.

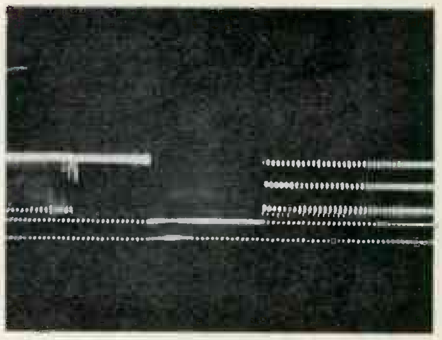


Fig. 10. Oscillogram of video information in splice.

the same as the width of a guard band, the gap is optically straight, and inclined to the perpendicular at an angle of 33 minutes of arc. This places the erasure pattern exactly parallel with the video record pattern. The audio and cue tracks are not affected by the new head; and, as stated above, erasure of the control track is optional.

It will be seen that the functions of the Editor are of the logic type and serve to provide precisely timed and electronically gated video erase and record currents. A block diagram is shown in Figure 9. The component sections of delay multivibrators, flip-flops, gates, and binary counters are all classic circuit configurations that do not warrant discussion at this time. The over-all functions, however, may be traced as follows:

Following initiation of the Record mode, a delay multivibrator provides 60 milliseconds delay during which all normal record relays have time to operate. Flip-Flop No. 1 then operates, which places AND Gates No. 1 and No. 3 in a "ready" state. Pulses, derived from the Intersync unit, that mark the third vertical sync pulse in every frame interval, are reshaped in a Pulse Former and routed to AND Gates 1 and 2. Gate 1, which is in a "ready" state, therefore, operates at the first framepulse and triggers Variable Delay Multivibrators No. 1 and No. 2. Multivibrator No. 1 serves to provide the necessary 9.3 milliseconds of delay before the video erase current is turned ON. Erasure

(Continued on page 27)

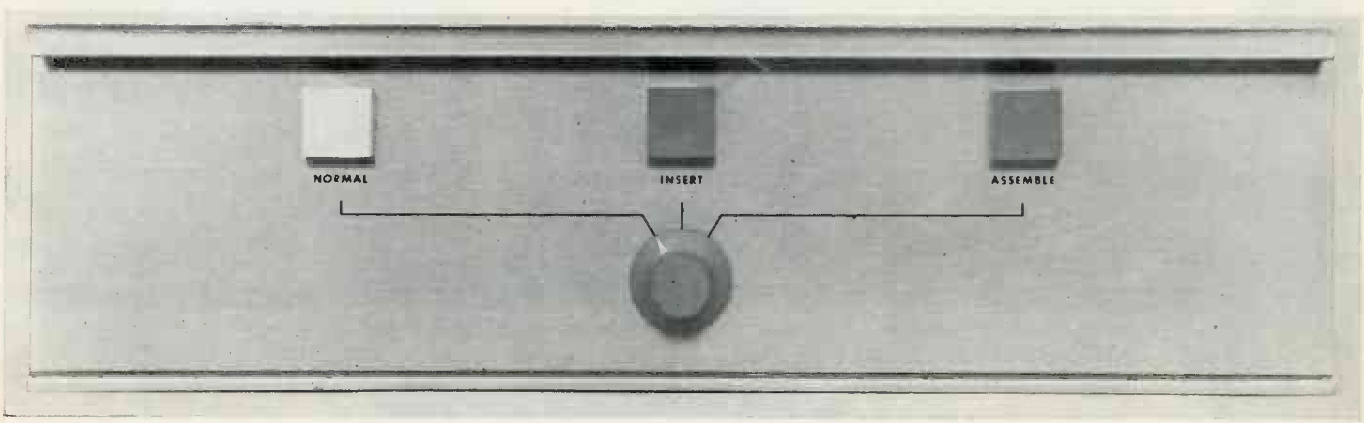


Fig. 11. Panel view of complete video insertion panel.

Transmitter Maintenance

(Continued from page 5)

rical modulation occur. Such an unbalanced condition can be the result of any of a number of factors. For instance, in a Class-C stage, insufficient grid excitation, too great a change in output impedance, or simply overmodulation, can cause carrier shift. In Class-B operation, not only will output impedance and overmodulation affect symmetry, but improper bias can be the root of the trouble.

Judging the performance of the various stages in an FM exciter is also done by observing the panel meters. At times, external instruments, such as a VTVM, an oscilloscope, and a sweep generator, are used. A record should be kept of past performance—a log of weekly meter readings, a separate one for monthly or quarterly test-point voltages, and possibly a record of quarterly sweep-alignment 'scope traces. It may also be helpful to note the settings of tuning controls and neutralizing capacitors. Most of the newer FM exciters require little or no re-calibration.

A transmitter as a whole is checked dynamically for power output (by the antenna ammeter or reflectometer), for frequency (by the frequency monitor), for modulation (by the modulation monitor), and for quality (by the sound on a *good* monitor amplifier and speaker—and by the audioproof method). An FM transmitter is additionally checked for bandwidth and phase linearity by a sweep generator and an oscilloscope. When written records are kept of these observations, it becomes simple to anticipate and prevent serious trouble or even outage, in many cases.

FM

The operation of a multiplex system at an FM station introduces new problems and techniques. The multiplex gear should be treated as a miniature and separate transmitter modulating the main carrier—an SCA or background music type using FM, while a stereo unit utilizes AM. Thus the trouble-shooting techniques used to service multiplex generators are *basically* the same. There are additional considerations, however, for one thing, strict phase linearity becomes mandatory on the main transmitter. This means that all main-channel stages past the point of Mx insertion must be examined for phase linearity with 'scope and sweep generator, both when tubes or other components in those stages are changed, and also at quarterly intervals. There are also specialized linearity considerations imposed on the subcarrier transmitter, and since *two* programs are being sent through the same transmission facility, crosstalk can appear in the system, and must be held to a minimum. A common cause of excessive crosstalk is improper neutralization. Mx generators seldom have as many controls as main transmitters, therefore stages must be checked with a VTVM and frequently with a 'scope and sweep generator. Such measurements should be done on a quarterly basis, with a complete log being kept each time. However, where *any* kind of Mx is used, it is a good idea to check the crosstalk with the main channel at least once a month.

SOME DO'S AND DON'TS FOR FM STEREO

By Lloyd Jones
President KMUZ-FM
Santa Barbara, California

A pioneer in FM stereo recounts some of the problems that he has encountered in setting up a first class operation, and gives some ideas for new operators in this field.

MULTIPLEX FM stereo broadcasting is here to stay providing the listening public receives a technically perfect signal and the type of entertainment it desires. There are three groups of people that must see to it that this is done: The manufacturers, the service/sales people and the broadcasters. The end product will be no better than the poorest link in the chain.

Stereo Problems

Let us set forth what appear to be some very important conditions for all three groups to follow from this writer's experience after six months of stereo broadcasting, going into dozens of homes to find out why they were not receiving stereo, investigating reports of servicemen saying the station "was not broadcasting stereo," "was transmitting distortion," etc., and going into the service shops to talk with the servicemen and sales people. Frankly, we are worse off now than at the beginning of television broadcasting! It is amazing to find that the service man and the public will blame a $100,000 broadcast station for just about everything — it just could not be their $100 "super-colossal" box. Granted, the broadcaster has a few troubles, but usually is aware of it before anyone else and makes immediate corrections.

First, the manufacturers *must* supply information with each adapter, or tuner, as to which slot or knob is the "separation" control and what to expect from it. Most of the units encountered were not marked! Give the timid servicemen encouragement to adjust your listeners' sets to their peak performance, not just mediocre performance. There is some question as to whether these sets can be factory aligned with test equipment, and expect it to agree with the transmitted signal. The manufacturer should also advise that their set will perform best when an outdoor antenna, properly matched to the lead-in be used. Stereo is just as critical as TV insofar as the antenna, orientation and lead-in are concerned. What we *see* as ghosts on a TV set we *hear* as distortion and lack of separation in stereo. It makes no difference how strong the stereo signal is, what is important is a signal without multipath phase distortion. Antenna placement, orientation and lead-in must function without appreciable standing waves. In other words, the built-in antenna is not desirable for stereo reception, although adequate for monaural reception.

Second, the servicemen must study, and find out *how* stereo works and what the result of a properly working system sounds like. Tell them, "do not blame the broadcaster to cover up your own lack of knowledge. Get a good book on FM stereo multiplexing and study the diagrams of all the stereo adapters. Take the initiative, tune in a stereo station and turn the separation control for maximum separation and then carefully check the balance control for equal volume from both left and right speakers during stereo music." (Note: Most stereo broadcast stations use the left channel for all voice news-

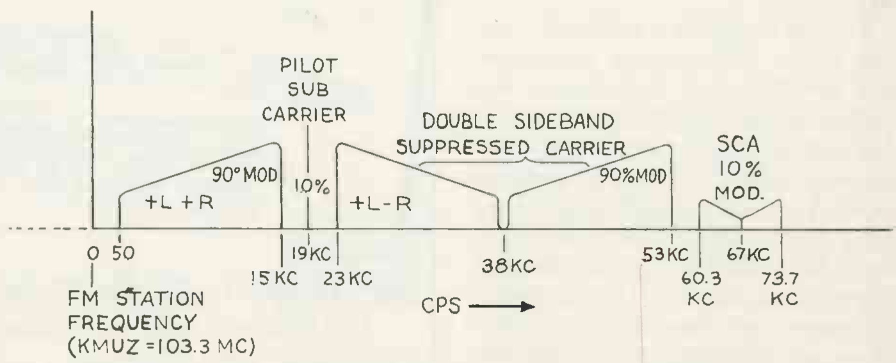


Fig. 1. Distribution of channels and frequencies in standard stereo carrier.

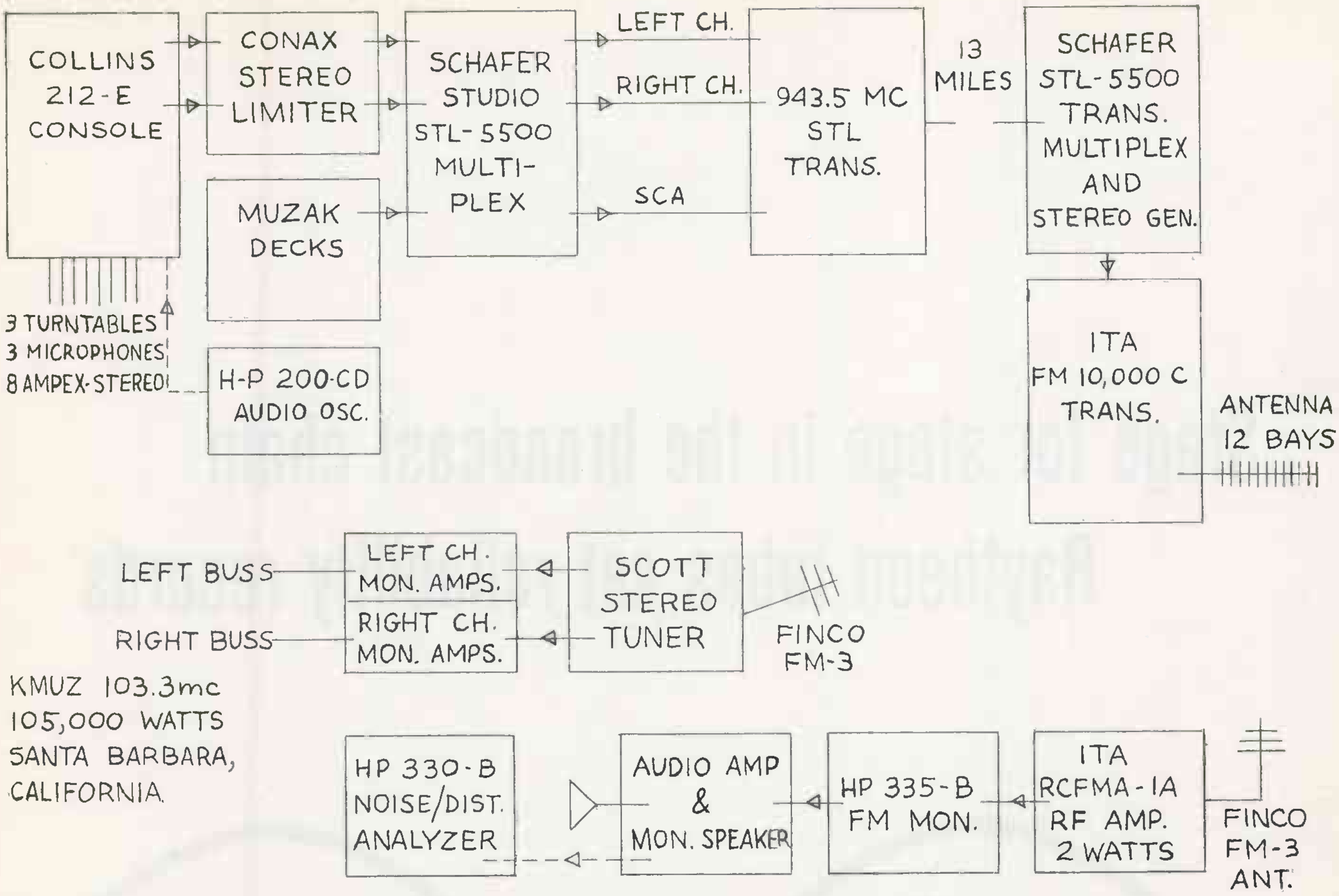


Fig. 2. Block diagram of audio/stereo equipment at KMUZ-FM.

casts and announcements.) You should hear practically no voice from the right channel when the volume of the left channel is at good room volume, and equal volume averaged over a few minutes listening from both speakers when stereo music is playing. Note Fig. 1 and see how the stereo and SCA signals are spaced frequency-wise. Never try to use a TV antenna for stereo reception. It will degrade the TV picture and stereo results are poor.

The service/sales people must learn that they can sell an adequate antenna system with a stereo system easier than they can make excuses, call-backs and then eventually sell an antenna system. Be forewarned that all FM tuners are not broadbanded enough to receive stereo. Any I. F. amplifier with less than 150 kc bandpass will not be able to give distortion free signals.

Third, the broadcaster must have excellent stereo equipment and keep it in perfect working condition. Since this writer has not visited many other stereo broadcast stations we shall relate how KMUZ is operated. (Perhaps a lot of letters from other broadcasters will permit a compilation of a very interesting list of items and thoughts on the subject of stereo.)

KMUZ broadcasts taped stereo music twenty-four hours a day. All voice announcements and newscasts are on the left channel only, offering the servicemen a definite time every few minutes for making his separation and balance adjustments. We measure our separation each week and find no trouble in maintaining 30DB separation at 100 cps, 35DB at 1,000 cps and 32DB at 10,000 cps. You should be aware that some stereo records have very little separation, with the better records having about 30DB of separation. Do not judge a system by listening to only one selection. During our voice announcements the separation is around 40DB most of the time. Fig. 3 shows the broadcast engineer what he must have on an oscilloscope when certain adjustments of the stereo generator are correct.

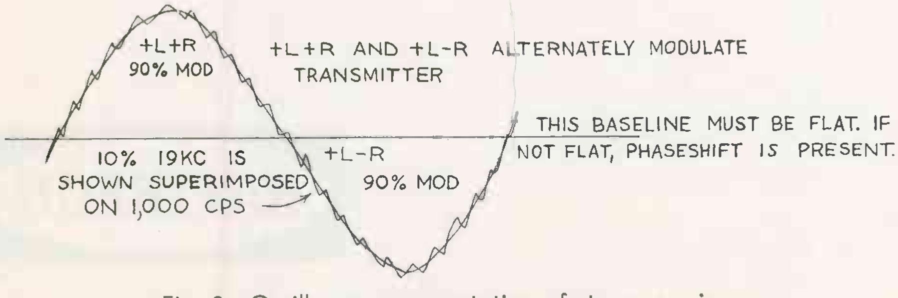


Fig. 3. Oscilloscope presentation of stereo carrier.

Fig. 2 shows the overall system in block diagram for regular operation as well as making regular off-the-air system performance checks.

Let all three groups join in the effort to build, install and supply the very finest stereo for the rapidly growing public acceptance of this wonderful new medium.

Stage for stage in the broadcast chain Raytheon tubes set reliability records

Raytheon manufactures quality tubes for every broadcasting requirement . . . rugged performers that log in record hours of service, parlay this dependability into lowest service cost per hour for you wherever they are installed.

RAYTHEON

A Composite Antenna

By Elton B. Chick, Assistant Director of Engineering
Rounsaville Radio Stations

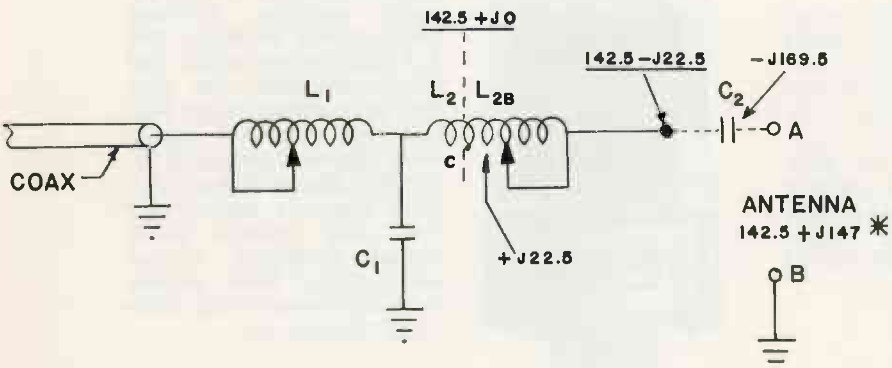


Fig. 1. "T" Net.

*Driving Impedance

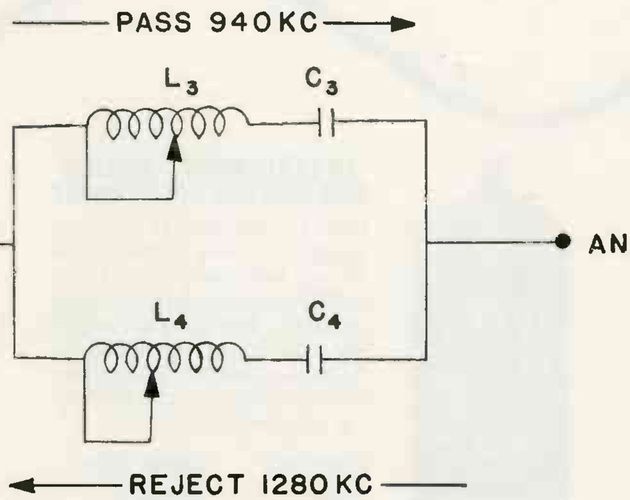


Fig. 2. Pass-Reject Network.

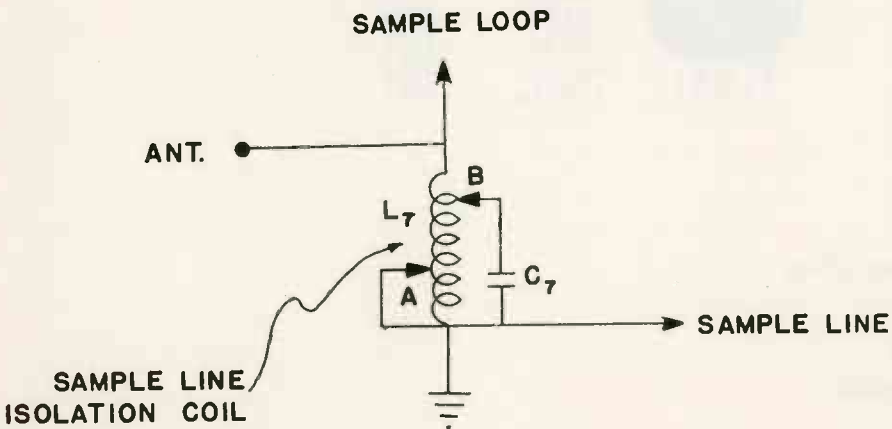


Fig. 3. De-Tuning Net.

In the construction of WYLD's transmitter plant it was desired to use composite antenna tuning units and phasor. These units were to be fabricated on the job, from components mostly on hand, so that a worthwhile savings was realized. While the unit described here is typical in some respects it also represents many of the special problems found in the design, construction and adjustment of these units.

Network Design

The primary purpose of the antenna tuning unit is to couple and to match the antenna impedance to the transmission line impedance for an efficient transfer of r.f. energy. In directional antennas the network must also produce a specified phase shift. In this case a three element array was used. After mutual impedance measurements were completed the driving-impedance of each tower was calculated.[1] From this data, using handbook equations, the net works were designed. The driving-impedance of one tower was found to be 142.5 + j147 ohms (towers were top loaded). The network used to match this tower to the 51 ohm line will be described. A phase shift of —76 degrees was required at this point.

In addition to matching the two impedances and providing the phase shift, the net was used to cancel the reactive component of the driving-impedance. To cancel this inductive reactance a capacitor was used in series with the antenna lead-in. The value of this capacitor, C_2 of Figure 1, must be such as to have a reactance of 147 ohms. Then:

[1] Driving-impedance of a directional antenna tower is similar to the base impedance of a single non-directional tower except that the directional tower is space coupled to other towers of the array which alters its base impedance.

Tuning Unit

It is not very usual in these days of "instant" this and "instant" that to find stations going in for their own large equipment construction. However, if there is ample material lying around unused, and the labor is already paid for such procedure, it has much to recommend it. In this case a good looking piece of equipment has resulted. We have departed from our custom of deleting "fancy" math because this is germane to the story.

$$C = \frac{1}{2\pi f X_c} = \frac{1}{(6.28)(.94)(10^6)(147)} = .00115 \text{ ufd.}$$

A suitable capacitor of this value was not on hand, so a smaller capacitance was used, a .001 ufd was chosen. This gave a reactance:

$$Xc_2 = \frac{1}{2\pi f X_c} = \frac{1}{(6.28)(.94)(10^6)(10^{-9})} = 169.5\Omega$$

This was more reactance than needed, that is, 169.5 — 147 or 22.5 ohms more. The combination of antenna reactance and C_2 became capacitive—more inductance was needed. Because the antenna reactance is not easily altered this additional inductive reactance was provided by the output leg of the T net, L_2b. By adjusting L_2b to a reactance of 22.5 ohms the combination of L_2b, C_2 and Xd became a series resonant circuit. Terminals C and B now show only the antenna resistance. The next step was to match the 142.5 ohm tower to the 51 ohm line with a —76 degree network.

Matching Network

Using equations from Terman's handbook,[2] the reactance values of the net components were calculated as follows:[3]

$$Z_1 = -j\frac{R_1 \cos B - \sqrt{R_1 R_2}}{\sin B} =$$

$$-j\frac{51(.2419) - \sqrt{51(142.5)}}{.9703} = +j74.6$$

$$Z_2 = -j\frac{R_2 \cos B - \sqrt{R_1 R_2}}{\sin B} =$$

$$-j\frac{142.5(.2419) - \sqrt{51(142.5)}}{.9703} = +j52.3$$

$$Z_3 = -j\frac{\sqrt{R_1 R_2}}{\sin B} = -j\frac{\sqrt{51(142.5)}}{.9703} = -j87.9$$

Where: R_1 is line impedance Z_0, (51 ohms)
R_2 is antenna resistance (142.5 ohms)
B is 76°, Sin B=.9703, Cos B=.2419

Inductance and capacity values are:

$$L_1 = \frac{Xl_1}{w} = \frac{74.6}{5.9\,(10^6)} = 12.65 \text{ uhy (input leg)}$$

$$L_2a = \frac{Xl_2a}{w} = \frac{52.3}{5.9\,(10^6)} = 8.86 \text{ uhy}$$

$$L_2b = \frac{Xl_2b}{w} = \frac{22.5}{5.9\,(10^6)} = 3.81 \text{ uhy}$$

$$L_2a + L_2b = 8.86 + 3.81 = 12.67 \text{ uhy (output leg)}$$

$$C_1 = \frac{1}{W \times C} =$$

$$\frac{1}{5.9\,(87.9)\,(10^6)} = .00193 \text{ ufd (shunt leg)}$$

Where: $W = 2\pi f = 6.28\,(.94)\,(10^6) = 5.9\,(10^6)$
Output leg of T net is $L_2a + L_2b$

Due to stray capacity, coupling and other effects these values were not those finally used, but allowed the selection of components. Exact adjustments were made with an r.f. bridge. The inductance and capacity values selected are as follows:

[2] Terman, F. E. Electronic and Radio Engineering 4th Edition, McGraw-Hill

[3] It is interesting to note that these equasions reduce to a much more simple form when B = 90°.

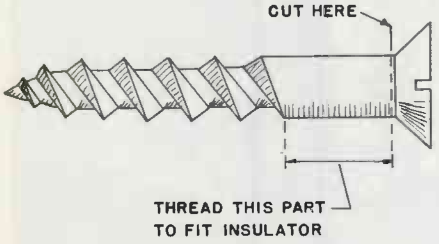


Fig. 4a. Special Screw.

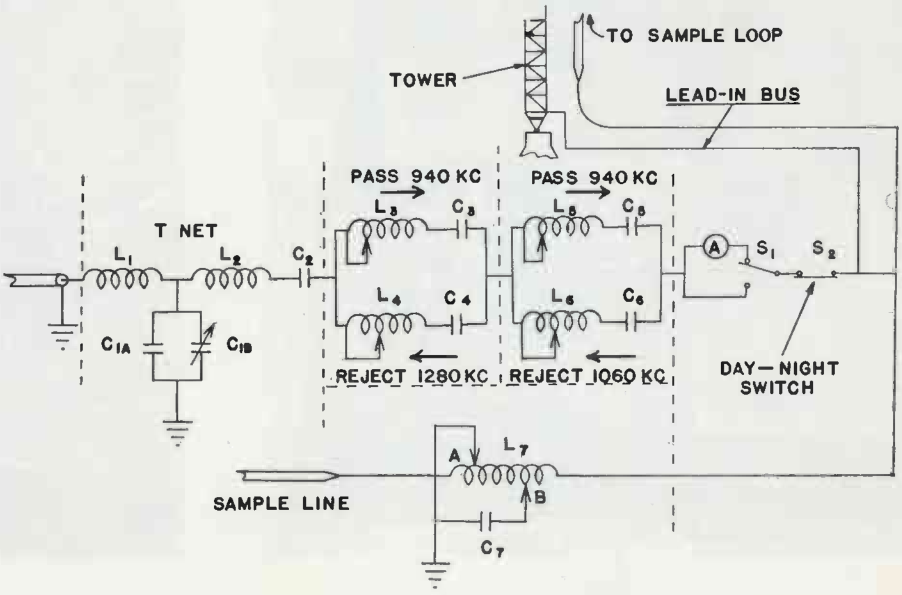


Fig. 4b.
Antenna Tuning Unit
Schematic.

L_1 15 or 20 uH or more
L_2a and L_2b combined 15 to 20 uH or more
C_1 .001 ufd. mica plus variable vacuum capacitor

Current ratings of the coils and capacitors were estimated since the network would handle relatively little power. With a field ratio for this tower of 0.47, representing a power of about 120.5 watts, the base current would be:

$$I = \left(\frac{W}{R}\right)^{1/2} = \left(\frac{120.5}{142.5}\right)^{1/2} = .92A.$$

A base ammeter with a scale 0-1.5 A was used.

Ordinarily it would not be good design to use coils rated 10 or 20 times more than required but in this case components on hand were used. The result was a very conservatively rated net which is an advantage in reducing the possibility of component failure and lightning damage. Where components were purchased the current and voltage ratings were calculated to hold down the cost.

Special Problems

Because of WYLD's proximity to other stations, isolation networks were required to avoid cross modulation. Also, a means of de-tuning the towers was needed to avoid pattern distortion of another nearby directional antenna. To provide these features, pass-reject networks were used for isolation and the sample line isolation coils were used to de-tune the towers.

In the isolation networks, Figure 2, the reactance of L_3 was adjusted to equal that of C_3 thus forming a very low resistance (series resonant) path for 940 kc energy. At a frequency above 940 kc this series combination is inductive and may be parallel resonated to form a very high impedance path into the T net for the undesired frequency[4]. The reactance of the parallel resonating capacitor C_4 was adjusted to the proper value by adjustment of coil L_4. Two such networks were constructed for each tower of the array thus allowing isolation at two frequencies.

De-tuning the towers amounted to adjusting their electrical length to a half wave and grounding them. The sample line isolation coil was used for this purpose. This unit is a portion of the sample line. It is made of coax on a large form, the outer conductor being used as a coil. In Figure 3, the position of tap B was adjusted for minimum reradiation of the undesired signal, as measured by a field intensity meter with the aid of its null characteristics. Also checks of pattern distortion were made and this distortion minimized. Once this condition was found, the coil's reactance was carefully measured for reference. By adjustment of tap A the sample line coil was made parallel resonant at WYLD's frequency. When this was done it was then necessary to reset tap B to the reference reactance. Because of this interaction it was necessary alternately to adjust tap A and tap B. After several adjustments tap positions were found which satisfied both conditions simultaneously. Because the sample line isolation coil is parallel resonant at the operating frequency, its very high impedance has little effect on the driving-impedance and is effectively removed from the antenna circuit. Connections were made inside the coil and soldered in place to prevent accidental maladjustment.

(Continued on page 26)

[4] This method may also be used to reject a frequency below the series resonant frequency. Below series resonance the reactance of the series combination is capacitive and may be resonated by a parallel inductor.

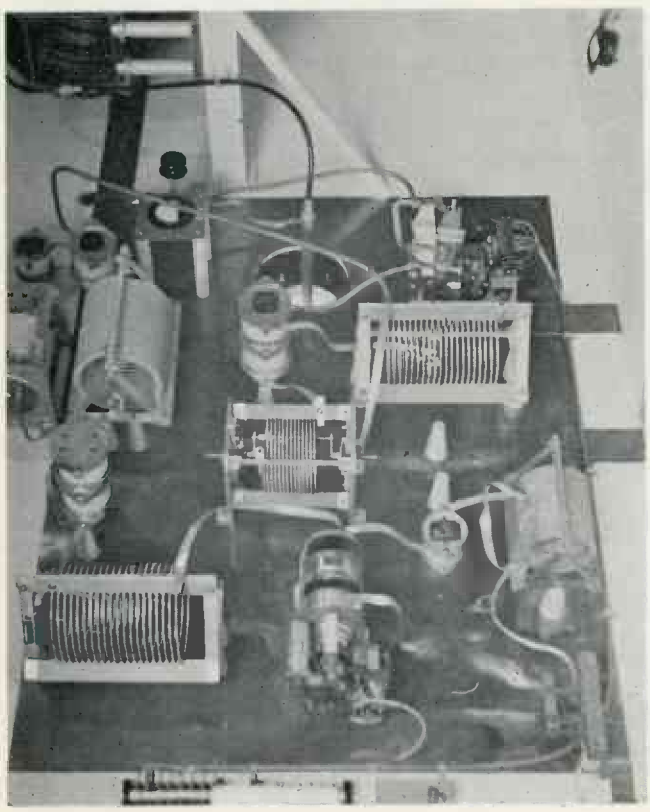


Fig. 5.

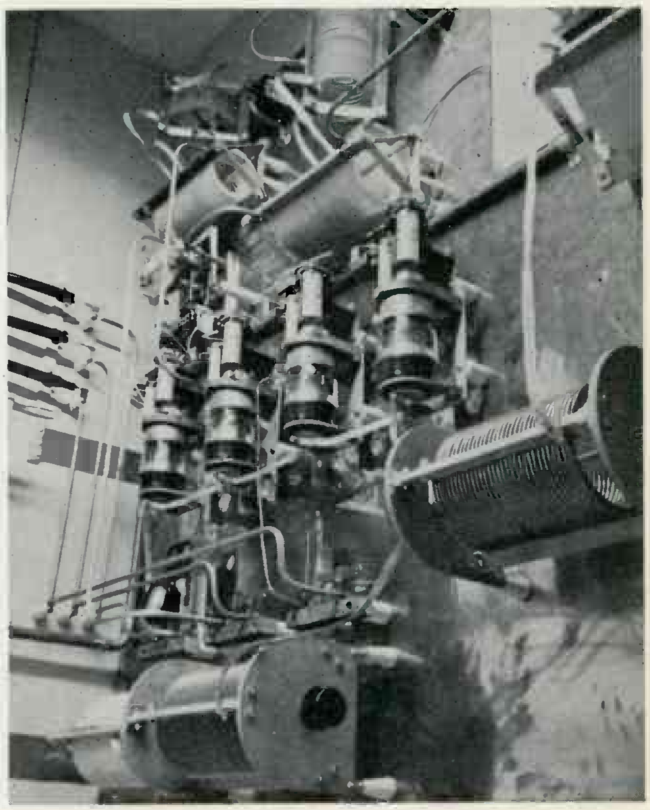


Fig. 6.

Antenna Tuning Unit

(Continued from page 24)

Physical Layout

The tuning unit is housed in a small frame building. Inside this building one wall is covered with ¾-inch plywood. A large copper sheet was tacked to this plywood and the network components mounted on the copper sheet. A hole was cut in the tuning house wall and the copper sheet to allow entrance of the lead-in bus and sample line. The lead-in bus consists of 1-inch copper pipe, brazed to the tower and supported at its other end by a bowl insulator mounted on the outside wall of the building.

Except where directly grounded, all components were mounted on insulators. Special care was taken in the layout to allow ease of wiring and adjustment. Also, accurate measurements were needed in the drilling of pilot holes to allow fitting of components to mounted insulators. A combination wood-machine screw was made for this job by removing the heads of wood screws and threading the upper portion of the screw with machine screw threads, necessary for the insulator. Figure 4 is a sketch of this home made screw.

In addition to the components of the basic "T" net and isolation traps, mounting was provided for the base antenna ammeter and for the antenna switch used for switching between directional and non-directional operating conditions. The unit described here has no provision for a remote antenna ammeter. Phase monitor meters were used to indicate antenna currents. Special scales were ordered for the phase monitor meters to match those of the base meters.

Wiring

Wiring of r.f. components is done with ½-inch copper strap or ⅜-inch copper tubing. The tubing was used only for the longer runs where more rigidity was required. In working these materials a very handy tool is the Whitney No. 5 Jr., sheet metal punch. Clean holes from 3/32 inch through 9/32 inch may easily be punched in either the strap or tubing. The tubing must be flattened with a vise or hammer before punching. To form neat bends in the tubing a ⅜-inch flexible tubing bender was used.

Solder connections to the copper sheet are easily made with a small bottled-gas torch. Before soldering, the copper sheet and connecting strap were cleaned with steel wool and a thin coat of non-corrosive solder paste was placed on both the sheet and strap. A piece of cloth or a small brush is handy in making a neat joint, excess solder can be brushed or wiped away. The finished joint is cleaned with a solvent such as denatured alcohol. Straps were tacked or held in place by a small wood screw before soldering to the sheet. Wiring to the antenna switch, solenoids and vacuum capacitor motor are contained in a pre-formed piece of ⅜-inch copper tubing which is clamped to the copper sheet. Line metering jacks were constructed of old switch parts. A grounding strap for the r.f. bridge is made of a piece of RG17/U coax braid, flattened and dressed at each end.

Video Tape Editing

(Continued from page 16)

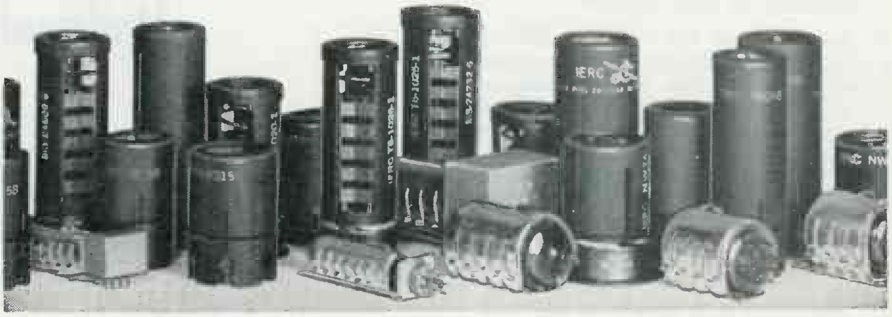
turn-on is accomplished by Flip-Flop No. 3 and an electronic switch.

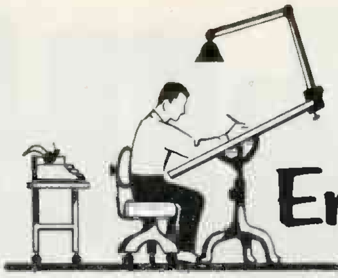
Because timing is referenced to the third pulse in the vertical sync train, and at this time the rotating video head drum is positioned to place the active head tip at the center of a video track, a 525 microseconds delay is provided by multivibrator No. 2. This allows the head to travel to the end of the track, at which time the succeeding head on the drum periphery is positioned at the beginning of the next track. From this timing reference, 18 television frames are counted off by the binary counter system and at the end of this period Gate No. 3 operates. Video record current is then turned ON by the action of Flip-Flop No. 4 and a second electronic switch.

Timing for the out-going "splice" is provided by the operation of Gates No. 2, and No. 4, and Variable Delay Multivibrator No. 3 which together with the reuse of the counter train resets Flip-Flops No. 3 and No. 4 and places the two electronic switches in the OFF condition.

An additional flip-flop (not shown on the block diagram) is operated by the binary counters exactly 18 frames after the video record current is turned OFF. This permits the audio track to be cleared of all extraneous video information by the action of the audio erase head. (New audio information has, of course, accompanied the new video information.) A time delay circuit allows all audio functions to revert to normal before stopping the machine. In this way any possibility of transients on the audio track is avoided.

The quality of the finished "splice" may be observed in Figure 10 which is an un-retouched oscillogram of the video, blanking and synchronizing information in the video waveform at the moment the electronic "splice" passes the video heads. Subjectively, the splices appear the same as a change of picture content caused by camera switching.





Engineer's Exchange

Voltage Regulation for G. E. Unilevel Amplifier

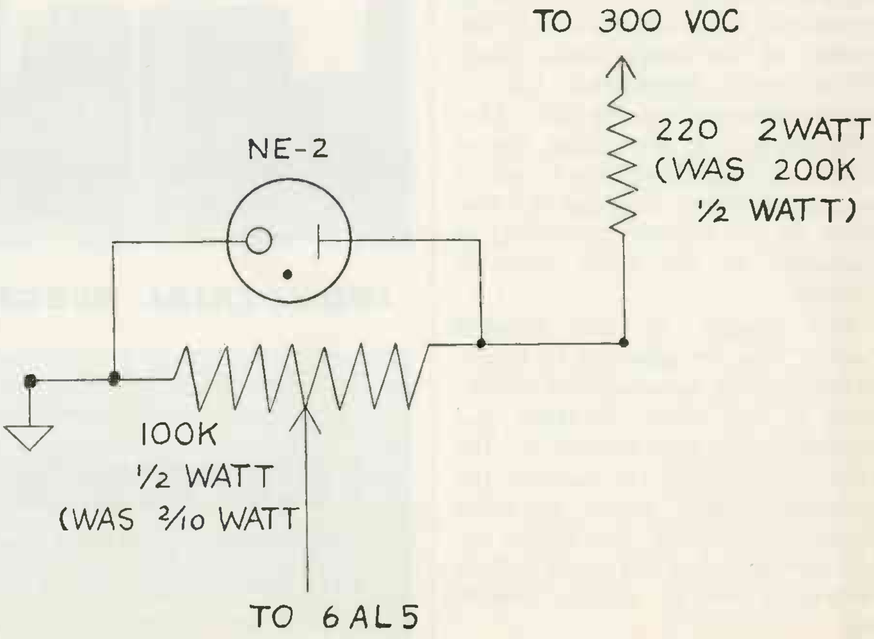
By Bruce L. Mackey
Chief Engineer
WKRT RADIO

Many stations today, in an effort to maintain a high level of average modulation and effectively increase coverage through this means, employ some sort of automatic gain regulating amplifier. Many of these stations employ, as we do, the General Electric BA-9-B Unilevel amplifier.

We have experienced, however, some difficulty in maintaining the threshold voltage at a constant value due to line voltage variations which occur in our control room. If the threshold voltage varies, the operating parameters of the amplifier vary accordingly, producing changes in the output level and the amount of compression that can be obtained with a given input level.

Since the Unilevel amplifier does not employ any form of voltage regulation, as do most other amplifiers of a similar nature, we set about to devise an effective method of maintaining a constant value of threshold voltage.

The threshold voltage (which determines the point at which the amplifier begins to compress) is controlled by a 100 K .2 watt pot which is fed at the high end by a 200K ½ watt dropping resistor from a 300 volt tap in the power supply, and which is grounded at the low end. The center tap is connected through two isolation resistors to the cathodes of the 6AL5 bias rectifier. In order to maintain a constant voltage across the pot, an NE-2 neon



lamp was inserted at this point. This effectively maintains the voltage across the pot at 65 volts.

The pot was replaced with one of the same value (100K) but with a ½ watt rating. The 200K dropping resistor was replaced with a 220K 2 watt value. The increase in the wattage rating of the pot and the resistor provided cooler operation and less drift of these components due to heating. It was necessary to change the value of the 200K resistor to 220K to enable the NE-2 to operate within its ratings, and therefore assure long and trouble-free service.

The result of these modifications is that for a variation of as much as 35 volts in the DC power supply, the voltage at the center tap of the threshold control will not vary more than ¼ of a volt, producing no measurable change in the operating characteristics of the amplifier.

The Hickock Model 6000 Tube Tester—Modify it Now!

By Lloyd Jones
Santa Barbara, Calif.

The 83 tube has been a very important tube used in the Hickok tube testers for a long time. Now that the 83 is so hard to buy it has become necessary to find a substitute. This task led us to try using silicon diodes to replace the 83 and the 5Y3 tubes. The results are very pleasing in that the tester may now be used all day and the panel is still cold, whereas the original tester with tubes would get so hot after an hour or so that it was almost too hot to touch the panel. The only negative result is the lack of control of line voltages when they are off by plus or minus about three volts. This is not a very important problem just so long as the line voltage reading of 115 volts AC is also 115 volts AC when read in the octal socket pins 2 and 7 as described below. All other filament voltages will be very close to being correct clear down to the 0.6 volt tap.

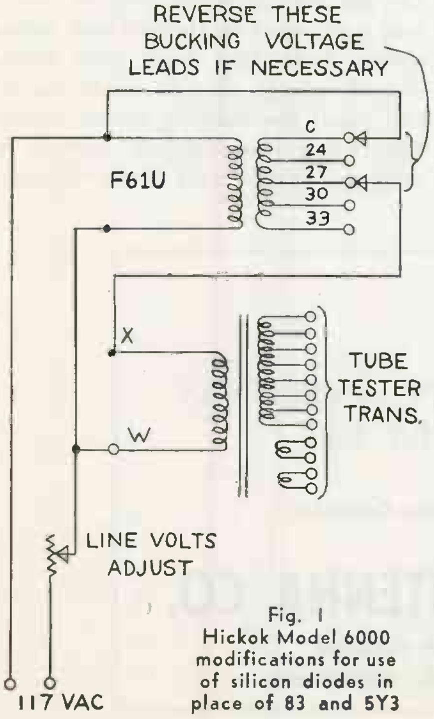


Fig. I
Hickok Model 6000 modifications for use of silicon diodes in place of 83 and 5Y3

To make the modification you will need the following material:

1 Tarzian tube replacement No. S-5011A (1N1150) for the 83.
1 Tarzian tube replacement No. S-5018 (1N1238) for the 5y3.
1 F-61U Triad, or equal, bucking transformer to reduce the line voltage to about 80 to 85 volts.

Make sure the AC line cord is not plugged in.

Remove the screws holding the front panel to the cabinet, lift the panel out and turn upside down.

Remove the 83 and 5Y3 tubes.

Mount the F-61U transformer in an area where it will clear all other parts and still fit when the panel is put back into the cabinet. Wire the transformer according to the diagram in Figure 1. Use temporary connections to the secondary (30 volts) until you can test and see that the windings are phased to reduce the 115 volts to about 85 volts on the main transformer terminals X and W. When this done make the connections permanent and insulate the splices well. (Or use tie-points if you prefer.) Also make sure to select the proper tap, 27, 30 or 33 volt tap to have the closest reading on the external voltmeter which will agree with the 115 volt *line* reading and 115 volts as read by putting the voltmeter test prods into the octal socket holes 2 and 7, the tester FILAMENT VOLTAGE SWITCH on 117 volts and the filament selector switches on H and S. If the line voltage and the indicated filament voltage is within plus or minus two volts, everything will be fine. At this point, the tester meter should read very close to the center line marked LINE TEST. You will now note that the line voltage control on the tester has less effect than it used to, but again, this is not too important if your line voltage is quite close to 115 or 117 volts, and the previous adjustments have been made.

After making all the above modifications following the diagram in Figure 1 and having the voltages indicated above, you may plug in the respective Tarzian replacements into the proper sockets.

Turn the panel right-side-up and rest it in its normal place in the cabinet.

Turn the Filament Selector Switch down to about the 5 volt position.

Plug the tester AC cord into an outlet.

Plug into the proper socket a tube such as a 12AT7, 12AU7, or 12AX7.

Set the filament voltage switch to 10 volts. Set all other controls for testing the tube which is in the socket according to the roll chart. The filament should now be lighted. Lift the tube up out of the socket just far enough to be able to place external AC voltmeter test prods against pins 4 and 5, and while the tube is still lighted the voltage should read 10 volts, plus or minus 0.1 volt. (If other tubes are used in other sockets, with other filament voltages, and for instance the octal socket is used, pins 2 and 7 will be the heater pins for a majority of octal type tubes, you may make similar tests for 6.3 volts AC.)

Replace the screws holding the panel in the cabinet.

This completes the modification.

Now is a good time to test some of those old tubes. Learn to trust your tube tester to tell you that the tube has poor or good heater-cathode emission, and that the *gm* is poor or good. Learn which tube types will give the *gm* reading listed on the chart and higher, and a few types which will read somewhat lower than the *gm* readings on the chart, but are actually good tubes. Use new and old tubes for these tests.

Learn to recognize how fast the *gm* meter will rise as the tube heats up, and in most cases this is a fair indication that the tube has a lot of emission reserve, or whether the emission is low when the meter rises rather slowly. When testing 12.6 volt tubes, switch the filament to 10.0 volts and note if the *gm* reading drops by 20%, throw that tube away. When testing 6.3 volt tubes, switch the filament to 5.0 volts. If the *gm* reading drops 20% or more, you may want to throw these tubes away. Note that good new tubes should nearly always come up to full rated *gm* reading, or be within 5%, when the filament voltage is dropped to the next lower voltage.

Beware of the rare instances when some of your tubes will work in equipment actually having excessive filament voltage, yet the tubes will test poorly. Or, just as important, tubes that test good in the tester, yet will not function in the equipment due to low filament voltage in the equipment.

After making the above modifications we like our type 6000 better than ever, and highly recommend that you change over now and not wait for your 83 tube to go out.

Eliminating Guy Wire Pattern Distortion

By John Humphries
President, KXTR-FM
Kansas City, Mo.

Shortly after the commencement of broadcasting at KXTR-FM, it became evident through listener reports that reception of KXTR was not uniformly good throughout the greater Kansas City area. These reports were numerous enough that an accurate field strength survey was deemed necessary.

An approximate circle was driven around the transmitter at a radius of 4 miles and both listening and field strength tests were made on this circle. The results of these measurements indicated that field strength was greatly reduced at 3 points, 120 degrees apart, and further investigation revealed that these low signal areas extended roughly as three radii from the transmitter spaced at 120 degrees intervals.

This led to suspicion of the tower guy wires because of the relationship of low signal areas and guy wire

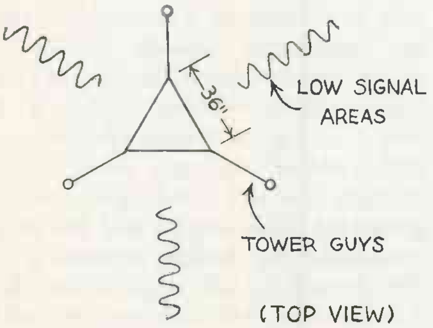


Figure 1

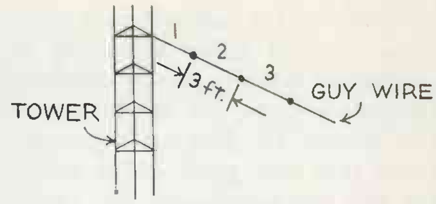


Figure 2

placement. This is indicated in Figure 1.

The nine guy wires on the 148 ft. tower were at the 40, 90 and 140 ft. levels, extending 80 ft. out from the base and spaced at 120 degree intervals. At the tower guy junction, the wires were broken by insulators at 3 ft. intervals, as indicated in Figure 2.

From the relationship of the guy wires and low signal areas, it was decided that at least some of the 3 ft. sections which were spaced within one wave length (10 feet) of the antenna were acting as passive directors, and causing the directional radiation pattern.

The reasoning for this is that to act as a director, a passive element must be resonant at a higher frequency than the driven element, and must be spaced less than one wave length, becoming more and more effective as the spacing is decreased. Since the suspected guy sections were somewhat shorter than ½ wave length at KXTR's frequency, 96.5 mc, a resonance of the guy element at a higher frequency was indeed indicated.

To try and determine whether or not these sections were actually resonant and re-radiating energy to cause a directional pattern, the sections marked 2 and 3 in Figure 2 were electrically shorted together on three of the guy wires.

During this work, done while the transmitter was on, appreciable sparks could be drawn from these short guy sections, indicating a fair amount of RF pickup. After shorting these sections together, a definite improvement was noted in the low signal area opposite the set of guy wires worked on. In view of this improvement, sections marked 1, 2 and 3 in Figure 2 were shorted together on all nine guy wires. Electrically, this left a 9 ft. guy section grounded to the tower, and the long remaining guy section extending to the ground on all guys. Since the 9 ft. section was not near an odd multiple of ¼ wave length, at

KXTR's frequency, no difficulty with its length was expected.

After completing this work, listening and field strength checks on a circle around the transmitter at a radius of 4 miles indicated no asymetry in the pattern.

It is concluded that the spacing with relationship to the antennas and the length of at least some of the 3 ft. insulated guy sections were such that resonances occurred, and the sections acted as parasite directors, causing distortion of the pattern.

Bullock Appointed Asst. To Kliegl Vice-President

Kliegl Bros., New York, N. Y., has announced the appointment of Robert W. Bullock as assistant to the vice-president in charge of TV sales and engineering.

Prior to joining Kliegl, Bullock served as lighting facilities engineer in the audio-video engineering group of NBC, and later was a lighting director on such shows as Continental Classroom, Huntley-Brinkley News, Young Dr. Malone and Concentration.

Wind Turbine Co. Expands Operations

Wind Turbine Co., West Chester, Pa., has transferred its entire operations, including research, engineering, manufacture and all other activities, to a larger plant near Elverson, Pa.

A modern plant, almost three times as large as the old facility, will permit more efficient handling of the company's presently expanded government, industrial and civilian commitments, and will provide for future growth. A feature of the new plant is the rooftop testing facility for antennas which will enable the testing out of antennas in a shorter time.

AES Announces N.Y. Convention Program

More than 100 papers covering nearly every aspect of sound and sound reproduction will be presented at the Fourteenth Annual Audio Engineering Society Convention to be held at the Hotel Barbizon-Plaza Oct. 15-19.

Because of the growing importance of communications, emphasis will be placed on new aspects in this field—FM stereo broadcasting and modern telephony. According to the convention chairman, H. E. Roys, the 15 sessions will interest not only engineers, but also audio personnel and technicians in specialized branches who regularly attend the Society's conventions. Three sessions will be devoted to disc recording and reproduction, with special attention given to European recording techniques.

Guest speaker at the annual banquet to be held in the Barbizon Room Thursday, Oct. 18, will be George R. Marek, vice-president and general manager, RCA Victor Record Division, who will speak on "Sound—History and Future." Presentation of awards and fellowships by the Society will take place at this time.

The complete list of technical sessions follows:

Monday, October 15
9:00 A.M.—Annual Business Meeting
9:30 A.M.—Microphones and Earphones
1:30 P.M.—Audio Electronics
7:30 P.M.—Loudspeakers

Tuesday, October 16
9:30 A.M.—Disc Recording and Reproduction I
1:30 P.M.—Disc Recording and Reproduction II
7:30 P.M.—Recording Techniques in Europe
7:30 P.M.—Music and Electronics

Wednesday, October 17
9:30 A.M.—Magnetic Recording
1:30 P.M.—Requisites of Modern Telephony
7:30 P.M.—Stereophonics—(Sponsored by IRE-PGA)

Thursday, October 18
9:30 A.M.—Sound Reinforcement and Acoustics
1:30 P.M.—FM Stereo Broadcasting I
7:00 P.M.—Annual Banquet—Presentation of Awards

Friday, October 19
9:30 A.M.—FM Stereo Broadcasting II
1:30 P.M.—Broadcast Audio/Studio Equipment
7:30 P.M.—Psychoacoustics

EXHIBIT HOURS—AUDIO ENGINEERS SHOW
Tuesday through Friday, Oct. 16-19, 1962. Noon to 6:45 P.M., except Thursday and Friday to 5:00 P.M.

Product News

MAGNETIC TAPE MESSAGE REPEATER

A fully transistorized magnetic tape message repeater, said to play without interruption or stop on cue, has been developed by Cousino Electronics Corp., 1941 Franklin Ave., Toledo, Ohio.

The audio-announcer, model AA-2320, can perform as the playback unit of prerecorded messages, and plays the Echo-Matic self-threading cartridge which is designed to provide tamper-proof housing and automatic rewinding of the magnetic tape loop. Automatic shut-off is provided by metal foil or conductive paint at stopping points desired. Restart is by footmat start switch, remote start cord, photoelectric cell, clock or other switching devices.

The unit measures 5⅞ x 9 x 5⅜ inches and weighs 9 lb. Audio response ranges from 80 to 10,000 cps, flutter and wow is less than .4 per cent RMS and signal-to-noise ratio is 45 db.

MINIATURE SIGNAL BUZZERS

Hanell, Inc., 1824 W. Kinzie St., Chicago, Ill., has announced a new series of miniature signal buzzers, measuring ⅞-inch cube, for operation on ac voltages from 6 to 120, as specified, drawing as little as 150 mils.

The buzzer operates on the vibrating reed principle, utilizing only one moving part, the manufacturer states, and features small size, flexible mounting arrangement, long life and low cost. It is available with slip-on or standard solder terminal lugs, and mountings are cadmium-plated for corrosion resistance. Dust-proof enclosures are also available, as small as 1-inch cube.

ENGINEERING-SCIENCE SLIDE RULE

Keuffel & Esser Co., Hoboken, N. J., has introduced the Deci-Lon®, a new slide rule with expanded computing capacity, which features choice and arrangement of 26 scales; greater consistency and logic; convenience and speed in operation; and lifetime construction. The unit is built on the principle of the Deci-Trig®.

The Deci-Lon incorporates a new proximity grouping of scales, additional calibrations, the extended use of color coding, and a redesigned indicator for easier manipulation. Besides a wider field of view, the indicator also has a red hairline to contrast against the rule's black graduations. Precision molded of synthetic material, the unit is said to be completely shatterproof, and humidity variations have no effect on its operation. End plates are newly designed to insure accuracy, rigidity and performance of alignment.

Product News

NEW ELECTRIC GENERATOR

A new electric generator that can be carried in a car for instant use anywhere has been announced by Hearth Industries, 1014 Brooklyn Ave., Wellsville, N. Y.

According to the manufacturer, 2,250 watts of 110-volt ac provides a surplus of power for lights, electrical equipment and power tools. The 94-lb. generator Mark II, is designed to be carried on the job. Electric power is produced by a new method that is said to eliminate the heavy armature and armature windings, as well as brushes and the problems they cause. It has permanent ceramic magnets. It was further stated that the new construction will not burn out, the only coils are the copper ribbon coils in the stator, and no damage will occur from an overload or short circuit.

A starter kit is available when using the unit as a stand-by source. The generator is driven by a Briggs & Stratton, four-cycle engine, using standard gasoline or LP Gas, and equipped with stellite positive rotating valves.

TEL-AMATIC BOLEX MAGAZINE CONVERSION

S.O.S. Photo-Cine-Optics, Inc., 602 W. 52nd St., New York 19, N. Y., has announced a new Tel-Amatic Bolex magazine conversion. According to the manufacturer, any Bolex camera can now be used with Mitchell type 400-ft. and 1200-ft. loads where a continuous run of film is necessary, or where reloading of the camera on location is inconvenient. With a changing bag, unloading and loading of the film magazine is said to be simple. If desired, 100-ft. or 200-ft. daylight loading spools can be used in the external magazines. When necessary, the magazine can be quickly dismounted.

The unit includes 115-volt synchronous motor maintaining 24 frames per second for accurate recording. The motor is mounted on separate base with on-off switch, reverse switch and 12 ft. of heavy-duty cable. The complete unit consists of one 400-ft. Mitchell type magazine, cover plate (used when magazine is not on camera); torque takeup motor and belt; recessed rollers on mounting plate; saddle block permanently mounted to camera; bellows coupler; and heavy-duty fiber case.

FM REBROADCAST RECEIVER

A new crystal-controlled, commercial-type stereo/monaural FM rebroadcast receiver designed to eliminate the need for telephone lines or conventional hi-fi receivers has been introduced by Vitro Electronics, division of Vitro Corp. of America, 919 Jesup-Blair Drive, Silver Spring, Md.

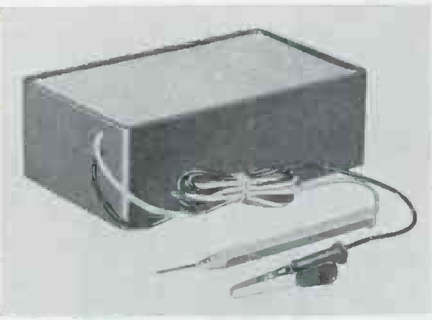
Designed specifically for FM network applications, the Nems-Clarke type FMR-101 has an RF section designed to produce a noise figure of 3 db and a sensitivity of two microvolts for 30 db quieting. A specially designed filter network is said to provide an IF bandwidth of 200 kc with a shape factor of 2.7 to 1. It is a single superheterodyne receiver with an intermediate frequency of 10.7 mc.

Completely transistorized and nuvistorized, the compact model has a solid state power supply. The unit measures 19 x 3½ x 14½ inches and weighs 18 lb. According to the manufacturer, it can be pre-tuned to any fixed point in the FM band and makes possible extremely high quality reproduction.

MAGNETIC-TAPE CLEANER

Cybetronics, Inc., 132 Calvary St., Waltham, Mass., is offering the new Bulletin E, which describes the new magnetic-tape cleaner that handles most common types and widths of magnetic tape used in data processing, instrumentation and telemetering. The cleaning process of the new device is said to be entirely mechanical and requires no chemical solvents.

Details include advantages, operations, dimension, photograph and general description.



WIRE CONTINUITY BUZZER

Stellar Electronics, 15 S. Vinedo Ave., Pasadena, Calif., has announced a compact wire continuity buzzer designed for fast, economical wire tracing. The instrument is said to buzz consistently from 0 through 2 ohms in a moderate tone, clearly audible above background noises, and eliminates the need for visual indicators. It operates for nine months on two standard size D flashlight batteries.

Designed for easy portability, the unit measures 6x3½x2 inches high, and weighs 14 oz. The case is constructed of high-impact plastic.

MOVABLE-UNIVERSAL TEST EQUIPMENT TABLE

Seaboard Products, 1100 Prospect Ave., West Islip, L. I., N. Y., has developed a rigid, lightweight, portable table called the Universal model No. 1419, designed to accommodate various sized units of test equipment and easily moved from one point to another as needed.

The new model features a modern appearance and durability. Angled legs are widespread to make the table tip-proof, and ball bearing casters permit positive, easy-rolling action on any type of floor covering. Model 1419 is 26 inches high, and model 1168 is 16 inches high. A Formica or Marlite insert can be fitted on top of the table for units to be placed on temporarily. Without insert, equipment can be attached to Universal table top.

COLOR LIGHTING BULLETIN

Kliegl Bros., 321 W. 50 St., New York 19, N. Y., has published a six-page folder on its complete selection of color media for use in theatrical, photographic, motion picture, television and decorative lighting.

Included in the bulletin is information on all 60 of the company's Cinemoid color light filters.

Product News

TURRETS AND ATTACHMENTS FOR CCTV CAMERAS

Blonder-Tongue Laboratories, Inc., Newark 2, N. J., has announced the development of a series of lens turrets and attachments for closed-circuit TV cameras.

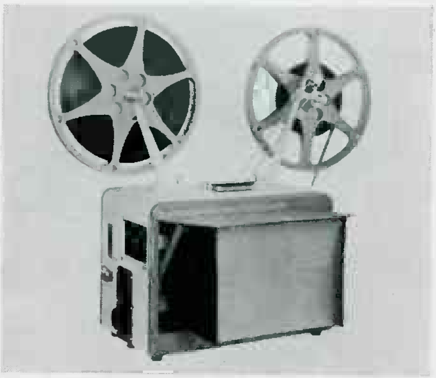
A manually-operated turret, model HT-10, is an attachment for the transistorized TV camera, model TTVC-1, and is expected to service a variety of studio needs in classroom and industrial closed-circuit TV systems. It is capable of holding up to four C mount lenses.

A remote-control model of a similar turret, the RT-10, is capable of automatically switching camera lenses and can turn in either direction. In addition, a motorized attachment, model RF-10, is designed to permit a TTVC-1 camera operator to adjust focusing by complete remote control.

NEW TECHNICAL BULLETIN

Prodelin, Inc., Hightstown, N. J., has published a two-page, fully-illustrated technical bulletin, No. 110, which describes the 2.5 db gain Lewis mobile whip antenna for 144-174 Mc/s service. The antenna eliminates base insulator breakage by grounding directly to the vehicle, and incorporates an impedance matching inductor which is designed to enable installers to tune for maximum efficiency in the field without physically cutting the antenna.

The information includes a discussion on antenna mounting locations and its effect on efficiency and radiation patterns. It also contains engineering data, diagrams and charts.



MOVIEMATIC REPEATER AND DUOLITE 16MM SOUND PROJECTORS

Victor Animatograph Corp., Div. Kalart Co., Inc., Plainville, Conn., has announced a new line of Moviematic Repeater and Duolite 16 mm sound projectors.

The Moviematic Repeater projectors are available in five models, designed for showing 16 mm sound motion picture film either on their own built-in screen or a distant screen, without having to rewind the film or thread the projector for each showing. The film is loaded into a power-driven cartridge for projection in the Moviematics; however, some models permit the entire cartridge to be removed when it is desired to show other films on standard reels.

The Duolite model ST-18 is said to have all the conveniences of a conventional 16mm sound projector, plus the added feature of a built-in screen for table-top use in a lighted room.

Book Reviews

Sideband Communications Handbook

Published by Howard W. Sams & Co., Inc., and The Bobbs-Merrill Co., Inc. 278 pages plus foldout section. Price $6.25.

The author of this valuable one-volume reference on sideband communications techniques, Harry D. Hooton (W6YTH), has done a commendable job in reducing to readily understood language the problems presented by this highly-efficient mode of communications. Although, at the present state of the art, sideband techniques are not readily adaptable for broadcast use, the broadcast engineer owes it to himself to be knowledgeable in this area. For those broadcast engineers who are also interested in amateur communications, this book provides complete instructions for the design and construction of SSB equipment.

Advertisers' Index

Product News

TRANSISTORIZED PROFESSIONAL TAPE RECORDER

An all-transistorized professional magnetic tape recorder-reproducer, said to be the first precision audio recorder of its caliber with solid-state electronics, has been developed by Vega Electronics Corp., 10781 N. Highway 9, Cupertino, Calif.

According to the manufacturer, the unit has a signal-to-noise ratio equal to or better than competitive tube-type professional recorders, and a constant-tape-tension system that will handle thin-base, double-length tapes without tape deformation. Additional features include 0.03 per cent wow and 0.08 per cent flutter, equal to .09 per cent combined wow and flutter, at 7½ ips; and fast start-stop action.

The model V-30 is a two-speed, two-channel audio frequency recorder-reproducer for ¼-inch width magnetic tape. The two standard speeds are 7½ ips and 3¾ ips, with frequency response at 7½ ips of 50 to 18,000 cps, ±2 db. Other speed combinations can be supplied on special order.

NEW ATC SOUND SALESMAN

Automatic Tape Control, Inc., Bloomington, Ill., is offering a new addition to its standard product line of tape cartridge equipment for the broadcast industry.

The Sound Salesman is a portable, lightweight (13 lb.) cartridge playback machine designed for use by station sales personnel to audition commercials or programs at the sponsor's office or place of business. Packaged in a high-impact plastic carrying case, provision is made for line cord and cartridge storage. The machine comes with a self-contained audio amplifier and loudspeaker designed to provide more than adequate audio volume for effective presentation purposes.

RCA SEMICONDUCTOR PRODUCT GUIDE

The RCA Semiconductor & Materials Div., Commercial Engineering, Somerville, N. J., is offering a new 12-page Semiconductor Product Guide which provides the latest data on the company's full line of silicon and germanium transistors, silicon rectifiers, special computer diodes, tunnel diodes and varactor diodes. A handy by-application classification guide simplifies the process of locating the right transistor for any type of service.

NEW CAPABILITIES BROCHURE

"Super Power Transmitters/Systems" is the title of a new capabilities brochure issued by Continental Electronics Mfg. Co., subsidiary of Ling-Temco-Vought, Inc., P. O. Box 5003, Dallas 22, Tex.

In 36 pages the brochure reviews the company's experience in super-power electronics and depicts the facilities for additional projects.

NEW ELECTRONICS COURSE CATALOG

Eight new electronics courses are among the 30 correspondence courses on electronics, radio, television and telephony described in the new catalog 189L, being offered by International Correspondence Schools, Scranton 15, Pa. Also described is a series of new electronics training kits which are optional with all courses and are suited for either individual study or special educational and industrial-training programs.

LIGHTING EQUIPMENT CASE DATA SHEET FROM COLORTRAN

ColorTran Industries, 630 S. Flower St., Burbank, Calif., has released a technical data sheet on lightweight carrying cases for ColorTran lighting equipment.

Contents include complete descriptions and specs in chart form of the ten types of cases, as well as size, weight, specific use, and price. Photographs are also included, showing the custom-contoured foam interiors.

HAWAIIAN REPRESENTATIVE WANTED—National broadcast equipment manufacturer is looking for experienced sales representative—preferably a man currently providing a technical service to radio stations in Hawaii. Send detailed resumé with first letter to Broadcast Engineering, Dept. BE-80, Kansas City 5, Mo.

Professional Services

Classified

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

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

EQUIPMENT FOR SALE

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

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

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

PHILCO MICROWAVE LINK. 7 KMC System. Type CLR-6 also in stock: Repeaters, 12 and 24 channel multiplex. Large quantity. Exc. cond. Radio Research Inst. Co., 550 5th Ave. New York, N. Y. 5-62 8t

35MM GPL PA 200 TELECAST PROJECTOR. Type used by the networks. Excellent Condition. PRICED RIGHT. Broadcast Engineering, Dept. BE-9, Kansas City 5, Mo. 9-62 1t

10 Kilowatt Power Supply. Never been used. Good condition. Crated. Complete. 9100 volts @ 1.5 amps, normal. Maximum current 1.8 amps. $890.00 f.o.b. Salt Lake. Ross Andrus, 964 Pinnocchio Drive, Salt Lake City 16, Utah. 9-62 1t

BUY, SELL OR TRADE

Will buy or trade used tape and disc recording equipment — Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 10 BE Pennsylvania, Tuckahoe, N. Y. 4-62 6t

Will pay cash for type BW-5 or BWU-5 sideband response analyzer. Please indicate price and condition of equipment. Please reply to Broadcast Engineering, Dept. BE-8, Kansas City 5, Mo. 9-62 1t

MISCELLANEOUS

TV CAMERA—Low Cost—Easily Built—Complete schematics, instructions 50c. Denson Electronics, Rockville, Conn. 7-62 3t

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

SARKES TARZIAN SILICON RECTIFIERS

eliminate broadcast interruptions caused by vacuum tube rectifier failures

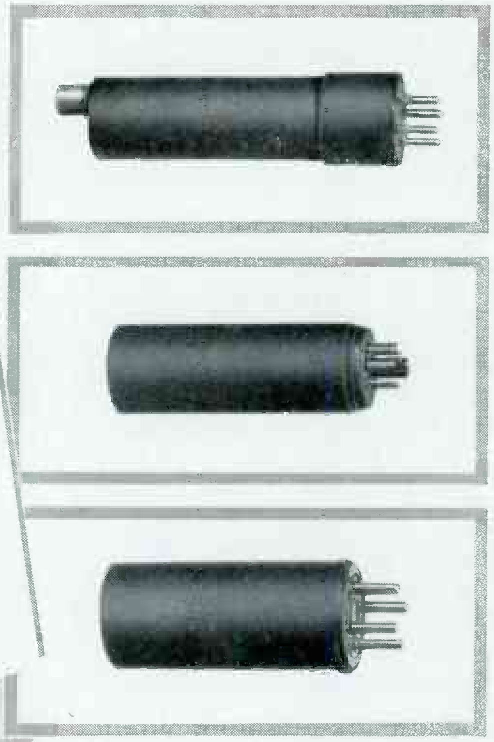
Here's proof of long, trouble-free life of Tarzian Silicon Rectifiers—

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

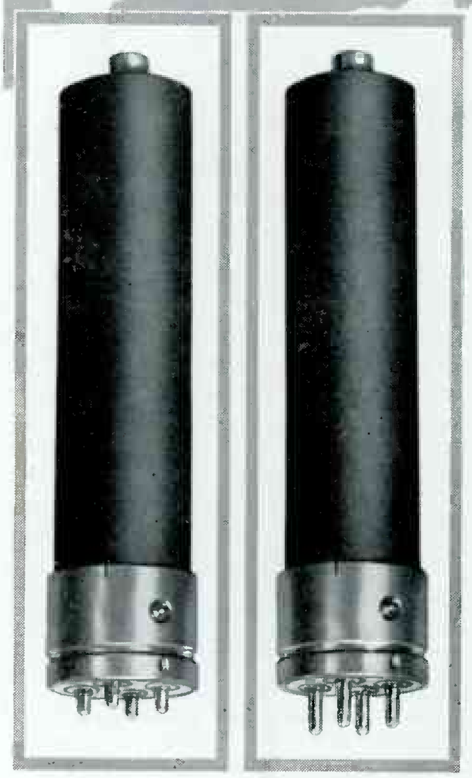
We have also installed the S-5373 at the transmitter and they too are doing very well.

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

FRED MOLCHIN
Chief Engineer, Station WTTV
Indianapolis, Indiana



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



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

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

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

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

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

Specifications and prices are waiting for you.
Write today.

SARKES TARZIAN, Inc.

World's Leading Manufacturers of TV and FM Tuners • Closed Circuit TV Systems • Broadcast Equipment • Air Trimmers • FM Radios • Magnetic Recording Tape • Semiconductor Devices

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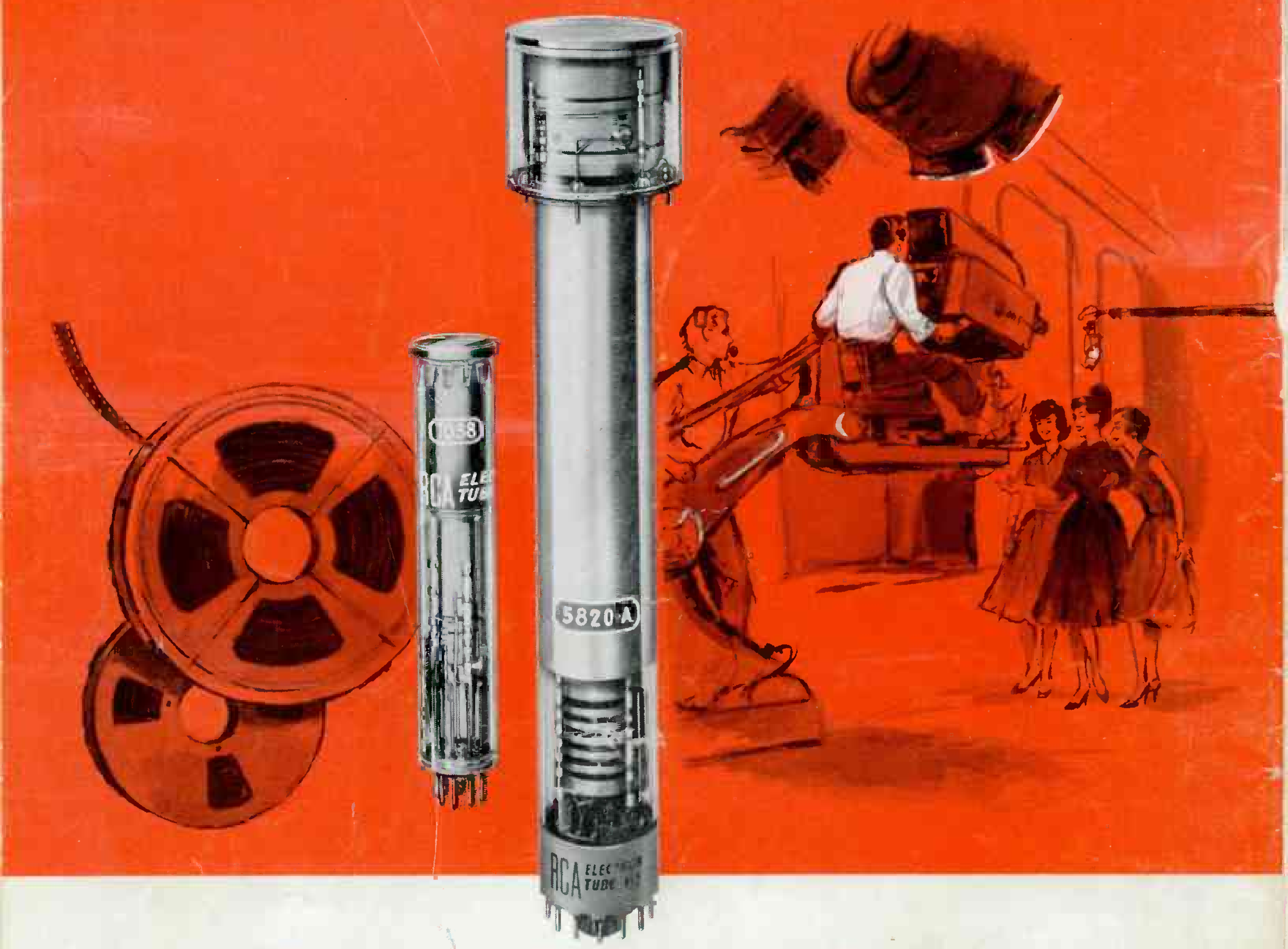
RCA TV CAMERA TUBES



RCA's Image Orthicons and Vidicons Meet Industry's Demands for Image Quality

Image quality and TV-Camera Tube quality go hand in hand. And the star performers in the quality department in any TV function are RCA Image Orthicons and RCA Vidicons. In both lines, RCA has the widest range of tubes in the field, plus unmatched performance and reliability characteristics.

RCA introduced the first Image Orthicon in 1946; the first Vidicon in 1952. Over the years, RCA research and development continue to set the "standards" of image quality for studio, closed-circuit, and remote TV. While no one camera tube possesses all of these characteristics, some of the RCA standards include: highest sensitivity, highest resolution, lowest lag, highest signal-to-noise ratio, finest registration capability, greatest freedom from spurious signals, and the most uniform tube-to-tube product.

These families of RCA TV-Camera Tubes include units for low-light-level work, others that double for indoor and outdoor operation, and for color and black-and-white. There are tubes for superior successive recording of tapes and tubes to suppress "TV Ghost" and other undesirable effects.

Whatever your station requirements, there's an RCA Image Orthicon or an RCA Vidicon to provide superior TV-pickup for your specific application. For information on specific types, see your authorized RCA Distributor of Broadcast Tubes. RCA ELECTRON TUBE DIVISION, HARRISON, N. J.

Recently sent to TV-station Chief Engineers throughout the country, this attractive, two-color brochure, RCA Camera Tubes—1CE-262, contains pertinent information and illustrations pointing out some of the superior design features found in RCA TV Camera Tubes. Additional copies may be obtained through your local distributor.

The Most Trusted Name in Television