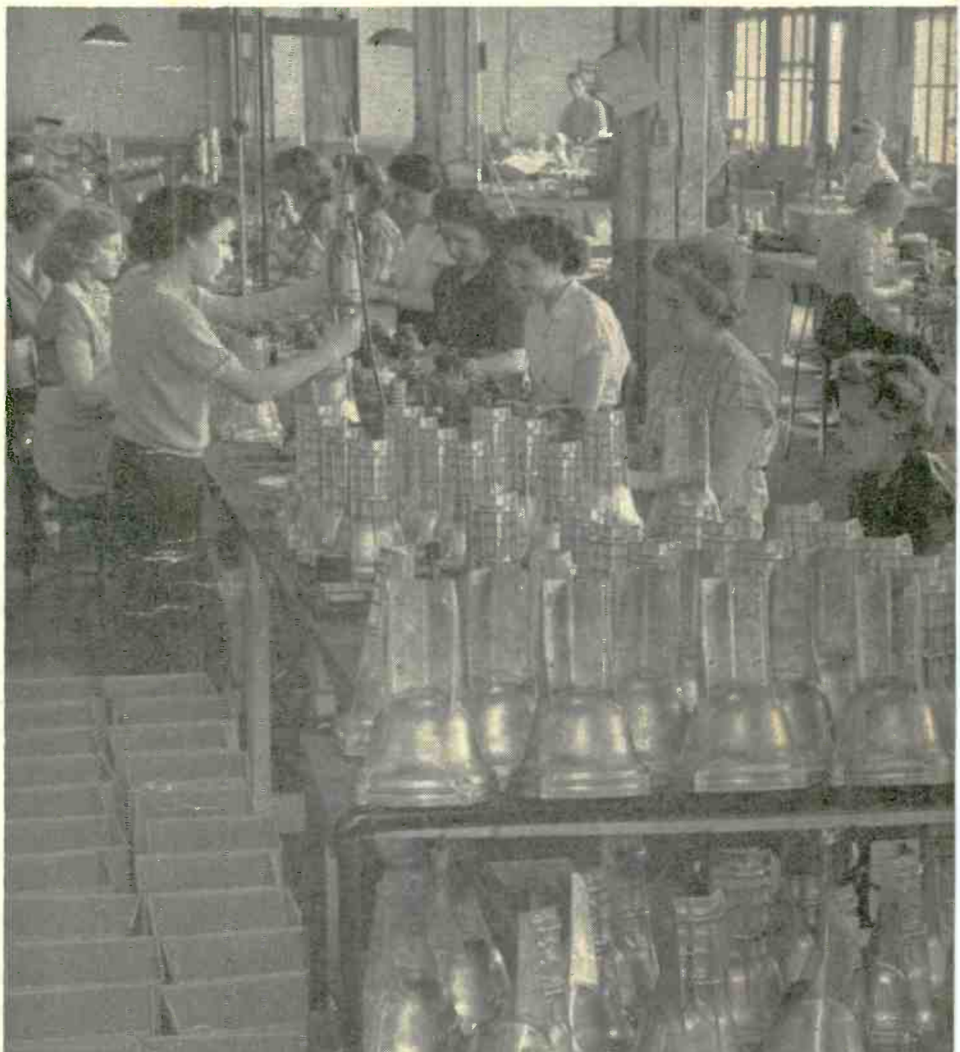
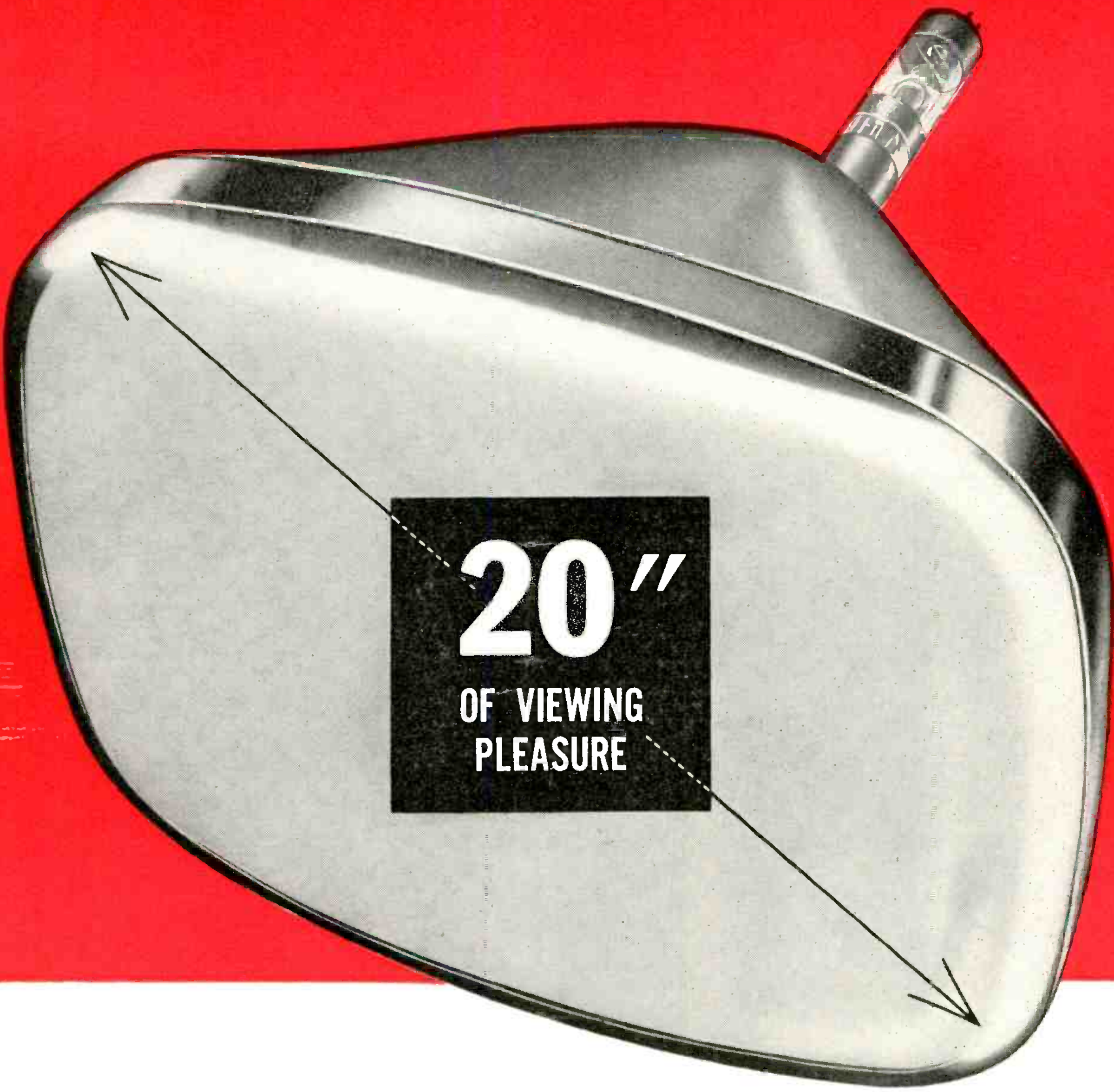
RADIO and TELEVISION maintenance



FRINGE AREA ISSUE

● Fringe Area reception is often improved with antenna rotators, shown here in construction at the Rad

RCH 1951



the Du Mont type 20CP4

For the set that follows the "seventeen" in rectangular pictures, Du Mont supplies the "twenty" all-glass rectangular Type 20CP4.

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*Teletrons**

Allen B. Du Mont Laboratories, Inc., Cathode-Ray Tube Division, Clifton, N. J.

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RADIO INDUSTRY NEWSLETTER

RCA RELEASES 3-COLOR TUBE

Data on the manufacture of the RCA three-color television tube was just released by the company to other tube makers licensed to use RCA patents. Although the release of the information will probably not speed the coming of color TV, due to the war situation, it is the action which FCC asked the company to take months ago. It is expected that more months will pass before the tubes are available, since even RCA is not producing them yet.

COLOR TELEVISION DECISION IMMINENT

A decision from the Supreme Court on the color television issue, appealed to the higher court after the inconclusive decision of a Chicago court, was forecast for this month by FCC chairman Wayne Coy. The commissioner also said that the war economy will dictate whether color TV makes a large or small beginning.

ENLARGE PLANS FOR 'UTILITY' TV SETS

Further plans for "utility" TV receivers are being made by set manufacturers, with transformerless power supplies, selenium rectifiers, electrostatic focusing and deflection, and smaller speaker magnets scheduled to cut down on the consumption of vital materials. The so-called utility sets are said to be the last step before what would be actually lower-quality units, or "austerity" sets. Utility models will be advertised, probably, as using substitute materials without any loss in quality.

NBC TO WORK OUT SLAVE TV-FILM UNIT

A new slave camera for TV broadcast is on the schedule of experiments at NBC. The device, which will be a movie camera attached to the side of the TV camera, will permit higher quality in kinescope recordings, since the films will be made direct, controlled by the same switches that control the TV pickups, instead of being filmed from a monitor. The development is expected to improve the quality of re-broadcast programs considerably.

FM STATIONS TO HIT MFRS. FOR NEGLECT

FM broadcasters, it is reported, will soon attack RTMA members for laxity in promoting the suffering medium of audio broadcasting. With FM stations dropping fast, the broadcasters will request cooperation from the manufacturing group's members. FM stations have been successful in only a few localities, and the nationwide picture is not encouraging to the system's backers. The output of FM receivers has, according to the station operators, been "disproportionately small" in relation to the production of AM and TV sets.

NEW BILL TO CHANGE FCC SCOPE, POWERS

A change in the operation of the FCC is foretold by the passage of a bill in the Senate. The bill provides the commission with power to issue "cease and desist" orders to stations for violations of minor rules. At present, the commission's only positive weapon against infractions was the power to revoke operating licenses. Heretofore, the group has allowed small offenses to go unpunished rather than to put the violators out of business. FCC will retain its position of granting and renewing licenses.

MFRS. START SERVICE TRAINING PROGRAMS

With the shortage of radio and television servicemen growing more acute, several manufacturers are initiating plans to increase technical education opportunities. Sylvania Electric has begun a series of meetings on TV service, to continue throughout the year. RCA Institutes, the manufacturing company's service-training department, has begun a "home-study" course, also for working technicians.

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RADIO and TELEVISION maintenance

MARCH, 1951

FEATURES

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DEVOTED TO SERVICE OF RADIO-AUDIO-VIDEO

Service Technique

In Fringe Areas You Should Be Familiar With

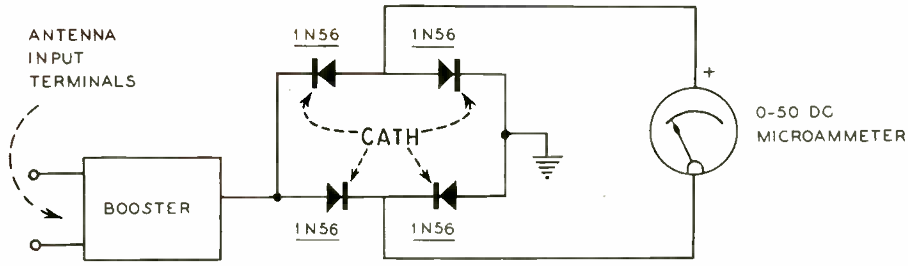

FIG. I RF TYPE FIELD STRENGTH METER -RTM-

Field Strength Measurements

By RUFUS P. TURNER

AFTER the first fires of the DX craze burned low, and sensitive superheterodyne receivers and high-powered, locally-situated broadcast stations assumed dominance in radio, service technicians stopped thinking about field strength. This is quite understandable. Good, strong broadcast signals have been available in most communities for many years. The outside antenna almost completely disappeared, because satisfactory signals could be picked up without it. Only engineers concerned with the performance of a transmitting station needed to determine how strong a signal was at a given receiving location. Many radio service technicians who have come up during the last ten or fifteen years have never given a thought to field strength.

TV Range Limited

Television, however, with its limited-range transmitters and variations in receiving conditions, has brought the practical technician again face to face with field strength problems. The TV serviceman uses field strength measurements in one form or another to evaluate the merits of antennas, guide him in situating and orienting antennas for strongest signal pickup, and to survey areas for appraisal of reception conditions to be expected by potential TV customers. Practical field strength tests eliminate much guess work and speculation.

Moderately-priced instruments have been made available for TV field strength measurements by service technicians. This equipment, plus the inevitable makeshift gimmicks and methods which have put in their appearance, have provided the TV technician with new tools for doing a better job.

Correct procedure for tests and a clear interpretation of the results obtained in field strength operations depends largely upon a good understanding of the problem and of the instruments and methods employed.

Signal Field Strength

The radio wave emitted by a transmitter consists of an *electric* and a *magnetic* component. These components operate at right angles to each other. Both *induction* and *radiation* fields are set up by the transmitting antenna. The induction field decreases rapidly in intensity as the distance from the transmitting antenna is increased. The strength of the induction field is negligible a short distance from the transmitter. But the radiation field decreases less rapidly in intensity as the distance increases. If signal strength is measured quite close to the transmitter location, chances are that the induction field is the predominant one checked. At a distance from the transmitting antenna equal to the transmitter wavelength divided by 2π, the radiation and induction field intensities are approximately equal.

The induction field is of little interest to the practical TV technician, since measurements are made at such a great distance from the transmitter that inductive effects are not present. In order to encounter a strong induction field, it would be necessary to test within a very few feet of a transmitting antenna operated in any of the twelve present-day TV channels.

It is the radiation field which brings picture and sound information to the receiving point, and it is the strength of this field that is of interest in receiver-location field-strength measurements.

Minimum Intensity

Attenuation conditions, reflection phenomena, polarization, and absorption effects all are quite different on TV frequencies from those in the broadcast band and on the lower short waves. All of this adds up to the fact that an impractically weak TV signal is more apt to appear at a relatively nearby receiving point than is the case with lower frequencies. The boundary at which the signal strength has fallen to the minimum value which will give satisfactory TV reception with a conventional installation is the beginning of the fringe area. Actual depth of the fringe area, before the point is reached where the received signal drops to a level no longer useful, will depend upon conditions in the neighborhood of the receiving antenna. Authorities have specified the fringe area signal strength as 500 microvolts per meter. This means that a TV receiver must be capable of full performance at this signal intensity, in order to operate satisfactorily within the fringe area.

Because of their design, some TV receivers inherently are more capable than others of doing a good job with weak signal input. This increased sensitivity ordinarily is obtained through the medium of higher gain in the IF video, and sync amplifiers. Similarly, some antenna arrays deliver stronger signal voltages to the receiver input terminals than those of different design. Antenna height and placement likewise are factors often in the utilization of low field intensities.

Many factors act singly or in combination to cause low field strength in a given locality. Among these are distance from the transmitter; topography of the region lying between transmitter and receiver; channel frequency; nature and type of buildings and other prominent objects in the vicinity of the receiving antenna; and objects obstructing the transmitter-receiver path.

Field Strength Meters

A TV field strength meter consists essentially of a receiver which may be tuned to each of the TV channels and which actuates an indicating meter. In instruments designed for accurate, quantitative measurements, the meter scale is calibrated to read in microvolts. Instruments intended for less demanding indications have arbitrary meter scales satisfactory for *relative* indications of field strength. While the latter type of scale does not indicate microvolts directly, it will show the magnitude of one signal (or signal condition) with respect to another.

Several portable field strength meters lately have been placed on the market for the technician. As a rule, the more complex of these instruments use a superhet front-end tuner. This is followed with an IF amplifier and second detector. This last stage drives a simplified DC vacuum tube voltmeter stage which in turn actuates the indicating meter.

At the receiving location of interest, the meter is connected to an exploring antenna or to the antenna which is to be used later with the receiver. The tuner is switched successively to the channels on which broadcasts arrive, the antenna is rotated for maximum meter deflection, and the reading recorded.

Commercial Meters

Commercial meters include the following, which are listed alphabetically rather than as to specific merit: APPROVED ELECTRONICS CORP., Mod. A-460; 30-50 microvolts and 100-20,000 microvolts. A phone jack is provided for aural monitoring of the received signal. NATIONAL COMPANY, INC.; a complete 7-inch TV receiver with a microvoltmeter added. The actual televised picture, as well as the meter indication, may be observed with this instrument. SIMPSON Mod. 488; 0-50, 0-500, 0-5000, and 0-50,000 microvolt scales. A phone jack is provided for aural monitoring of the received signal. This instrument is exceptionally light in weight. SIMPSON Mod. 351 TV Antenna Compass; consists of a sensitive DC microammeter, germanium diode signal rectifier, and connecting cables. Gives relative field strength readings when connected to the video electrode of the picture tube in the TV set.

TRANVISION Mod. FSM-1; Superhet type with indicating microvoltmeter.

Makeshifts

Figures 1 and 2 show makeshift FS meter arrangements which have been used by TV technicians. The first circuit employs a conventional TV booster as an RF amplifier ahead of a rectifier and indicating DC microammeter. The meter rectifier is a bridge circuit composed of four 1N56 high-conduction germanium diodes. This rectifier setup gives maximum meter deflection on weak signals. A calibration chart or curve, in which microammeter readings are recorded against RF microvolts input, may be prepared by means of a standard signal generator having a microvolt-calibrated output attenuator.

The signal generator output is connected to the antenna input terminals of the meter. The generator output impedance must be matched to the booster input impedance. Generally, the generator impedance will be somewhat lower than that of the booster, and sufficient additional resistance (in the form of carbon or non-inductive wirewound resistors) must be added in series with the booster input to make up the impedance.

The generator output impedance may be 15 ohms, while the booster input impedance is 300 ohms. The impedance difference in this case is 285 ohms. In order to match the two instruments, one 142.5-ohm resistor must be connected in each lead to the booster.

The sensitivity of the setup shown in Fig. 1 is governed entirely by the gain of the booster. Furthermore, the sensitivity usually will decrease as the channel frequency is increased. This necessitates making a separate calibration for each channel. A complete calibration is very necessary, since the microammeter reading will not be exactly proportional to signal strength. This is because the 1N56 response curve is not linear at the voltage level about which this circuit operates. A meter-reading ratio of 2 to 1 thus does not necessarily mean that one signal is twice as strong as another.

Heterodyne Detector

A somewhat different arrangement is shown in Fig. 2. This is a silicon crystal type heterodyne detector followed by a high-gain audio amplifier, germanium meter rectifier, and indicating DC microammeter. The heterodyning signal is furnished by an unmodulated signal generator tuneable from 50 to 230 Mc. The generator is tuned to beat with a desired TV signal, the audio section amplifies the beat note, and the 1N34 diode rectifies the audio output voltage and actuates the meter.

In order for this setup to be reliable, the AF amplifier must have constant gain, and the signal generator (or test oscillator) must have constant output

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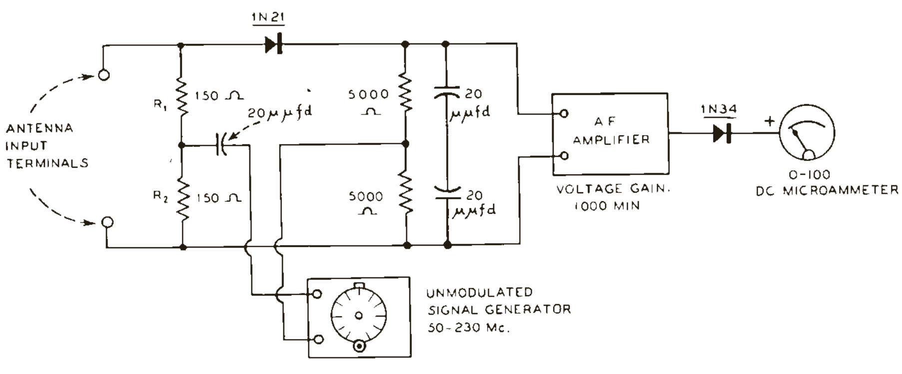


FIG 2 HETERODYNE-TYPE METER -RTM-

R&TM Survey

It Makes the Difference Between Profit and Loss

GETTING THE MOST OUT OF THE ANTENNA

By DAVID T. ARMSTRONG

PROBABLY no single piece of television receiver equipment is more disregarded than the antenna. Yet in nearly all fringe areas, the antenna is a chief cause for complaint about the quality of reception. Where an ordinary antenna works well, and the installation is near the stations to be received, a haphazard setup may suffice; but in the fringe areas, particularly where there are all kinds of man-made interference, a top-notch antenna installation is often the difference between profit and loss on a job.

It is assumed here that the reader is familiar with the variety of antenna types, and perhaps owns a good book on antennas. We will indicate here some items to look for in connection with an antenna installation that will prevent service problems involving the antenna.

Basic Requirements

The fundamental requirements of a good antenna system for TV include:

1. It should be installed so that there are no reflections in the antenna system which would cause smearing of the picture or distortion of the sound.

2. It should be so directed that there will be no reflected signals from nearby buildings or metal structures that might cause multiple images (or ghosts) to appear on the screen, and distortion in the sound.

3. It should be so placed that the pickup of interference from man-made sources of TVI is minimal.

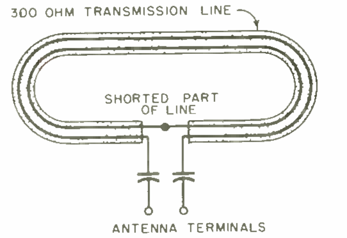
4. The system should be sufficiently well designed that it is capable of providing good signal pickup on the low TV band and the high TV band. This is one of the most difficult requirements for an antenna to meet.

Bear in mind that nearly 90 percent of reception difficulties in the first 30 days are traceable to losses, distortions, and interferences which affect the incoming signal *before it reaches the first tube in the RF or converter stage.*

The television antenna is like the secondary of a transformer, of which the transmitting tower is the primary. Take a typical transformer and measure the amount of voltage induced in it as you rotate the secondary through 360 degrees. Obviously, position of the secondary of a transformer is important in connection with the induction of a desired voltage; likewise the position of the antenna is most important since nothing can be done to reduce the distance between the primary and secondary. It then becomes exceedingly important to position the receiving antenna so that the maximum signal is obtained.

Tall Mast Important

It is for this reason that a steel structure between an antenna and the transmitting tower may become the secondary of the transformer and absorb much of the signal that should go to the antenna. There are ways of getting around this in some cases, but none is better than erecting an antenna high enough to get the signal over the intervening structure. Where this is impossible some less satisfactory method will have to be tried.



1/4 WAVE AT CHANNEL 4 FREQUENCY FOR LOW BAND, WITH 5 μμf CAPACITORS.
1/4 WAVE AT CHANNEL 10 FREQUENCY FOR HIGH BAND, WITH 2 μμf CAPACITORS

FIG. 1 -RTM-

Resonant Antennas

In modern television, resonant antennas are the type generally used because for a given field strength the maximal voltage will be developed in an antenna that is resonant to the frequency of the desired signal. This means, of course, that the best reception would be attained with, say, seven separate antennas for seven separate channels; but this is a ridiculous answer to the problem.

An antenna has a certain amount of inductance, capacitance, and resistance which help it to act like a resonant circuit. The inductance and capacitance are not lumped as they would be in a single coil or condenser, but rather distributed along the length of the antenna. The ungrounded antenna then will be resonant whenever its total length approximates a multiple of the half wave length of the frequency to which the receiver is tuned.

A resonant circuit with a low Q will have a broad response. The Q of the antenna should be sufficiently low so that the frequency response is broad enough to cover at least seven channels, separated as far as channel 2 and 13. The Q of the resonant circuit for the antenna depends upon the diameter of the conductors in relation to their length. When the diameter is large, the inductance per unit length decreases while the capacity per unit length increases. This means that a decreased L-C ratio causes the Q of the equivalent resonant circuit to become low.

Conversely, when the diameter of the conductors is small, the L-C ratio is increased, with a resultant increase in the Q of the resonant circuit.

A half wave dipole then, made with quarter wave elements using two-inch diameter tubing, will operate over a much wider frequency range than a dipole made with ⅜-inch tubing. Too many installation men use the cheaper product without regard for the effect this may have on the range of frequency that must be covered. When you need range of coverage from Channel 2 to 13, an antenna with ½-inch or ¾-inch tubing will be more effective than one with thinner tubing.

Antenna Selection

The particular type of antenna used and the transmission line connecting it to the receiver will vary from installation to installation, depending upon the local conditions. Some of the basic factors which influence the antenna selected and its installation are:

1. The exact location and height of the array. Use a sensitive field strength meter to measure signal strength, if it is at all possible, and find the best spot for the tower.

2. The man-made noises originating near the antenna which would be likely to affect the transmission line.

3. The possibility of multiple signal paths that may be picked up by the antenna, the transmission line, or the receiver itself.

4. Whether the high and low band channels are located in the same general direction from the antenna, or are in widely separated positions.

General Recommendations

The following suggestions grow out of much long and hard-earned experience with transmission lines:

1. If unshielded transmission line is used, it should be of the outdoor type to prevent excessive losses as a result of weather conditions.

2. Avoid running the line inside any type of conduit as this will change the characteristic impedance.

3. Avoid splices in the line; run a single continuous piece of transmission line if it is possible.

4. Caution the customer not to paint the line, particularly with a lead-base or aluminum paint.

5. Run the transmission line through a hole in the window casing or through a hole in the wall of the house.

6. If there is a run of more than five feet inside the house, particularly a run under a rug, use the heavy outdoor type line. This type may be run up to 20 feet under the rug without adversely affecting impedance.

7. In running the indoor line along moldings, use standoff insulators. Be sure to keep the indoor transmission line away from radiators, pipes, and metal objects.

8. *Use a lightning arrestor with every installation.* Be sure to use the special type for TV which does not change the characteristic impedance of the line and which protects both sides of the line.

There are other suggestions that could be made, but these are basic. Following them is likely to help in making a satisfactory installation.

Servicing Hints

Here is a quick check on the proper orientation of a TV antenna. Disconnect the transmission line from the receiver and touch one antenna terminal and then the other. If there is much change in the picture received it may be due to improper positioning of the antenna. It helps to make this rough test with the contrast control set where the picture is fairly light.

It is urged that you make it a practice to use two separate transmission lines for good high-low TV reception from the low frequency antenna and the high frequency antenna. Both lines should be twisted one turn per foot in the conventional manner, should be kept at least 12 inches apart and should be held firmly in place with standoff insulators spaced about four feet apart.

There may be a point between the receiver and the antenna terminals where a piece of tinfoil wrapped around the transmission line will improve the picture brightness. Find this spot for each separate transmission line, when there are two, and fix the metallic foil firmly in place.

Standing Waves

Standing waves in the transmission line, or a mismatch in impedance (caused sometimes by proximity to foreign objects) may be eliminated sometimes by use of a matching stub made from about 40 inches of transmission line. Remove the insulation from the ends, baring the wire. Connect two of the bare wires together, thereby shorting one side of the transmission line. Connect the remaining two to the antenna terminals where the antenna leads are. If there is improvement in picture quality, shorten the stub an inch at a time until there is no further improvement in picture quality. The standing waves in the line will then be dissipated. A simple test for the existence of these standing waves in connection with this matching stub is to squeeze the transmission line between the fingers at six-inch intervals from the receiver terminals to about five feet from the receiver. When there is no improvement in the picture upon squeezing the transmission line the standing waves have been balanced out.

Some types of common interference can be minimized considerably by using a quarter wave stub of 300 ohm transmission line with one end shorted. From the other two ends connect a low value capacitor, something like 2 to 5 mmf, in series with the transmission line where it connects to the antenna terminals. This is a type of absorption wave trap and will have the effect of preventing any change in the R-F response curve, which might result in impairment of picture detail. (See Figure 1.)

Inevitable Losses

A survey of the antenna installations in any given neighborhood will reveal to the practiced eye of a careful workman that there are many sloppy and inadequate installations which are robbing much of the signal strength present and preventing it from getting to the receiver where it will do some good.

Consider the losses that are inevitable in a good installation. Perhaps these figures will help the serviceman take his work a little more seriously. In an area where the field strength is of the order of 5000 microvolts there will be losses in a good installation of such magnitude that only *about 1000 microvolts* will be delivered to the antenna input terminals. These losses are primarily the result of the connection of the antenna to the transmission line and the connection of the transmission line to the antenna terminals. If it were possible to connect the antenna directly to the antenna terminals the loss would still be about 50 percent. For good and

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Service Technique

FRINGE AREA SERVICING

Problems May Often Tax Your Ingenuity But They Can Be Solved

By RUDOLF F. GRAF

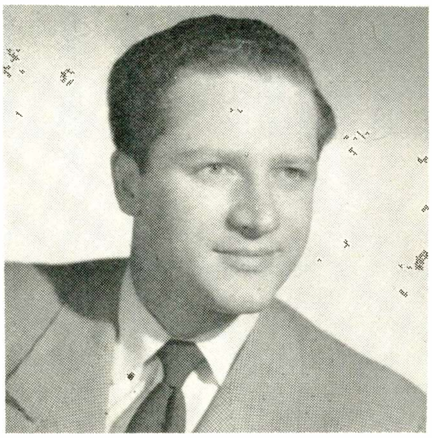
ALTHOUGH television receivers, upon leaving the factory, are properly adjusted to give satisfactory reception on all channels, it is still the serviceman who makes it possible, by his installation, to get pleasing and dependable reception at the final location of the receiver. The installation of sets in areas more than about 40 miles from the transmitter, in the fringe areas, presents a number of problems. These difficulties, though they may at times tax the ingenuity of the television technician, *can be solved*.

The factors which are involved in the proper operation of the receiver are the stability of the sync circuits, signal-to-noise ratio, proper definition, interference and sound. The elements involved in obtaining peak performance in fringe area installations are: the antenna, the transmission line, the booster amplifier, and the receiver itself.

Signal Strength

Let's see, first of all, determine what we can expect in the way of signal strength in a fringe area location. The present allocation plan as set up by the FCC specifies a field strength of 5,000 microvolts per meter for a primary service area, and 500 microvolts per meter for a secondary service area. The primary service area is generally found within a radius of ten miles from the transmitter, and the secondary service area between that limit and the 30-mile mark. Within these confines most commercial receivers will yield satisfactory pictures with the usual installation.

We shall consider the problems encountered when the field strength drops to values of about 50 microvolts.



RUDOLF F. GRAF

Field strength is the intensity of a signal at a certain distance from the transmitting antenna. This intensity is a measure of the number of microvolts of the signal, from any one particular station, which would be intercepted by an antenna exactly one meter (3.281 ft.) long. Hence the term "microvolts-per-meter." Usable pictures have been produced on the screens of television receivers in areas where the signal strength was as low as 3 microvolts per meter.

The Antenna

The first and most important link of the fringe area installation is the antenna. It must have as high a gain as possible and, if interference from other stations is a problem, be sufficiently directive to pick out only the desired signal. There are many good antennas on the market, which may be stacked for highest gain. We shall not go into all the available types, but restrict our discussion to three antennas which are particularly suitable for fringe area work. These antennas are most effective for only one channel. To use them, a separate antenna is generally required for each channel. These may be employed in addition to an antenna which is used only for other nearby stations.

Yagi Antenna

The Yagi is a very good fringe antenna. Because of its flatness and simplicity, it can be easily stacked for higher gain. Its high front-to-back ratio makes it ideal for rejection of co-channel interference. Several Yagis can be mounted one on top of the other on the same mast, each cut and oriented for a particular channel. For best fringe area results, the antenna should be cut at or near the picture carrier. If the sound comes in too weak, the front director may be shortened by about five percent to improve it. As many as four Yagis may be stacked for higher gain.

Corner Reflector

The corner reflector has an excellent front-to-back ratio (100:1), a narrow beam angle, and a gain of approximately 10 Db over a simple dipole. The driven element is mounted a half wavelength, or slightly less, from the vertex of the reflector and the reflector elements are spaced one-tenth wavelength apart. The two groups of reflector elements are mounted at an angle of 90 degrees and may be connected together electrically, although that is not necessary. The transmission line should be run out at the rear of the reflector, in order to keep the whole system as symmetrical as possible. The antenna should be used with a 300 ohm line and is generally satisfactory for reception on only one channel.

Rhombic Antenna

If there is sufficient space available for its erection, the rhombic antenna is

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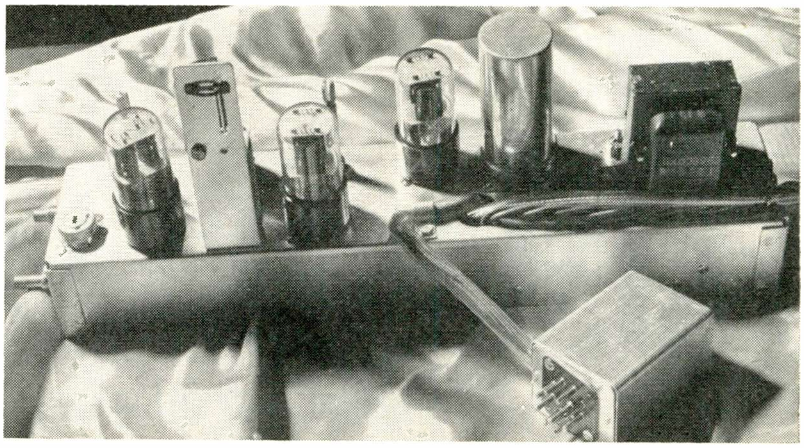
New Developments

Techniques Used by Zenith In Its Test System for

"BOX OFFICE" TELEVISION



The Phonevision decoder unit, which is attached to the chassis of the subscriber's TV set. This supplementary unit is shown as part of the receiver block diagram below.

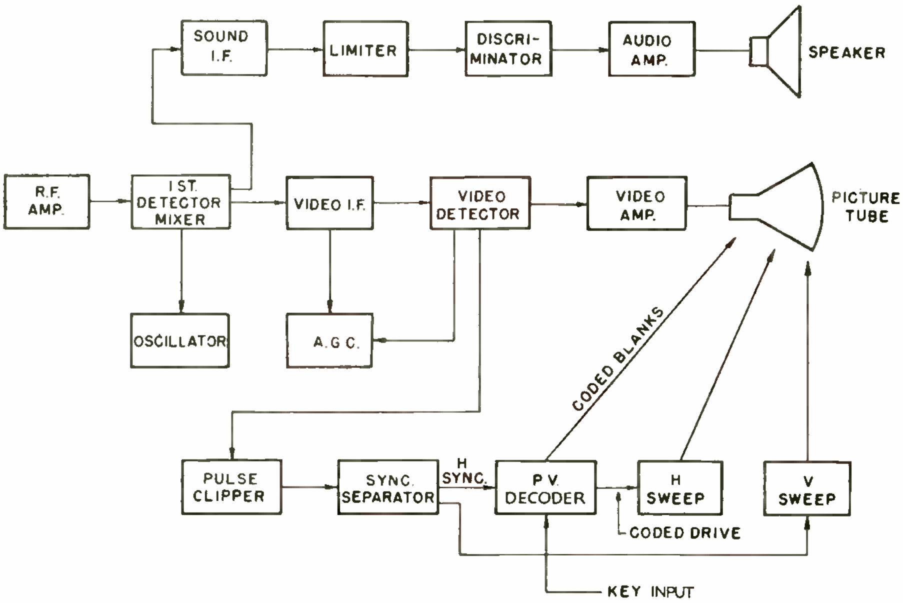
By RICHARD L. BROWNE

IF TELEVISION broadcasting, as we know it, cannot provide the programs the American public wants to see, some form of box-office TV must be found to supplement the present commercial sponsorship of commercial shows."

Those are the words of Wayne Coy, chairman of the Federal Communications Commission, the group that will decide, in a few months, whether the "Phonevision" system is sufficiently worthwhile for commercial licensing.

At the moment, of course, Phonevision, which is the form of subscriber-television backed and developed by the Zenith Radio Corp., is under test in 300 homes in and around Chicago. This test, which is claimed to be bringing good results all around, will last until March 31, for a 90-day experiment among a sample of the population.

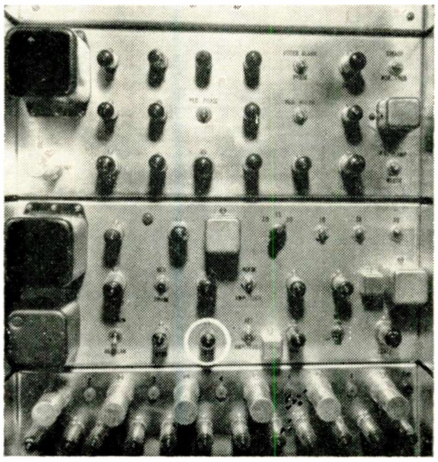
If the first four weeks' results are any criterion of the eventual acceptance of the system, it is fairly plain that it will be a success. For the families concerned "bought" movies over television sets on an average of just less than twice a week for each installation during this period; and each time, it cost a dollar to see the program. The movies, to make the results more interesting, were all at least two years old, and were competing with the latest releases being shown in the city's theatres. In addition, about 20 percent of the audience had already seen the pictures.



Decoding Units

Phonevision installations, at the receiving end, consist of decoding units which straighten out the scrambled pictures sent from the TV transmitter. A decoder is a small supplementary chassis installed within the set. The signal, which keys the decoding process, comes over the user's telephone wire from the exchange station, on a carrier which is at a higher frequency than the audio band of the telephone, so that telephone conversations are not interfered with. A cable from the telephone installation to the television receiver brings the decoding signal into the decoder unit, while the main section of the broadcast signal comes through from the transmitting antenna in the usual way.

The code signal, which originates at the transmitter as the transmitted signal is being regulated, is distributed through the telephone exchange just at the time specified by the subscriber. As outlined by Zenith, the subscriber would dial a certain number in advance of the program he wished to see. The figures



Part of the Phonevision coder at the transmitter. The "heart" of the system, the random-noise tube, is circled.

which he dialed would identify him for later billing purposes, and at the same time would set the exchange mechanism to send through the decoding signal throughout the duration of the program he wished to see. This procedure, however, is only the basic one. Additional details will be decided on when and if the system is prepared for full-scale operation.

Traffic Problems

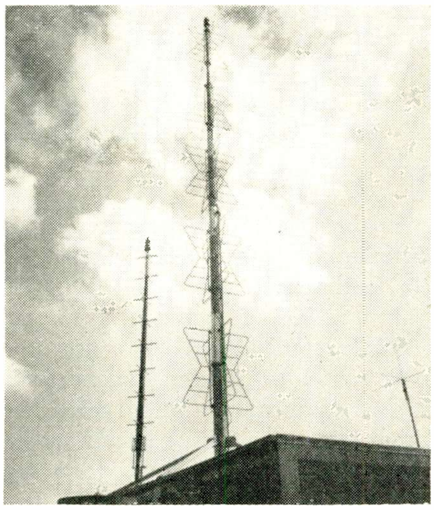
Certain problems of traffic-handling would arise, as might be expected, with the prospect of a very popular program which would be requested at a large number of receivers throughout the listening area. These difficulties, it is expected, would almost solve themselves, if the customers were willing to request programs more than a few minutes before they started.

The code signal itself, which clears up the scrambled picture at the receiver while it is being jumbled at the transmitter, shifts the video information in the signal with respect to the horizontal synchronizing pulses, so that part of the time, the video seems normally phased with respect to horizontal pulses, and the rest of the time, there is a noticeable phase shift. These two conditions, or modes, are interchanged at a random sub-field rate. Thus, the picture may be normal for several fields, then out of phase for several more. The changeover from one mode to the other is determined by a noise source, so that it will be entirely random, and thus secret. If the coded signal is tuned in on a receiver which has no coder, the picture moves back and forth horizontally on the screen, at an irregular rate. With a decoder in operation, the key signal causes the circuit to compensate for the phase shift.

To allow for small variations in the normal delays occurring in the transmission of the key signal over the telephone line, the key is sent from the transmitter about one field before it is used at the receiver. Synchronization of the keying signal with the proper field in the receiver is accomplished by combining the key with a pulse from the vertical sweep. Thus, the mode of a particular field is determined by the presence or absence of the keying signal when the vertical pulse appears.

120-Cycle Bandwidth

The bandwidth, then, which is needed for the transmission of the key is about



Antenna of Zenith's experimental Channel 2 TV station in Chicago, center. At left is the company's FM station antenna.

120 cps. The highest possible keying rate, or change from one mode to the other, is 30 per second.

Extra equipment needed at the transmitter for sending Phonevision, that is, the coder, consists of a unit inserted between the convention sync generator's horizontal section and the horizontal sweep and shading sections. In addition to shifting the video phase, the coder also adds "jittered blanks" to the signal, for the purpose of eliminating low-frequency modulation of the signal caused by the changing phase relationships of the video and the steady blanks. While the coder is producing these variations in the transmitted signal, it is also sending out the keying signal for receivers.

Noise Generator

The first section of the coder unit, the random key generator, is activated by the normal transmitter vertical drive. The vertical signal is mixed up with the random noise pulses in a blocking oscillator circuit, after the noise signal is fed through a limiter for regulation. The blocking oscillator can be set to operate between 60 and 20 times per second. In connection with a multivibrator, alternate signals from the blocking oscillator give square-wave control signals. The square wave controls an oscillator which operates at the carrier frequency of the key signal. The output from this stage is fed to the link which connects to the receiver.

The oscillator output also is fed to the part of the coder which generates the horizontal drive for the camera, monitors, and shading generators at the transmitter. A gating circuit, actuated by the oscillator signal plus the vertical pulses, controls a single-trip multivibrator. Application of the pulses, which are positive in the presence of the key signal and negative in their absence, to the multivibrator, causes a change in the mode of operation. The change occurs at the time of the first

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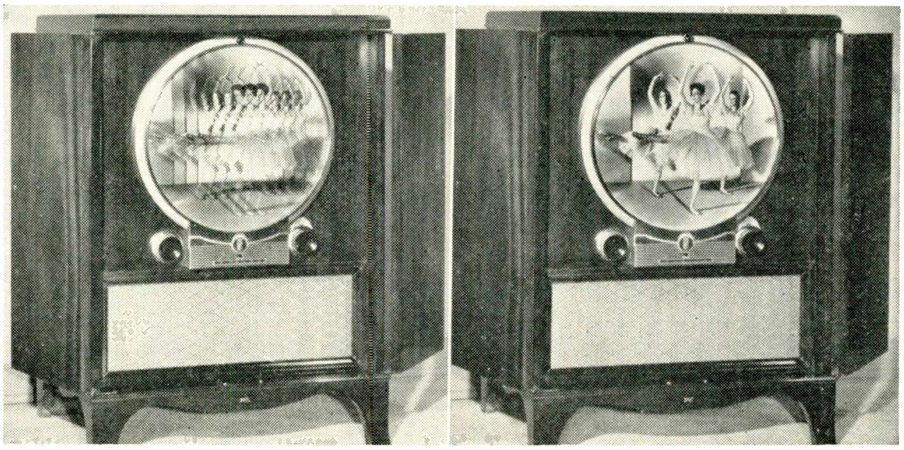
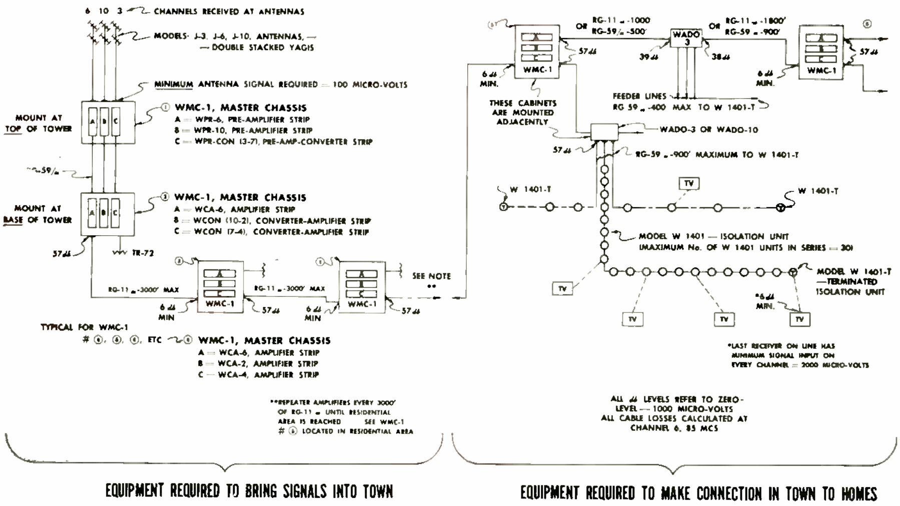


The scrambled TV picture as it is received without the decoding signal is shown at left. Video information and horizontal sweep are out of phase part of the time, producing a picture which shifts back and forth horizontally. Right, normal picture when the decoder is operating.

New Developments



Block diagram of the Jerrold Antenna system installation for a town. At present, the system delivers a maximum of three channels, with an individual amplifier strip for each channel in each repeater-amplifier unit.

Pushing Back the Fringe

A GOOD many television-less communities are likely to have reception in the comparatively near future, whether the new-station freeze is lifted or not, thanks to a development brought about by the Jerrold Electronics Corp. of Philadelphia.

The new system, which operates on the principle of the usual multiple-receiver installation, like those now used in many apartment buildings, hotels, and dealers' stores, but expanded to supply as many as 25,000 receiver outlets with usable TV signals, is already in operation in several locations, which are between 100 and 125 miles away from the nearest transmitter.

Jerrold Electronics, which manufactures the "Mul-TV" multiple receiver system described in the July, 1950 issue of RADIO AND TELEVISION MAINTENANCE, is now prepared to install 150 of its large "booster antenna stations," as they might be called, at costs varying with the size of the installations.

Operation of System

The operation of the installations is analogous to that of conventional multiple systems. A large tower, with individual antenna arrays cut to the proper lengths for the channels to be received, is set up on high ground near the town to be serviced. The signal-boosting equipment is installed at the antenna tower, and the signals are then piped through lines to the receiver outlets, the owners of which subscribe, by a monthly charge, to the service.

At the present time, the system is operating in Mahonoy City, Pa., Astoria, Ore., Bellingham, Wash., and Lansford, Pa.

The Lansford installation, which uses an 85-foot tower, erected on the peak of a nearby mountain, brings television within reach of the residents of Panther Valley, about 70 miles away from the three stations in Philadelphia, a location which is completely hidden by surrounding mountains from line-of-sight reception.

Business Possibilities

A boon to advertisers, to local dealers in TV sets, and to station operators, the installation opens up a new vista of business possibilities which were previously out of the question. At Lansford, the sponsoring company of what is really a community project invested $30,000 in the system. Each receiver connection to receive one stations costs $100, plus $25 for each additional channel to be received. A service charge of $3 monthly for the first channel, plus $1.50 for every additional one, is also made. The group originating the utility, the Panther Valley Television Company, expects to get its investment back within six months; from that date, only maintenance of the equipment will be required, and the rest of all collections will be profitable.

One possible flaw in the system, the fact that the spot commercials used by Philadelphia advertisers will have little use for local listeners, is being worked out. In the future, it will be possible for local advertisers to break into the signal during the Philadelphia commercial.

Double Reception Areas

Dealers in the town, who had almost given up hope of ever being able to profit from the huge public interest in television, can now sell nearly all the receivers they can supply. Since the first news of the system was revealed, groups of dealers throughout the country have shown great interest in the system. Many station operators feel that the arrangement could double their effective listening areas, if enough of the installations are put up. According to Jerrold President Milton J. Shapp, it is possible to set up the booster stations as much as 250 miles from the transmitters, thus bringing signals into thousands of unexploited homes. For practical purposes, the installations could be thought of as entirely new TV stations, operating on network bases, which neither require the heavy expenditures necessary for setting up conventional broadcasting stations, nor violate the FCC rule against new construction.

Supplementary Boosters

To maintain the high signal level reached after the received signals are put through the initial amplifier, which provides gain of about 500, the cables on the route from the antenna tower

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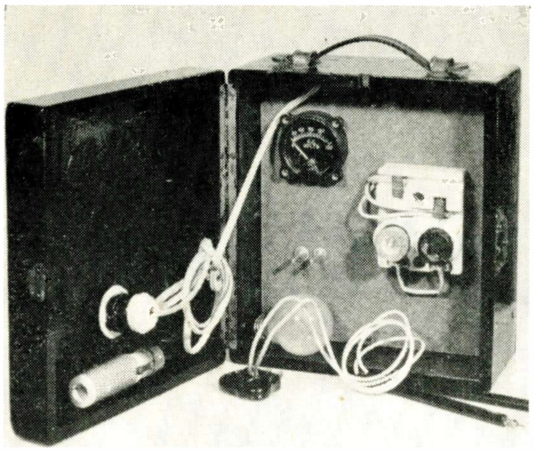
Shop Equipment



The complete home appliance tester in its case. AC voltmeter is optional, may be replaced with a pilot light to show when the tester is activated. Dummy receptacle in the lid of the case holds power plug when it is not in use.

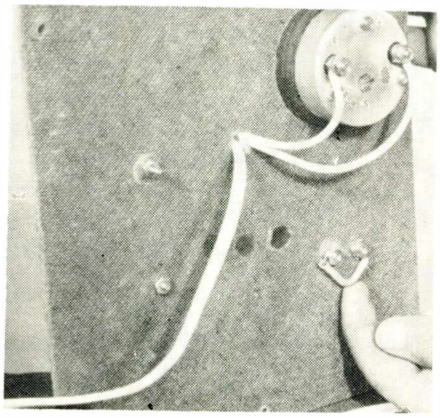
BUILD THIS SIMPLE HOME APPLIANCE TESTER

By HARRY F. LEEPER

SINCE most radio and television technicians are often called upon to do some work on home appliances other than receivers, it is a good idea to have a test tool that will do the job without tying up the conventional shop equipment. Here is an appliance tester that will do much of the work coming into the shop, and that will do some things that could not be done with radio and TV instruments, without a number of special adapters.

This piece of equipment, which can be easily and cheaply assembled from parts found in the shop, consists of an AC voltmeter, a standard two-outlet fuse block, a dummy female receptacle, and a pair of iron prongs, like those found on the older flatirons or other devices.

Mounted on a sheet of press board, and fitted into a woden case, the sockets of the fuse block are connected in series, while the voltmeter is hooked up across the line voltage input. The dummy receptacle, left open, is mounted on the box cover, and the prongs, connected together in the rear, are mounted on the press-board panel.



Prongs connected together behind the panel provide a test for appliance cords suspected of open circuits.

For use, a screw-in receptacle is inserted in one outlet of the fuse block, and a 40 or 60-watt lamp is screwed into the other socket. The line cord is plugged into a power outlet, and the meter reads the line voltage, serving as an indication that the unit is energized.

To check an appliance cord, the cord is plugged into the receptacle. Twisting and folding the cord will reveal intermittents, since a short circuit will light the lamp. To find an open in the cord, the female end is pushed onto the shorted prongs mounted in the panel, and the male plug is inserted in the fuse-block receptacle. If the line is open, then the lamp will not go on. If the lamp lights up, however, the cord is proved to be good.

For particularly stubborn cases of intermittent operation, a heater unit can be substituted for the lamp. The heater unit, drawing about 660 watts, puts a greater load on the cord, of course, and is more likely to reveal the break.

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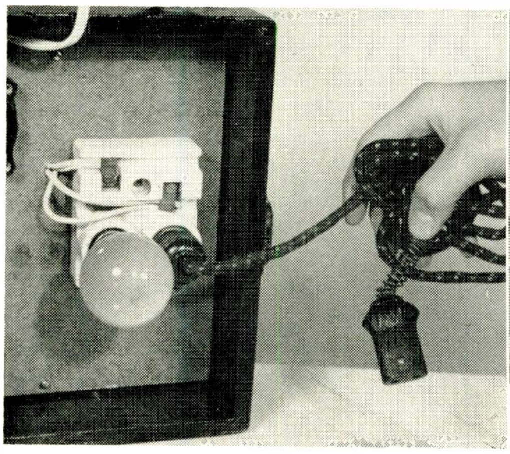
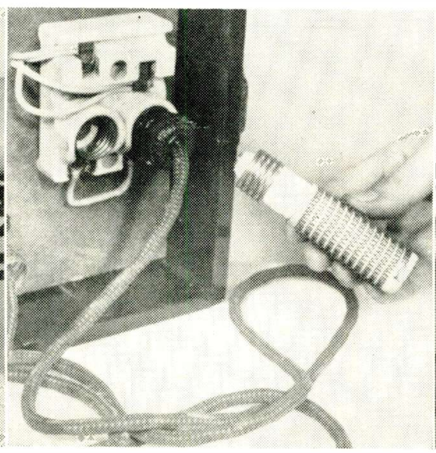
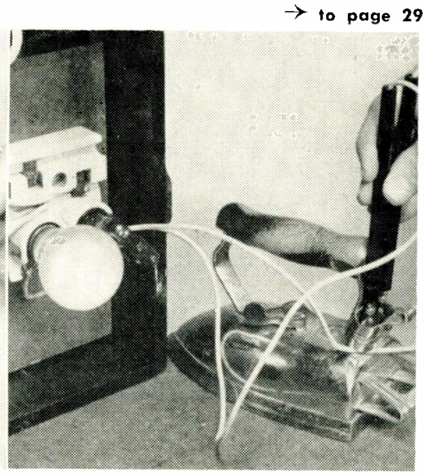




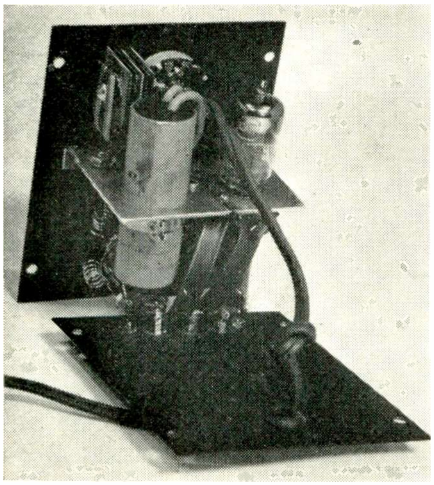


Appliance cord is tested for short circuits, below, left. Twisting and folding the cord will reveal an intermittent short if it is present. When the short contacts, the lamp will light. In the center, a heater unit, which draws about 10 times as much current as the lamp, is inserted in the socket to put a greater load on the suspected cord. At right, a flatiron is tested and found to be good, since the lamp lights up. In this test, care must be taken to avoid shock at the bare prods of the test leads, which are in series with the power circuit.

Design and Service Data on

TELEVISION PREAMPLIFIERS

By NORMAN L. CHALFIN



Parts arrangement in a typical all-channel TV booster. Note selenium rectifier and use of a single tube, a duo-triode used for two-stage amplification.

THE fact that best reception of television stations can be had over a "line-of-sight" path has challenged radio engineers to find means of extending this range over the horizon.

One approach to increasing the number of elusive microvolts which get down the lead-in and into the first stage of the TV receiver has been to erect complex multi-element antenna arrays. A second approach has been through the development of antenna preamplifiers.

In addition to the signal increase, an antenna booster for TV receivers will add to the selectivity of the set, so that better image rejection can be effected. This will result in reduction of interference from stations in the 88-108 Mc FM band and from amateur and other RF signals which may, through heterodyning with the TV set's local oscillator, cause interference with the picture. A further advantage of the added selectivity is the reduction of interference from local oscillators of nearby television receivers.

Different Circuits

Many different circuits have been employed in TV preamplifier application. One of these, shown in Fig. 1, employs a 6AK5 or 6AG5 pentode RF amplifier with a standard L-C circuit as the tuned element. This tuned element may be either on the grid, as shown, on the plate, or on the cathode. The operation of the tuned-grid and tuned-plate circuits are familiar to most technicians.

One feature which is often used in TV boosters is a resistive-load balanced input as in Fig. 3. This arrangement reduces the likelihood of standing waves, which mar the clarity of the image.

Narrow Band

It will be obvious by this time that while the circuit shown is a good amplifier with considerable gain, the use of lumped constant L-C arrangements with variable capacitor does not allow a wide range of tuning. To cover the ranges from 50 to 88 Mc and 174 to 216 Mc fully, one must switch for two tuned circuits, each covering one of these ranges. A ratio of two to one for tuning is the most practical obtainable with L-C combinations employing a variable capacitor. A further feature of L-C circuits is their higher Q with

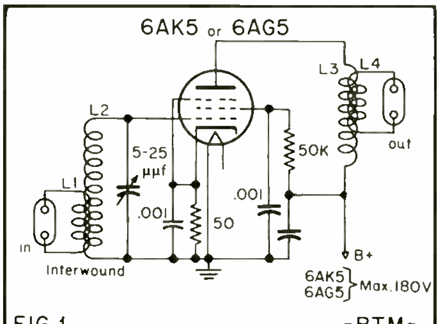
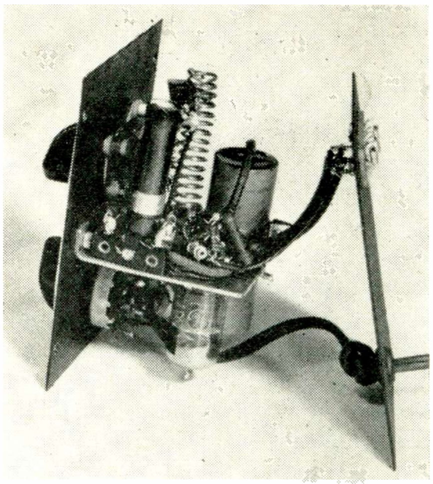


FIG. 1



Under-chassis view of the booster. Twelve-position selector switch can be seen, with coils attached. Short connecting leads are particularly important in replacing any parts of TV boosters, since losses and noise are easily introduced.

the consequent narrow band pass characteristics.

This narrow band pass can, however, be used to advantage for those sets that have appreciable dips in their IF bandpass characteristics. The booster can make possible selection of a frequency band to fill in the dip; this may not necessarily provide much gain although picture fidelity may improve. A band switch, however, can cause considerable circuit losses, reducing overall efficiency. Thus a lumped-constant booster circuit with a variable condenser and 2-band switch will have less gain than a booster of the same type for each band. Some commercial boosters have a cut out system wired to the on-off switch, as shown in Fig. 2. This is a five-pole, three-position switch. The third position is for switching high to low band.

High-Low Switch

The high-low band switch can be a second wafer on the same shaft with the three-position, five-pole switch. The

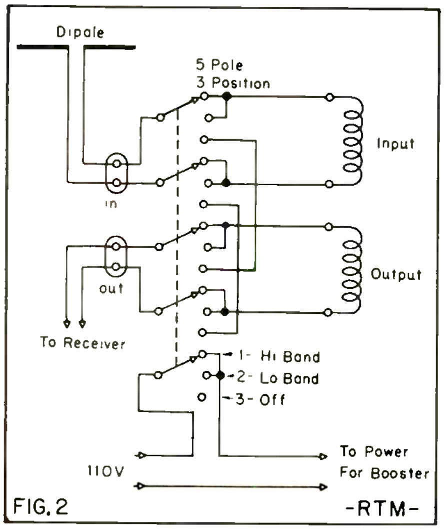


FIG. 2

second wafer has two poles and three positions. All the wiring necessary for these switching operations is likely to result in more losses. In spite of this, however, the amplifiers will still have useful gain.

Fig. 3 shows one way out of the problem of switching in a unit employing a 6J4 tube. If the 6J4 is not used, a 6J6 with the elements of the two triodes tied in parallel operates in the same circuit. A pentode could be used, too, but this requires more parts. This same arrangement is sometimes used in grounded grid application for coaxial input. In that case, position 1 is tied to ground at the input and the coax goes between position 2 and ground. The resistor R2 should be equal to the coax impedance for the coax application.

Wiring Precautions

When servicing boosters like that shown in Fig. 3, the usual wiring precautions should be observed. These apply as well as to all the other circuits described here. All grounds should be wired to a common point. This can be very practically accomplished by bringing a piece of bus bar up from the center shield on the bottom of a seven pin miniature socket. All resistors and condensers that go to ground should then be brought from the socket terminal to this ground.

In working on the coils to the selector switch, it is important that all connections of the coils come as close as possible to the switch terminals. The coils which provide selection of channels from 13 down to 7 (6 turns) can be a single coil stretched so that each turn touches one switch position. The balance of the coils are wired as closely as possible to the switch. With some switches just a single strap of wire forming the 7-13 channel tuning coil can be arranged, as in the early RCA Tuner.

Each individual coil should be perfectly concentric for best results. Some tuning adjustment may be required. This is accomplished by spreading or squeezing the turns together. Squeeze to lower the resonant frequency. Spread to raise the resonant frequency.

Wiring should be point to point and all leads should be as short as possible. Where a greater length is necessary, it should be allowed only at the ground or end, the shortest possible lead going to the hot side. This applies, of course,

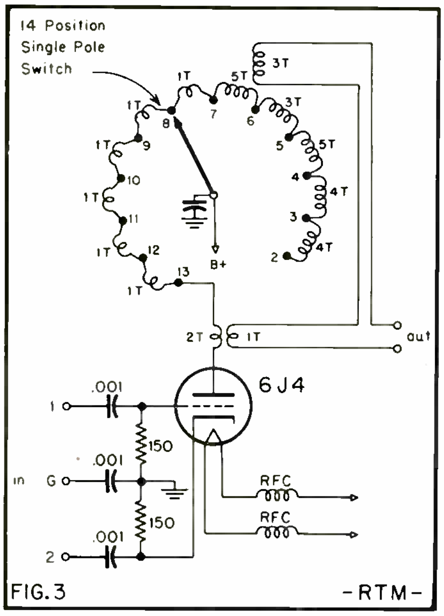


FIG. 3

as a general rule for wiring all high frequency apparatus.

Tuned Grid-Tuned Plate

The tuned circuit of Fig. 3 can, as we mentioned before, be employed in the grid circuit as well as in the plate circuit. One commercial booster uses a tuned grid, tuned plate RF amplifier employing additive inductance tuning. The tube is a 6AK5. For such a circuit (Fig. 4), it is important that the grid and plate tuning elements be isolated from one another. This can be done by setting a shield between the switch wafers and wiring. (This is employed in some Jerrold boosters.)

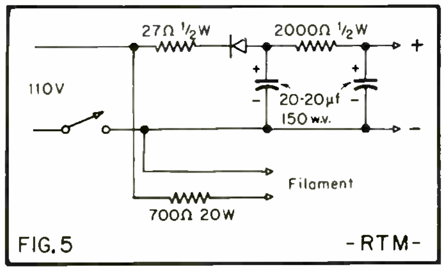


FIG. 5

Many other arrangements are possible for boosters involving more than one stage. Since impedance matching with inductances over the wide range required for television receivers is rather a complex matter a resistive match is desirable. Photographs are shown of the mechanical arrangement employed in such a booster.

The unit in the photographs was made with a selenium rectifier power supply derived from the line. This supply is shown diagrammatically in Fig. 5.

The tuning coil assembly for this instrument is the same as that for the 6J4 booster in Fig. 3. This unit, however, uses a 12AT7. It is just as well, though, to use two 6J4 tubes or two 6C4's, with RF chokes (Z-144 Ohmites) in each leg of each filament.

The two tube arrangement can operate slightly better, because there is some loss due to the degenerative action of feedback coupled through the common filament of each section of the 12AT7.

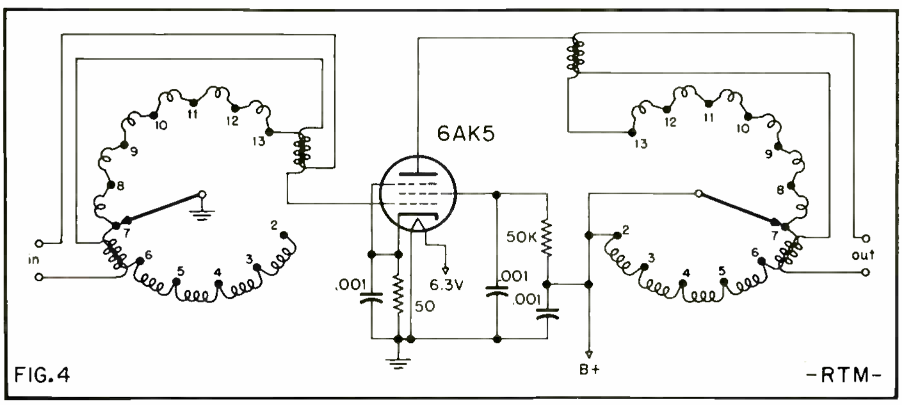


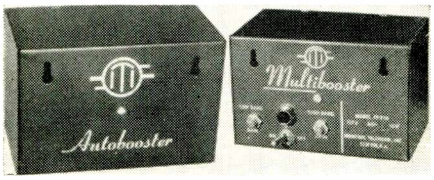
FIG. 4

Some of the interesting new items being made available currently in the Radio and TV service field are presented in this column. For further information, write to: Products Editor, RADIO AND TELEVISION MAINTENANCE, P. O. Box 867, Atlantic City, N. J.

WIDE-BAND BOOSTERS

Two new television antenna boosters have been developed by Industrial Television, Inc. Called the "Autobooster," the first of the units is an automatic, broad-band unit for a single receiver, while the second device, the "Multibooster," is intended for use in multiple installations.

The Autobooster, which covers both the TV bands and the FM band, without tuning or switching, turns on and



off the receiver through a relay. With two 6BC6's, it is said to give 9x gain on the low TV band, and 5x gain on the high band. It has provision for either single or double input, permitting separate high and low-frequency antennas and leads to be used without switching.

The Multibooster, which uses similar circuits to those of the Autobooster, is also automatic in operation, and contains separate high and low-band gain controls. Where excessive local oscillator radiation is a problem, the maker recommends use of this unit in conjunction with the Autobooster.

—— RTM ——

TWO-STAGE TV PREAMP

The "Super Skychief," a new, two-stage television preamplifier is now being produced by the Mark Simpson Mfg. Co.

The two-knob control, which is reported to prevent overloading of the receiver, provides exact gain control. When the booster is turned off, the set will operate through a direct connection to the antenna.

Containing eight tuned ciruits, which

the manufacturer claims assure "balanced" picture gradation and sound amplification, the unit is said to give uniform gain on all channels, with full 4.5 Mc bandwidth.

A pilot light and switch are included in the booster, as is a receptacle for the AC plug of the television receiver. The set may also be turned on and off by means of the booster switch.

—— RTM ——

MANUAL ANTENNA ROTATOR

A new television antenna rotator, which is operated manually, is the Select-A-Beam, developed by Neo Products. The mechanism, which is driven

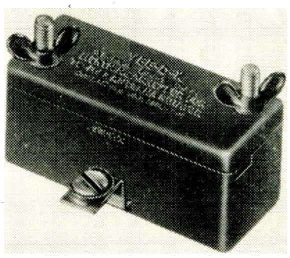
by a worm gear, can be operated by either an outdoor or an indoor control box.

Weighing three pounds, the device is equipped with guy wire anchoring lugs, and is claimed to fit "any standard antenna, whether for home receiver or for amateur transmitter and receiver."

The rotator turns the antenna through 360 degrees. A mechanical meter to indicate orientation is included with the control box.

—— RTM ——

LIGHTNING ARRESTER



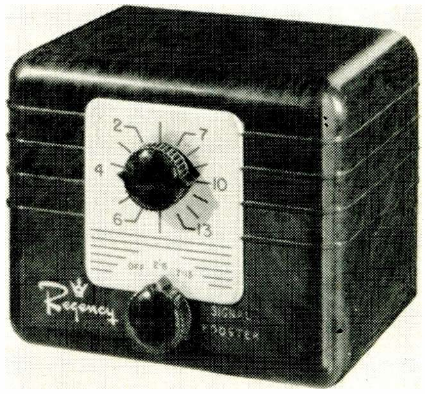
A new lightning arrester with two sawtooth contacts, for standard TV transmission line, has just been put on the market by LaPointe—Plascomold.

Part of the Vee-DX line of antennas and accessories, the new device is similar to the company's RW-204 arrester, which handles four-wire or two-wire line, but takes only two-conductor line, and is sold at a lower price.

—— RTM ——

REDESIGNED BOOSTER

In order to cope with allocation difficulties, the Regency TV booster has been redesigned. The new model, called the "DB 410" by the manufacturer, is similar in appearance to earlier models.



The unit contains contra-wound bifilar coils with push-pull triode connections for balanced output. Internal impedance match accommodates either 300-ohm twinlead or 72-ohm coaxial line. Bandwidth, according to the maker, I. D. E. A., Inc., is sufficiently wide for satisfactory operation on 12 channels.

The revised booster, like the company's other models, measures 4½ by

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In Fringe Areas Promise Less Than They're Likely to Get

DO YOU remember wicked Tantalus of Greek mythology whose punishment in the lower world was to be forever dying of hunger? Delicious fruit dangled just above his head, but whenever he reached forth his hand to take it, the fruit drew back so as to remain always just beyond the tips of his fingers.

Many TV fans in the fringe areas remind us of this wretched father of our word *tantalize*. They seem to feel that if they can just put another section or so on their TV tower, can just get that antenna up in the air a few more feet, they will suddenly get perfect reception. My experience, and that of other fringe-area TV installers does not bear out this fond belief.

Miniature Eiffel Towers

In a true fringe area where it is possible to secure line-of-sight reception by going up fifty feet or so, every extra ten feet of antenna height may well show a marked increase in signal strength; but in an area such as the one where I live—seventy miles from the nearest television transmitter—it would be necessary to put an antenna one thousand feet in the air to approach line-of-sight. While some of the miniature Eiffel towers sprouting from rooftops these days make one hesitate to say that such a dizzy height will *never* be achieved by some TV fan with a bulging pocketbook, certainly true line-of-sight reception will remain out of the question for most people living at great distances from TV transmitters.

JOHN T. FRYE

These people have to depend upon the TV signals coming down to them through refraction or reflection of the wave. Sometimes this occurs; at other times it does not; but an impressive amount of evidence indicates that when the signal is really coming in, it will be picked up just about as well on an antenna that is fifty feet in the air as on one that is twice that high; and, by the same token, when the signal is not being bent or reflected into the receiving location, neither the fifty-footer nor the hundred-footer will be able to pull it in.

Diminishing Returns

I'm certainly not arguing that *no* height at all is necessary. I contend that after you have the antenna several wave-lengths above ground, the law of diminishing returns sets in very rapidly and makes shoving the signal-sniffer on up into the stratosphere scarcely worth the added cost, trouble, and danger. Of course, when raising the tower-height a few feet enables the antenna to clear the top of a nearby building or power line directly in the path of reception, that is a different question.

It must be remembered that raising the antenna necessarily increases the length of the lead-in and the accompanying lead-in losses. There must, then, be a really substantial increase in signal-interception at the antenna to insure a noticeable increase in signal delivered to the set. That is why experiments with a telescoping mast are likely to be quite misleading unless the lead-in is shortened each time the antenna is lowered. It is unfair to saddle the lower antenna positions with the unnecessary lead-in losses of the greater elevation.

We all have experienced cases where raising or lowering the antenna a few feet has resulted in marked improvement in reception, but I look with considerable doubt on the theory that this proves TV signals exist in the form of "space loops," "ether swirls," or "strength layers." It seems much more likely that the change in antenna height results in a change in its impedance, producing a more favorable match at either the antenna or receiver. Possibly a standing wave on the lead-in moves up or down so as to deliver more power to the set.

Critical Heights

Then, too, hams have long known that there are critical heights above virtual ground (not necessarily the earth-level) that greatly favor reception of signals arriving at certain vertical angles. It is quite possible to shift the elevation of the antenna a few feet, especially when it is not too high to begin with, so as to throw out the welcome-mat for a signal coming in on a particular "glide path." Moreover, if the signals consistently arrive at or near that angle, the shift in elevation can easily produce a permanent improvement.

"Standard" Installation

A local TV installer, with nearly a hundred fringe-area installations to his credit, has done considerable experimenting on his own. He told me that he has just about "standardized" on an installation system for this weak-signal area. The antenna is put up about 50 feet above the ground, the tower usually mounted on the roof. The lead-in passes directly through a small hole

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trade LITERATURE

TV SERVICE

"TELEVISION SERVICING," a new handbook covering complete procedures in the maintenance of receivers, has just been put out by McGraw-Hill. In simple language, the book, which was written by Solomon Heller and Irving Shulman, shows exactly how to locate and correct the common troubles encountered in TV work, with test pattern analysis, installation, effects of component breakdown, and other sections devoted to specific aspects of television.

Priced at $6.00, the volume contains 434 pages.

Troubles outside the receiver itself are also covered, with explanations of the causes and cures of many types of interference, noise, weak signals, excessive signals, and other difficulties. In the parts of the book which deal with internal faults, the book gives directions on isolating the trouble to sections of the set, then on narrowing the possibilities to the exact part which is defective.

—RTM—

SERVICE BUSINESS

HOWARD W. SAMS & Co. is the publisher of "Making Money in Television Servicing," a new work describing, as the title suggests, methods of finding out the necessary economic facts that are required for the successful operation of a service shop.

The technical requirements, the state of the industry, the nature of business prospects in particular areas, and many other factors are of the highest importance in maintaining a business. This book shows the reader just how to find out for himself what procedures he should follow for profitable operation.

Among the information included is material on contractual relationships set up between dealers and service or installation agencies, as well as those made between consumer and service company.

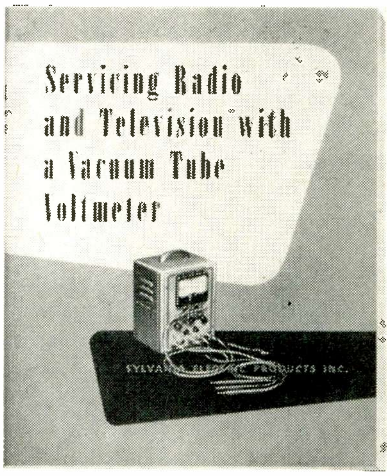
Pitfalls to avoid in business, as well as sound procedures to follow, are outlined. As the author, Eugene Ecklund, presents it, the material may well prevent some of its readers from being forced out of business.

With 136 pages, the book sells for $1.25. —N. L. C.

VTVM BOOKLET

DIFFERENT types of vacuum voltmeters, their adjustment, operation, and use are covered in a new book recently prepared for Sylvania Electric by Rufus P. Turner.

The 48-page booklet will be available to dealers buying Sylvania TV picture tubes through distributors, from April 1 to May 31. After that date, it will be sold at $1.00 per copy.



Divided into five chapters, the book gives radio receiver, audio amplifier, and television receiver tests and measurements. Full title of the book is "Servicing Radio and Television with a Vacuum Tube Voltmeter."

—RTM—

TV ACCESSORIES CATALOG

LAPOINTE-PLASCOMOLD Corp. has just issued its new 1951 catalog of television antennas and accessories.

In addition to detailed descriptions of lightning arresters, a three-way switch box, an antenna impedance matching device, and the company's line of antenna towers, a section of general information for the servicing trade is included. Installation instructions, technical specifications, and other material is included, relevant to the antennas presented, along with information on ordering.

—RTM—

GE REPLACEMENTS

REPLACEMENT parts for sets produced between October, 1945, and December, 1950, by General Electric Co. are listed in the company's new "Radio and TV Replacement Parts Catalog," a 144-page, cloth-bound volume.

A feature of the new compilation is a cross reference between drawings and part numbers. Also included are two change-of-address cards, to facilitate mailing of supplementary loose-leaf sheets.

Among other features of the catalog are alphabetical listing by part number, complete part descriptions, set models in which the various parts are used, list prices, and a revision service.

—RTM—

AUDIO EQUIPMENT

TWO NEW editions of semi-technical booklets by G. A. Briggs, on audio equipment have just come out.

The third edition of "Loudspeakers—the How and Why of Good Reproduction," thoroughly covers the subject of loudspeaker operation, with chapters of impedance, sound levels, frequency response, power, resonance and vibration, and other subjects of equal interest to audio fans. Illustrated with many diagrams, the book also gives details on baffles and speaker housings.

"Sound Reproduction," in its second edition, is Mr. Briggs' explanation of the sound field to music lovers who are not technically educated. The handling of the subject is complete enough that even technicians will be able to learn much from it.

Both booklets are available from the British Industries Corp., New York. —A. G. C.

—RTM—

COMPONENTS CATALOG

STACKPOLE CARBON COMPANY, Electronic Components Division, recently issued a 42-page catalog including descriptions of both new and already-established components for the trade.

In addition to standard lines of resistors, fixed and variable, the items mentioned in the catalog include line and slide switches, iron cores, choke forms and capacitors. Among new lines shown are various controls, switches, non-metallic "U" and "E" cores, width control and segmented de-

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Products for the Trade

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5½ by 3¾ inches, and utilizes a single tuning knob. One exterior change is the addition of a new gold-colored panel for the dial face. There has been no change in price.

—RTM—

ROTARY SWITCH

Solid silver contacts are included in a new rotary switch developed by Leeds and Northrup Co. Contact resistance in the unit, which is designed for precision apparatus, is about .001 ohm.

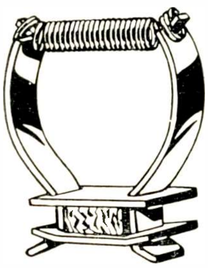
Electrical strays are also low in the switch, the manufacturer states.

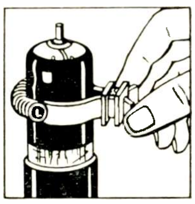
Available in combinations from single pole, 12 position, to 6-pole, 12 position, the switch, which is a shorting type, has an adjustable detent, with a screw for setting torque to the exact pressure desired.

Current handling capacity is one ampere at 110 volts, 60 cycles. The unit is tested for 100,000 revolutions.

—RTM—

OSCILLATION ELIMINATOR





Barkhausen oscillations in horizontal output tubes can be eliminated with a new device put out recently by Perfection Electric Co., the "B. O. Eliminator."

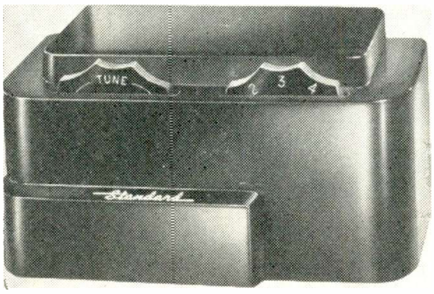
The eliminator, a magnet-clip device, which is slipped over the offending tube, is reported by the maker to remove the effect, in most cases, of Barkhausen oscillation, which is radiated from the screen grid of the horizontal output tube to the television set's front end, and which causes vertical black bars to appear on the picture. The effect is most noticeable in fringe areas.

For installation, the unit is put on the tube, and moved up or down and rotated until the bars disappear from the picture.

—RTM—

SINGLE-STAGE PREAMPLIFIER

Continuous, one-knob tuning is a feature of the new booster just developed by Standard Coil Products Co. High gain on all channels is claimed for the unit, with the single stage operating at a low noise factor. Printed circuits are used in the booster.

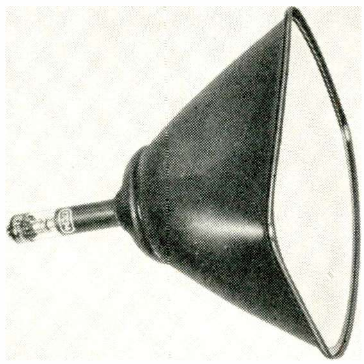


The device is made in a dark-brown plastic cabinet. It is called the "B-51 Standard Booster."

—RTM—

17-INCH RECTANGULAR

The Tube Department of RCA has just announced production of a 17-inch, metal, rectangular picture tube—the first metal rectangular to be put on the market.



Labeled the 17CP4, the new tube has a high voltage rating of 16 Kv. Deflection angle is 70 degrees on the diagonal, and 66 degrees horizontally. The ion trap requires only a single-field external magnet. Picture area is 14⅝ inches by 11 inches.

Use of metal for the shell, the company says, permits use of higher quality glass for the face plate than is possible in all-glass kinescopes. The face plate is made of frosted Filterglass.

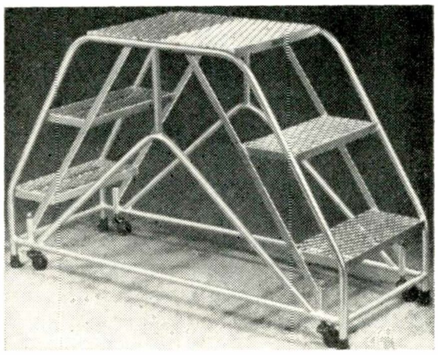
The tube's overall length is about 18 inches.

—RTM—

SHOP LADDER

For stock rooms or service shops, a new ladder, made by the Ballymore Company, has been announced.

Mounted on casters which retract when a person steps on the ladder, the device is made of tubular welded steel, with expanded-steel steps for non-slip traction.

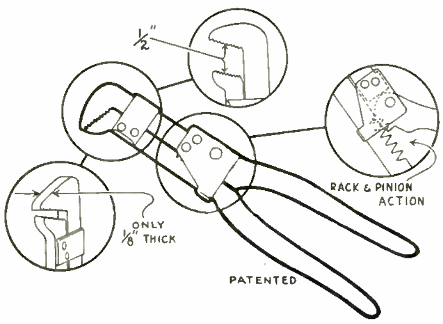


The ladder is 30 inches high, 48 inches long, and 17½ inches wide. The top step has a 20-inch tread, while the other steps have 7-inch treads. The ladder is finished in aluminum paint.

—RTM—

NEW WRENCH

Rack-and-pinion is utilized in a new wrench recently introduced. Designated the "Power-Grip," the tool has an angle head, to afford heavy pressure in ordinarily inaccessible spots. Thickness of the head is ⅛ inch, while the wrench's overall length is 5¼ inches. The jaw opening ranges from zero to more than ½ inch.



Made of alloy steel and guaranteed to be unbreakable, the wrench is finished in a dull black, with polished straps.

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Products for the Trade

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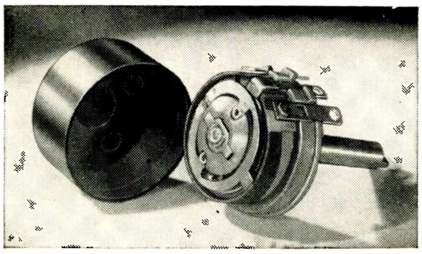


PRECISION POTENTIOMETER

Linearity within plus or minus 1½ percent is claimed for a new precision-built potentiometer now being produced by Clarostat.

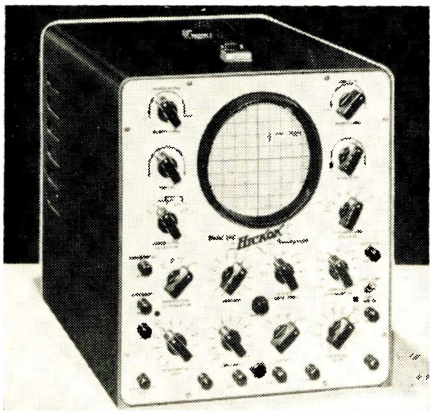
Developed to meet growing demand for precision components, the new controls are being manufactured in limited quantities. With mechanical tolerances held as close as plus or minus 0.00025 inch, the unit is reported to operate dependably over extreme ranges of temperature, humidity, altitude and barometric pressure, and is treated to withstand fungus growths and corrosive conditions without loss of efficiency. A silver contact is used to ride on the winding and contact rail.

—RTM—

FIVE-INCH 'SCOPE

The Model 640, a new five-inch oscilloscope, has recently been put out by Hickok.

With a wide-band amplifier, the frequency response of which is zero to 4.5 Mc, the instrument has 10 mv-per-inch sensitivity on the vertical DC and AC



amplifier, with sensitivity switch in high position, and 25 mv-per-inch characteristic with switch in low position.

Input impedance is two megohms, while direct connections to both horizontal and vertical deflection plates are provided for.

Linear time base from two cps to 30,000 cps is available, with either recurrent or driven sweep.

Modulation on the "Z" axis so that 15 volts capacitatively coupled to the grid of the CR tube will blank the trace fully at normal intensity is possible.

—RTM—

RESONANT CAPACITORS

Reduced cost and improved IF filtering are features claimed for new resonant capacitors put out by Aerovox. The units, which act as series resonant circuits, are designed primarily for bypass use.

The resonance, which occurs in the

425-485 Kc range, is achieved by winding sections of the foil so that inductance is increased. With a certain placement of the tabs, the resonance is controlled to fall in the IF band.

The condensers are available in three standard values—0.05, 0.1 and 0.2 mfd, 400 WVDC.

—RTM—

MINIATURE TUBE CAP

For use with 1X2 or similar miniature tubes, a new high voltage, low-loss tube cap, with the wire molded into the plastic cover as an integral unit, has been developed.

Described by the manufacturer, Alden Products Co., as the 90 ISTL, the cap has a long skirt designed to prevent danger of flashover from cap to chassis when operated at high voltages. Minimum strain on leads is said to result from the insulating molding, which is made of flexible polyethylene, while the design of the contact itself, with two smooth curved surfaces, is claimed to reduce the effect of corona.

—RTM—

DEVELOPMENTS IN THE NEWS

New Tube for Color TV Shown

LOS ANGELES—The newest invention for use with the CBS color television system, a tube using a rotating color phosphor disk within the envelope, was shown here recently by its inventors, Eugene Singer and Dr. Irving Rehman.

At the demonstration, which utilized the first working model of the tube, the Rehman-Singer system included projection of the tube image on a screen. Singer, a television set manufacturer, said that the greater light transmission of the tube permits projection on a screen of any size. He said that the previous arrangement of a disk rotating in front of the tube reduces the light output by 80 percent.

The tube can also be used for black and white pictures, the inventors said in a public announcement. They also said that, due to the war emergency, it would probably be some time before commercial exploitation of color TV is possible, and that they are working on an adaptation of the unit for military use.

Bureau of Standards Develops Accurate, Stable RF Generator

WASHINGTON—Extremely simple devices which produce voltages at a very low impedance and at a wide range of frequencies have recently been invented and developed by M. C. Selby of the National Bureau of Standards here. Known as "RF micropotentiometers," they provide accurate voltages from one to 100,000 microvolts without the use of attenuators at frequencies up to 300 megacycles and above. Thus, convenient standards of low voltages are made available which should greatly reduce equipment and shielding problems encountered in calibration of present-day commercial voltage generators, attenuators, voltmeters, and other radio-frequency equipment.

The micropotentiometers should prove especially useful in measurements of radio receiver sensitivity. Here the large disagreement between various standard voltage generators at high frequencies and low voltage levels has been due to three major causes. First, generator output impedance and receiver input impedance are not ordinarily known as functions of changing frequencies. Second, extreme care is necessary in using precision voltage-dropping attenuators. Finally, the long-time calibration stability of vacuum tube voltmeters is uncertain. For these reasons, manufacturers of voltage generators have not been able to guarantee the accuracy of their equipment at all frequencies. Development of the micropotentiometers now appears to have removed most of the obstacles to standardization of receiver sensitivity.

The new instruments consist essentially of appropriately housed and mounted current-carrying elements together with means for monitoring the currents they carry. Their electrical constants are simply determined by using known DC voltages and currents. The current-carrying elements are annular membranes, either metallic or nonmetallic, of various radii, thicknesses, and electrical resistivities. Monitoring may be accomplished by means of thermocouples, thermoelements, bolometers, stable vacuum tube voltmeters, or other devices whose indications are independent of frequency. Thermoelements have been used in measurements of one to 100,000 microvolts at frequencies from zero to 300 Mc and also for 100,000 microvolt measurements in the region of 1000 Mc.

These micropotentiometers are the first low-impedance (of the order of milliohms) devices which provide r-f voltages in the microvolt range and which make these low voltages available without the use of attenuators. They thus provide useful tools for many problems where constant voltage and low voltage sources are required. The devices are inherently frequency insensitive up to and above 300 Mc.

Extremely low and essentially nonreactive output impedance facilitates their use for checks and references with standard voltage generators. They may be used for direct calibration of percentage-modulation indicators. By means of known voltage ratios, the micropotentiometers may be used to extend the range for checking attenuators up to 120 db or higher.

In comparing the micropotentiometers with other sources, such as a voltage-measuring thermistor bridge, absolute reproducibility and agreement have been limited only by the relative complexity of the standards of comparison. Verification of the exact frequency and voltage ranges of the micropoteniometers in terms of other independent standards is still in progress at the Bureau, along with other phases of design and application. Probably the greatest single difficulty encountered in this work has been the lack of stable sensitive receivers which can indicate one microvolt (or lower voltages) at 100 Mc and higher frequencies with accuracies of 10 percent or better.

—RTM—

FRINGE AREA SERVICING

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ideally suited for fringe and ghost areas. This unit is characterized by a high gain over a relatively broad frequency range and can be made sharply directional by terminating the closed end of an 800 ohm non-inductive resistor. If front-to-back ratio is important, different values can be tried for best results. It can also be made bidirectional, by omitting the terminating resistance. The characteristic impedance of the rhombic antenna is 800 ohms, but for short distances a 300 ohm line is satisfactory. For longer leads, an open line with the wires spaced approximately 2 inches apart with a quarter wave matching section at the antenna is used. If the transmission line must be run through an area of high ambient noise, and it is necessary to use a 75 ohm coaxial line, a balanced-to-unbalanced transformer must be used.

Optimum Position

Not only is it necessary to use a high gain antenna for good fringe area results, but it is also important that the antenna be located in a so-called "space loop." Such a spot can be located by using a test antenna in this manner: construct a simple test antenna, such as a folded dipole, cut to the frequency of the desired station. Mount the test antenna on a light mast, about the same height as that to be used for the final antenna used. Locate the test antenna at the desired site and orient it toward the station.

Now move the antenna toward or away from the station until you find a space loop. This can be observed by a marked increase in picture contrast or a rise in AGC voltage. If it is desired to get the best location for more than one station, repeat the same procedure, and, if possible, find a spot which is good for both stations. If the simple dipole does not pick up a sufficient signal, a more elaborate antenna is indicated for the test.

A simple check to make sure that the antenna is properly located can be made

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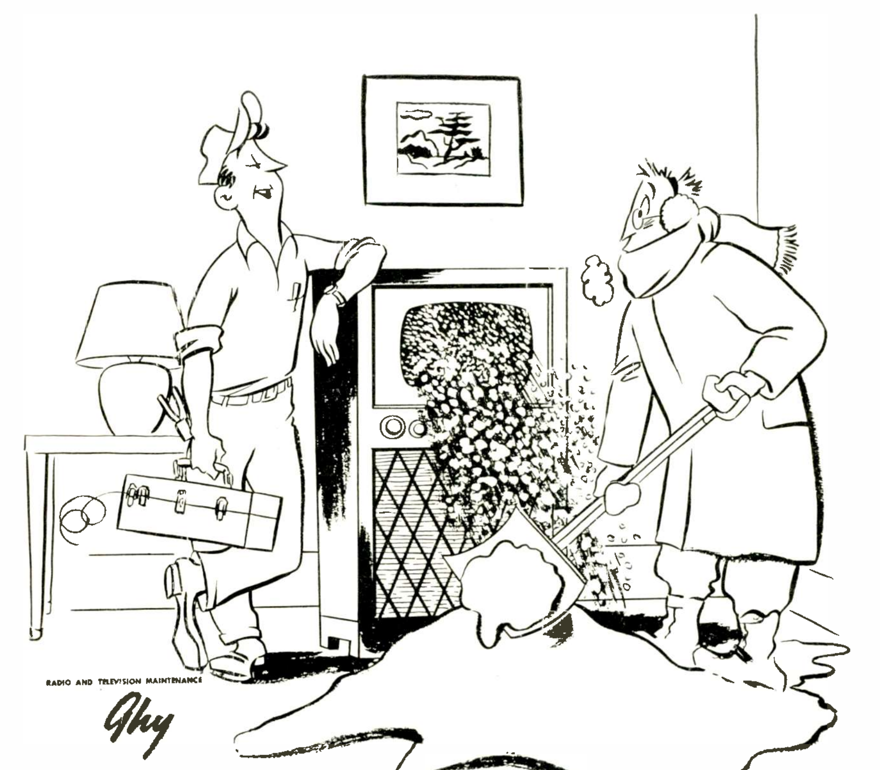
the maintenance mill **by Ghyssels**



"You have to expect SOME snow in a fringe area."

FRINGE AREA SERVICING

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if a twin lead transmission line is used. Reverse the leads at the receiver or at the antenna and observe the picture. If there is no change, the antenna is oriented properly. If, however, there is a change in picture quality, the antenna should be reoriented. This test cannot be employed, of course, if an unbalanced coaxial line is used.

Transmission Line

It would be senseless to erect an elaborate antenna, then use a low quality transmission line, and lose the carefully-obtained signal on the way to the receiver. If maximum signal is to be delivered, it is important that the line matches the antenna as well as the receiver. The line may be matched by using either a Q section or a quarter-wave matching stub.

In fringe-area work, it is essential to choose a line which has a low capacity, low loss and a good quality dielectric. This is particularly important if the line must run over a substantial distance. If the location is one where the line is subject to noise pickup, a shielded coaxial line or a shielded parallel line is necessary.

Booster Amplifier

For proper set operation in a fringe area, a well-designed booster or preamplifier is usually a necessity. The booster must not only amplify, but it must also have very little inherent noise. It is actually possible that with some boosters, the signal-to-noise ratio is worse than when no booster at all was used. It is generally advisable to use a booster which uses triode tubes rather than pentodes, since the level of the tube noise is much lower (because it has fewer electrodes), thus giving an improvement in the signal-to-noise ratio. It may sometimes be advisable to use two sharply tuned boosters in series, where one is tuned for best picture and the other for best sound. Although this is certainly not the most economical way to use boosters, it is sometimes the only way left. If the transmission line has to run for any appreciable distance, it often helps if the booster is mounted as near as possible to the antenna, so as to amplify the already weak signal before it picks up any additional noise along the line.

Correct Matching

As mentioned above, one of the important factors in the proper operation of the complete installation is necessity for correct impedance matching between the booster, the antenna and the receiver. If standing waves appear either between the booster and the set, or on the transmission line coming from the antenna, an improvement can be made in either one of two ways. If a coaxial line is used, a small variable condenser of about 15 mmfd maximum capacity can be connected across the line, at either the set or the booster, and adjusted for the best picture. For twin lead, the best thing to use is a small piece of aluminum foil wrapped around the line. The aluminum is moved along the line for best results and held in place with tape. An unshielded transmission line can be checked for standing waves by holding the line between two fingers and moving the hand along the line. If there is any marked improvement in the picture at any one point along the line, there are standing waves present, which should be tuned out by the foil method or some similar technique

The Receiver

Now let us turn our attention to the receiver itself. If it is possible for the serviceman to recommend the purchase of any one particular receiver, it is advantageous to suggest a set which has four high-gain IF stages, a good front end, and a full bandwidth of four megacycles. There are a number of simple modifications, however, that may be made on even such a receiver, which will materially improve its operation in fringe areas.

A simple modification in the RF stage would be to remove the RF amplifier grid return from the AVC line and ground it. This will prevent the AVC voltage from cutting down the necessary gain of the RF stage. This change should not be made, though, if strong stations are also received, since they would then overload the receiver. If a 6AG5, a 6AU6, a 6BC5 or a 6CB6 is used, a slight increase in B voltage, to no more than 200 volts, will increase the gain of this stage.

Now let us see what we can do with the video IF stages. One very simple way of attaining a marked improvement in gain is to replace the tubes in this stage with high-limit tubes of the same type or with some of the "hotter" new tubes. Since television receivers are manufactured for reception in normal signal strength areas, the tubes for the IF stages are not especially selected, but good average tubes are used. A tube very frequently employed in video IF stages is the 6AG5. This tube may be replaced with the new and hotter 6BC5. The 6BC5 is an exact replacement, but will give an appreciable increase in gain. (Transconductance of the 6AG5 is 5,000 micromhos, while that of the 6BC5 is 5,700 micromhos.)

Another good substitution for the 6AG5 is a 6CB6. The transconductance of this tube is 6,200 micromhos, more than 20% higher than the value for the 6AG5. If three or four tubes are substituted in the IF stages, the increase in overall gain is quite substantial. Pins 2 and 7 must be tied together if the tube is used in place of a 6AG5, since the 6CB6 has separate pins for the cathode and the suppressor. The set may also have to be realigned, since the interelectrode capacitance of the 6CB6 is slightly different.

Select Best Tubes

Another thing that may be done is to select from your present stock those tubes which are most used in video IF stages. Pick out the ones which give the highest reading on a *transconductance* tube tester and save them for just such an occasion. You may find that tubes of one particular manufacturer have a higher transconductance than those of the same type made by a different manufacturer. Make sure that you have a few of those hot tubes put aside from the rest. The tubes which are replaced may be used in a different receiver, or perhaps in the sound section of the same set. If you have no spare tubes on hand, it may sometimes pay to substitute tubes from the sound IF section into the video IF stages, providing that they are of the same type. A convenient way of observing whether there is any improvement is to measure the AGC voltage while trying different tubes. Be sure that a constant-strength signal is being received during this measurement.

Proper realignment will also generally improve the operation of a set. Since television receivers are aligned on a pro-

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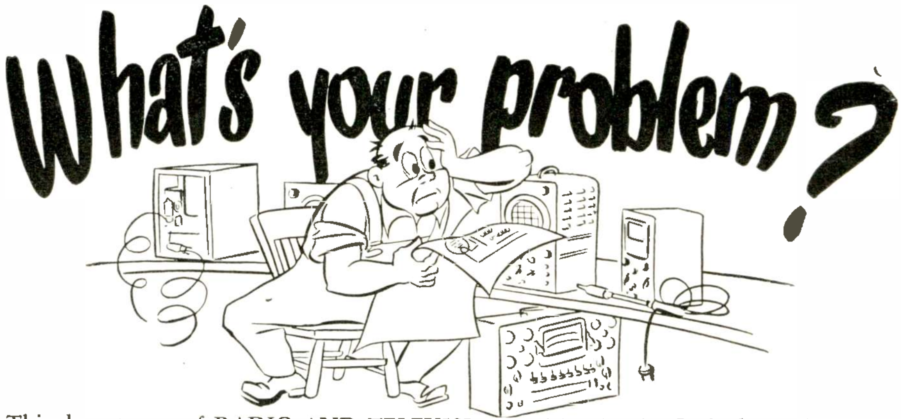

This department of RADIO AND TELEVISION MAINTENANCE is devoted to helping to solve the difficult service problems of our readers. Tough ones of general interest will be printed, and readers will send in answers. The best solutions will be printed in later issues. If only one answer to a problem appears here, its originator will receive $5.00 in cash. If two or more different ways of beating the poser are of nearly equal merit in the opinion of RTM editors, the second best will be worth $3.00 to the man who submits it, and the third best will bring home $2.00. Send your question or solution to: Problem Editor, RADIO AND TELEVISION MAINTENANCE, P. O. Box 867, Atlantic City, N. J.

HEAVY INTERFERENCE

In the January issue, Charles Karafa, Detroit, explained a very tough case he had with a TV installation opposite an automobile factory. His pictures were foggy, full of ghosts, and had horizontal black bars. Reader Maurice E. Reller gets $5 for his suggestions as to a possible cure for Mr. Karafa's difficuty, which follow:

GENTLEMEN:

In reference to Mr. Charles Karafa's problem, my suggestion is to make another survey of the situation. Determine whether the source of the black-bar interference is located in a position between the installation and the transmitters, or direction of best signal. If this is so, then I would say that the problem is hopeless. You have to appreciate the fact that hopeless cases *do* exist.

Assuming this does not apply to any or all of the channels, do a complete job of searching out all possibilities of locating the antenna, running the line in a direction opposite and as far as possible from the source of the interference. Make certain that the direction is such as to insure the least pickup on the transmission line. If it is possible to back a thousand feet away from the source of interference, do it by all means, and worry about line losses later.

If you are still with me at this point, I suggest trying a five-element yagi. Bring the receiver as close as possible to the new antenna location you have selected and probe the area thoroughly for best elimination of ghosts and other interference. If you succeed in obtaining a clean signal, then mount the antenna and complete the orientation job.

For a leadin, I would select 300 ohm shielded line, or, second best, a line consisting of twin 72 ohm coaxial cable. Whichever is used, install good grounds at regular intervals on the horizontal run. If it is possible to run the transmission line along or close to the ground, I would recommend doing so, even if it means ducking around a building or over an alley. After the transmission line has been installed and connected to the receiver, try stubbing at the terminals to improve the signal. If intereference is still troublesome, determine whether there is any direct pickup at the tuner. If so, install a copper screen, grounded, inside the cabinet, completely covering top, bottom and sides.

When all this has been completed, you may want to touch up the job by trying any or all of the following: installation of an isolation transformer with additional power line filtering in the primary; commercial interference eliminator and booster at antenna terminals of receiver; grounded copper window screen as an addition to antenna reflector, installed to the rear or sides of the antenna, wherever best results are obtained.

Good luck!

MAURICE E. RELLER,
St. Louis Park, Minn.

—RTM—

HUM DIFFICULTY

This department presented the case of Roy T. Fischel, a TV technician of Washington, D. C., last month, in which Mr. Fischel was having trouble with a

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FRINGE AREA SERVICING

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duction line basis, they are made to meet certain minimum specifications set up by the manufacturer. It is generally possible to "squeeze" out a little more gain with a slight touching up. Be sure, however, that the alignment is carried out under the same conditions under which the set will operate, that is, with a weak signal. If the receiver is checked in the shop with a signal from the shop antenna, insert an attenuator in the line which will give the same signal strength as that available at the final location of the receiver.

If the IF amplifier is stagger-tuned, it is possible to increase the gain materially by aligning the individual stages to give a grated overall gain with an accompanying decrease in bandwidth. This modification will increase the contrast but reduce the detail in the picture. A bandwidth reduction to 3 or 3.5 megacycles will not materially reduce the quality of the picture. This alignment should be carried out with a very low signal, so as to develop an AGC voltage corresponding to the amount developed under actual operating conditions. Remember that the shape of the response curve is affected by the AGC voltage.

Other Circuit Changes

If all these techniques do not produce satisfactory results, there are still some circuit changes which can yield a usable, if not perfect, picture. These steps should be taken only as a last resort.

One of the things that can be done is to increase the size of the loading resistor across the IF stage which is tuned to the high frequency end of the response curve. This will increase the gain at the end of the curve where the picture carrier is located. Try various sizes for best results, but be sure to stop at a value low enough to keep the IF's from oscillating. Now realign the set for best picture. The definition will be lowered, but the marked increase in signal-to-noise ratio may mean the difference between a usable picture or none at all. Another modification which will increase the gain at the low end of the video frequencies is to increase the value of the video detector load resistor, or increase the load resistor in the video amplifier. These resistors are usually from 3,000 to 5,000 ohms and should not be increased to more than 10,000 ohms.

FIELD STRENGTH MEASUREMENTS

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over the specified tuning range. Non-inductive resistors R_1 and R_2 in series match the antenna impedance. The values shown in Fig. 2 are for a 300-ohm antenna. R_1 and R_2 each would be 36 ohms if the antenna impedance were 72 ohms, and would be 75 ohms each for a 150-ohm antenna.

This arrangement, like the one given in Fig. 1, must be calibrated individually for each TV channel of interest with the aid of a standard signal generator. The same calibration procedure recommended in the preceding case should be followed here.

Since this FS meter utilizes a locally-generated signal in its input stage, it will radiate a small amount of energy (comparable to, but somewhat less than, that radiated by some TV receivers). For this reason, it should not be used over protracted periods of time, but measurements should be completed as quickly as possible and the signal generator promptly switched off.

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FIELD STRENGTH MEASUREMENTS

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Amateur Circuits Useless

Experimenters will be disappointed to learn that simple crystal-diode circuits, such as those used to check field strength around an amateur transmitting station, cannot be used for TV field strength measurements. These arrangements have much to recommend them—simplicity, small size, light weight, freedom from tubes and power supplies. They offer a continual fascination to the technician confronted with the task of hauling test equipment to the roof top. But they do not possess the required sensitivity. Even in setups using very high-Q coils in pushpull circuits with parallel crystals in each leg and a sensitive microammeter, the minimum readable RF signal rarely is lower than 0.01 volt. This is 10,000 microvolts, 20 times the accepted fringe area signal level.

Battery-operated superregenerative receivers also have been suggested as TV field strength meters. The superregenerative detector is extremely sensitive, but has two outstanding drawbacks: it radiates a compartively strong interfering signal, in some cases even when well-shielded and preceded by an RF amplifier; and it is endowed with an inherent AVC action which almost completely unsuits it to the job of distinguishing between signal strengths. In fact, one superregenerative outfit we tried had such an unexpected degree of automatic volume control that it showed almost no change in signal strength as the exploring antenna was moved through regions of strong and weak signals.

Meter Calibration

In a field strength meter, the factor of chief interest is the indication of signal intensity. The output meter reading therefore is of greatest concern. Where accurate measurements are to be made, the meter readings must be in microvolts. But when qualitative tests are good enough, relative readings on an arbitrary meter scale are satisfactory.

It has been pointed out already that a standard signal generator covering *on fundamentals* the TV channel frequencies and provided with a micro-volt-calibrated output attenuator, is required for accurate calibration of the field strength meter. Even factory-made FS meters should be checked occasionally against a reliable generator to insure accuracy of indications. It should be pointed out, however, that the absolute accuracy of a microvolt calibration is somewhat limited. This is due to the percentage accuracy of the attenuator in the signal generator. An accuracy of calibration of better than 10 to 15 percent seldom is bettered in the calibration process, due to the generator error plus the accumulated errors of the process. Nonetheless, such a calibration will be sufficiently useful for FS measurements at TV receiving locations.

Noise Generators

In some commercial field strength meters of the professional type, a self-contained noise generating circuit is included for calibration, in absence of a standard signal generator. The noise circuit makes use of shot noise generated in a special tube. Advantages of shot noise as a calibration source are: this noise signal is evenly spread throughout the radio spectrum, thereby requiring no tuning of the calibration generator circuit; the noise amplitude level is high; and since the noise amplitude is proportional to the DC plate current in the noise-generating diode tube, the circuit may be standardized easily and simply by adjusting the plate current to a predetermined calibration value. Pure shot noise is obtained in a vacuum tube when space charge is eliminated. This elimination is accomplished in the shot noise calibrator by reducing the filament temperature to the point where the plate attracts all of the electrons emitted by the cathode. Special diodes having plain tungsten filaments frequently are employed as noise generators. However, triodes occasionally are used with their grids and plates tied together for diode action, or with the grid employed as the diode plate and the regular plate left floating. The noise signal is applied to the first tuned circuit in the field strength meter. The calibrating voltage obtained is proportional to the impedance of this tuned circuit. In calibrating the FS meter against shot noise, the noise circuit first is standardized by adjusting the diode plate current to the level recommended by the instrument manufacturer. This is accomplished by switching the output milliammeter (or microammeter) temporarily to the diode circuit. With the noise signal then applied to the FS meter circuit, the gain of the instrument is adjusted by means of a calibration control potentiometer to give a prescribed *calibration level* deflection when the meter is switched to the output circuit of the instrument.

Making Tests

The principal uses the TV technician will find for the field strength meter are: (1) checking antennas for best placement and orientation, (2) making surveys to determine the average field strength in a particular locality, (3) checking antenna arrays for best type to install permanently, (4) checking the strength of local oscillator radiation from TV receivers, and (5) tracing noise and signal interference on TV channels. While operation of the instruments is entirely straightforward, the technician should keep in mind the following points regarding the use of field strength measuring equipment:

1. Use a battery-type instrument whenever possible. Extended power lines tend to increase the effective height of the receiving antenna and also to introduce interference patterns, especially when the lines are near the active elements of the antenna.

2. Connect the antenna to the meter through the entire length of the actual feeder which later is to be used with the TV receiver installed on the premises. Make all connections solid.

3. Take a separate field strength reading on each channel used locally for telecasts. In fringe areas, take separate readings at various times of the day.

4. When testing for best antenna site, make separate field strength readings with the antenna at various locations. At each location, orient the antenna for maximum meter deflection. Repeat the entire procedure with the antenna at various heights, to determine optimum elevation.

5. Keep out of the field of the antenna when making readings. Orient the antenna and then step clear of the region. Place the meter at the farthest distance consistent with ability to see maximum swing of the meter.

6. In localities where there are repeated complaints of poor reception, try to interest the residents in a field strength survey. (It might be one of those localities where signal strength is so poor that no set will work right.) Payment of your fee can be divided between a number of residents, all of whom can benefit from the project.

7. When making tests of local oscillator radiation from TV receivers, use a vertical rod antenna (an auto antenna will do). Support the antenna in a stationary position, and keep out of its field.

TRADE LITERATURE

→ from page 18

flection yoke types for television.

Copies will be sent on request to the company, at St. Marys, Penna.

—RTM—

NEW HANDBOOK EDITION

10

COVERAGE of nearly all phases of radio and television is provided in the second edition of the "Radio and Electronics Handbook," by William F. Boyce and Joseph J. Roche, an 890-page revision of the earlier compilation.

Selling for $5.95, the handbook should serve a definite need for the technician who wants a reference work that can be used quickly, to get brief information on almost any subject that is likely to come up in radio or television work. —N. L. C.

—RTM—

GETTING THE MOST OUT OF THE ANTENNA

→ from page 8

satisfactory operation 500 microvolts is desirable at the front end, with a minimum ranging from 150 to 250 microvolts depending upon the sensitivity of the receiver. You have to be careful about a fringe area installation to get that kind of signal into the set's front end.

In conclusion, it is suggested that in a new installation that gives trouble, immediately suspect the antenna. The receivers that are coming off the assembly line today are well aligned, and in most instances reception should be immediately good when the receiver is plugged in. The bumping around a receiver gets in transportation has less effect than is often thought. Make as good an antenna installation as you know how, based on the suggestions given here, in the manufacturer's literature, and from the basic texts on the subject. Most servicing problems will be forestalled, and many fretful calls from the customer will be eliminated.

—RTM—

PUSHING BACK THE FRINGE

→ from page 12

into the city are interrupted with supplementary boosters.

The manufacturer, which markets the systems direct and also through Philco distributors, says that the only real stumbling block which is foreseeable is that the shortage of materials, which is constantly becoming more severe, may cut off production, or seriously reduce it. For six months, at least, the company expects to be able to meet the demand for the installations, however. After that, it is thought that development of substitute materials will have become sufficiently advanced so that some production may continue. A lowering of the original cost for the equipment is also in view, the company said.

With this system, enterprising technicians and dealers in many sections of the country not now served by regular TV transmitters will be able to boost their own business and aid the community, while at the same time they are extending the limits of successful TV propagation, which has become an asset to every area in which it is found.

—RTM—

"BOX OFFICE" TELEVISION

→ from page 11

vertical pulse with the key, or at the first pulse without the key.

Normal horizontal drive pulses are sent into a phasing circuit which shifts their phase with respect to normal and feeds them into a blocking oscillator, which they trigger. The pulses are then fed to a long line with a specified delay time, and an electronic switch chooses either the pulses from the input or those from the output of the delay line, as controlled by the single-trip multivibrator. In this way, the coded horizontal drive is produced for the rest of the station equipment.

Horizontal Blanks

Since the phase shift time in the video signal occupies some of the time normally assigned to horizontal blanking, the new horizontal blank signal must be narrower. This signal is generated in another section of the coder by feeding the horizontal pulses from the output of the delay line into a single-trip multivibrator, after amplification and isolation. The multivibrator output is then mixed with normal vertical blanking signals, and the resulting signal is amplified, clipped, and distributed to the system.

Coded blanks are inserted by the final section of the coding unit. The blanks come from a single-trip multivibrator, which has been triggered by the coded horizontal drive, and are maintained at the average video level, both polarities of the wave form having been combined in two tubes with a common load impedance, and the resultant signal mixed with the video from the camera.

Decoder Operation

Only the relatively minor change of connecting the decoder is needed at the receiver, to convert a conventional set so that it will be able to receive Phonevision.

In the set's sweep section, the vertical pulse is separated normally, and fed to the vertical deflection circuit. The horizontal pulse, however, is sent into the PV decoder unit, which will be either built into future receivers, or used as a separate adapter for present-day TV sets.

Operated by the key signal from the telephone line, the decoder applies a correction to the horizontal pulse. With the key coming in at a level of about 50 millivolts, the first stage of the decoder provides gain. A gating circuit then combines the key information with the receiver's vertical pulse, and uses the combined signal to trigger a square wave generator. Between the gating circuit and the square wave generator, the first vertical pulse when the key is present, and the first pulse when the key is absent, can be detected. In this way, the generator changes the modes according to the changes in the key.

The square wave controls the phase of the pulse from the normal circuits of the receiver, and consequently that of the horizontal drive on the picture tube. The amount of compensating phase shift, then, agrees with that shift inserted at the transmitter and included in the key. A blanking circuit in the decoder, controlled by the horizontal pulses, restores the abridged blanking interval to its normal width.

Applications

The usefulness of such a system of subscriber television, whether it is the Zenith arrangement or some other, is not limited to the motion pictures now being shown in the Zenith tests, of course. Many special broadcasts, of more-than-average attraction to the consumer, could be presented through this means, and could thus raise the incomes of the broadcasters, according to analyses of the subject. Movies would probably be the chief substance of the programs, however, and with the income derived from subscriptions, it is predicted that first-run pictures could commonly be shown, instead of the older pictures now available for television.

Judging from the reaction of the "test families," who now may view Phonevision, the system, if approved, could grow rapidly throughout any community where installations were possible. This would probably mean an overall increase in the number of potential customers for television sets, since the possibilities of the new system would be added sales points for dealers, and the additional equipment would add only about $10 to $15 to the price of receivers.

Final decision from the FCC on subscriber television may not mean a great deal, however, as far as immediate commercial exploitation is concerned. As in the case of color TV, progress depends on the current state of the war effort, and even FCC approval, coupled with the willingness of manufacturers to produce such civilian goods, would not likely be sufficient to divert men and materials into what would no doubt be considered non-essential production. It probably will be a fairly long time, then, before this new development is put into common use.

—RTM—

Build This Simple Home-Appliance Tester

→ from page 13

to the contacts on the appliance. With a little practice, the operator will be able to make an estimate as to the condition of the unit under test by judging the brightness of the lamp. If the lamp does not light at all, an open circuit in the device is indicated.

The AC voltmeter can also be used separately, if desired, with the probes connected in the same way. To avoid the possibility of voltage feedback, the plug on the tester's line cord is inserted into the dummy receptacle. The lamp is replaced with a plug fuse, and voltage across the terminals of an appliance is read directly, up to the capacity of the meter.

The usual precautions against shock must be taken, particularly when the test probes, with their bare terminals, are used.

If voltage measurement is not considered necessary the voltmeter may be omitted, and a low-current pilot light used instead. The meter shown, obtained from the surplus market, was not expensive, however, and the likelihood is that any serviceman, if he does not have one in the shop, can buy one at low cost.

What's Your Problem?

→ from page 19

large hum bar on two local channels, on a Motorola set, while two other channels came through all right.

He had already checked all the electrolytic condensers in the set, and found them to be good, and he also made sure that the resistance and voltage values were correct according to the manufacturer's specifications.

RTM's $5 award for the best answer goes to Frank Florio, a New York TV station engineer.

GENTLEMEN:

In regard to Mr. Roy T. Fischel's problem appearing in the February issue of RTM, I'd like to explain how I have fixed a similar trouble in various makes of receivers.

The hum is neither radiated nor unfiltered B supply ripe ripple. It is of the heater-cathode leakage variety, and takes place in the RF oscillator.

Due to the frequencies involved and the value of distributed capacitances, it will usually show up on one or maybe two channels, while the other channels will be clear.

Changing the oscillator tube is the solution.

FRANK FLORIO,
North Bergen, N. J.

—RTM—

FIX ON THE FACTS

→ from page 17

bored in the roof, which is then carefully sealed with roof cement. Inside the attic, this lead-in goes directly to an automatic broad-band booster fastened to the rafters. Sometimes this booster is turned off and on by means of a switch-and-pilot-light combination mounted near the set; at other locations the power is fed to the TV set through the booster by means of a Romex line and outlet near the set. In this latter case, of course, the booster is turned on automatically when the set is switched on. The lead-in connecting the booster and the set is twisted, as is the lead-in from the antenna to the booster.

Advantages

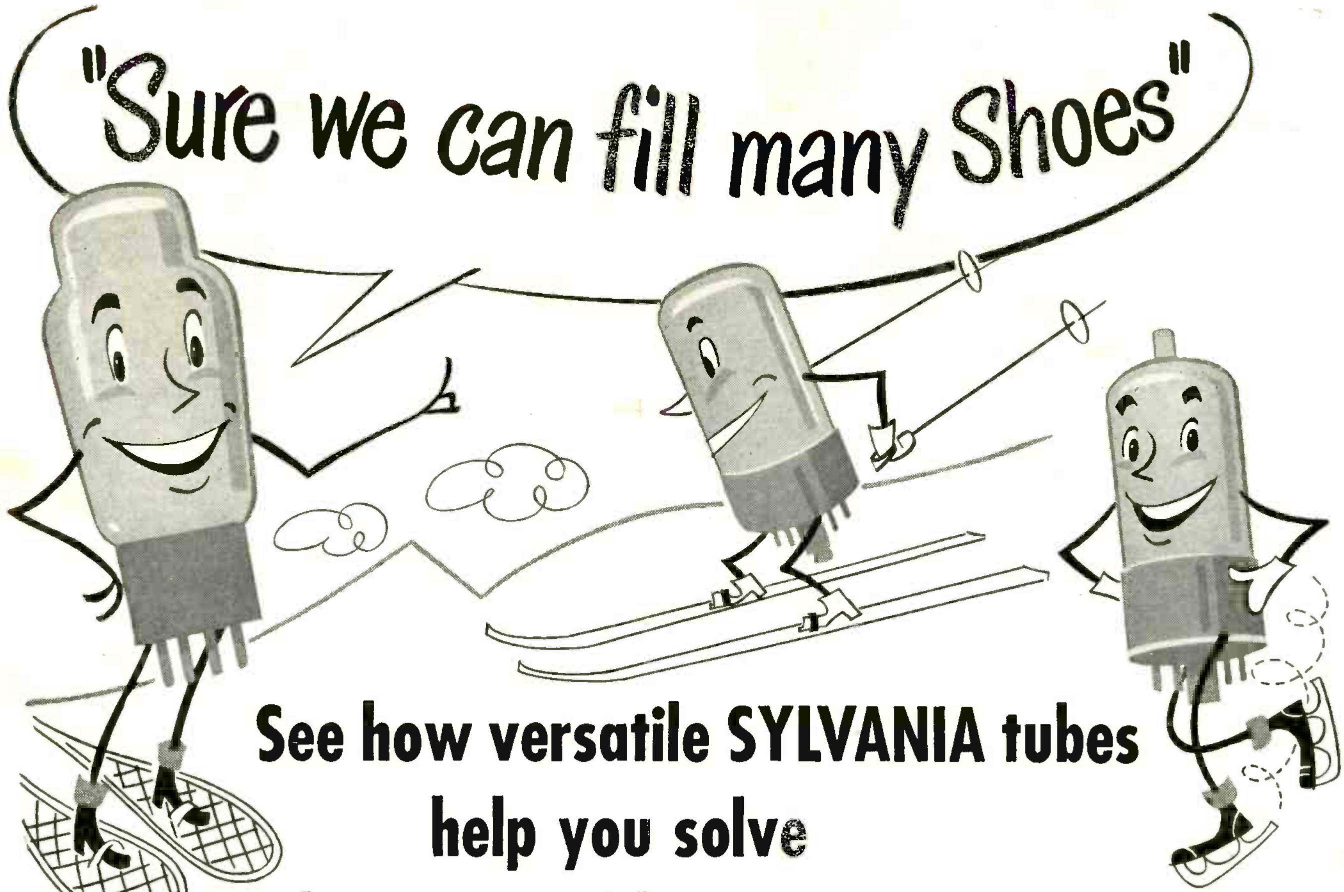
The installer claims the following advantages for such an installation: lead-in length and losses are held to a minimum; ignition noise pick-up by the lead-in is cut down; signal-to-noise ratio is much better than when the booster is placed at the set; by bringing the antenna into the attic, the receiver can be placed wherever wished, even against an inside wall, without materially increasing the length of the lead-in; since the booster is where the customer cannot readily get his hands on it, there is less "operator trouble."

In installations where the owner insists on being able to adjust things, a two-stage tuned booster is installed at the set; but the records show that this type of installation results in considerable more service calls than do the attic-booster jobs. This is not the fault of the equipment, of course. In the hands of an expert, a tuned-type booster can usually be made to produce slightly better results than are had with the broad-band type. Whenever you have anything to adjust by hand, though, you are certain to find many customers who will display an absolute genius in mis-adjusting it!

This same dealer is one of the smartest TV salesmen in the area, and the secret of his success is that he deliberately and consistently "under-sells" fringe-area TV reception. To hear him talk you would think he was trying to talk the customer out of buying a set. He tells him flatly that there will be many nights when reception will be too poor to enjoy. He advises that if the customer is not the sort of person who can enjoy TV reception when it is good and simply turn the set off and forget it when it is not, he should not buy a receiver. As he puts it, "If you're the kind of guy who insists on fighting this thing, it will drive you nuts."

Good Reputation

Human nature being the contrary thing it is, people still buy sets from this man, and invariably the results they obtain are better than he has led them to expect. But when an occasional bad night does come along, and when the telephones of most dealers are being rung off the wall, this fellow's customers simply remember what he told them and let it go at that. At the same time, he has built up a reputation for truth and honesty that contrasts very strongly and favorably with the reputations of competitors who have promised more in the way of reception than ultra-fringe area conditions can deliver.



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