RADIO and TELEVISION maintenance

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VIDEO DETECTORS AND VF AMPLIFIERS

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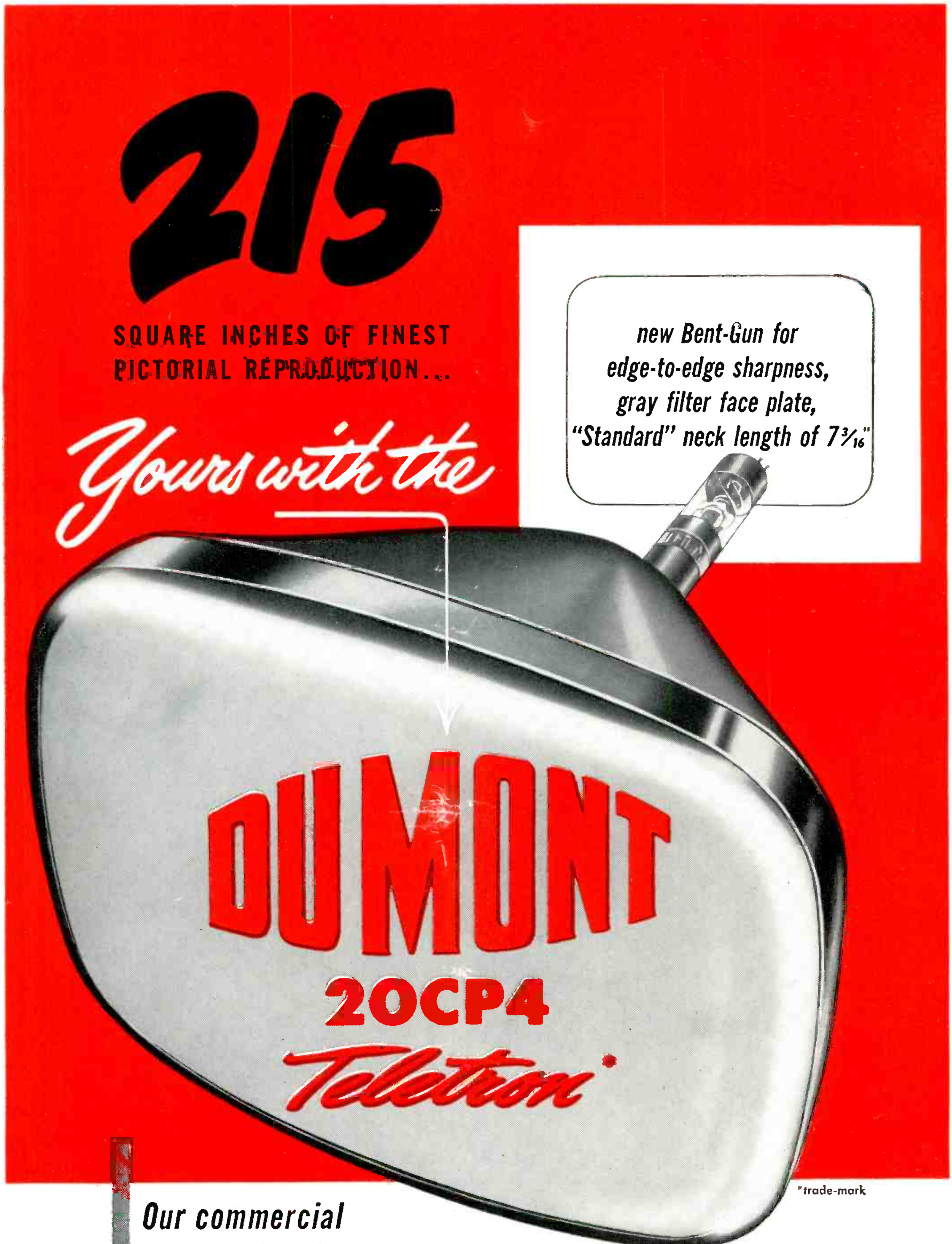
● A portable radio weighing only three pounds and taking no more space than a book is the new RCA "Personal" model.

JUNE 1951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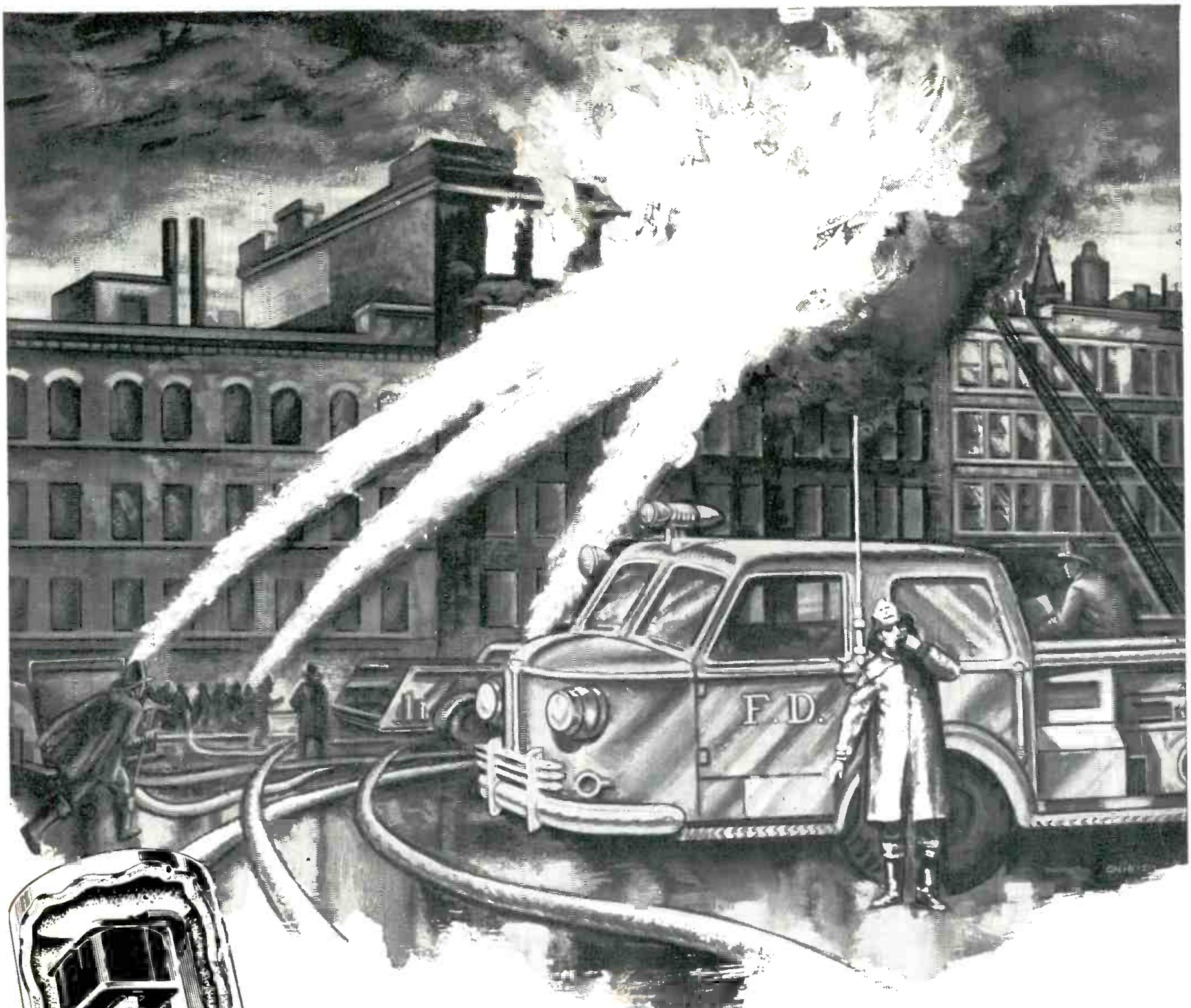

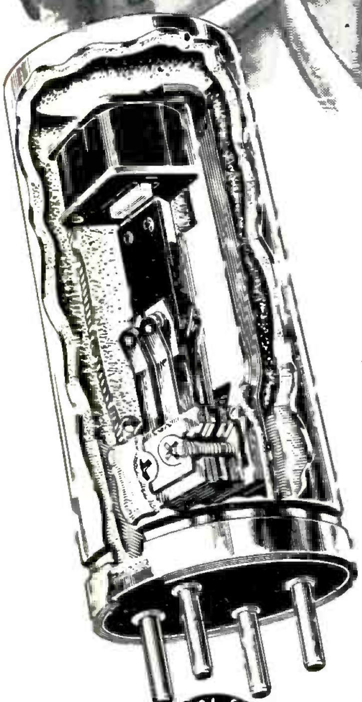

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JUNE 1951

FEATURES

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RADIO INDUSTRY NEWSLETTER

RCA LAYS OFF 1200 FOR RADAR CHANGEOVER

A late development on the electronics front is RCA's layoff of 1200 employees at its Camden, N. J. television plant. Reports were that the plant will not produce any more TV sets, but will be converted for the manufacture of radar sets. The swing-over to military work will not be completed until some time in the fall. In the meantime, the big producer is going to re-hire the discharged presonnel as radar manufacturing facilities increase in the factory. The move came only a few months after TV production was halted for scarcity of parts and other supplies, and then begun again.

COLOR TV GETS BELATED START THIS SUMMER

Color television is finally under way, now that the Supreme Court of the United States has once and for all decided in favor of the CBS system (on a suit charging the FCC with a wrong decison last fall). CBS starts commercial color TV broadcasting next month, but for some time it is expected that the broadcasts will be confined to off hours, such as early in the day and late in the evening. This situation will probably continue for a year or more, until a fair number of consumers have color receivers in their homes. Production on color sets, of course, will have to wait its turn in the defense-production rush.

CBS NOT WILLING TO WAIT FOR THE RCA COLOR TUBE

An aspect of the color television situation that is yet to be explored is the full development of the RCA three-color tube, and its application in the CBS system. Evidently, CBS looks somewhat askance at proposals to wait until it can eliminate the whirling color disk before it goes all out for color. Officials maintain that the spinning wheel produces good color pictures now, while the results that will eventually be obtained using the three-color tube under CBS standards are still considerably in doubt.

LOUIS FIGHT PROVES GOOD ON THEATRE TV

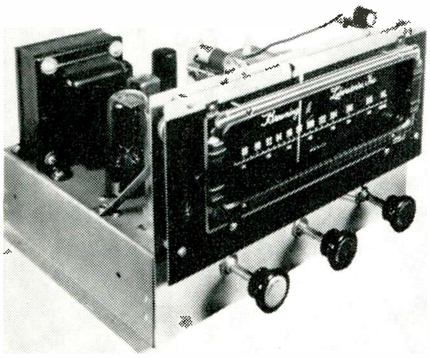
Theatre television has a promising future, if telecasting to theatres exclusively in the Joe Louis-Lee Savold fight are any indication. As an experiment, the fight was kept off the radio, and the only TV broadcasts of it went to eight theatres in six cities. The result was packed houses, with extra viewers squeezed into the standing room, in most cases. Operators of the movie houses reported excellent reception and viewing results. One theatre owner said the picture was just as good as that obtained in regular movies, and in his case, the projection was direct, rather than filmed and re-projected a few minutes later.

TV SALES SLUMP NEARING END, SAY EXPERTS

The slowdown in television set sales, brought on by a combination of credit restrictions, heavy panic buying in the early days of the Korean War, and high prices of food and other commodities, may be nearing its end. President Chester D. Tripp of the Television-Electronics Fund says in Chicago that current bargain prices on TV receves are not likely to prevail for long. He bases the forecast on a continuing study of industry inventories. Ross D. Siragusa, president of Admiral Corp., adds that sales have passed the low point, and are shortly going to improve. Whether sales will ever again reach last year's high-water marks, of course, is another question.

NO NEW TV STATIONS BEFORE DECEMBER FCC CHAIRMAN SAYS

Federal Communications Commission Chairman Wayne Coy predicts that it will be December before the group is ready to lift the freeze on construction of new TV stations. The commission is now beginning hearings expected to last two months, on city-by-city allocation of channels, both in the VHF and in the UHF. After the extensive hearings are at an end, possibly in mid-summer, another two months will probably be devoted to studying the record and working out a master plan of allocations. The filing of old applications and the amending of new ones can then be expected to occupy the commission for yet another 60 days or more. But then, Coy said, the group will be ready to go to work on granting permits for station construction.



AM-FM TUNERS FOR CUSTOM INSTALLATION

By RICHARD L. BROWNE

IN THE old days, the music lover was the sort of dreamy, impractical esthete who had no more mechanical knowledge than he needed to change a violin string. But today, it's a different story.

A new type of person has come out of the ranks of the longhairs, and he is occupying more and more of the time of the working radio technician. He is the music lover-audio fan, a rabid exponent of the highest fidelity in audio reproduction. He is willing to spend large amounts of money on his home receiver and record player; he will not have television in the house; and he will not settle for anything but the best equipment.

And it for this type of customer that the manufacturers of electronics equipment are developing really fine hi-fi units. The set makers realize that the volume sales are in TV, in AC-DC radios, and in other equipment where fidelity of sound is not merely omitted, but practically ridiculed. Just the same, they have put forth engineering efforts to snag the relatively small, but ever-growing, field of customers who care about good sound.

Among these manufacturers is Browning Laboratories, Inc., a firm that puts out some of the finest tuners imaginable. The Browning line ranges from a comparatively simple FM tuner, to a highly complex AM-FM tuner with 15 tubes, and no less than seven panel controls.

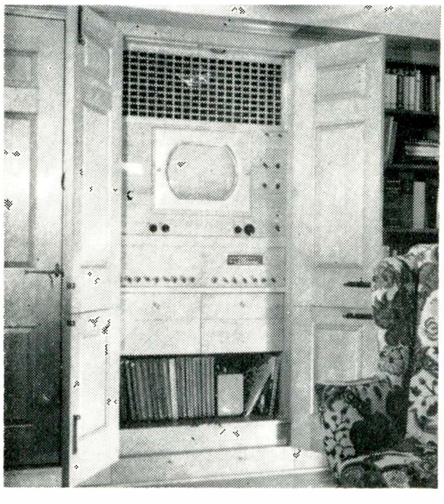
With any one of these units, the audio fan can get highest quality reception, as long as he puts the same loving care into the selection of his audio amplifier, his loudspeaker, and his cabinet specifications that he puts into the tuner. Among the virtues of the line (and equivalently, among the items that contribute to its expense) are automatic frequency controls, tuning-eye tubes, cascade limiters for FM, and about the most solid construction of mechanical fixtures there could possibly be.

FM-Only Tuner

The set shown in the illustration, and in the accompanying circuit diagram, is the Browning "RV-10-A," an FM-only tuner with its own power supply (one of the tuners in the line needs a separate power supply.) This is a 10-tube set. The lineup: 6AU6 RF amplifier, 7F8 Mixer-oscillator, two 6AU6 IF amplifiers, two 6SJ7 limiters, 6H6 discriminator, 6AL7 tuning eye, 6J6 afc reactance tube, and 5Y3 rectifier.

AFC Circuit

The detector uses the Armstrong circuit, and the afc circuit can be switched in or out of the rest of the unit at will.

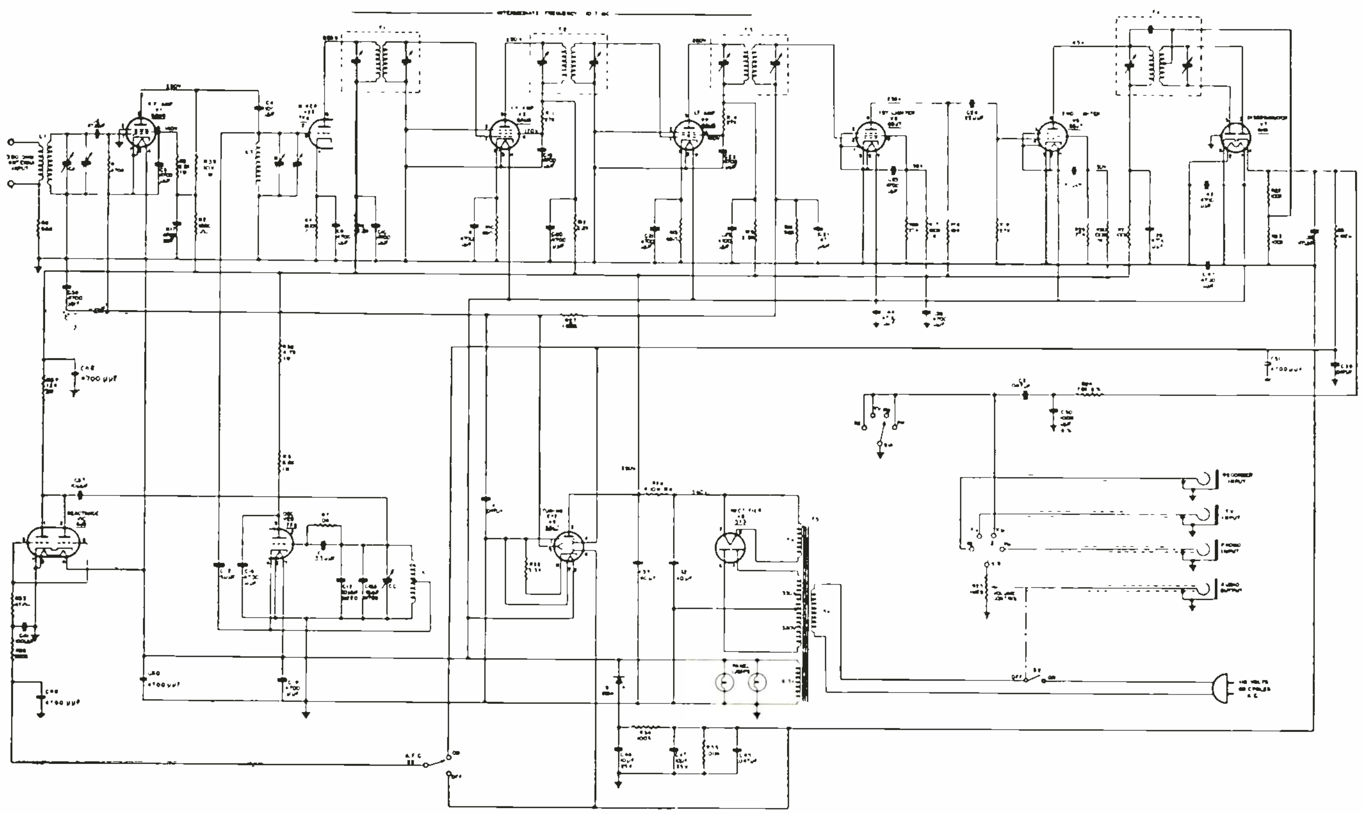


A top-notch custom installation featuring AM-FM tuner, hi-fi audio equipment, television, record players, and even an antenna rotator control.

These afc circuits, found only in the more expensive sets, either AM or FM, take a control voltage from the discriminator and apply it through a triode (in this case) to the oscillator. When the dial indicator is brought near the station, the afc takes over and pulls the oscillator until the discriminator signal is right on the button. As Browning points out in an instruction booklet for laymen, the dial can be turned for a considerable distance on either side of the actual correct point of tuning, without suffering a loss of tuning. This is because the oscillator frequency, when the afc is switched in, does not move, along with the tuning condenser, as it normally would. Instead, it automatically compensates for the capacitance change, until the normal resonance is so far off that the station slips out entirely. The best practice in using the afc, of course, is to keep the needle about in the center of the space where the station comes in properly.

Custom Installations

The Browning sets are specifically built for high-quality custom setups. Custom, because these units have practically no other use except in specially hooked-together systems. For an example, look at the illustration of the magnificent custom AM-FM-TV installation shown here. It is certainly not a typical one. For one thing, the usual owner of such a built-in setup is not keen on taking up any of the space devoted to a home music system with a television set. This particular outfit, though, includes not only a large-screen TV receiver, but also an antenna rotator. For another thing, it is obvious that the set owner has been able to pour a really substantial amount of money into the installation. The tuner itself is the 15-tube



Circuit diagram of the Browning RV-10-A, an FM-only tuner equipped with tuning eye, automatic frequency control, and cascade limiters. Note duo-triode 6J6 with two triodes hooked in parallel as afc reactance tube at lower left; connections of 6AL7 tuning-eye tube to discriminator; and inputs for phono, recorder, and TV audio detector signal, with output to audio amplifier, at lower right.

Browning AM-FM job. The audio amplifier, which is used in place of the television set's one-sided amplifier, is a high-fidelity one, with controls for everything from volume, through dual tone controls, to a crossover selector for the loudspeaker system, which is mounted in the top grille of the installation. In addition, the two drawers set under the tuner and amplifier contain a couple of record changers, for both 78 and 33 rpm records. Even if this is not a typical installation, however, it does show, at least, what can be done if there is money enough available for the project. The complete setup, taken as an integral piece of equipment, is far superior to all but the absolute tops in commercially produced consoles. For, even if a manufacturer were to market a set with all the facilities included in this rig, he could never achieve the individual selection of first-quality parts, each chosen with loving care, that can be given to such an installation as this.

In its "Engineering Notes," the Browning company gives a few pointers on the installation, care, alignment and general handling of its receivers. These can well be used as an all-around guide to proper behavior in the presence of high-fidelity equipment.

Impedance Match

One paragraph in the notes considers the importance of feeding the output of a tuner into an amplifier with the correct gain. Imagine connecting a first-rate tuner to an amplifier input, where the gain is so high that one or the other of the volume controls must be practically at zero! Yet this is not uncommon.

In the matching of any tuner to an amplifier, the rule should be that the output volume control of the tuner, and the input control of the amplifier should both be at about 50 per cent, to produce a reasonable listening level of sound. One case is reported where the output of a tuner was fed into an amplifier input designed for a high-impedance velocity microphone. The net result at the loudspeaker, naturally, was terrible, compared to the optimum results obtained when the tuner and amplifier were properly matched. In most of the Browning tuners, the outputs are designed for introduction into circuits with impedances of at least one megohm. The input impedance of the audio amplifier, in the AM-FM jobs, forms part of the load impedance of the AM detector. In one of the Browning units, the so-called RJ-20, there is an audio stage included in the tuner chassis, and the impedance match is not so critical.

Hum Problems

When making an installation of custom equipment, or even simply putting in a simple FM tuner for a customer, the serviceman often runs into hum problems. The general recommendation put forth by Browning in connection with its products is this: proper bonding between the tuner and the amplifier chassis is the quickest way to eliminate ordinary 60-cycle hum. This doesn't apply, of course, to cases where the hum occurs in either of the individual chassis, but even then, it might help. The connection, if there is hum with only a lead-shield connection between the chassis, should be made with a piece of heavy copper braid, secured to both the units in question. If that doesn't do the trick, a good ground connection, linking the AC units with a cold water pipe, might help. Another good way of cutting down of hum is to bypass one or both sides of the AC line to chassis ground, with 0.01 mfd, 600-volt condensers.

One type of hum difficulty occurs in the case of the tuner utilizing a spearate power supply. The natural inclination of the installer in this case would be to take the necessary voltages from the

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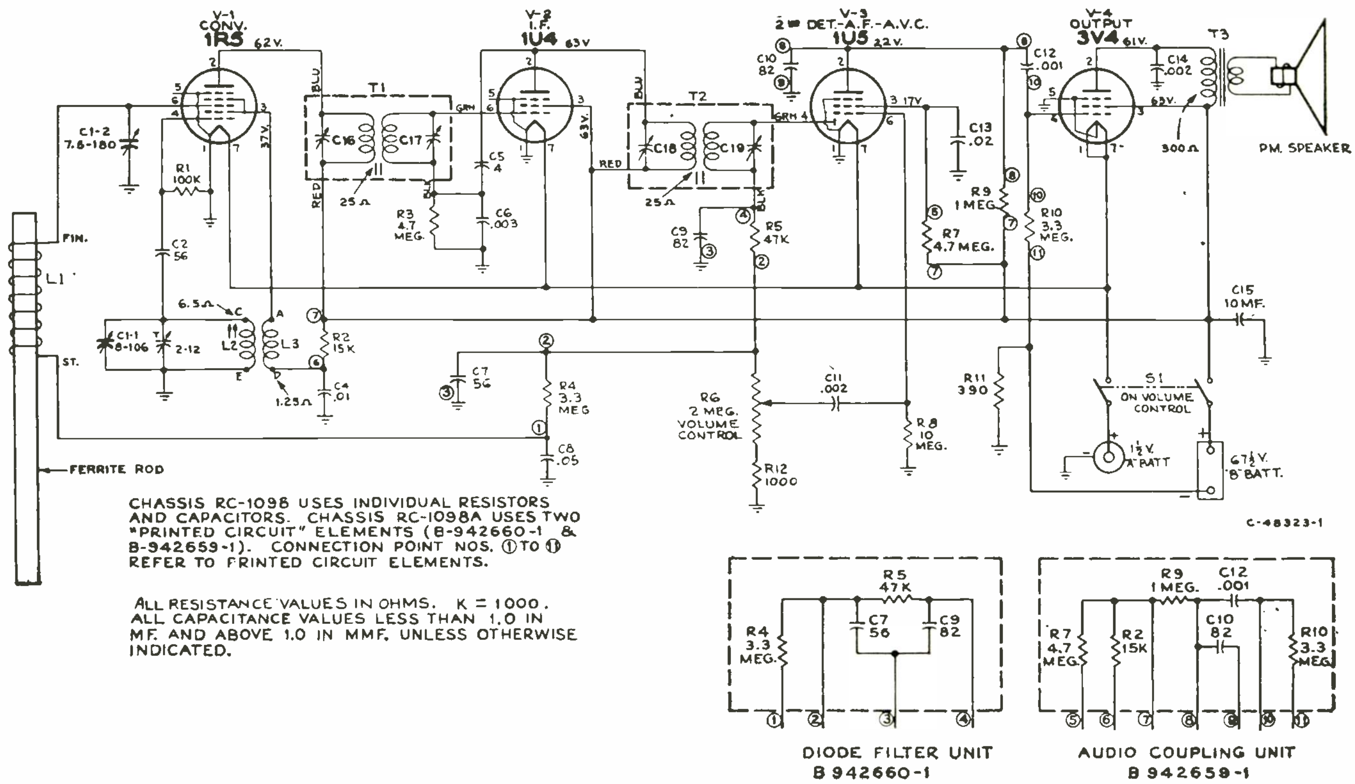

Schematic diagram of the new RCA "Personal" portable, a tiny four-tube receiver which is completely self-contained, yet is no larger than a popular novel, and weighs less than three pounds. Two printed circuits, the diode filter unit and the audio coupling unit shown at lower right, help in space-saving engineering. Maximum power output is 0.1 watt.

BOOK-SIZED PORTABLE RADIO

RCA'S NEW "PERSONAL" WEIGHS ONLY 3 POUNDS

THE LATEST thing in portable radios is RCA's new "Personal" type, a tiny receiver that weighs less than three pounds, and is only about as big as a popular novel.

This diminutive receiver includes a four tube superhet circuit, and puts out plenty of volume through its elliptical PM speaker. A 1R5 converter serves the functions of RF, oscillator and mixer, a 1U4 is used for an IF amplifier, a 1U5 is hooked up as detector, AF amplifier, AVC control diode, and a 3V4 is used for audio output.

New Antenna Type

The antenna is a new type—a winding on a ferrite core—which is adjustable for different inductances, and eliminates need for an antenna enclosed in the "flip-up" lid found in earlier personal radio designs. The new set has no lid to open. Both the tuning and off-on-volume controls are external.

Actual measurements of the little receiver are 2 inches deep, 5⅝ inches high and 7½ inches long. Inside the case, the chassis layout is made to squeeze the most parts into the smallest space possible. The tubes, IF transformers, pencil-shaped antenna and "A" battery are lined up at one end of the chassis. The central space of the set is used to house the loudspeaker, output transformer, and two-gang tuning capacitor.

The Cover

The tiny oval loudspeaker used in the new RCA "Personal" portable is no longer than a cigarette, but it provides undistorted output of 0.075 watt; plenty of volume for average room listening. Exact measurements of the miniature speaker are 1⅞ by2¾ inches.

The rest of the space is taken up by the "B" battery and the volume control.

Printed Circuits

In later models of the set, some of the individual condensers and resistors of the original design have beeneliminated and replaced by two printed-circut plates. As can be seen on the circuit diagram, these two slim parts take the place of six resistors and four capacitors—a considerable saving when space is as precious as it is within one of these minature sets.

All this provides a maxiumum power output of 0.1 watt, which is sufficient for any normal use. Undistorted output runs to 0.075 watt, loud enough for all ordinary radio uses.

This set is another move in the general direction of miniaturization, which is found in many and different applications of electronics, with the notable

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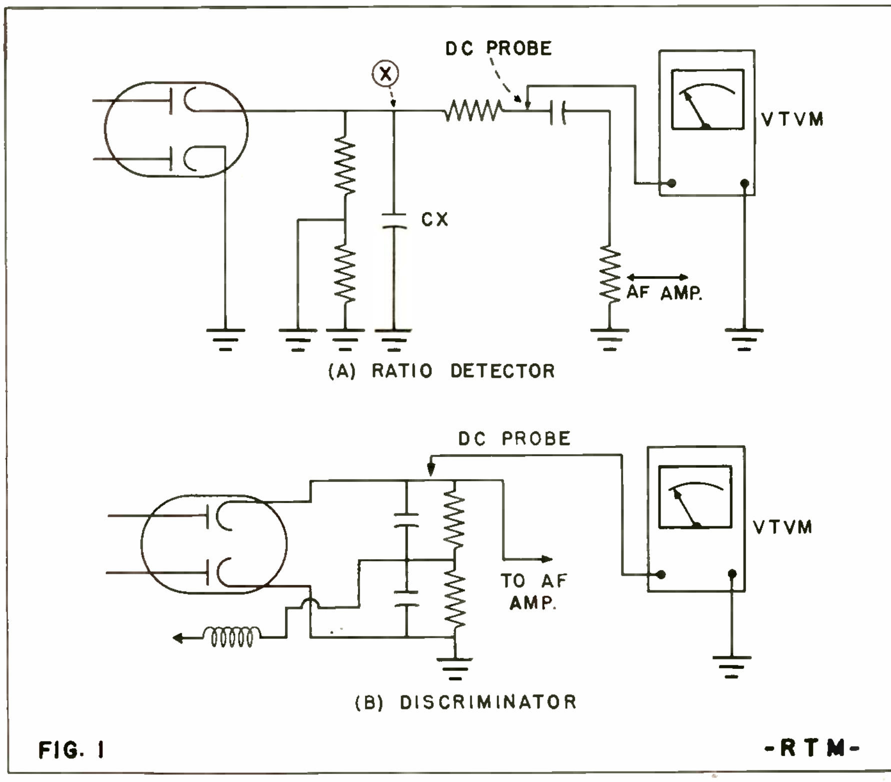
PRACTICAL FM ALIGNMENT WITH SWEEP GENERATOR AND 'SCOPE

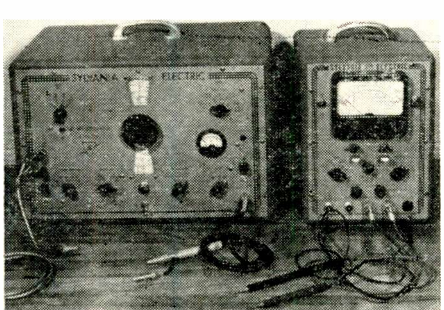
By RUFUS P. TURNER



Meter connections for ratio detector or discriminator alignment, for the preliminary quick-check outlined in the text. This check is made to find out whether the FM set under test is in operating condition, and to show how badly it may need alignment.

THERE is no compromise with good alignment practice in FM receivers. To obtain top performance, each circuit, especially the FM second detector, must be adjusted correctly. The FM receiver is less tolerant of incomplete alignment than an AM set. For this reason, there is no alternative to devoting the required time and care to FM adjustment. A necessary part of troubleshooting in FM receivers consists of examining circuit operation, as revealed by the state of alignment in individual stages.

Because the FM receiver is a high-frequency set, its circuits are susceptible to small changes in capacitance and conductance. Aging of components, replacement of tubes and parts, and mechanical abuse of the set can cause these small changes. The net result is a shift in the circuit adjustments, and proper operation may be restored only by realignment.



The author's Sylvania equipment (AM signal generator and VTVM) used for the preliminary check.

A series of standard tests may be applied to the FM receiver, and can be mastered readily after being used several times.

Standard Receiver Tests

Two general types of FM receivers must be handled by the service technician—one type employs the discriminator as a second detector; the other makes use of the ratio detector. The discriminator always is preceded by a limiter stage, while most sets with ratio detectors do not use limiters. In following the procedure outlined in this article, explanations regarding the limiter can be disregarded when no limiter is used.

Preliminary Check

Preliminary Quick-Check: A convenient preliminary test may be made to determine quickly if the receiver is in operating condition at all, and to show its approximate condition of alignment. This test may be applied to both ratio-detector and discriminator-type receivers.

For this check, a signal generator covering the FM carrier frequencies, and a DC VTVM will be required. With the receiver switched on, (1) set the DC VT voltmeter to its 3-volt range and connect its DC probe to the load resistor of the second detector (See Fig. 1). (2) Connect the signal generator to the antenna input terminals of the receiver. (3) Tune the receiver and signal generator (with internal modulation switched off) to any carrier frequency in the FM band. 100 megacycles makes a good test point. (4) If the receiver stages are aligned, the meter deflection will be zero, because the generator is tuned exactly to the receiver carrier frequency setting. The meter will deflect upward (positively) as the generator frequency is increased above the carrier

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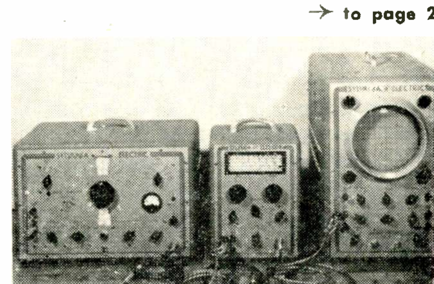


AM generator, sweeping generator, and oscilloscope, for the complete FM alignment procedure.

Service Technique

TELEVISION SERVICE

In A Wartime Economy

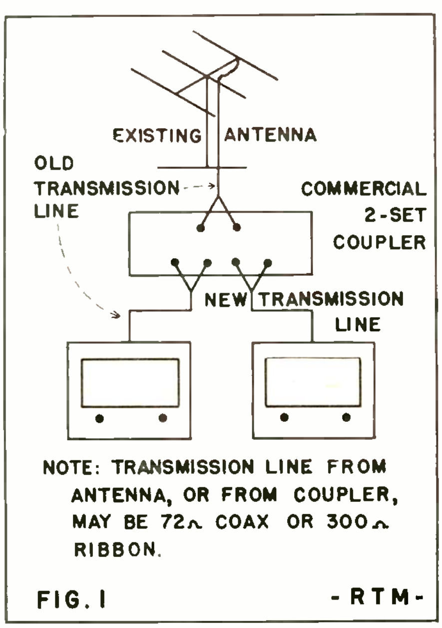
By IRA KAMEN

ALTHOUGH the country is entering a wartime economy, television as a medium of entertainment will not stop operations any more than radio did in World War II.

Certainly, TV far surpasses all other mediums for continuous entertainment at army camps and in the homes of private citizens.

There is no doubt, however, that as industry turns more and more to military production, there will be shortages of the materials used for TV receiver installation and operation.

These shortages can and will be licked. Here are some practical solutions to problems which will develop.



Circuit connections for two-set coupler, connecting FM and TV, or two TV sets, to a common antenna. Coupler is especially useful in apartment house installations or other multiple-dwelling installations.

Shortage of Coaxial Cable

Three-hundred-ohm transmission line is now available and may continue to be obtainable at all times because of the use of some readily available substitute dielectric materials for the usual polyethylene. Three-hundred-ohm line may be used as a substitute for coaxial cable when it is circuited through an impedance-changing device.

This device converts the 300-ohm, balanced impedance into the 75-ohm, unbalanced impedance required for the inputs of many TV receivers—Du Mont, Andrea, Firestone, Sears, Teletone, and others.

Coaxial cable was selected by manufacturers because of its shielding, which reduces interference. The transformer also meets this requirement as it has high-pass filter action. Interference signals picked up by the antenna and transmission line in the IF bands (21 to 27, 32 to 38, and 42 to 48 Mc, depending on the particular TV receiver) are attenuated by the filter action.

Shortage of TV Antennas

In two-family homes, and in single-family homes or commercial establishments where there are two TV sets operating under one roof, a commercial 2-set coupler may be employed to operate two TV sets from one common antenna. The simple circuit appears in Fig. 1.

The 2-set coupler also has high-pass filter action, which eliminates interference and improves the signal-to-noise characteristics of the two-set installation.

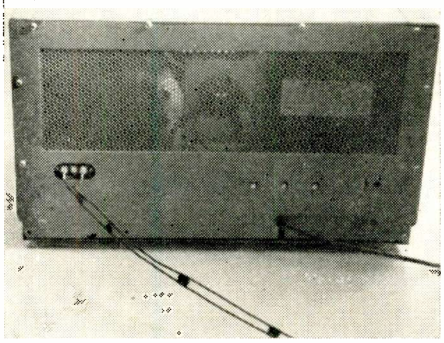
The coupler can also be employed to operate an FM and a TV set simultaneously from a common antenna. Experience has shown that every time an FM receiver is hooked up to an external antenna, the FM reception has improved. One of the reasons that FM has not realized wider acceptance in many areas is the poor performance of sets with only indoor antennas in multiple dwellings. The coupler allows excellent FM reception with the existing TV antenna.

Shortage of 300-ohm Line

In the event that 300-ohm transmission line disappears from the market, it is possible that indoor antennas can be assembled using rubber-covered lamp cord or straight wire properly spaced in air and separated, every so often, by high-frequency tape, as shown in the illustration. Using the method of taping wire lines together it is quite possible that the air-spaced line can be successfully used for outdoor installations.

Shortage of Steel Masts

It is amazing how long a well painted broom handle will last on a rooftop when it is used with a light antenna. While it may require two wooden masts to last the year out, it is better to go through the replacement installation than to accept compromise indoor antenna television reception. As a rule, wooden masts are unsatisfactory for use with stacked antennas employing cross-arms and reflectors. Multielement yagis also tend to provide a heavy, out-of-balance load which quickly splits the wooden mast. Simple straight and folded dipoles are preferable for the wooden mast installations. New investigations are showing, by the way, that some kinds of treated wood actually outlast steel masts.



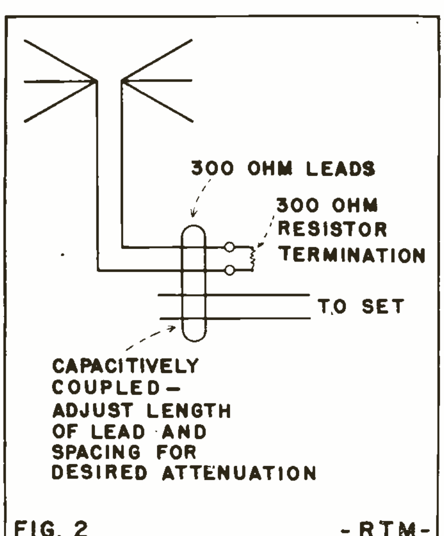
Separate wires spaced with electrical tape can serve as a substitute for 300-ohm transmission line in an emergency.

Shortage of Filter Networks

It may become difficult for manufacturers of FM and diathermy filters to make those products, in which case it may become necessary for the serviceman to improvise. Table 1 shows the starting length for adjusting 300-ohm quarterwave transmission-line filters to eliminate diathermy and FM interference. These lengths are called "starting lengths" because the actual quarter-wave stub length cannot be determined until the transmission line is in the installed position and the interference line is on the TV screen. The serviceman then gets to work with a pair of cutters and starts with this length. He keeps cutting, inch by inch, until the interference is attenuated by the filter action of the quarter-wave stub.

Shortage of Attenuators

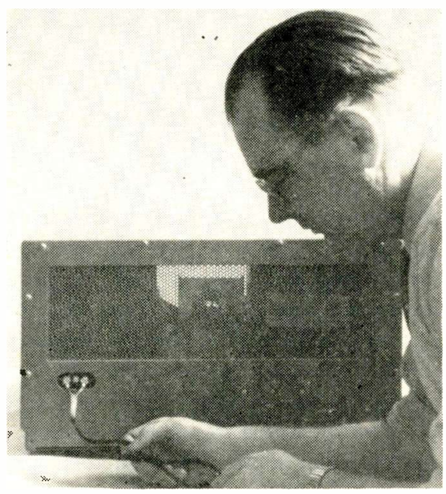
In many strong-signal areas it is necessary to install resistive networks



A home made, but effective, attenuator for installation in areas where the signal is too strong, is a terminated transmission line capacitively connected to the set. Loss cuts signal to proper level for presentation to the set's front end.

between the antenna transmission line and the TV receiver to prevent the front end from becoming blocked. In the event that resistors are not available for attenuation networks, it is possible to couple the TV receiver capacitively to a terminated transmission line and attenuate the received signals by virtue of the capacitive coupling loss. This loss can be as much or as little as desired, depending upon the length the lines are coupled and whether or not there is a layer of high-frequency tape, or if they are taped together as shown in Fig. 2.

In the event that 2-set couplers are not available, two sets may be coupled to one antenna by this means (see Fig. 3), although there will be some interaction between receivers due to reradia-

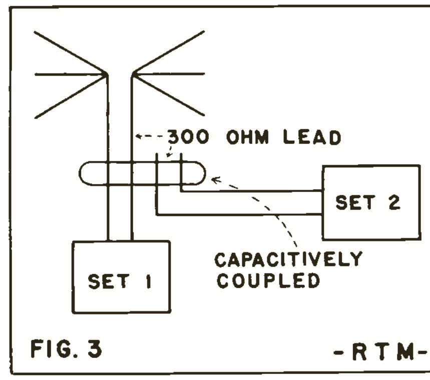


Serviceman cuts quarter-wave stub until interference line disappears from the picture. Stub is a piece of 300-ohm line connected to the antenna input terminals of the receiver; starting lengths, to be used for the various channels on which interference might occur, are shown in Table 1, below.

tion from the local oscillator of either receiver. Capacitive coupling is not new to some servicemen in urban areas, who have made installations of this type in multiple dwellings where only some tenants were allowed outside antenna installations. In single-channel areas where the local-oscillator problem does not exist, the connections can be made without impairing the of reception

TABLE I.

CHANNELS	STARTING LENGTH 1/4 Wave Open Stub
2, 3,	45 inches
4, 5, 6	35 inches
FM Band	30 inches
7 through 13	16 inches



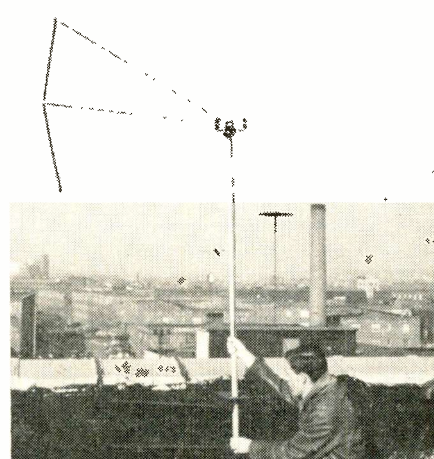
Emergency substitute for a two-set coupler. Leading lines from the two receivers are capacitively connected.

either receiver. It is interesting to note that the quality of signal is usually not impaired although the loss may favor various bands of frequencies, depending upon the length of the coupling lead between the two transmission lines.

Installers and Servicemen

With over 18,000,000 television sets on the market, and an average of perhaps five service calls per set, it is quite probable that in a year or two, it will be impossible to handle service calls, with a small force of servicemen not in the armed forces or in government industry.

Some consideration may have to be given to training women in servicing television receivers. In fact, it may become necessary for the set owner to remove the chassis and deliver it to the service shop in the event of serious manpower shortages.



Wooden masts, made from broomsticks, made perfectly good suports for the simpler types of antennas in many cases. Shortages of steel masts have made these installation feasible in many TV localities.

Service Technique

ALIGNMENT OF FM SETS CAN BE DONE QUICKLY AND EASILY WITH ONLY AVTVM AND AN AM SIGNAL GENERATOR

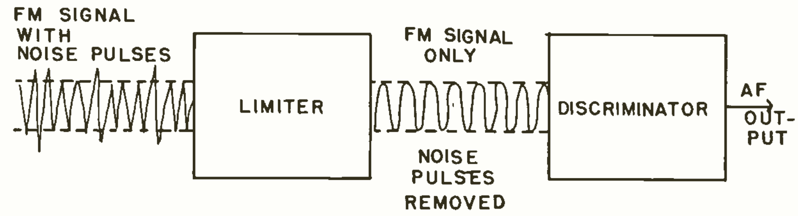


FIG. 1 -RTM-

Limiter-discriminator demodulating system used in most present-day FM sets.

FM ALIGNMENT WITH THE VTVM

By RUDOLF F. GRAF

THE audio signal associated with any television broadcast is sent out as a frequency modulated signal. Therefore all television receivers employ FM detectors in the audio section. Fundamentally the operation of all FM and TV receivers is not much different from that of any other superheterodyne receiver. Let us review that circuit briefly:

The signal which is intercepted by the antenna and fed to the set, is amplified in the RF stage. The output signal from the RF stage is fed to the mixer or converter stage where it is combined with the local oscillator voltage to produce the IF signal. This IF signal is then amplified and applied to the detector stage where it is converted into corresponding audio signal voltages. The audio voltages are again amplified and are finally applied to the loudspeaker. This is the basic operation of any superheterodyne receiver. It holds true whether the incoming signal is frequency modulated or amplitude modulated. The mixing process and the conversion of the signal take place in either case. The only important difference lies in the method which we employ to extract the audio component from the modulated signal.

If the incoming signal, and hence the IF signal, is amplitude-modulated, the detector circuit employed must be of such a nature as to convert amplitude variations of the signal into corresponding audio variations.

On the other hand, if the incoming signal is frequency-modulated, the detector must be one which will convert frequency variations into the required audio signal. It is this latter type of detector, and its associated components, with which we concern ourselves here.

Practically all of the present day FM and TV receivers use either a ratio detector or a discriminator in the detector stage. The fundamental difference between a ratio detector and a discriminator type of detector lies in the fact that the discriminator detects AM as well as FM signals, while the ratio detector does not respond to AM signals.

Since static and other noise signals are essentially AM, a limiter stage is required in sets employing a discriminator, to remove the noise pulses before the signal is applied to the detector. This system is shown in block diagram in Fig. 1.

Variations in signal amplitude may also be due to fading of the incoming signal, but since the limiter removes all amplitude variations above a certain minimum strength, its output signal has a constant amplitude. The frequency modulation of the signal is not affected by the limiting process. Limiter stages

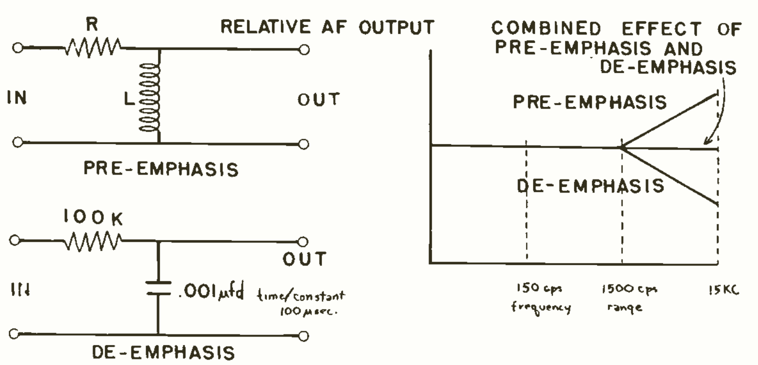
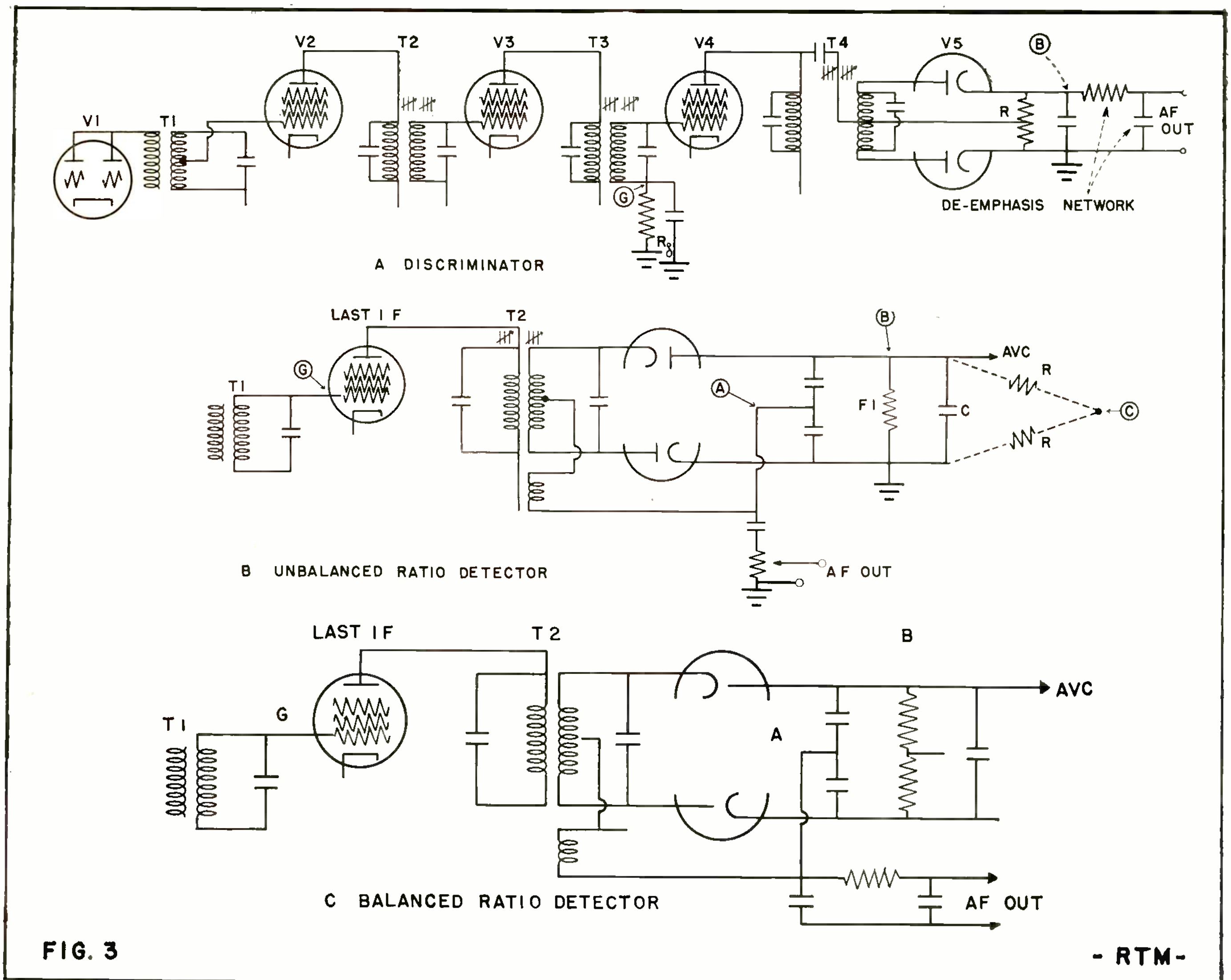


FIG. 2 -RTM-

Pre-emphasis and de-emphasis networks, with their individual and combined effects on the FM signal. In the operation of these networks, the higher frequencies are made stronger at the transmitter: thus they compare more favorably with the noise signals they have to compete with. At the receiver, the entire group of high-frequency signals, including both information and noise, is cut down to a specified level.



Skeleton diagram of the FM circuits, with some parts left out for clarity. The essentials are left in to show test points used in alignment of the set. The tests and procedures given in this method are more laborious and time-taking than the visual system, but require considerably less equipment.

generally employ sharp-cutoff pentodes which are operated with grid leak bias and low plate and screen voltages.

Emphasis Networks

A de-emphasis network is always used after the FM detector before the audio signal is amplified. This network, which consists simply of an R-C combination, is used to attenuate severe noise signals which are generally found in the high-frequency portion of the audio spectrum. The de-emphasis network does not only attenuate the high frequency noise, but it also reduces the audio signal at the higher audio frequencies. In order not to change the nature of the transmitted audio signal, a pre-emphasis network is employed at the transmitter. This network has exactly the opposite characteristic of the de-emphasis network, so that the overall effect on the audio signal is the same as if no pre-emphasis or de-emphasis existed at all.

Another advantage of these networks lies in the fact that since the high-frequency components of an average broadcast are generally much weaker than the low frequency components, they are actually sent out stronger than normal. Thereby we achieve a very desirable increase in the signal-to-noise ratio, which makes for better reception. The components of these networks are so chosen that their time constant is about 50 to 100 microseconds and the frequency at which they become effective is about 1500 cycles per second. Complete pre-emphasis and de-emphasis networks as well as their individual and combined characteristics are shown in Fig. 2.

Alignment

Alignment of either the ratio detector or the discriminator as well as the preceding IF stages, can be accomplished by any one of two methods. The first method requires the use of only a vacuum-tube voltmeter and an AM generator. The second method employs an oscilloscope and a sweep generator with a marker. Here we consider only the first method.

Discriminator

In order to describe the alignment of a discriminator circuit let us refer to Fig. 3A. There we see a representative skeleton diagram which leaves out non-essential element connections. The AM generator required must cover the IF range of the receiver and should be sufficiently accurate to permit settings 25 Kc to 100 Kc above, and 25 Kc to 100 Kc below the receiver's intermediate frequency. This is necessary in order to check the band pass of the tuned circuits, and to check the linearity of the detector circuit.

Procedure

Set the generator to the exact intermediate frequency of the receiver and

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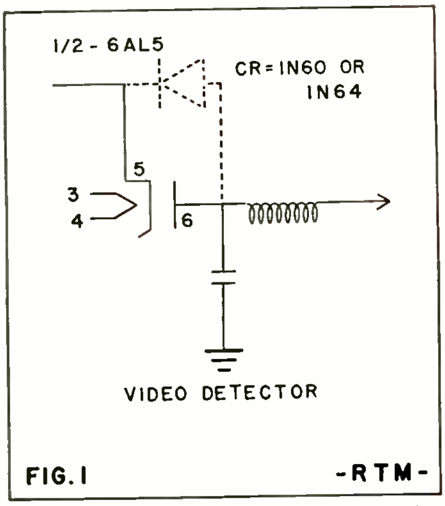

Crystal detector used for demodulation of a TV viedo signal. Use of crystals in place of vacuum diodes is increasing with TV design development.

Video Detectors and VF Amplifiers

By DAVID T. ARMSTRONG

THE functions of the television video detector and amplifier are to process the signal of the IF amplifiers sufficiently to produce a picture of good detail and proper contrast in the CRT. The detector and video amplifier must be able to: 1. demodulate the IF carrier and pass on both video intelligence and synchronizing signals, as well as the sound IF in the intercarrier systems; 2. amplify the demodulated signal with proper DC voltage level to provide good black and white contrast; 3. provide a linear frequency pass band from about 30 cps to 4 Mc; 4. keep phase distortion to an unobjectionable minimum.

Of these essentials, the serviceman should bear in mind that the linear frequency response is the hardest to obtain, and that it is the most important of the functions of detection and amplification of the video signal. Frequency response is the chief distinguishing difference between a video amplifier and an ordinary audio amplifier.

The video detector is usually a diode. The circuit may be either a series or shunt type. Some means is usually provided in the system to keep the IF signal out of the video amplifier. The series choke coil between the output of the diode detector and amplifier input provides some video compensation and keeps the IF signal out of the amplifier. Therefore, whenever there is insufficient compensation, or whenever the IF signal is getting by, the defect may be localized in the video detector system.

Conventional Detector

The video detector operates in a conventional manner. It may be half a 6AL5, or a crystal as shown in Fig. 1. In intercarrier sets, the video detector works on the 4.5 Mc beat between the picture and sound carriers. Since these carriers result from a crystal controlled carrier frequency at the television transmitter, the resultant beat is highly stable, much more so than that produced by beating the sound carrier with a local oscillator.

The video detector output signal is amplified by the video amplifier; sound is taken off at the plate of the video amplifier by a 4.5 Mc trap. This signal voltage is further amplified by the sound IF and the audio component is removed by the ratio detector or the limiter-discriminator.

When a crystal detector is used to rectify the composite video signal from the output of the last video IF, the positive portion of the signal is developed across the load resistor and condenser. This is the signal that is amplified by the video amplifier—the analogy to conventional radio operation is exact.

An average AGC voltage is generally obtained by an RC network on the output of the crystal or tube detector. Usually a condenser, in conjunction with a one megohm resistor, charges to a value proportional to the amplitude of the rectifier carrier. It is this DC voltage which is fed to the RF amplifier and the signal grids of the video IF amplifiers to control the gain of the receiver in accordance with the strength of the incoming signal. AGC is to the television receiver what AVC is to the broadcast receiver.

Germanium Diodes

A great many 1950 model receivers incorporate germanium crystal diodes for video detection. The polarity of the picture signal at the output of the video detector is a design and not a service problem, but this polarity must be observed and maintained during servicing. Unless the basic polarity considerations are observed when replacing a germanium diode video detector, white and black objects will be reversed, i.e., appear as they do on a photographic negative. At the same time, synchronization will become extremely critical.

Germanium diodes are marked differently, and the serviceman must become familiar with the markings of the chief manufacturers (GE, Sylvania, and Raytheon) making these components. The section of a germanium unit marked with a minus sign is the cathode, and the section having a positive sign is equivalent to a plate. In circuit diagrams the arrowhead sign indicates the plate, and the bar represents the cathode. Sylvania units are marked CATH to indicate the cathode terminal.

Precise Values

In a detector circuit, the value of each component is usually carefully selected by the manufacturer. The value of each of the plate load resistors is sometimes changed from what would be required in a basic detector circuit to overemphasize the higher frequencies; this is one method of compensating for reduced bandwidth in the RF and IF stages. Whenever replacement in the detector circuit is necessary the technician should use peaking coils and resistors of *precisely* the same value.

White trailing reflections in the picture usually indicate phase shift and poor low frequency response. This condition may result from a reduction in resistance value of the detector plate load resistor or the video amplifier plate load resistance. It would be a good experiment for the television technician to actually change the value of the detector load resistance and the value of the video amplifier load resistance in a bench receiver to become familiar with the picture effect of value reduction in this component.

Any reduction of the load resistance values in these specific circuits will affect the amplification of all frequencies. Where there are peaking coils in the circuit, the higher frequencies will not be affected so much as the lower frequencies. However, before the serviceman hastily concludes the resistance has changed to a lower value, he should also suspect misalignment, so that the picture carrier is more than 50 per cent down. Moreover, the defect could be caused by a temporary condition in the transmitted signal.

Phase shift, and loss of both high and low frequency response may be due to the video amplifier load resistor changing upward in value to several times its rated value.

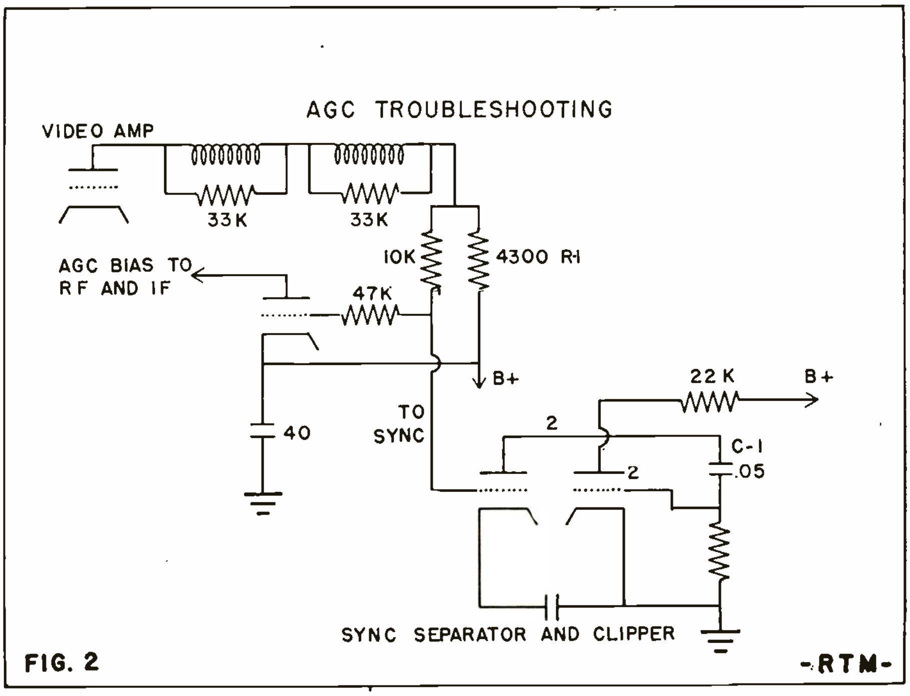

FIG. 2

Video Amplifier

Basically, a video amplifier is similar to an audio amplifier with the following exceptions: 1. The plate resistor loads are low and there are compensating chokes to raise the high frequency response. 2. The tubes used must have high mutual conductance, with low input and output capacities. 3. The DC component must either be preserved or restored.

The DC component is lost through capacitive coupling between stages. The video amplifier is usually a high G_m pentode in a single stage of video amplification, or a duo-triode, which provides a two stage amplifier. The input and output capacity of a dual triode is small and the compensation required is not so great as it would be for a high G_m pentode, like the 6AC7.

The output of the detector is fed to the amplifier grid in a conventional manner and the amplified signal appears in the plate circuit. It is important to remember that in most receivers the signal goes three ways, because at this point there are three basic components in the composite video signal: 1. The sound is taken off by a 4.5 Mc trap and fed to the audio system; 2. The picture intelligence is delivered to the grid or the cathode of the picture tube depending on the polarity of the signal. Sometimes the signal is DC coupled to the CRT and sometimes it is capacitively coupled. Whenever it is capacitively coupled there must be DC restoration; 3. The synchronization pulses are coupled to the grid of the sync separator tube and fed eventually to the horizontal and vertical oscillators.

Direct Couplings

Some video amplifiers are direct-coupled, to eliminate any necessity for DC reinsertion. When the output from the video detector is negative, noise pulses will drive the video amplifier tube beyond cutoff; this helps the video amplifier to function as a noise limiter. The output from the video amplifier will then be in a positive direction, which means it will be applied to the cathode of the CRT. This is identical to grid modulation with a negative signal. The DC bias on the picture tube governs the brightness of the tube and the brightness is adjusted by the picture control potentiometer.

In a video amplifier, a voltage gain is necessary since signals of about 120 volts peak-to-peak are desirable for properly driving the CRT.

Servicing Hints

Sound bars in the picture are very annoying to a set owner. They are usually eliminated by correct alignment of the video IF sound traps. If this doesn't do the trick, check the oscillator alignment, the first 21.25 Mc trap, or suspect microphonic tubes.

Microphonic trouble is a constant source of difficulty in TV receivers. It is most persistent in connection with oscillator tubes, or with combination mixer-oscillator tubes. Try several tubes and select one with least microphonics and minimal oscillator frequency shift. But keep in mind that replacing a mixer or oscillator tube or a combination mixer-oscillator tube usually necessitates readjustment of the overall oscillator circuits.

It helps to solder the tube socket saddles firmly to the chassis. It is always desirable to shock mount the front end tuner on rubber floats.

One common cause for microphonics is the loudspeaker itself. Shock mount the speaker with rubber grommets. This is getting to the trouble at its source.

Occasionally, 60 cycle hum may be noticeable with the volume down. Try replacing the first audio tube. If the hum persists, try decoupling the screen and plate of the final audio output. Sometimes replacing the final audio output tube will eliminate sound bars in the picture, particularly when this occurs with loud volume. These bars may also be eliminated by decoupling the screen and plate of the audio output tube.

When there is no picture, but a raster and sound, check the complete

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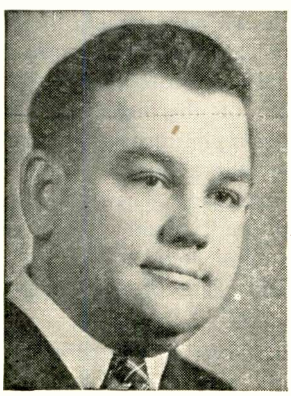
"FIRST CATCH YOUR RABBIT . . ."

ALL OF you have doubtless read that classic recipe for making rabbit stew that blandly begins: "First, catch your rabbit." That matter-of-fact instruction certainly takes a lot for granted, doesn't it? Well, I am convinced that the joker who cooked up that recipe must be the same one who prepares alignment data on FM receivers.

"Attach the sweep generator to Pin #8 of the 6SB7," he will glibly instruct you, but Pin #8 is buried so far down beneath the wave-band switch and a dozen other solidly-anchored items that you cannot event get a glimpse of it, let alone fasten the signal generator clip to it. "Attach two carefully-matched 220,000 ohm resistors connected in series across R19," the alignment data goes on, "and connect the probe of the VTVM to the juncture of these two resistors." That sounds just dandy, but R19—when you finally manage to identify it—usually turns out to be located in such a position and possessed of such short leads that an attempt to attach anything to it bulkier than a wishful look will quite likely produce a short and bring the rectifier to an untimely end.

Variant Hookups

But when you do not have specific instructions given by the manufacturer



JOHN T. FRYE

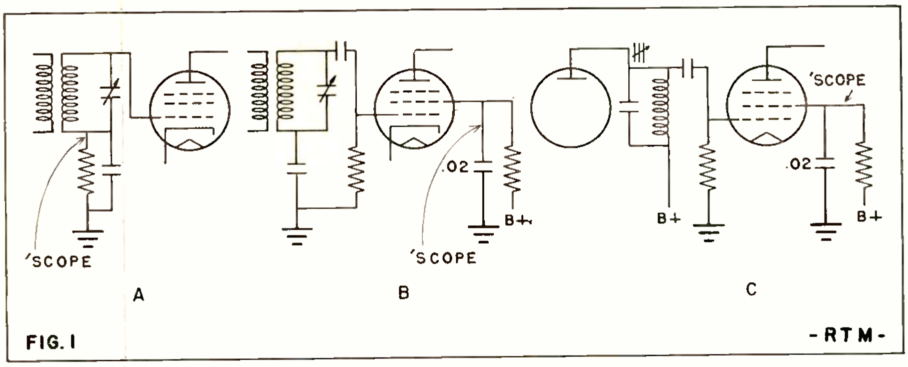
and have to fall back on general alignment information, the situation is even worse. For example, ordinarily you align the IF and limiter stages first, if there are any limiter stages. You are told that you should attach your 'scope across the grid-return resistor of the last limiter stage and adjust the preceding IF trimmers for maximum height and proper symmetry of the trace seen on the 'scope screen. That works out fine as long as the limiter has the circuit of Fig. 1A, for in that case attaching the 'scope has no effect on the tuning of the limiter input circuit; but the story is different when you encounter limiter stages wired as in Figs. IB or 1C. In either of these cases, attaching the oscilloscope across the grid-return resistor will completely upset the tuning of the input circuit.

There is an easy way around this, however. Simply attach the 'scope "hot" lead to the screen-grid of the limiter tube. While this element is bypassed to ground by a condenser of .01 or .02 mfd., the reactance of such a condenser at the 60- or 120-cycle sweep rate is quite high, and a good pattern can be obtained at this point without upsetting the tuning of the input circuit. The shield of the 'scope lead, of course, should go to the set ground. Incidentally, I believe it is better to attach the oscilloscope to a limiter stage, when one is used, for aligning the IF's than it is to attach it to the discriminator. It has been my experience that a discriminator—especially at some critical settings of the secondary trimmer—can toss some confusing little contributions of its own into the IF response curve in which you are primarily interested.

Detector Types

Of course, if there is no limiter, then you do not have this choice; and that brings up another tough problem that we meet head-on when the manufacturer's data it not on hand. That is the problem of deciding just what kind of a detector the set uses. It is a Foster-Seely, a Fremodyne, a radio detector, a locked-in oscillator, or one of the new gated-beam jobs? If you are an old hand at the business, there are helpful clues: if the set is a Philco and employs an FM-1000 tube about its middle, you are pretty safe in guessing that it has a locked-in oscillator, while if there is a 6BN6 in the tube lineup, the chances are excellent that the receiver uses a gated-beam detector, etc.; but even with a diagram it is often no simple matter to decide quickly just what sort of detector must be dealt with. For instance, there are at least a half-dozen variations of the ratio detector in common use. The tough part of all this is that each type of detector has a different "recommended" method of alignment, and the step-by-step procedure of each of those methods is a nerve-wracking and time-consuming business.

Up to a point, I have always been a great exponent of following the set-manufacturer's instructions; but I am growing a little exasperated at the hundred-and-one methods of aligning FM receivers found in the published recommendations of the radio factories. I'm strongly reminded of some of the instructions put out during the early days of the superheterodyne receiver, when an alignment job was really a fear-inspiring undertaking. The oscillator had to be carefully detuned by paralleling the oscillator tuning condenser with another "outboard" tuning condenser; the AVC voltage had to be replaced with a battery; the output meter had to be connected to just a certain point in the circuit; etc., etc. That's a pretty far cry from the way we align an AC-DC midget today, isn't it? If we hadn't found a faster and equally-as-good sys-



Different connections for FM limiter circuits. In (A), the normal 'scope connection has no effect on the limiter's input circuit tuning. In (B) and (C), however, the hot lead from the 'scope is coupled to the screen grid of the limiter tube by attaching it to a fine wire wrapped around the element's pin connection.

tem, not many customers could afford to have one of these little sets aligned.

Universal Method

Now that FM is no longer confined to the expensive consoles, we need a quick, universal way of handling FM alignment—one that will work with any type of detector and that permits easy connection of the necessary instruments. To this end, I recently spent many hours experimenting with every method of FM alignment I ever heard of. The various methods were compared on two main points: (1) the time and effort required to do the whole alignment job, and (2) the quality of the job as determined both by oscilloscope analysis and actual listening tests.

The modulated AM generator and output meter method was the quickest to use, and it could often be employed without even removing the chassis from the cabinet. It also permitted the discriminator secondary to be set with reasonable accuracy in the center of the IF band. On the other hand, it did not permit any check of the linearity of the detector action to be observed, and receivers aligned solely by this method gave only fair performance. When an unmodulated AM generator was employed in connection with a VTVM, it was possible to adjust the discriminator secondary to the center frequency with great precision, but again no linearity information could be had without laboriously plotting a graph. Performance of receivers aligned in this way was somewhat better than with the previous system, though.

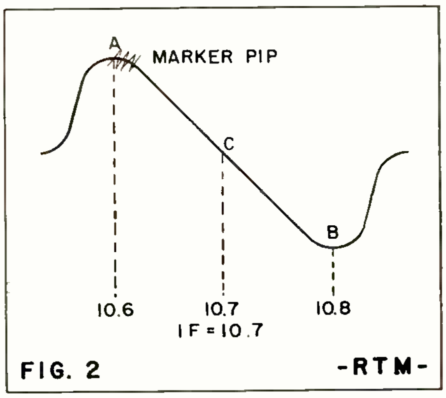
The sweep-generator-and-'scope method proved to be faster than the VTVM system but slower than alignment with the modulated AM generator. A further drawback was the expensive and rather complicated equipment required; but none the less, it was by far the best system for seeing at a glance exactly what effect any single adjustment had on the overall performance of the receiver. A clincher in its favor was the indisputable fact that a set aligned carefully with the 'scope sounded better.

Standardized Procedure

The more or less standardized procedure evolved from these experiments is as follows: first, the outputs of the sweep generator and the AM generator, connected in series, are connected from converter grid to ground. If the grid lead is hard to reach, the tube is removed from the socket, a turn of fine insulated wire is made around the grid prong, and then the tube is replaced. When the signal generator is connected to this wire, sufficient signal is always radiated to the grid. The shielded lead from the 'scope is connected to the hot side of the volume control, which is almost always easy to reach. The horizontal connections of the oscilloscope are connected to the horizontal sweep terminals of the sweep generator. An isolation transformer is invariably used.

With the sweep width of 250 Kc, the trace of Fig. 2 is seen on the screen. IF and limiter trimmers are adjusted for maximum size of this trace. The discriminator secondary is adjusted for the straightest possible line between points A and B. Marker pips from the AM generator are used to determine whether the "knees" of the figure at points A and B are each removed a full 100 Kc from the IF, which is made to fall right in the middle of line AB at C. If any of these conditions do not prevail, the various IF, limiter, and discriminator trimmers are simply manipulated until the trace on the 'scope screen is as near the ideal outlined above as it can be made to go—and don't give up too easily! Since the effect of each adjustment is instantly apparent, all you need do is move a trimmer and note if this improves the trace or not, and then be guided accordingly. At first, the process is pretty much a cut-and-try procedure, but it is surprising how, with a little practice, you know almost instinctively which trimmers to turn in what direction to remove an unwanted bend from the response curve.

While, as mentioned before, a slightly different procedure might be a little better for a certain type of circuit, this is the only one that the writer has found that can be depended upon to produce results with any type of FM detector. Since, with this system, the oscilloscope actually traces out the audio voltage developed by varying the frequency around the IF center point, it will faithfully depict the ability of any system to translate frequency deviation, into audio potentials.



Optimum response curve at discriminator transformer secondary. Straight line between points A and B is desired.

trade LITERATURE

ENGINEERING TV BOOK

A NEW engineering book, a text, on television is "Elements of Television Systems," by George E. Anner. Published by Prentice-Hall, as an addition to that company's engineering series, the volume sells for $10.35.

For anyone who really wants to know thoroughly the workings of television, in all the aspects not important for servicing sets, the book is no doubt worth the price. But for the working technician, it probably would be of relatively little value.

There is no question that the book is a valuable one for the field it covers. The treatment of nearly every aspect of present day television is complete, and the author's perspective of the comparative worth of the various informative sections he is presenting is important to the long-range student.

In addition to completeness and thorough treatment, however, there is still another compliment which must be paid to Mr. Anner: his writing style is first-rate. It isn't uncommon for the author of a technical work to lose himself and his reader in mazes of language which are as complicated as his subject, and this failing is easily explained—the ordinary author of this type of book is not, basically, a writer, but an engineer. And therefore it is to be expected that he will find considerable difficulty in getting across his knowledge so that it is intelligible to the reader, unfamiliar with the subject and the writer's different habits of expression. Because of this situation, it is more than gratifying to come across someone like the author of this book—a man who knows his subject completely, who is willing to take the trouble to present it completely, and who is able to do the job the way it should ideally be done.

The subject matter proceeds from basics in the history and development of electronic television through to the latest news in the field—color. In order to remove a few misconceptions, Mr. Anner first describes television which is transmitted over wires, and then goes on to enlarge the subject to include the more complex systems necessary to propagate pictures and sound through the air.

It must be kept in mind that the author is *not* trying to give a shortened version of the technique of television; he is, on the contrary, attempting to portray, for the engineering student, the exact meaning, or as he calls it, the philosophy, of television systems, and the engineering thought which has gone into their development. For this reason, the book considers a great deal of material not particularly important to the serviceman, but very interesting to the man who wants to know, all-inclusively, what it is all about. —A.G.C.

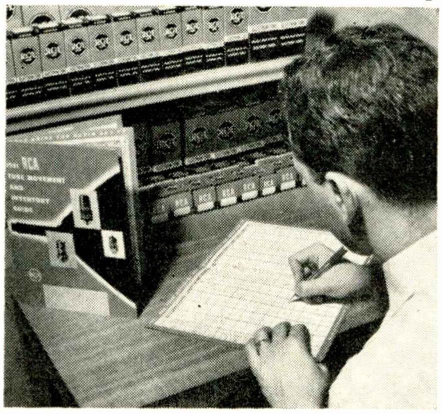
—RTM—

INVENTORY GUIDE

A new tube movement and inventory guide for the radio service dealer has been announced by the RCA Tube Department. The 16-page book, in chart form, is designed as a year-round master control covering more than 400 receiving tubes and kinescopes.

Through a simplified record-keeping system, the new Guide provides the dealer with "at-a-glance" control of his electron-tube stocks, and enables him to maintain balanced inventories with a minimum of bookkeeping.

The charts in the guide are arranged in double-page spreads to provide tabular space for a full 12-month inventory-order record for every RCA receiving



tube and kinescope in the dealer's stock. One column lists the "U. S. Ratio" of each tube type, based on a study of national movement in the renewal market. Another column enables the dealer to list his own movement of each type, based on the national figure and his own local market. In addition, there are columns for the dealer's inventory, orders, and average monthly movement by type.

By providing a clear, visible record of each tube type, the new RCA Guide makes it possible for the dealer to note his completed and unfilled orders, his sales by type for each month, and the general trend of his tube movement. It eliminates stock searching, and provides an accurate gauge of his business volume in a simplified form.

The guide is now available from RCA Tube and Parts distributors.

—RTM—

ARRL HANDBOOK

THE Radio Amateur's Handbook is in its 28th edition. This 1951 manual needs no particular introduction—the older editions are too familiar to all radiomen for that. But it might be well to point out the new sections included in this edition.

There are two completely new chapters, in addition to a revision of the entire text. One of the new sections considers the design and construction of single-sideband suppressed carrier radiotelephone transmitters. Complete information for the construction of two single-sideband exciters is given, as is a description of a two-stage linear amplifier.

The second new chapter is devoted to mobile radio receivers and transmitters. Several converters and transmitters are completely described, with appropriate antenna systems and power circuits.

Another major revision concerns the sections on antennas and transmission lines. Previously covered in a single chapter, the two subjects are now dealt with separately for more complete presentation.

There are a total of 27 chapters in the book. The first sections, as in earlier editions, present the basic material which has served as a textbook for many beginning amateurs, and as a reference work for just as many advanced technicians. Subjects which are considered in their own chapters include: power supplies, HF communication, keying and break-in, frequency and phase modulation, interference (broadcast and television types) vacuum tube principles, and UHF communication.

The 768-page volume sells for $2.50. It contains nearly 1200 illustrations, with schematic diagrams, photographs, charts and tables. Many of the pictures are designed to help the reader with parts layout and constructional details when he builds equipment from discussions in the text—this feature in itself is of considerable value to amateurs.

Service technicians, on the other hand, will probably be more interested in the new methods presented for eliminating television and broadcast interference, and possibly in the mobile radio section.

All things considered, the new edition of this standard handbook might well be on the shelf of anyone who does any kind of work in electronics.

—R.L.B.

—— RTM ——

TV ANTENNA BOOK

A NEW second edition of the Howard W. Sams book, "Television Antennas," is specifically designed for television servicemen. It is a treatment of everything connected with antennas that could possibly be of any use to the TV man, from design and construction information to troubleshooting at installations where there is something wrong with the antenna.

Written by Donald A. Nelson, the book, which is a paper-bound, two-dollar volume, goes in detail into all the various designs used today for TV reception, and covers all phases of installation of the covers all phases of installation of the units as well. In 223 pages, it is divided into five major divisions: antenna principles, construction, commercial designs, installation, and common problems.

With all this information, illustrated of course, with sketches of the antennas described, and photographs in a few cases, the book should be a handy guide for the man who has to put in antennas, and a good background work for the shop man.

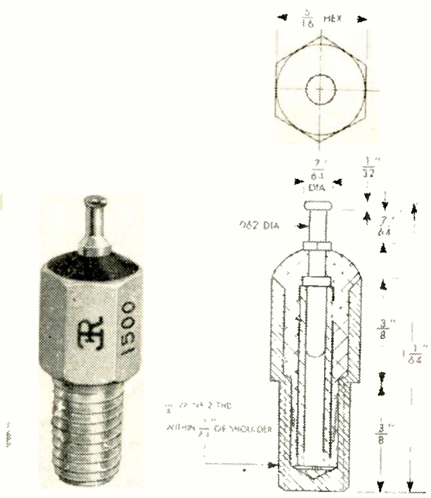
In a great many cases, servicemen have at this late date evolved methods and components that they will stick with forever; but it might do them good to study a book of this sort to find out whether that standard installation procedure they have been following might not be surpassed by other setups. Granted that a given type of antenna usually functions best in a given territory, it is still to the advantage of the installer to keep up with all types of antennas, and all types of installation practices; for there are always cases in which the usual methods will not bring results. No one single arrangement will be the optimum one for all the installations, even in a single locality.

—R.L.B.

STAND-OFF CONDENSERS

The basic design of the Erie Style 326 Stand-Off Ceramicon provides, in a hermetically sealed case, a by-pass-to-ground through the shortest possible path, according to information released by the manufacturer.

Advantage is taken of concentric electrode configuration in maintaining this short path by making connection to the



outer electrode at the plane of the chassis. The result is an extremely low and uniform series inductance. In assembly operations both location and length of leads are accurately fixed, resulting in mechanical uniformity. This feature has been demonstrated to be of importance in good VHF and UHF design.

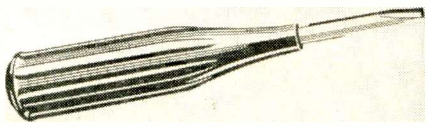
The manufacturer describes the unit as being completely sealed and having unusual mechanical ruggedness.

Electrical shielding is provided by means of the grounded metal case. A post terminal provides a sturdy tie point for several connections, and is made to match standard tube socket terminal height in the interest of maintaining uniform short leads.

The Erie Style 326 Stand-Off Ceramicon is for threaded mounting installation. According to the specifications furnished it is available in standard capacitance values in MMF: 10, 33, 47, 68, 82, 100, 680, 1,100 and 1,500. Voltage rating is 500 Volts DC.

—— RTM ——

NYLON ALIGNMENT TOOL



A new alignment screwdriver, molded of nylon, has been announced by Jaco Products Co., of Cleveland, Ohio.

The unbreakable tool is tough enough and has a large enough handle so that the user is able to exert greater torque pressure in adjusting tight screws than with conventional alignment screwdrivers.

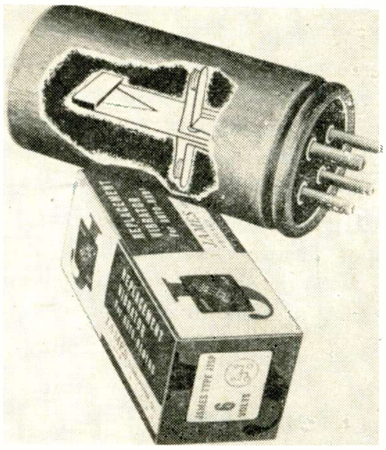
—— RTM ——

NEW VIBRATOR DESIGN

The James Vibrapowr Co., manufacturer of radio and communications vibrators, has developed a new "Angle Drive" vibrator principle from a recently issued U. S. Patent. Its design is the result of engineering and production research since 1936 and incorporates revolutionary vibrator improvements, the manufacturer claims.

"Excessive hash noise, stuck contacts, poor starting, and piling—common faults of present vibrator design—are eliminated through 'Angle Drive,'" according to the company.

The "Angle Drive" mechanism will be incorporated in all James designs for interrupter and synchronous models. These models are the complete replacement line for auto and communications application.



Full information and literature may be obtained from jobbers, and free sample vibrators may be acquired by writing direct to James Vibrator Company, 4036 N. Rockwell Street, Chicago 18, Illinois.

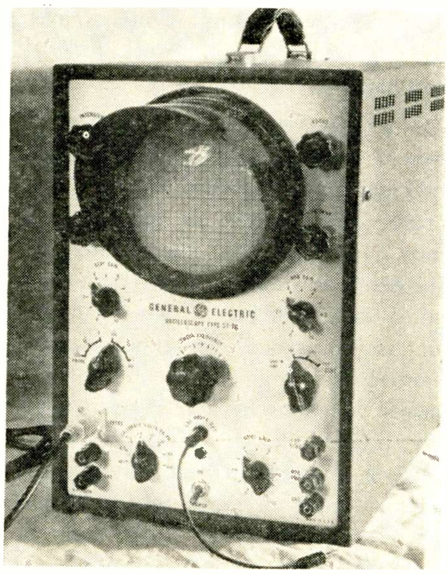
—— RTM ——

5-INCH 'SCOPE

A new five-inch oscilloscope, designed especially for use in microwave installations, has been announced by the General Electric Commercial Equipment Division.

The new scope, type ST-2C, has a high sensitivity and wide frequency response. The vertical sensitivity AC input is 0.075 volts rms per inch; the vertical amplifier frequency response, prove and AC, is 20 cycles to 3 megacycles, +0, —30 per cent.

Useful for television stations and general laboratory work, the new oscillo-



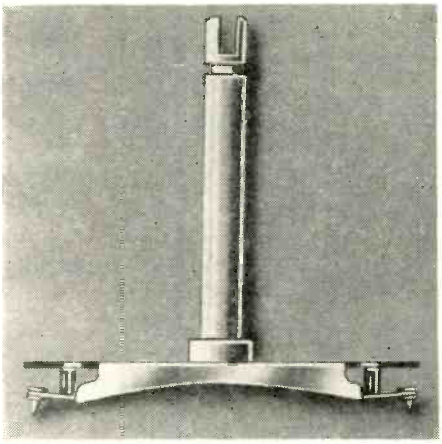
scope is of small weight (43 pounds) and size to permit portablity.

All frequently used controls are located on the front panel and are grouped conveniently according to their function. The panel is simplified by the use of concentric controls in the sweep oscillator. The cathode ray tube is cradled in rubber and is provided with a ¼-inch thick green-colored safety window.

Wide frequency response is obtained without recourse to peaked amplifier coupling circuits, resulting in excellent transient response. Straight resistance coupling is used and there is no positive slope to the frequency response curve. The response falls off gradually and the slope can be used to view signals containing frequency components up to seven megacycles.

—— RTM ——

REPLACEMENT DIAMONDS

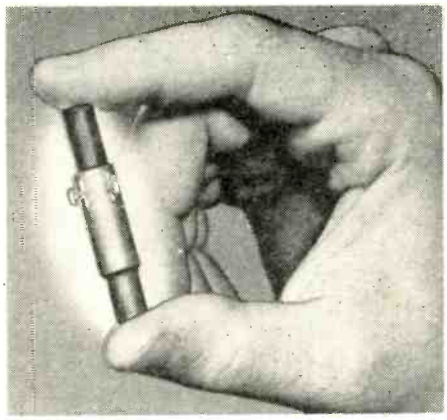


Electrovox Co., East Orange, N. J., manufacturer of Walco needles has announced the availability of diamond tipped replacement needles to fit most phonographs and cartridges.

The needles are now available for Astatic, General Electric Variable Reluctance, Shure, RCA, Philco and Webster-Electric cartridges.

Available data show that a diamond's resistance to abrasive wear is 90 times that of sapphire, the next hardest substance known. The diamond is therefore ideally suited for use as a needle tip, especially in connection with microgroove records. It is not only more economical in the long run from the standpoint of needle purchases but adds a definite measure of security to the life of the records on which it is used.

2-INCH LOOP ANTENNA



The new Grayburne "Ferri-Loopstick" broadcast radio loop antenna combines high efficiency, sensitivity and ommi-directivity with the smallest size in the industry.

Released by Grayburne Corporation, 20 South Broadway, Yonkers 2, New York, the Ferri-Loopstick features a Q of 240-275, while ordinary loop antennas have a Q of only 110. (Measurements made with Boonton Q-Meter).

The antenna increases the sensitivity and signal-to-noise ratio of receivers—of particular importance to portables.

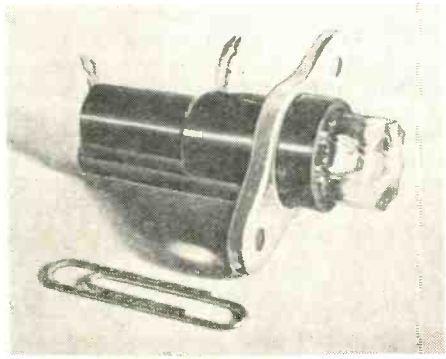
It includes a Ferrite core formed by a special process.

Dimensions: Diameter, ½". Length, 2".

—— RTM ——

INDICATING FUSE HOLDER

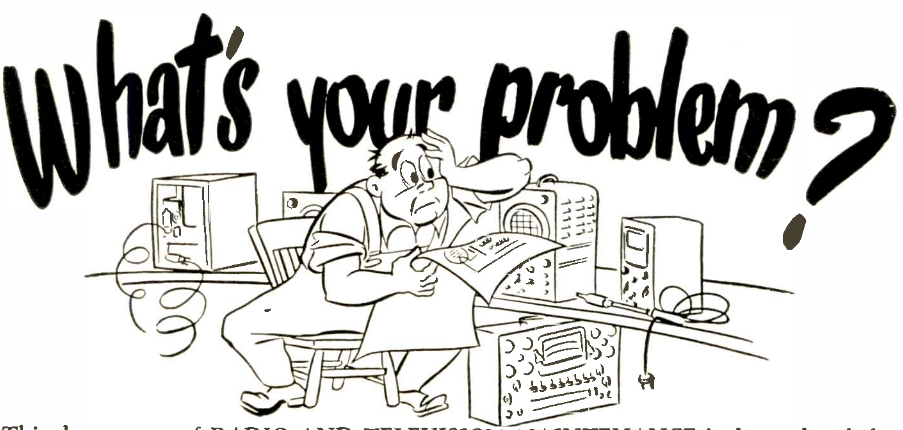
A new miniaturized indicating fuse-holder that instantly spots blown fuses has been announced by Alden Products Company, 117 North Main Street, Brockton, Mass.



The miniature fuseholder, Model 440-3FH, has a neon bulb and double con-

→ to page 29

What's your problem?



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.

AM INTERFERENCE

In the April issue of this magazine, Alfred J. Bernard, Camden, N. J., described a problem he had with oil-burner interference on an Arvin AC-DC set. The editor received so many answers that he is presenting here two of the best.

RTM's five-dollar award for the best answer goes to Reader J. M. Wallace, and the second prize of $3.00 will be sent to Reader Willie Cook. Here are their solutions to the problem:

GENTLEMEN:

Re oil burner AM interference in the April issue, the inquirer makes no mention of the high-tension ignitor voltage, generally used to fire all types of oil burners.

While this high-tension spark may cause interference close by, generally there is a control relay in the stack to shut off the spark as soon as the burner warms up. The complete HV assembly is usually enclosed, with the only part that is not enclosed being the electrodes, which are away back in the gun.

A good grade of high-tension transformer would have a static shield over the primary, or line, winding. This shield should be well grounded. Also, all wiring in connection with it must be well shielded (conduit or BX) and this shielding also grounded.

If the power supply feeding the oil equipment does not use a grounded neutral, I would suggest that a line capacitor filter be installed as close as possible to the burner: two 0.1 mfd 600-volt capacitors should be connected in series across the line with the center point grounded. (This should also be enclosed in a steel box, through which the supply to the burner passes.)

Perhaps the general ground to the equipment has been broken somewhere. One terminal of the igniting leads may be grounded. Neither of these, however, should be so grounded.

I have known the circulating fan, used with some oil burner-air conditioning equipment, to have caused very unpleasant interference.

As both the fan frame and motor were mounted on sound-proofing material, connecting both together and grounding them eliminated all interference.

I hope this will be of some assistance.

—J. M. WALLACE,
Toronto, Canada

GENTLEMEN:

I have just read Mr. Bernard's problem in your April issue and I think perhaps he is approaching the oil burner interference from the wrong angle.

The oil burner motor, being a split-phase type, seldom if ever causes such interference. However, the ignition system which lights the oil spray produces the worst type of interference imaginable. This is due to an arc or spark between ignition points, set up by approximately 10,000 volts from the ignition transformer.

Sometimes it is possible to set the whole oil pump assembly on a piece of sheet metal and connect the metal to a good ground, to eliminate the noise.

Another method is to use what is known as an "intermittent ignition stack control" on the furnace, which limits the time of interference to about 45 seconds, or the time required for the smoke pipe to reach a temperature which automatically turns off the ignition but leaves the oil pump running. Minneapolis-Honeywell produces a stack control of this type which retails for about $40.

I hope this will solve Mr. Bernard's problem, and I feel quite certain it will, because I have had about the same problem he has, when dealing with a constant-ignition oil burner.

—Willie Cook
Justice, West Virginia

BROKEN ADJUSTING SCREW

GENTLEMEN:

I have a 16x13 model RCA Victor radio in for repairs. On this set, the screw adjustment on the variable condenser is out of commission. The tuning screw has been turned too much, and no stations come on the set now.

Replacement condensers are no longer available for this model. Sometimes other variable condensers and IF's can be used for the originals in a set, but is there any way to *repair* this trouble, where the screw has been turned too far?

I have asked other repairmen, but they say they never have run across anything like this.

Thank you for any help you can give me.

—Paul Wellnitz,
Pine Island, Minn.

—RTM—

Video Detectors and VF Amplifiers

→ from page 15

video circuit. The fault may lie in the video detector, or video amplifier. A quick voltage check should reveal the source immediately in most instances.

A weak picture with insufficient contrast and no sound may be caused by RF tuner misalignment or oscillator alignment out of adjustment. In every instance, begin checking from the CRT back through the video amplifier, video detector, IF, and finally the front end.

With intermittent video and sound and a good raster, suspect any of the tubes in the video amplifier, or related circuits. Suspect the low voltage rectifier or the low voltage power supply system, or trouble in the contrast control circuit.

Smearing is usually evidence of poor low frequency video response. Check the video detector, then the video amplifier tubes and the low frequency compensating network.

Poor picture detail may be caused either by the RF or IF video bandpass; or the trouble may lie in the video amplifier high frequency response. Blooming in a picture may be caused by the resistor on the high voltage lead being intermittent. Try replacing the resistor as a first move.

A grainy picture may be caused by a strong interference signal from some nearby transmitter. This will be evident in that it occurs on only one or two channels. The installation of a proper attentuating stub usually eliminates this difficulty. Or it may be possible to tune the receiver for the best possible sound and touch up the sound traps at 21.25 Mc for minimum sound interference.

When overloading of the picture occurs, the contrast control may become inoperative. It is then most likely that one of the IF coupling condensers is leaking or shorting. The resistors associated with the contrast control may have changed in value.

Sometimes there is no picture. Check the mica coupling capacitors in the IF and amplifier stages. One certain check to make is to measure the AGC voltage. If it reads positive or less negative than 1.5 volts the mica coupling capacitors may be suspected.

A weak picture may be caused by a number of factors, among which the following are important: RF, IF, video detector, or video amplifier. This symptom may show up in a strong signal area; with intercarrier sound there may be both weak picture and weak sound. Check for opens or loose connections in the antenna system. Check all voltages starting with the video amplifier and working back to the detector, the IF, and finally the RF. Invariably, this solves the problem. Weak picture and low sound may be caused by AGC action in a strong signal area.

Video Amplifier and AGC

In some circuits, the negative bias on the AGC tube is obtained from a voltage drop across a part of the plate load of the video amplifier. Therefore, a fault in the video amplifier circuit will affect the AGC system, which in turn will affect other circuits. Since AGC voltage is used for controlling other stages, defects in the AGC system often appear as faults in other circuits.

Trouble in the AGC system can also show up as a raster with no sound and no picture. A fault in the video amplifier circuit, such as a defective tube or an open peaking coil, can cause the AGC tube to draw excessive plate current and develop a high voltage (approximately 15 volts) at the control grid of the first IF amplifier tube and across the plate resistors of the AGC tube. This voltage will bias the RF amplifier and the first and second video IF's to cutoff.

When an AGC circuit becomes inoperative, lack of control bias can cause the picture signal to develop negative voltage across the video detector load resistor. This can be high enough to cut off the video amplifier. A quick check for this defect may be made by removing the antenna; under these conditions some picture will appear with the weak signal supplied to the front end.

Under normal conditions the AGC voltage measured at the control grid of the first video amplifier tube will be approximately -4.5 volts. This value will vary slightly with the signal input and with the contrast control setting. Since the AGC tube is dependent upon other circuits for proper functioning, it will be affected by defective components in the video amplifier, the damper circuit, and the sync separator circuits.

This is what usually happens. The voltage present at the junction of the video amplifier plate load resistors is applied to the control grid of the AGC tube; see Fig. 2. If the video amplifier tube or circuit becomes defective, the voltage drop across the resistor R_{-1} is decreased, and an increased positive voltage is applied to the grid of the AGC tube. The AGC tube is no longer at cutoff between sync pulse intervals, and an increase in plate current results. This AGC voltage developed may be of sufficient amplitude to cut off the RF amplifier and the first and second video IF tubes. This means no sound (in an intercarrier system) and no picture.

With one type of AGC trouble when there is a weak picture with loss of horizontal and vertical sync, or no picture at all, the picture may be observed faintly by turning up both brightness and contrast controls. The AGC voltage measured at the control grid of the first video IF amplifier may be –0.2 to –0.4 volts. In receivers employing a circuit similar to that shown in Fig. 2, if C_{-1} shorts in the sync separator and clipper circuit, the sync tube will draw grid current. This will bias the AGC tube to cutoff. Then no AGC voltage will be developed and, since the RF tube and the first and second video IF's are not controlled, their gain will be at maximum. Under the influence of a strong signal, sufficient negative voltage will be developed across the video detector load resistor (usually about 4700 ohms) to drive the amplifier to cutoff.

When this happens, and removing the sync clipper and separator tube provides a picture with brightness and contrast restored but without horizontal or vertical sync, replace the condenser C_{-1} with an 0.05 mfd unit rated at at least 600 volts.

Summary

Whenever the symptoms indicate a defect in the video detector or the video amplifier circuits the following test procedures are suggested:

1. Check the tubes, preferably by substituting new ones, known to be good.
2. Check the socket voltages at critical points.
3. Check the peaking coils for any open circuits.
4. Check the resistors for a change in value, either above or below the rated values.
5. Check the capacitors: for shorts with an ohmmeter; for opens by bridging with another capacitor; for change in capacity value with a condenser tester.

—— R T M ——

FM Alignment with the VTVM

→from page 13

turn the modulation off. Set the VTVM to –DC volts and use the lowest range. Connect the probe to point G on the limiter grid and the common lead to the chassis. Now connect the generator to the grid of the mixer tube V_1, and adjust the primaries and secondaries of T_2 and T_3 for maximum reading on the meter. Finally peak the sound trap, which is the *secondary* of of T_1. As the meter reading increases, reduce the generator output control to get a readable indication on the meter. In order to check the linearity of the IF stages, increase the setting of the generator to a frequency which is 25 Kc higher than the IF and note the meter reading. Now set the generator to a frequency 25 Kc lower than the IF and again note the meter reading. The readings should be close to the same value. Now repeat the process for frequencies 50 Kc above and 50 Kc below the IF. As before, both readings should be close. Again, repeat the procedure for plus and minus 100 Kc. If the two corresponding readings in all three cases check fairly close, we are ready to align the discriminator. If they don't check, the set must be realigned more carefully.

To align the discriminator connect the generator, set to the exact IF, to the grid of the limiter V_4. Connect the meter between point A and ground and adjust the secondary for maximum meter reading. Now move the meter probe to point B and adjust the secondary for true zero reading. There will be three conditions under which the meter will read zero: with the secondary tuned much below the IF; with the secondary tuned much above the IF; and with the secondary set exactly *to* the IF. This last condition must be obtained for proper operation. As the secondary is tuned, the meter needle will suddenly go from a very positive maximum reading to a very negative maximum reading. The secondary must then be adjusted to that point where the needle goes through zero between the two maxima. It may be advantageous to turn the ZERO ADJUST of the VTVM so that the needle is at midscale or some other convenient reference point, in order that this true zero point may be found most easily.

In order to check the linearity of the discriminator, set the meter to midscale with the ZERO ADJUST. This can be done with the meter either in the –DC volts or the +DC volts position. Set the generator to frequencies which are equal amounts above and below the intermediate frequency and note the meter readings. For equal increments of frequency away from the IF, the meter readings should increase and decrease by equal amounts. If this is not the case, the discriminator transformer must be realigned.

Ratio Detector

Fig. 3B illustrates an unbalanced ratio detector. In this case the alignment of the IF stages should be left until the detector circuit is properly adjusted. Set the generator to the intermediate frequency of the receiver and connect its output between the point G and ground. The VTVM is connected between point B and ground, with the COMMON lead on ground. Since B is the point at which the AVC voltage is taken off, the voltage at this point will be negative with respect to ground. Now adjust the primary of T_2 for maximum meter reading.

Because this is an unbalanced detector, it is necessary for us to establish an artificial center to align the secondary of T_2. In order to do this, connect two equal resistors, whose value is between five and ten times the value of R_1, between point B and ground. Don't forget to remove these resistors after the alignment is completed. It is important that the values of the two resistors be as close to each other as possible, in order to obtain a correct alignment. Once you have found two matched resistors, it is advisable to put them aside and have them handy for future alignment jobs. Now connect the COMMON lead of the vacuum-tube voltmeter to point C, which is the junction of the two resistors, and connect the probe to point A. With the generator still set at the at the IF value adjust the secondary of T_2 for true zero in the same fashion as for the discriminator. Linearity can also be checked in the same way as outlined for the discriminator.

IF Stages

To align IF stages, connect the VTVM to point B, and adjust the IF transformers for maximum reading. Bandwidth is checked in the same manner as outlined previously.

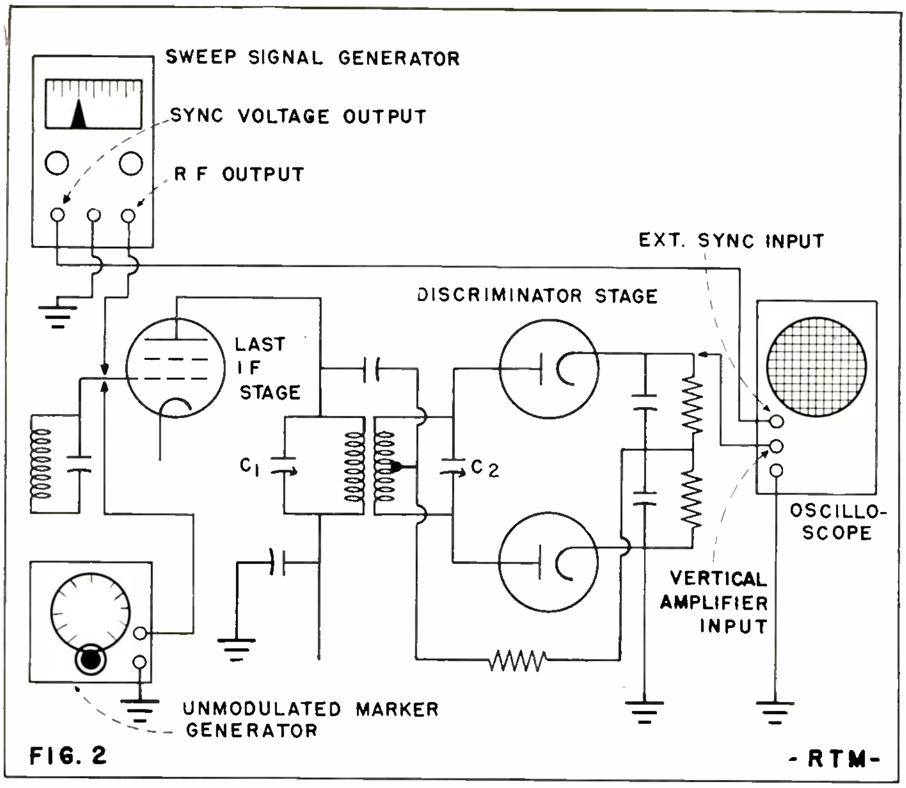
In receivers using balanced ratio detectors, the alignment procedure is somewhat simpler. A representative circuit is shown in Fig. 3C. As before, connect the generator between point G and ground and the meter between point B and ground. The meter is again set to –DC volts. Detune the secondary and adjust the primary for maximum reading. Then move the meter probe to point A, and align for true zero as before. To align the IF stages, reconnect the meter to point B and adjust for maximum meter reading.

Servicing

There are various symptoms that may be encountered due to trouble in the detector. Among these are weak or distorted output, noise, static, high frequency hiss, or a combination of any of these. Some symptoms may be caused by defects in other stages, and it is important to be sure the trouble definitely lies in the detector. The usual procedures for troubleshooting—tube checking, voltage and resistance analysis. should indicate any difficulties in any of the other stages. The detector circuit is, of course, subject to the usual troubles of open resistors or open coils and shot red, leaky or open condensers. Regular servicing with a volt-ohmmeter and a signal tracer will indicate and localize the trouble to any one particular stage in a short time.

A very simple way of determining whether the trouble lies before or after the discriminator involves the voltage developed across the grid leak resistor R_g shown in Fig. 3A. If there is a negative voltage developed across R_g when a signal is applied to the mixer grid, then the trouble lies beyond the limiter stage. This voltage must be measured with a vacuum-tube voltmeter. Then, if the audio stages are checking OK, the trouble has been localized to the discriminator. If the noise level becomes high the trouble probably lies in faulty limiter operation. Check the plate and screen voltages and see if they are as low as they should be. If the plate and screen voltages are too high, this stage will simply work as an IF amplifier and will not limit. It is advisable to check with the manufacturer's voltage data.

If it is impossible to get a zero voltage reading at point B, the trouble may be due to unbalanced diodes, unequal resistors R or simply misalignment. Now let us turn to the ratio detector. The capacitor C together with the resistance across it, is used to suppress AM noise pulses. Thus, if the reception becomes noisy, the condenser and the resistor (or resistors if detector is balanced type) should be checked. This condenser, which is a low voltage electrolytic, generally does not short, but it may lose capacitance. If the higher-frequency components of the audio signal seem to be unusually strong, the condenser of the de-emphasis network is generally first to be suspected. The condenser may open due to excessive heat and thus make the de-emphasis circuit inoperative. This holds true as well for the discriminator detector. Low output is generally due to bad detector tubes. misalignment or a leaky coupling condenser to the first audio amplifier.



Method of connecting the sweep generator, marker generator, and oscilloscope for alignment of the FM second detector. See text for alignment procedure.

FM Alignment with Sweep Generator

→ from page 9

value and downscale (negatively) as the generator is tuned below the receiver carrier setting. Fig. 1 shows how the meter is connected to the ratio detector and discriminator. It may be necessary to increase or decrease the setting of the signal generator output attenuator in order to obtain a desirable amount of meter deflection.

This test serves to establish that the front end of the receiver, IF amplifiers, and second detector are operating and are at least approximately aligned. If the meter does not fall to zero as the generator is tuned to the carrier frequency, the discriminator or ratio detector is out of adjustment.

If no meter deflection is obtained, even with maximum signal generator output and with the meter set to its lowest DC range, the technician should determine (with the same equipment) whether the second detector, IF, or front end is out of operation. To do this, transfer the generator's hot lead to the plate of the last IF amplifier tube (use an isolating capacitor to protect the signal generator from B plus if no isolator is contained in the signal generator output) and set the generator to the intermediate frequency, usually 10.7 Mc. Leave the meter connected to the detector output, as before. If the discriminator or ratio detector is operating, the meter will read zero when the generator is set exactly to the intermediate frequency and it will be deflected positively and negatively as the generator is tuned to each side of the IF. If the detector is found to be operating, transfer the signal generator output to the plate of the first IF amplifier and repeat the test. If operation is verified at this point, transfer the generator output to the plate of the 1st detector (detector section of the converter stage) in the front end. This stage-by-stage check serves to identify a dead stage.

Detector Alignment

FM Detector Alignment; Discriminator: The following instruments are required for this adjustment: (1) a frequency modulated signal generator covering the receiver intermediate frequency and having a sweep width of at least 300 kc. and sync signal voltage output. (2) A good oscilloscope. (3) An unmodulated signal generator (for providing marker pips on the detector response-curve pattern) tunable from several megacycles below to several megacycles above the intermediate frequency. The instruments are connected to the FM second detector stage in the manner shown in Figure 2.

Switch on the receiver and allow at least 15 minutes for warmup. (1) Set the oscilloscope VERTICAL GAIN control at about half maximum. (2) Set the HORIZONTAL GAIN control at about one-fourth maximum. (3) Set the INTERNAL SWEEP to 60 or 120 cycles, corresponding to the sync voltage supplied by the sweep generator. (4) Set the oscilloscope SYNC AMPLITUDE control to about half maximum. (5) Set the oscilloscope SYNC switch to EXTERNAL.

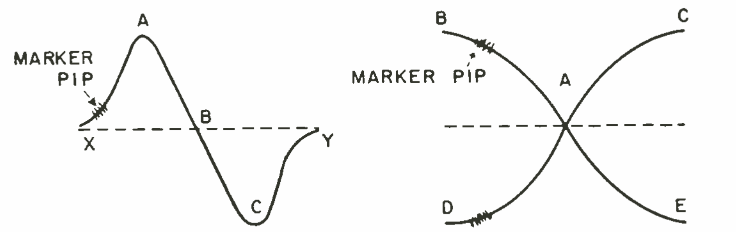
(6) Set the sweep generator to the IF value of the receiver. (7) Set the sweep width to 300 Kc. (8) Set the unmodulated marker generator several megacycles lower than the receiver intermediate frequency, and reduce the output of this generator to zero by turning its attenuator all the way down. (9) If the oscilloscope sweep frequency is set exactly to the generator sweep frequency, a pattern resembling Figure 3A will be seen on the 'scope screen. If the oscilloscope sweep frequency is twice the sweep generator sweep frequency, the pattern will resemble Figure 3B. (10) Adjust the VERTICAL and HORIZONTAL GAIN controls of the oscilloscope for a pattern of a height and width for easy readability. (11) Adjust the INTENSITY, FOCUS, PHASING, SYNC AMPLITUDE, and FREQUENCY controls of the 'scope for a single-lined, sharp, stationary image. (12) Keep the sweep generator output at the lowest value which will give a large, clear pattern. Too much generator output will overload the receiver stages. (13) The observed pattern may not have the symmetry shown in Figure 3. If it does not, adjust trimmer C_1 across the discriminator transformer primary (or the primary tuning slug, if this is a

slug-tuned transformer) for symmetrical height from the zero axis of peaks A and C in Figure 3A, or points B, C, D, and E in Figure 3B. Then adjust trimmer C_2 across the secondary of the discriminator transformer (or the secondary tuning slug, if this is a slug-tuned transformer) to bring points B, X, and Y in Figure 3A (or point A in Figure 3B) in line with the zero axis. (14) The frequency at any point along the detector response curve now may be identified by means of the marker generator. Increase the output of this generator slowly and tune the marker frequency cautiously upward into the region of the receiver intermediate frequency. Note that a pip or wave appears on the curve at some point. Tuning the marker generator moves this pip along the curve to any desired point. (15) Reduce the output of the marker generator until this pip is just barely visible. Too strong a marker signal will distort the detector response curve. (16) The frequency corresponding to any point at which the pip appears may be read directly from the dial of the marker generator.

Ratio Detector: The test equipment required for alignment of a ratio detector is the same as that specified for discriminator alignment. The oscilloscope and signal generator controls are set in the same manner.

Fig. 1A shows a typical ratio detector circuit. (1) Connect the vertical amplifier input terminals of the oscilloscope between points X and ground. (2) Connect the signal generator and marker generator to the grid of the last IF tube, as shown in the discriminator circuit, Fig. 2. (3) Adjust the trimmers or tuning slugs of the ratio detector transformer to give a symmetrical alignment pattern such as is shown in Figure 3.

In general, the ratio detector requires no special attention different from that given the discriminator. The overall action of one stage is the same as the other.



(A) OSCILLOSCOPE SWEEP SET TO GENERATOR SWEEP FREQUENCY

(B) OSCILLOSCOPE SWEEP SET TO TWICE GENERATOR SWEEP FREQUENCY

FIG. 3 -RTM-

Scope traces found in FM alignment under ideal conditions. At (A), scope's sweep frequency equals generator sweep frequency. At (B), scope sweep is double that of the wobbulator.

IF Alignment

IF Amplifier Alignment: (1) Connect the outputs of the sweep signal generator and marker generator to the grid of the last IF Tube. (2) Connect the vertical amplifier input terminals of the oscilloscope across the grid resistor of the first limiter stage. If there is no limiter, connect the 'scope to the ratio detector output at Point X in Figure 1A, and temporarily disconnect capacitor C_x to remove the self-limiting action of the ratio detector. Reconnect the capacitor as soon as the alignment is completed. (3) Connect the sync voltage output of the sweep generator to the EXT SYNC input terminal of the oscilloscope. (4) Set the oscilloscope internal sweep to the same frequency as the sync voltage output of the sweep generator. (5) Set the scope SYNC switch to its EXTERNAL position. (6) Set the SYNC AMPLITUDE control to about half maximum. (7) Set the VERTICAL and HORIZONTAL GAIN controls to half maximum. (8) Set the sweep generator to the IF value of the receiver, and set the generator sweep width to 300 Kc. (9) Advance the sweep generator output slowly, and adjust the oscilloscope controls for a single-lined, clear, stationary pattern. (10) The pattern, which shows the same selectivity characteristics as a broad-tuned amplifier, will have the general appearance of Fig. 4. Note that the bandwidth is measured at the point corresponding to two-thirds of the overall amplitude (h) of the response curve. Adjust the trimmers or slugs of the last IF transformer to give the bandwidth specified by the receiver manufacturer or found in the service manual. (11) When checking bandwidth, the frequency at any point on the curve may be checked by means of a pip set up by the marker generator. (12) Transfer the two signal generator outputs to the grid of the next preceding IF stage and repeat the test procedure, adjusting the IF transformer in the output of that stage. (13) Repeat

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this procedure at each IF grid; and finally transfer the two generator outputs to the grid of the converter tube in the front end, adjusting the trimmers or tuning slugs of the 1st IF transformer. Presence of oscillation will be detected during adjustment as a wave superimposed upon the selectivity pattern. Preserve the ideal response curve (Fig. 4) as nearly as possible. Be on the lookout for trouble, such as loose connections, damaged IF coils or trimmers, or defective loading resistors when checking stage response.

Front-End

Front-End Alignment: Leave the oscilloscope connected to the FM second detector output as outlined in the previous test, but move the output of the sweep generator to the antenna input terminal of the receiver. Use a dummy antenna between the generator and receiver, if required.

(1) Set the sweep generator to some point within the FM band, such as 100 Mc. (2) Set the generator sweep width to 300 Kc. (3) Tune the receiver to the same frequency. (4) Adjust the trimmers or tuning slugs in the RF detector, and oscillator stages in the front end of the receiver for maximum height and proper bandwidth of the response pattern (Fig. 4) seen on the oscilloscope screen. (5) If the oscillator stage has a low-frequency series-padder capacitor, re-tune the generator and receiver to

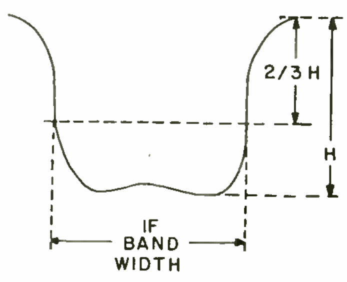

FIG. 4 -RTM-

Ideal response curve to be obtained when aligning FM IF stages.

the low-frequency end of the FM band (88 Mc) and adjust this padder to restore maximum height and proper bandwidth to the selectivity curve seen on the scope screen. (6) Retune the generator and receiver to 100 Mc and repeat the trimmer or slug adjustments at that frequency. (7) Jockey back and forth between the 88- and 100-Mc points until no further touching-up of adjustments is required.

—RTM—

Book-Sized Portable Radio

→ from page 8

exception of television picture tubes. Ever since the development of the handie-talkie, that World War II mircle of size reduction and compactness-engineering, it has been known that much space has been wasted in manufactured radios and other equipment. And with the public clamoring for smaller and smaller sets, together with the development of all types of seven- and nine-pin miniature tubes, not to mention such space-savers as printed circuits, germanium diodes, or the subminiature tubes, it has been found that in many cases a set is just as efficient as a larger prototype, while occupying only one-half or one-third the space of the original.

Miniaturization

Not all of the market for these miniatures is created by simply the novelty appeal of the tiny receivers, however. In portable radios particularly, and also to some extent in home sets, there is a real reason for reduction in size. This reduction, of course, is most valuable in portables, which often must be packed along with a number of other things for travel.

It will probably be not too long before even this tiny personal radio is made to look monstrous beside some newer development. With a little imagination, one can visualize the realization of something closely akin to the "2-way Wrist Radio" of comic strip fame, although that one seems as far from present day developments as a rocket trip to the moon.

—RTM—

AM-FM Tuners For Custom Installation

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audio amplifier, if it is capable of supplying them. The recommendation here is that, even if the plate supply is taken from the amplifier, the AC filament supply should be entirely separate, and the leads should be as short as possible.

To isolate a particularly troublesome case of hum not removed by the standard procedures, the input of the amplifier should be shorted directly, with the tuner lead disconnected, and the volume control set at a normal listening level. To find a hum in the tuner itself, a pair of high-impedance headphones can be connected to the output, with ambient noise at the lowest possible level. If hum is found in the tuner, there are several things that might be expected to be causing it. Bad filter condensers, of course, are a likely possibility, as are shielded braids grounded too often. In this connection, it should be pointed out that an extra, heavy ground connection between the different units of the assembly could cause trouble, through formation of a ground loop. If hum gets considerably worse rather than better, when the heavy braid connection is made between two chassis, it might be well to disconnect the shield, and insulate it, from the male plug connector. Thus, the shield would continue effective, as a shield only, since it is at ground potential, but it does not serve as one side of the circuit. Instead, that function is performed by the heavy connection.

Acoustic Feedback

Acoustic feedback is another item which often causes trouble in custom installations. Customarily, that is, in commercial sets, this is taken care of by the manufacturer's design department; but in assembled setups, the installer must keep it in mind. Two kinds of difficulty in this respect are common: one is feedback through the phono pickup, and the other is the creation of offensive microphonics through vibration of the cabinet. The first and best way of eliminating this is to install the loudspeaker in a separate cabinet, all by itself. That method of assembly has several other advantages, in addition to the prevention of excess vibration in the cabinet containing the tuner, amplifier, and phono units. It provides opportunity for construction of a closed baffle of the correct size and mechanical strength, and it permits placement of the speaker at the place in the room where it will do the most good, rather than necessitating placement in a spot selected simply because there is enough room for the very large piece of furniture that is the usual console set.

Shock Mounting

But if, for one reason or another, it is not possible, or not feasible, to set the speaker in a separate cabinet, then the feedback problem becomes very real. The most direct solution to the difficulty is to shock mount each individual assembly separately, on sponge or foam rubber, or on low-tension springs. Probably the easiest method is to set the units on rubber cushions.

With these few points in mind, it is unlikely that the competent service technician should have any particular trouble in the installation of individualized audio installations.

In the last few years, when some sections of the listening public have turned to first-quality electronic units to build up their own audio systems, the manufacturers have worked to equip their products with standard connectors, and standardized accessories, so that it is now possible for even laymen to do the work by themselves. As it happens, this is not common. It is still primarily the serviceman's job to install and maintain such equipment. And there is very little work more satisfying than to create out of different units, a comprehensive, top-quality music system.

Products for the Trade

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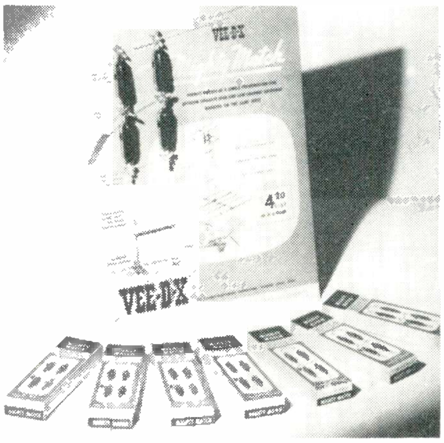
tacts, molded as an integral part of the crystal clear lens. The neon bulb glows when a fuse blows. It can be seen from any angle, giving an immediate indication of trouble.

This new fuseholder is a compact unit that takes very little mounting space on or behind the panel (requires mounting centers and clearance behind the panel of 1⅜").

—RTM—

PLASTIC ANTENNA MATCH

The VEE-D-X "Mightly Match," which permits the use of a single transmission line between separate high and low channel antennas mounted on the same mast, is now being manufactured of high-dielectric plastic.



The availability of new materials has resulted in increased production and improved delivery, it was announced.

—RTM—

AUTOMATIC PIX FOCUS

A new cathode-ray television picture tube developed by the cathode-ray tube division of Allen B. Du Mont Laboratories, Inc., incorporates 100 per cent built-in automatic focus, eliminating

need for a focus coil, focus control or other focusing mechanisms presently used in all existing types of magnetic and high voltage electrostatic cathode-ray television picture tubes, it is claimed.

Design of this new tube effects substantial savings in brass, copper, steel, aluminum and rubber and is in line with the government's request for critical materials conservation.

—RTM—

ROBOT OPERATOR

A new "Robot" operator, used for rotating an antenna, makes only one rpm, then reverses its direction.

In case of iterference, by any object, so that it cannot go through its normal cycle, the friction rollers on the operator slip until the obstructing object is removed. If the obstructing object is not removed in a few seconds an automatic electrical overload cuts out and the operator stops completely.

The Robot operator (Model SMS) offers an automatic power limit for an operation requiring a reversing travel cycle, or intermittent cycle in one direction for any special application.

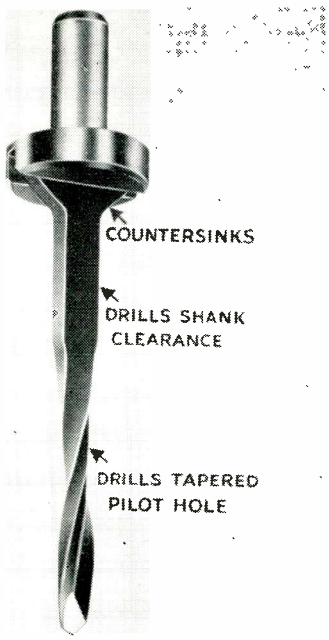
For further information, write to Robot Appliances, Inc., 13165 Prospect Avenue, Dearborn, Michigan.

—RTM—

NEW TWIST DRILL

A really new twist drill has been put on the market. Called "Screw-Mate" because it matches the body shape of the corresponding size wood screw, this 3-in-1 drill will countersink, drill shank clearance, and drill tapered pilot hole, in one operation.

The tapered pilot hole allows even the first threads of a wood screw to do their share of the holding. Formerly, when a straight pilot hole was drilled, only a portion of the screw threads did the work, necessitating the use of longer screws in many cases.



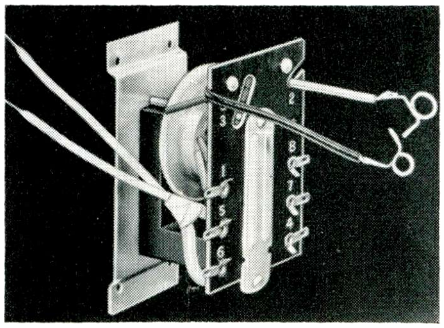
The shoulder on the tool stops the drill at just the right depth, while the size of the drill is slightly smaller than the body of the corresponding wood screw to provide a snug fit. Screw-Mates fit any drill gun, hand drill, or drill press and are available in a variety of sizes. For sizes, literature, and prices, address: D. R. Carner Co., Inc., 106 Hospital St., Providence, R. I.

—RTM—

FLYBACK TRANSFORMER

The RAM new Model X053 flyback transformer, was just released by RAM Electronics, Inc., South Buckhout Street, Irvington-on-Hudson, N. Y.

Pattern-wound and constructed, the X053 generates 16 KV for both regular deflection and electrostatic deflection picture tubes—up to and including the 20″ size. When used with the RAM Y70F10 Cosine Deflection Yoke, the horizontal sweep exceeds the needs for all types of 20 inch tubes. The X053 is built to take up 23,000 volts without breakdown.



At maximum operating voltages, it produces no Barkhausen oscillations, ringing, whistle or corona, the maker states.

—RTM—

NEW ION TRAP

A new Ion Trap called the "E-Zee-On" has been announced by the Indiana Steel Products Company.

The trap possesses a uniform field pattern and can be adjusted in a matter of seconds with one hand. It's a slip-on, grip-snug beam bender made of one piece, permanently magnetized Cunife that cannot be put on backward and requires no manual clamping.

According to the manufacturer, the unit provides a uniform magnetic field pattern, resulting in bright, uniform definition easily attained by sliding it

forward and backward on the tube neck. Because of its uniform weight distribution, it will not jar loose or slip, nor come out of adjustment.

For descriptive folder, write the Indiana Steel Products Co., Valparaiso, Indiana.

—RTM—

VOLT-OHM-MILLIAMMETER

Hickok Electrical Instrument Co., 10634 Dupont Ave., Cleveland, Ohio, has come out with a new volt-ohm-milliammeter, claimed to be the thinnest instrument of its kind. It has a five-inch meter, and a guaranteed unbreakable case.

Battery operated, it provides 20,000 ohms per volt input resistance on DC, and 5,000 ohms per volt on AC. Voltage ranges AC and DC: 2.5, 10, 50, 250, 1,000 and 5,000.

Milliamperes DC: 2.5, 10, 50, 250 and 1,000. Microamperes DC: 0 to 50. Amperes DC: 0 to 10. Ohmage ranges: 0 to 1,000; 0 to 10,000; 0 to 1 meg.; and 0 to 100 meg.

RCA-17GP4

RCA-20GP4

RCA-14GP4

ANOTHER IMPORTANT RCA *Engineering Advance...*

Electrostatic Focusing

for television picture tubes

... and how it will benefit you

Once again, RCA engineering has made an important technical advance that benefits the entire industry—by developing an improved method of electrostatic focusing. Electrostatic focusing has now been incorporated in three new RCA rectangular kinescopes.

The new tubes require no focusing coil or focusing magnet. They provide pictures of the same high quality obtained from magnetic-focus types.

It will be a while before you as a dealer or a serviceman will have occasion to stock these electrostatic-focus kinescopes. But . . . because these tubes permit important savings in critical materials, manufacturers can produce more television receivers upon which your future business will depend.

In the meantime, RCA is producing sufficient quantities of its magnetic-focus kinescopes to meet your current replacement requirements.

Keep informed... stay in touch with your RCA Tube Distributor

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ELECTRON TUBES **HARRISON, N. J.**