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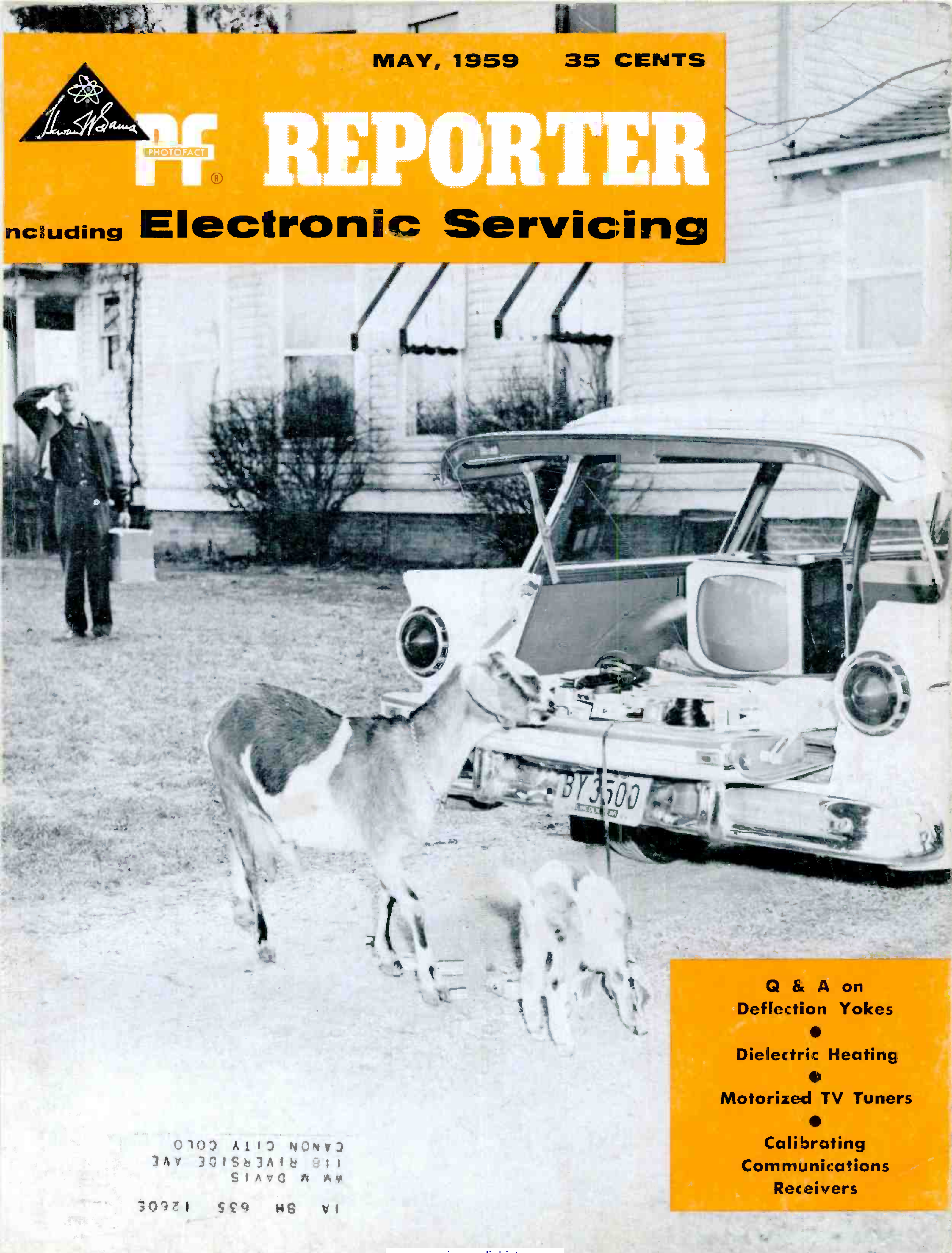
PF REPORTER

PHOTOFACT

including **Electronic Servicing**



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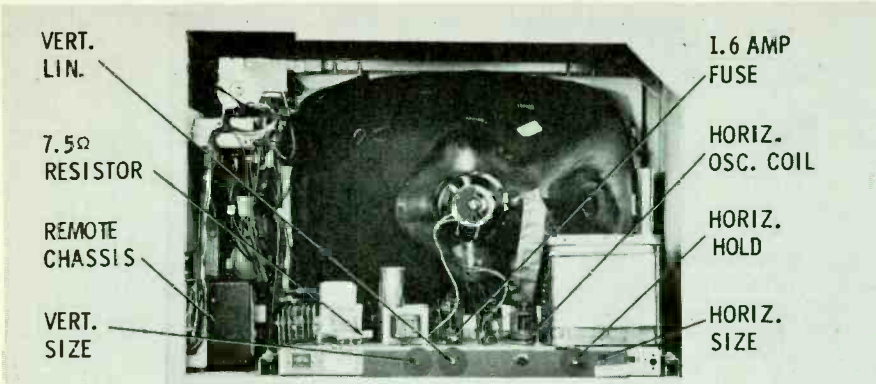
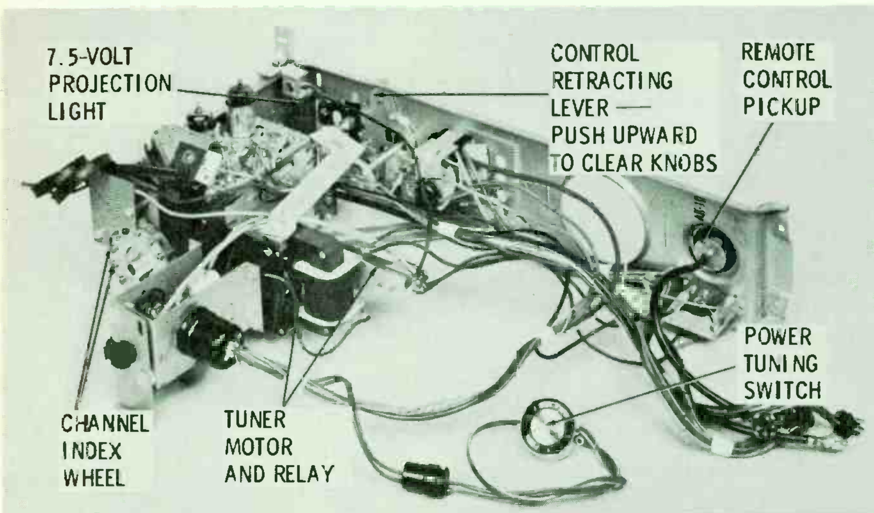
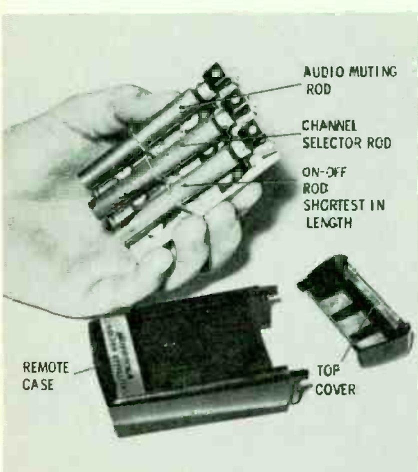
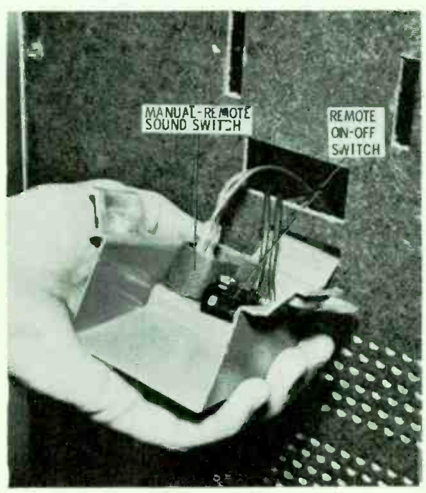
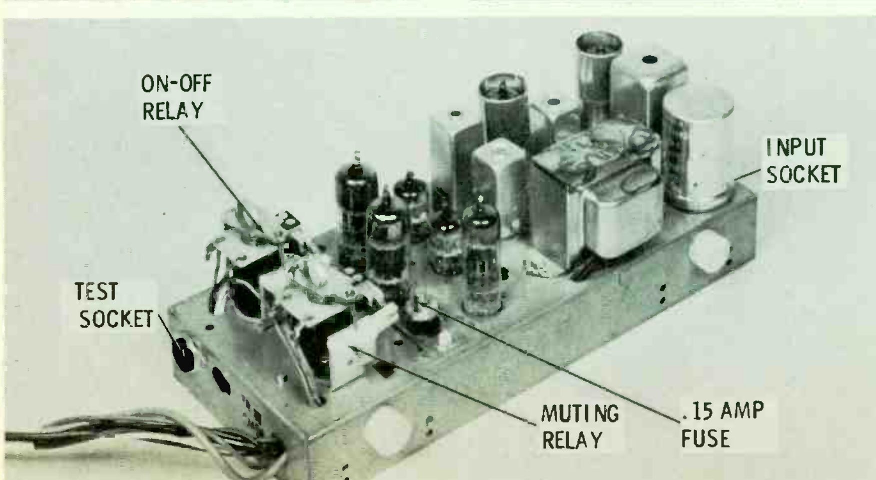
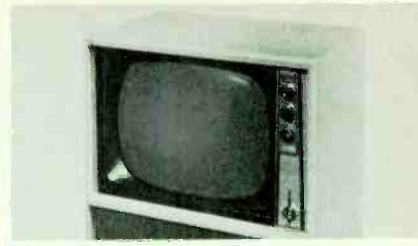












Motorola Model A21K106B
Chassis WTS-553

This late-model console features a 21" 90° picture tube, power *Insta-Matic* tuning, and remote control. The safety glass comes out the front by removing five Phillips-head screws holding the top retaining strip.

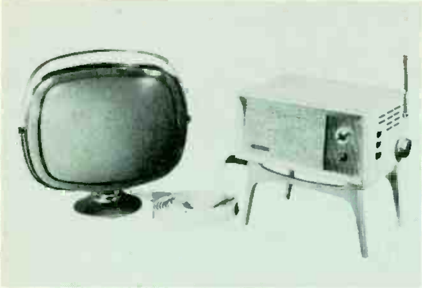
The main TV chassis is a fairly narrow horizontal style powered by two 350-ma selenium rectifiers. It employs 600-ma series-string tubes, using several new types which include an XL84/8BQ5 in the audio output stage, a 12AF3 damper, and a 3A3 rectifier in the high-voltage supply. The 1.6-amp fuse pointed out in the photo is a slow-blow LC type connected in the B+ line. In series with this is a 7.5-ohm surge-limiting resistor soldered in position on top of the chassis near the selenium rectifiers. Forward from this point, behind the seleniums, you'll find another resistor, which is a thermal unit that controls warm-up of the tube filaments. This component is rated at 200 ohms cold and 6 ohms hot.

The front control panel, tuner, and power mechanism are all mounted together. When removing this assembly, remember to pull the bottom of the bracket to the rear first, in order to clear the vertical-hold and brightness control knobs. Next, move it toward the right to clear the front flange, and then lift it out.

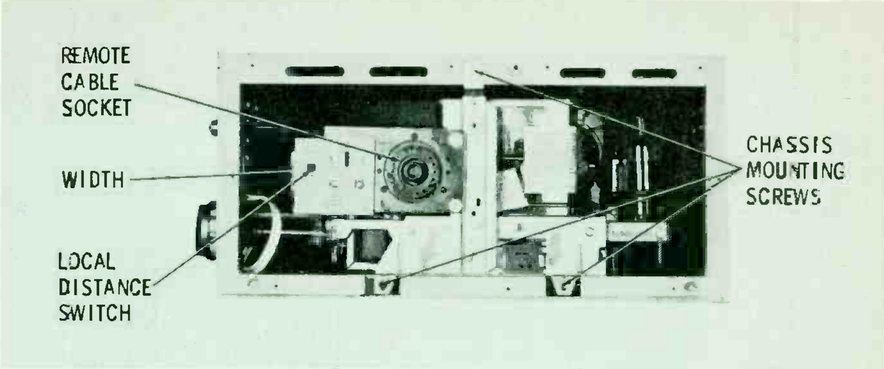
The wireless remote system operates on the ultrasonic wave principle. The waves are produced by tuning rods, which are struck by spring-loaded percussion hammers in the remote hand unit. The waves are then picked up and detected by a separate receiver chassis. The hand unit or transmitter is strictly mechanical and, outside of an occasional adjustment, should require little service.

On the back cover of the set, you'll find a plastic holder for the hand transmitter. This holster-like device snaps into mounting slots on the back and contains two switches. The remote/on-off switch automatically changes set operation from manual to remote or from remote to manual whenever the transmitter is removed or replaced. The other switch is a two-position slide-type that connects or disconnects the remote sound-muting circuit.

The separate receiver chassis for the remote-control system mounts along one side of the cabinet just to the left of the main TV chassis. Making use of three 6CX8's, two 6AL5's, one 12BY7A, and a 6X4 power rectifier, the chassis is shown here with relay cover removed. The test socket at one end affords several convenient contact points which are used in the alignment of the system's tuned stages.

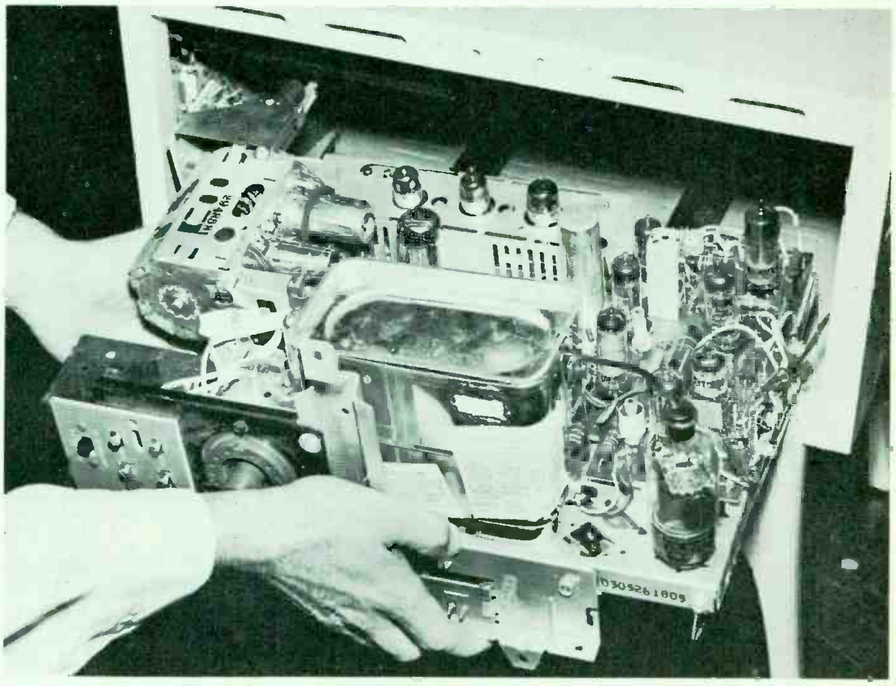


Philco Model UG-4710L Chassis 9L38U

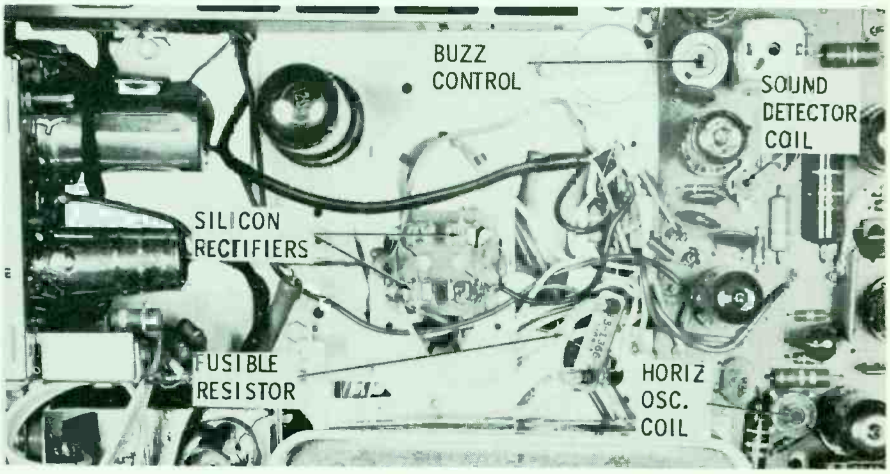


This unusual VHF-UHF model with portable picture tube is part of the new *Predicta* line. The 21" 110° short-neck CRT is mounted in a remote assembly and connects to the receiver chassis by a 25' multiconductor cable.

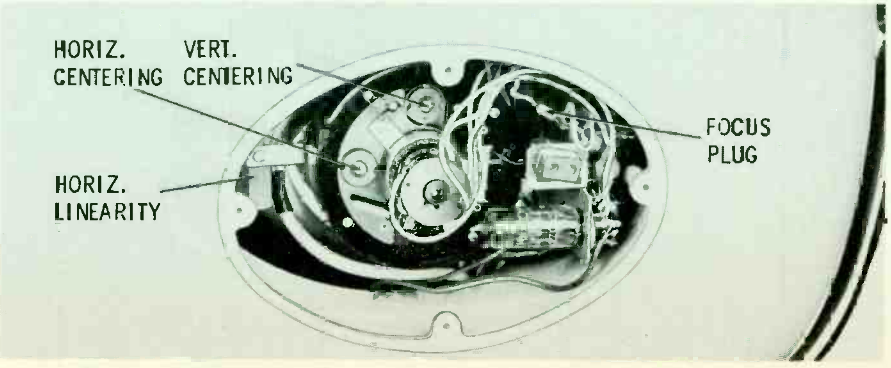
The "hot" chassis is laid out horizontally in the close quarters of a rectangular cabinet. The only service adjustments on the back of the set are the local-distance switch and the width control. Brightness, vertical hold, and horizontal hold are positioned on the side along with the UHF tuning knob. You might keep in mind that vertical linearity, height, and horizontal range controls are adjustable through hollow shafts of these side controls with the use of a thin screwdriver.



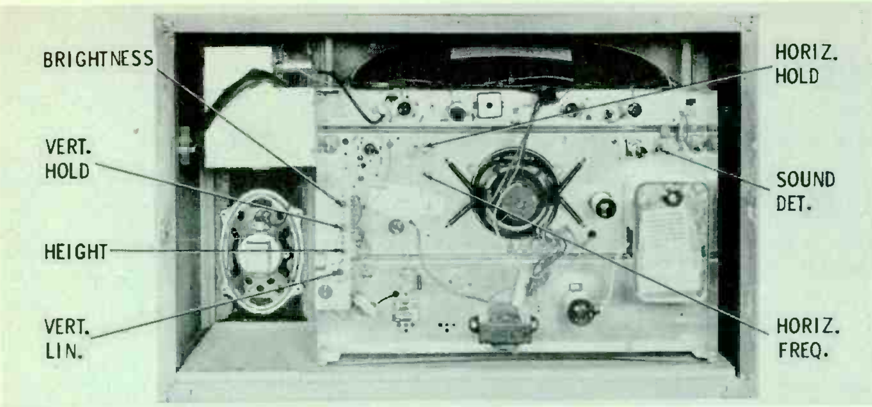
To substitute tubes in this set, you'll find it necessary to at least partially remove the chassis. It slides out as shown by extending the built-in antenna and removing the three mounting screws from the back. If you intend to pull the unit completely, remember to disconnect the speaker leads from the printed board on the right side of the chassis. For a house call on this set, you might make sure your tube caddy is equipped with a 9BR7 (sync and AFC), 10DE7 (vertical oscillator - output), and a 12D4GT (damper).

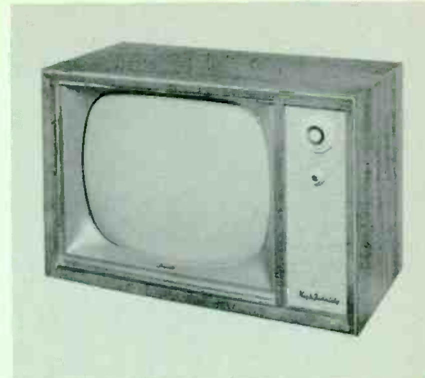


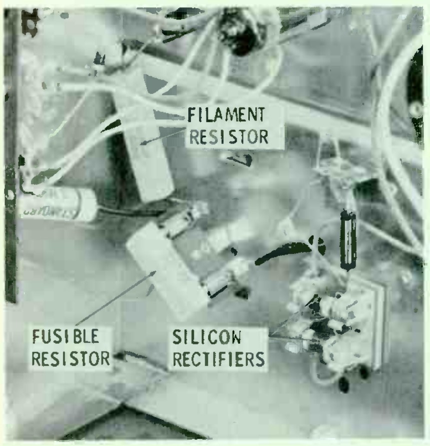
Two silicon rectifiers and a plug-in fusible resistor are located on top of the chassis in front of the high-voltage cage. The 500-ma silicons are connected in a voltage-doubler supply, while the 5.6-ohm resistor protects the input circuit. A special thermistor unit, rated at 400 ohms cold and 11 ohms hot, is connected in series with the filament string. This component is located under the chassis and is therefore not shown in the photo.

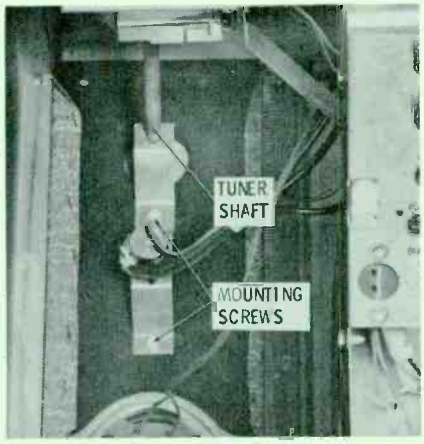


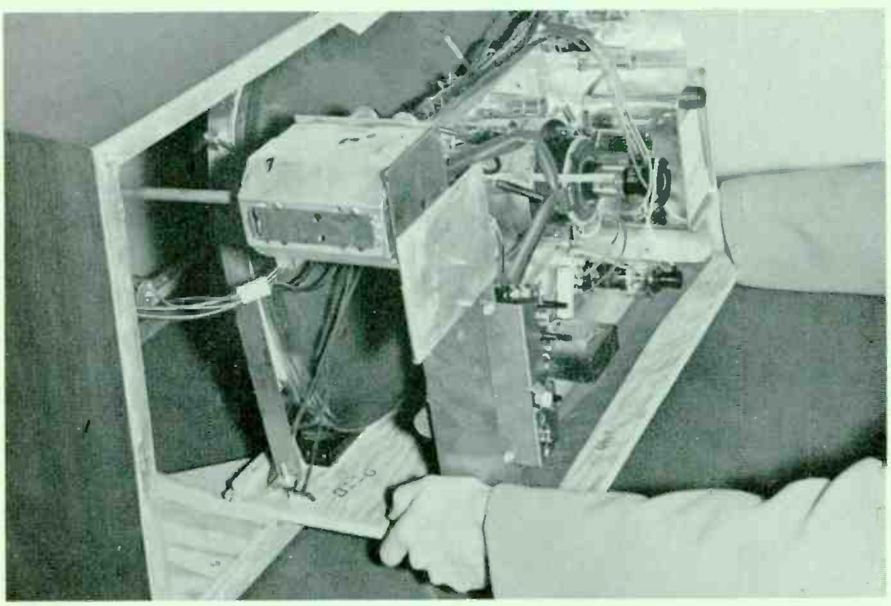
Removing the small cover from the rear of the picture-tube assembly, you'll find a video-amplifier stage, horizontal-linearity adjustment, focus connection, and centering controls as pictured. The 3CB6 video-amplifier circuit, constructed on a small printed-wiring panel, is used in the remote assembly for impedance matching and to overcome losses introduced by the remote cable. The flexible cable, which connects to the base of the CRT stand, has 15 conductors including a high-voltage lead having a potential of approximately 15KV. One side of the AC line is also connected through the remote cable to an interlock on the rear cover of the picture-tube assembly. To operate the receiver with the cover removed, don't forget to jumper this interlock plug.











Sonora Model LB-2159

Front controls of this new lowboy include only VHF tuning, contrast, and volume with on-off switch. The transformerless chassis drives a 21CQP4 picture tube and a 5" by 9" oval speaker.

Components are well spread out on the vertically-mounted chassis, with all tubes except the 1K3 high-voltage rectifier in immediate reach. Brightness, vertical-hold, height, and vertical-linearity controls are grouped on a metal strip with the interlock connection. The remaining service adjustments are located as shown in the rear cabinet photo. The 600-ma series-string tube complement is as follows:

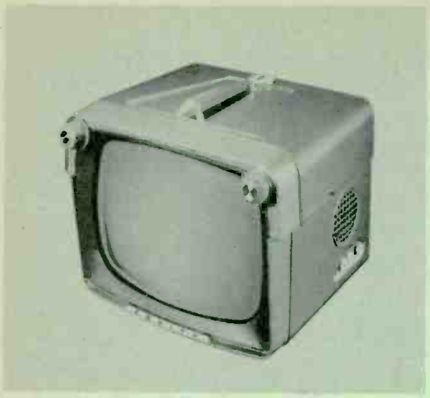
2BN4—RF amp.
5CG8—conv.
5AV8—IF/horiz. disch.
5EA8—IF/horiz. osc.
6AW8—video/sync sep.
6AW8—sound IF/AF out
3DT6—sound det.
10DE7—vert. osc./out
3AL5—horiz. AFC
25DN6—horiz. out
19AU4—damper
1K3—HV rect.

On the lower-left section of the chassis pan, you'll find a pair of plug-in silicon rectifiers for the low-voltage supply, as well as two large wire-wound resistors. The fusible unit is a plug-in type having a value of 7.5 ohms, while the 10-watt filament job is rated at 27 ohms.

The dual volume - contrast control mounts on a bracket directly above the speaker as shown. The bracket, which also acts as a guide for the tuner shaft, must be removed when pulling the chassis. To adjust the local oscillator for each channel, remove the tuner knobs and use an alignment tool at least 10" long to reach the slugs from the front.

The chassis and picture tube mount on a plywood base which may be removed from the back of the cabinet as shown. To free the base, remove three bottom bolts and the two screws holding the front control bracket. Pull off the front knobs, remove the antenna strip, and unsolder the speaker leads.

If it becomes necessary to clean the safety glass and screen on this set, the glass can be removed from the front by taking off the top trim strip. After removing the four Phillips-head screws securing the strip, tilt the cabinet forward while holding the glass and then lift it up and out. Make sure that the lower strip is in its proper position before replacing the glass.



Zenith Model C1715L
Chassis 16C20

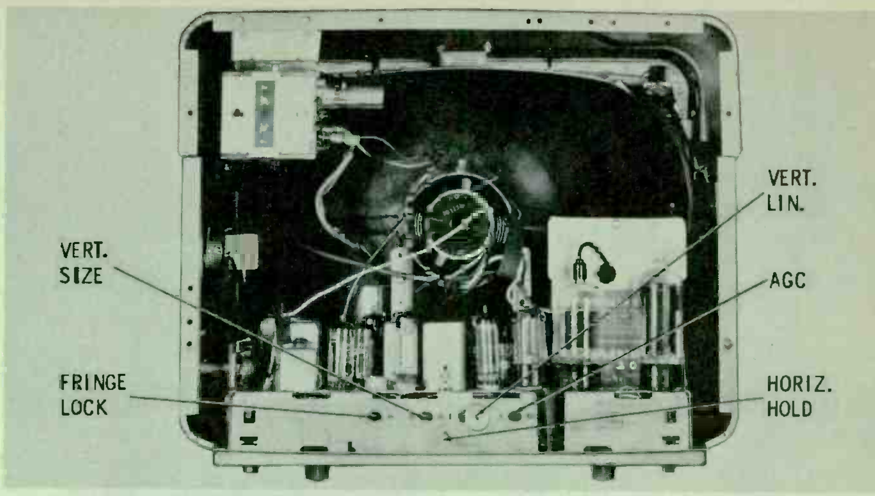
A 17CRP4 90° picture tube and a 12-position bandswitch-type VHF tuner are incorporated in this metal cabinet portable. The front operating knob in the upper-left corner is a volume control with push-pull power switch, and the dial in the opposite corner is for channel selection and fine tuning. Controls on the side of the cabinet directly below the speaker grille include vertical hold, brightness, and contrast.

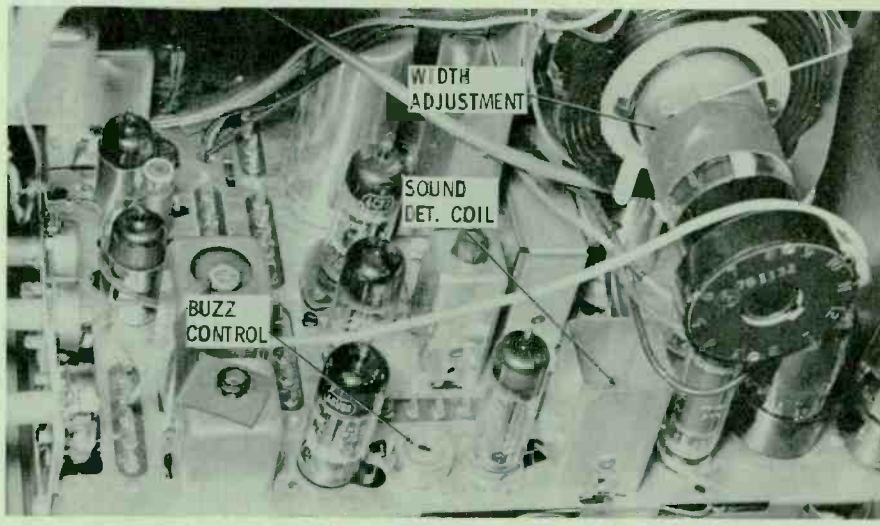
The horizontally-mounted chassis is conventionally wired and powered through a transformer. The tuner, employing a 6BK7B RF amplifier and 6U8A converter, mounts separately at the top of the cabinet. Most of the service adjustments are positioned on the rear of the chassis as shown. after adjusting AGC, the FRINGE LOCK should be set for the most stable synchronization possible. The horizontal-hold control is a coil adjustment with stops to limit rotation of the slug. To set frequency, remove the control knob and position the slug so that horizontal sync is not disrupted when switching from one channel to another. After adjustment, replace the knob with its pointer centered between the two stops.

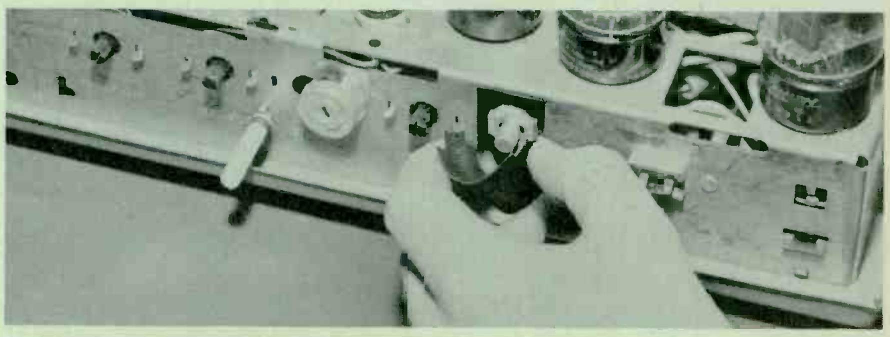
On the top rear edge of the chassis, you'll find two more service adjustments —a buzz control and sound-detector coil. Raster width is determined by the position of a metal sleeve on the neck of the picture tube. The sleeve is held in position by a strip of tape and grounded to the yoke support bracket by a piece of spring wire. Width is varied by moving the sleeve in and out of the yoke windings.

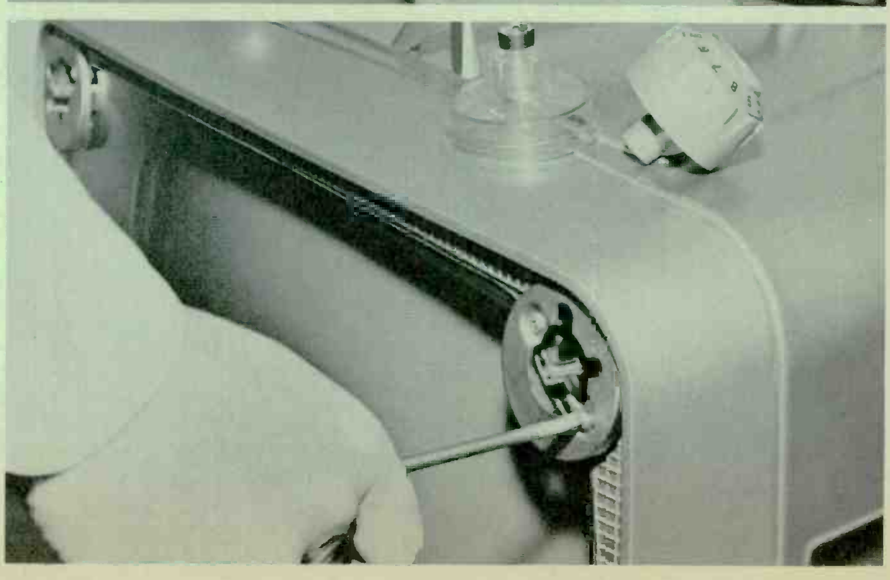
On the back of the chassis, you'll also find a slow-blow fuse covered by a small bowed piece of fish paper. The cover is easily removed by pressing the paper together and pulling it from the chassis cutout. Although the fuse is positioned close to the flyback section, it is electrically in the main B+ line and is rated at 700 ma. Incidentally, the latest tube types employed in this chassis include a 6CY7 vertical oscillator-output and a 6EA8 horizontal AFC-oscillator.

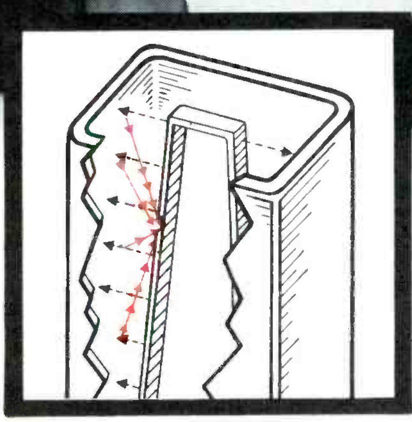
The safety glass on this portable is removed by taking off the front push-on type knobs and removing the Phillips-head screws as shown. After removing the two metal retainers, tilt the glass forward at the top, then lift it up and out.











Back emission

MAJOR CAUSE OF POWER RECTIFIER FAILURES

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NEXT MONTH

Keeping Posted on TV Tubes
Here's some "aspirin" for your tube-stock headaches. In addition to a chart of the 64 rarest tube types, naming the exact TV chassis where each one is found, this feature will clear up some of the confusion surrounding the many different types of 110° vertical output tubes, IF pentodes, and dampers now in use.

Bench Servicing New Sets
Part 2 of this series, dealing with Motorola Chassis TS-552, will describe what it's like to dismantle and service a modern-type horizontal chassis with separately-mounted tuner and operating controls.

Air-Conditioner Maintenance
An easy-to-understand explanation of the mechanics involved in cooling and dehumidifying, plus considerations for the proper selection and installation of "packaged" units.

PF REPORTER

Including Electronic Servicing

Volume 9, No. 5 — MAY, 1959

CONTENTS

ABOUT THE COVER

"Shoo nanny, you're eating my stock in trade — and the nearest distributor is 40 miles away!" Unless you're overly fond of goat's milk, we hope you are never confronted with this situation — else your customers may well wonder who really is the "goat."

USE HANDY CARD AT BACK TO ENTER YOUR SUBSCRIPTION

Letters to the EDITOR

Dear Editor:

The item in *Troubleshooter* (March issue) about getting a shock from the cabinet of a Motorola set reminded me of a similar case I saw one day while over at a friend's shop. We finally ran the trouble down to the fact that a new picture tube had been installed and the insulation left out so that the outer aquadag coating was grounded to the frame.

CHARLES SWAYNE

Davenport, Iowa

A set delivered in this condition CAN be the cause of a fatal accident. A word to the wise . . . —Ed.

Dear Editor:

I've been waiting to see if you were going to publish a *Subject Reference Index* for 1958 as you did in past years. I keep all your magazines for refence, and the indexes help me find the solution to many a service problem.

If I missed your notice of the new Index, and you have one ready, please forward me a copy.

A. DE QUINZIO

Brooklyn, N. Y.

Your free copy of the 1958 Index *is on its way. If any of you other readers have missed out on this offer, just drop us a card.—Ed.*

Dear Editor:

Would it be possible for me to obtain *two* copies of the *Tube Substitution Guide* which you reprinted from last summer's article. The copy I have has been glued together, wet on, stomped on, walked over, taped, torn, pasted, cut, and twice retrieved from the washing machine—in general, used and misused. The only objection I have to this *Guide* in its present condition is that I can no longer read it.

MITCHELL UNION

Orangeburg, S. C.

Coming up—two fresh new copies of the Guide and a Purple Heart for your old one.—Ed.

Dear Editor:

I was just reading about Mr. Albert W. Corbin's problem with gym acoustics (*Troubleshooter*, March) and would like to pass on the solution we used for a similar problem.

When our local National Guard armory was completed several years ago, the same problem existed—large room, concrete floor, high ceiling, and lots of windows. The Guard Company solved the problem to a great degree by suspending opened parachute canopies a few feet below the ceiling. I have attended several meetings in this armory, and the acoustics are good. Before the parachutes were put up, the sergeant in charge of the place told me that they could hardly use it for classroom instruction because of the echoes.

Parachutes probably wouldn't be practical in Mr. Corbin's case, but he might be able to use some similar type of material that would do just as well.

WILLIAM L. RUTLAND

Americus, Ga.

Just don't go making any practice "jumps," Bill. We wouldn't want to lose a reader because his chute didn't work. —Ed.

Dear Editor:

PF REPORTER is the best in the field, but the lack of articles on electric organs should be remedied. How about a series on all kinds available? One per month would be valuable. 30% of my business for the last three months has been in this field.

ROBERT RICHARDSON

Baldwin Park, Calif.

Hang on, Bob! We're trying to squeeze some appropriate coverage in the July issue.—Ed.

Dear Editor:

I thought your "Operating a Scope" article (October, 1958) was excellent and clipped it out for my file. It was far more concise than any scope manufacturer's instruction manual I have seen.

Those of your critics who complain about such articles being too simple haven't got the inexperienced younger generation at heart. Many students purchase your magazine for reference and for the practical data which doesn't appear in textbooks.

I do have one grievance, and that's about your article format. The way some other magazines assemble their advertising (all in the front and back sections) makes sense. Should anyone care to save some of the subject matter, he can easily remove it without including a lot of irrelevant material. People like myself, who like to save good reference material, would appreciate your starting all articles on right-hand pages and continuing on consecutive pages in regular book fashion.

STANLEY ANDERSON

West Islip, N. Y.

Thanks for the bouquets—and "ouch" for the brickbat.

You'll have to admit we've improved, Stan. The added 8-page section up front contains the most "clipped" data ever published. Also, many articles are presented on consecutive pages; a very minimum begin in front and continue in the back.—Ed.

Dear Editor:

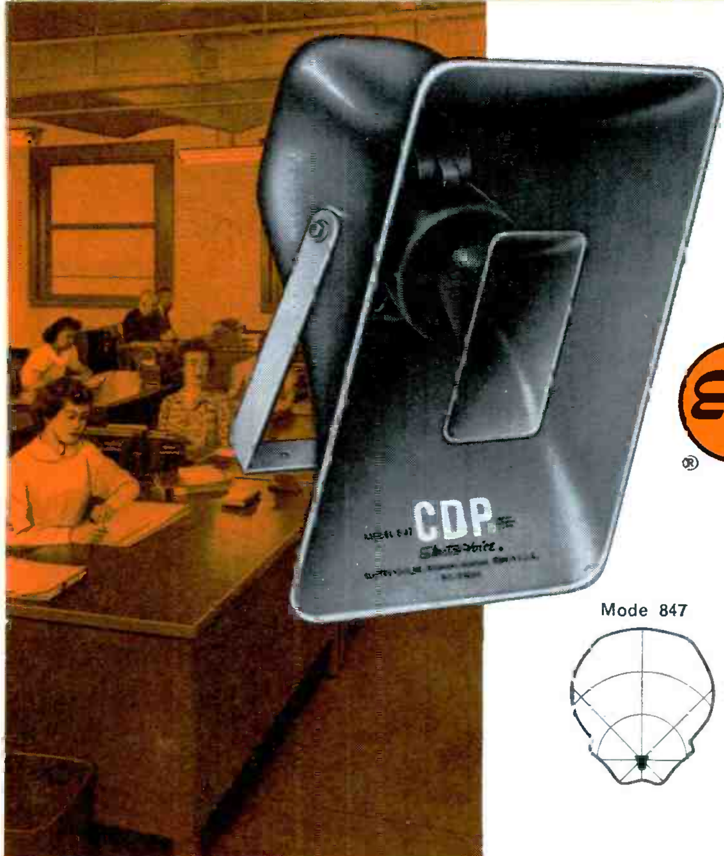
Was pleased to note that your January cover featured a Volkswagon service truck. As the old says goes, "Great minds run, etc." In the contest we are currently sponsoring, grand prize is a Volkswagon truck equipped with 117-volt generator and Jackson test equipment, ready and waiting for the serviceman who best describes why he likes our products.

HENRY WORKMAN

President

Workman TV, Inc.

Wow! Just for writing 10 words! Better get your thinking caps on, you guys. Your distributor should have the details. —Ed.



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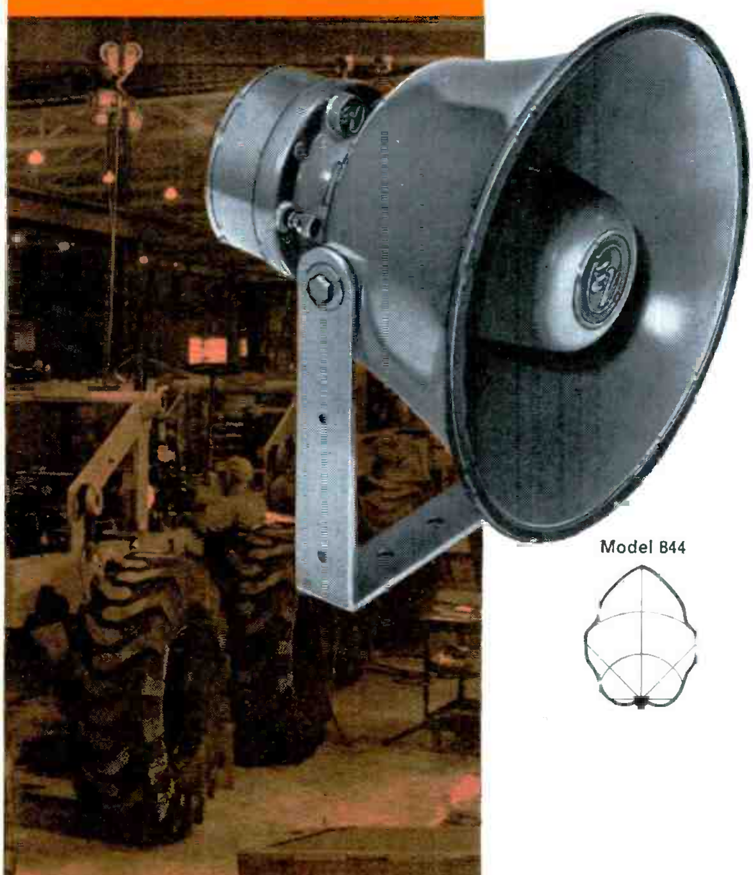

Model 847 25-watt CDP. Has two coaxially-mounted horns working from opposite sides of a single diaphragm. Special edgewise-wound voice coil provides 18% greater efficiency. Wide-range response: 250-10,000 cps. Sound pressure level: 114 db. Dispersion: 60° x 120°. Imp.: 16 ohms. Indestructible fiberglass horn. Size: 11¾" x 7¾" x 10¼" deep. Net wt. 6½ lbs.
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Model 844

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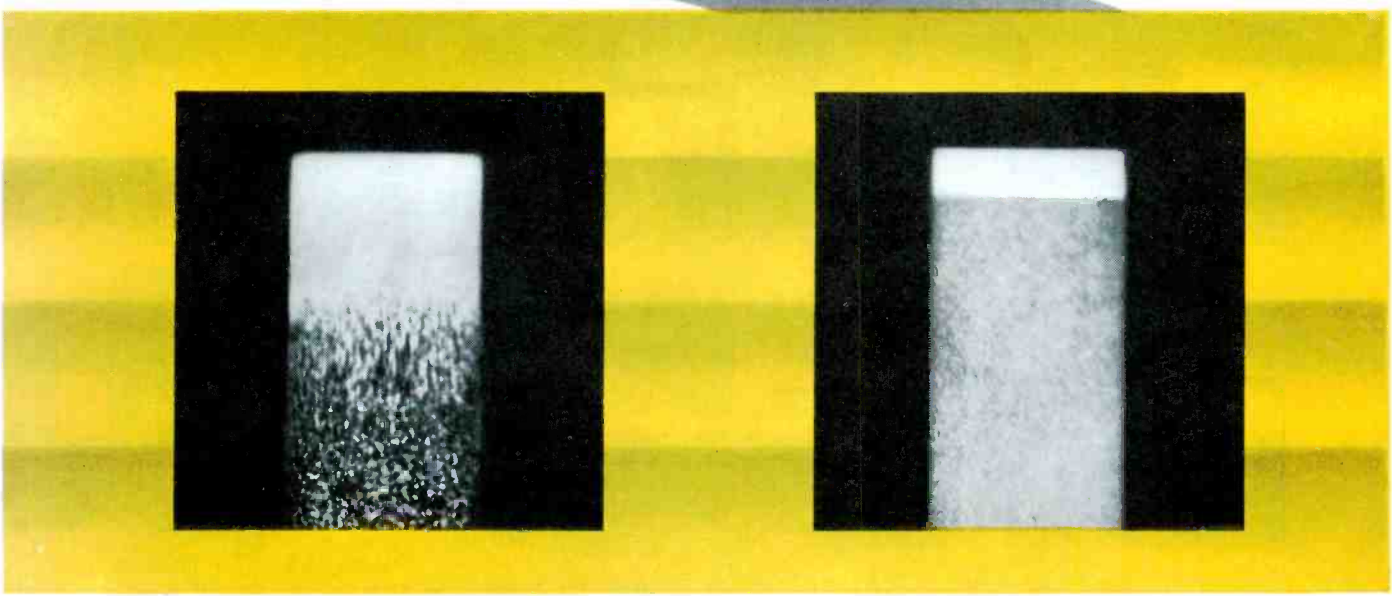

Inherent physical superiority of Sylvania's exclusive Sarong cathode, right, over a conventional cathode, left, is evident in this photomicrograph comparison. The texture, thickness, sharp coating edges and overall uniformity of Sarong represent major improvements in the heart of the electron tube never before achieved in mass production.

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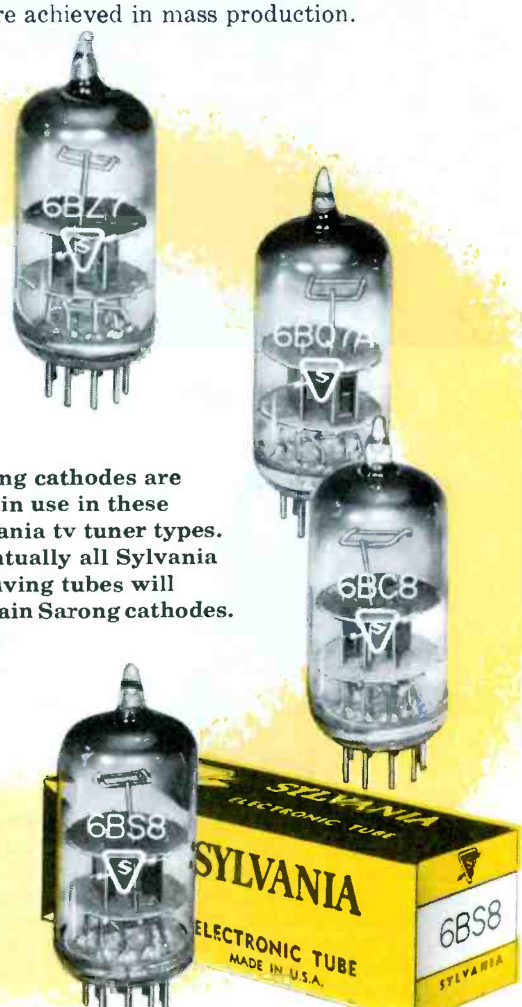

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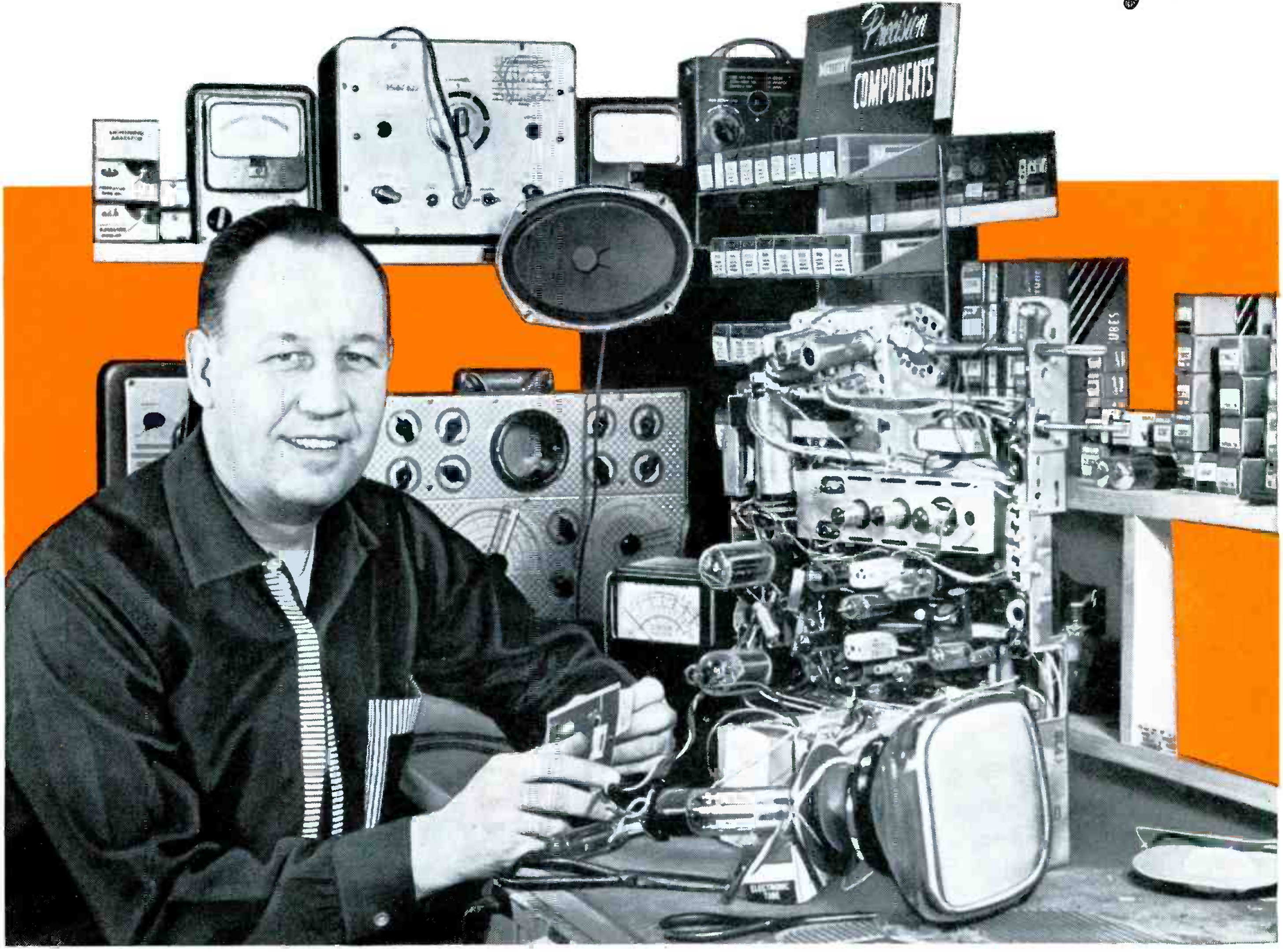

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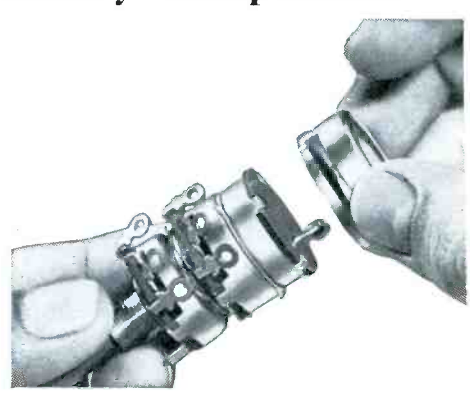

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Shop Talk

MILTON S. KIVER

Author of . . .
How to Understand and Use TV Test Instruments and Analyzing and Tracing TV Circuits

The growth and acceptance of hi-fi is further emphasized by the ever-increasing number of FM (many are AM-FM) tuners and receivers making their appearance these days. With more of these sets in circulation, the need for their repair is correspondingly greater. A study of the similarities and differences between these units and the conventional AM radio will prepare you to meet the challenge and share in the reward.

Of course, a frequency-modulated signal is certainly quite different than an amplitude-modulated signal —it is produced differently, it conveys information differently, and the modulation is recovered differently. However, the serviceman is not so much concerned with these variations as he is with the differences in receivers. Here he gets a decided break—the only stages which are different are the detector and the limiters.

In all other respects, the two types of receivers are essentially comparable. Before you readers jump down my throat for this statement, let me hasten to add that I haven't forgotten the higher operating frequency and wider bandwidth of the RF and IF stages in an FM receiver. From an operational point of view, these sections in both types of receivers function in a similar fashion.

Once you place the FM receiver in this light, you begin to see that many of the same servicing techniques should surely apply to both systems. For example, take signal tracing; a signal is injected into the circuit, and its effect on the loudspeaker is noted. If an appropriate sound is heard, the signal is injected at a prior stage; i.e., one farther away from the loudspeaker. By gradually working from loudspeaker to antenna, you will isolate any stage through which the signal cannot pass—and you will do it in relatively short order.

Will this system work in FM receivers? Absolutely! Furthermore—and this may come as a surprise to many of you—exactly the same signals may be employed in comparable sections of both types of receivers.

For example, we would require an amplitude-modulated signal in the IF range (455 kc) for testing the IF section in an AM receiver. In the IF system of an FM receiver, we can use an *amplitude-modulated* signal operating at 10.7 mc. Does this sound strange? Maybe it does, but if you inject such a signal and keep its level low enough so that its amplitude is not smoothed out in the limiter stages preceding the FM detector, you will find that an audio note will be heard from the loudspeaker. This definitely signifies that the AM signal has reached the FM detector, been demodulated, and then passed through the audio system to the loudspeaker.

This action can take place because no FM detector now in use is completely immune to amplitude modulation. In fact, Foster-Seeley discriminators are inherently sensitive to amplitude modulation, and it is because of this characteristic that one or more limiter stages are always used just ahead of it. The purpose of the limiter is to remove any amplitude modulation which may exist in the received FM signal. When the signal is not strong enough to drive the limiter to saturation, noise and other distortion is passed, and consequently heard from the loudspeaker.

A gated-beam FM detector, using either a 6BN6 or a 6DT6 tube, is also sensitive to amplitude-modulated signals which are too weak to bring the limiting action of the tube fully into play. All that remains, then, is the ratio detector, and this circuit owes much of its popularity to the fact that it is more immune to amplitude modulation than Foster-Seeley discriminators. A ratio detector is rarely preceded by a limiter stage; however, this detector requires perfect alignment and circuit balance to provide optimum rejection of all amplitude-modulation. Of course, this happy state is very seldom encountered. Here again, an AM test signal will produce an audible output from the loudspeaker.

Finally, what is true of the IF stages is also true of the RF stage. AM signals of the proper frequency can be used for signal-injection testing in RF stages. Thus, all you require to check an FM receiver is an audio signal, AM signals of proper frequency for the IF and RF stages, and a VTVM or 20,000-ohms/volt VOM. If the signal output of an FM receiver is weak, distorted, or absent, start at the stage closest to the loudspeaker with an audio signal. If application of this signal at the control grid of the audio-output stage produces a clear sound from the loudspeaker, shift the signal to the preceding audio-amplifier grid. Do this for each stage in the audio system.

If no trouble is found, move back to the IF section and employ the same technique. Start at the control grid of the stage just ahead of the FM detector. A frequency of 10.7 mc is almost universally employed for the intermediate frequency, so an AM signal at this frequency is required. If the signal generator does not go as high as 10.7 mc, try a subharmonic. Use the closest subharmonic you can—5.35 mc, for instance.

With the modulation on, slowly raise the signal level. If the signal can pass through the IF stage and the detector, it will be heard in the speaker. If no sound is heard, check voltages and resistances in both stages.

Work your way back through the IF system, adjusting the output from the signal generator until an audible output is obtained from the speaker.

• *Please turn to page 47*

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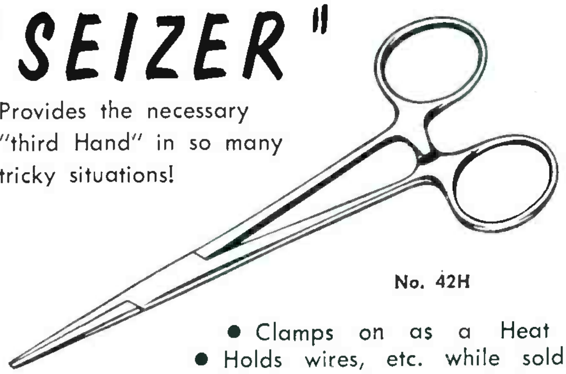

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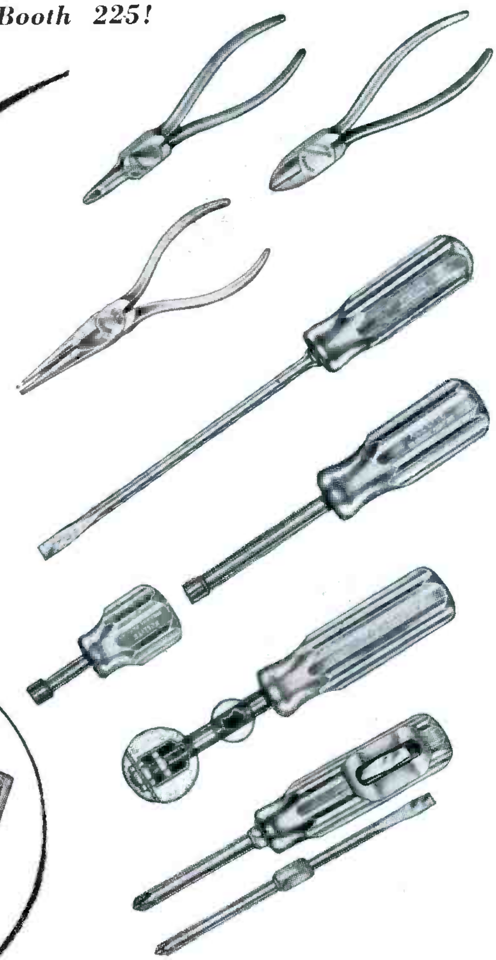

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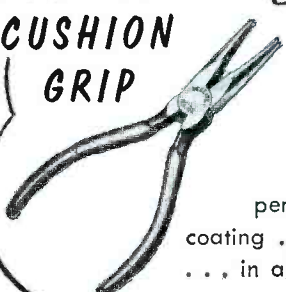

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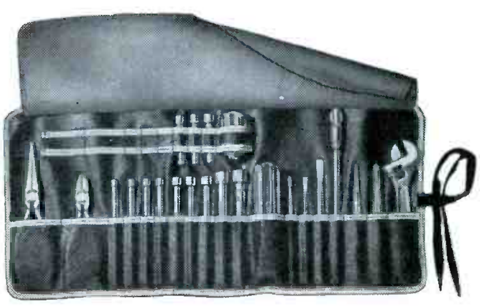

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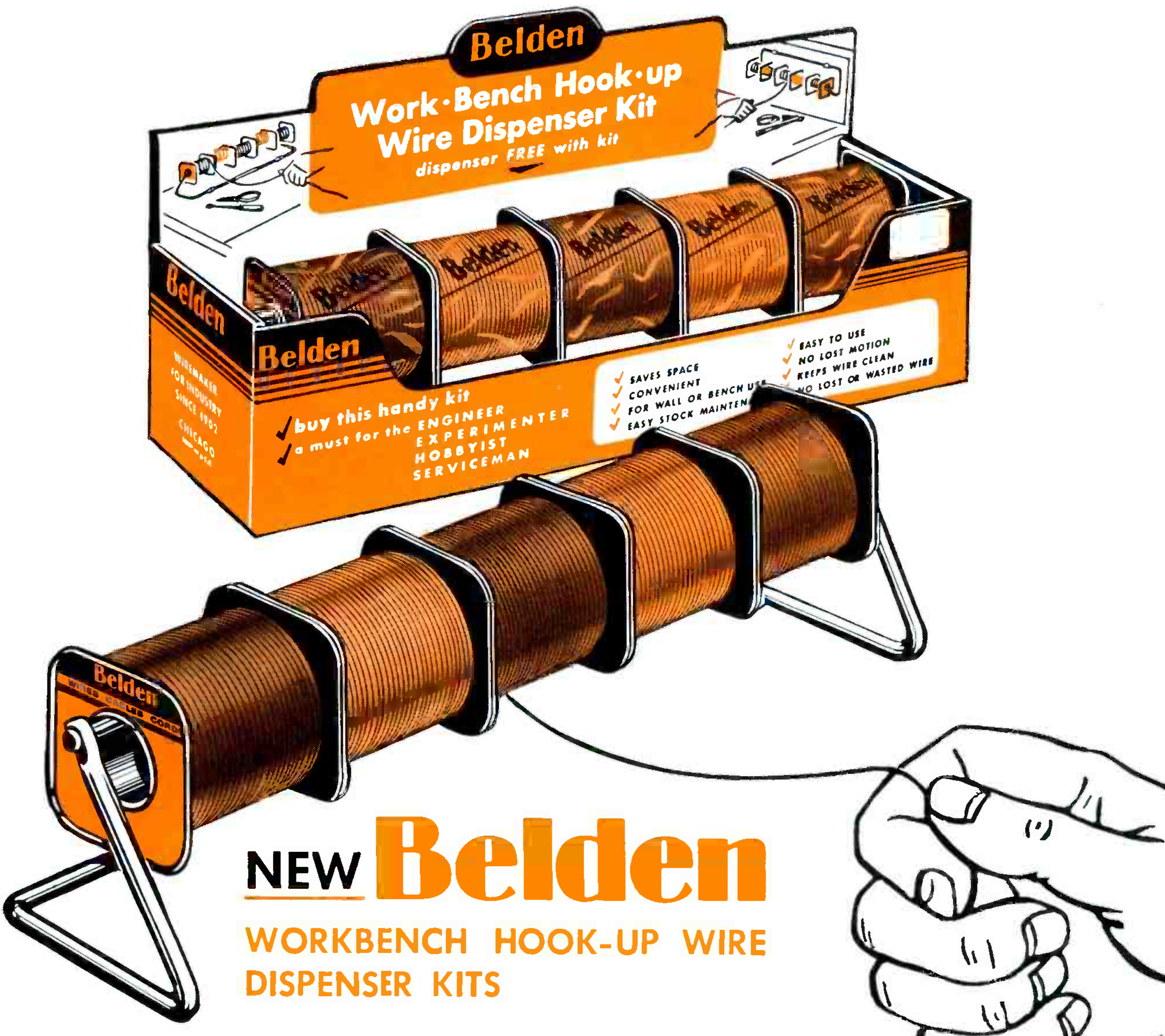

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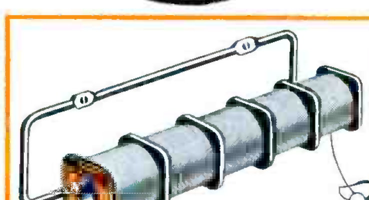

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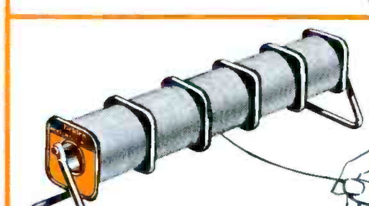

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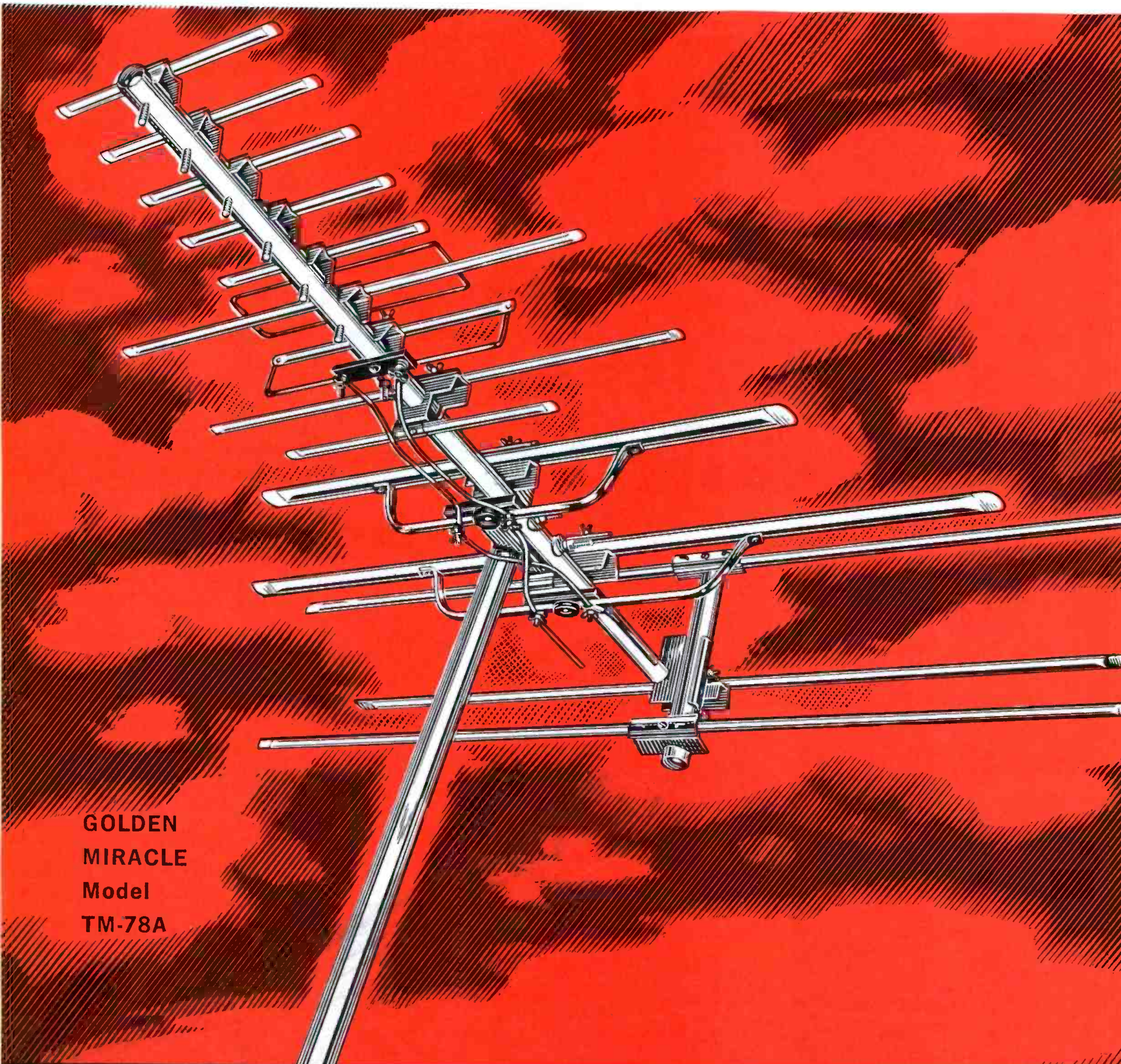

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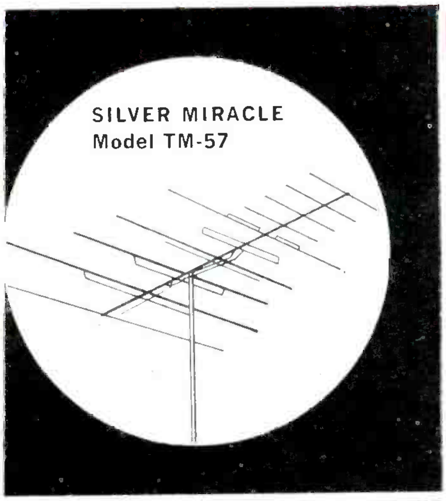

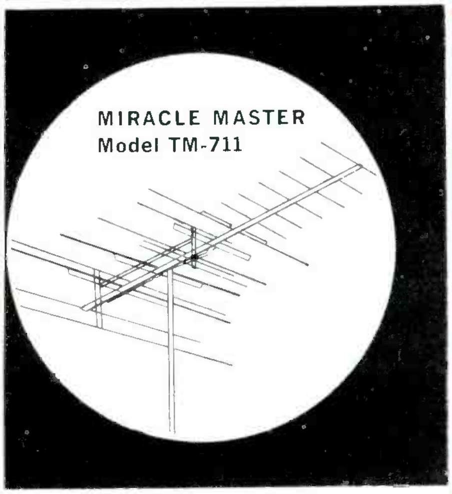

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Aligning & Calibrating COMMUNICATIONS RECEIVERS

How to recognize symptoms of misalignment, and readjust receivers for best performance

by Jack Darr

After a communications receiver has been put into good working order (all tubes and voltages up to par), it must be checked for alignment and calibration. This was discussed briefly in the March issue. Misalignment, we said, is most often due to tampering; however, even in the later model sets, which have iron-core IF transformers, there will be a certain amount of drift. Poor IF or RF alignment will show up as a loss of sensitivity, or will cause stations to come in at incorrect points on the receiver dial.

IF Alignment

Intermediate frequencies used in most sets fall within the common 450-kc band. Sets without special crystal filters in the IF section are aligned in the conventional way. However, the accuracy of the signal generator used is extremely important. For a quick test, compare the generator frequency with the signal from a standard broadcast station. The communications set itself, or any BC receiver, may be used for this. Tune in a station with a carrier as near 910 kc as possible, and with the generator at half this frequency (about 455 kc for a 910 kc station) zero-beat the unmodulated signal from the generator against the station carrier, and note the dial reading on the generator.

Any error found may be used as a correction factor in calibrating the generator. For instance, if the station carrier is 950 kc and the generator shows 470 kc, the error is 5kc (the generator should read exactly 475 kc). Using this correction factor to tune the generator to 455 kc, the dial should read 450 kc. Don't forget to use the correct multipliers; you're using the 2d harmonic, and the error will be exactly half the difference between two times the generator reading and the station's carrier frequency. The third or fourth harmonics may also be used, if necessary, in which case the multiplier (and divider) becomes 3 or 4, respectively.

If a 455 kc crystal is available, it should be used. Many standard signal generators have provisions for use of external crystals. If desired, a special crystal oscillator may be built, using the popular Pierce circuit, which is rich in harmonics. However, for most alignment work, cross-checking with broadcast stations will prove highly accurate.

Both set and signal generator should be warmed up for at least 15 minutes to reduce the possibility of thermal drifting. Actually, the stability of a signal generator is more important than its initial calibration. If you handle quite a bit of communications work, it would be worthwhile to completely recalibrate the signal generator, using BC station carriers as standards.

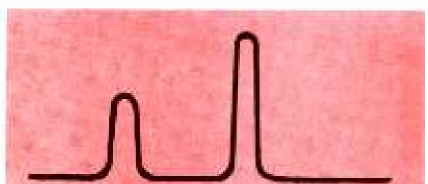

Fig. 1. Pattern seen when checking signal generator against crystal filter.

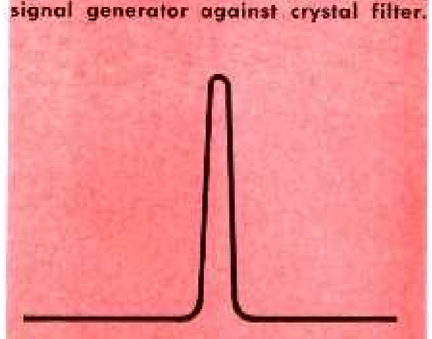

Fig. 2. Converging the two frequencies increases the height of the pattern.

Output Indicators

If the receiver is equipped with an "S" meter, it may be used as an output indicator; otherwise, the more common methods will suffice—monitoring AVC voltage with a VTVM, or output signal across the voice coil, for instance. The AVC meter reading is more convenient, since unmodulated signals must frequently be used. The oscilloscope and sweep generator will be very useful for final tests, and almost indispensable for quickly checking IF crystal filters. The latter check could be performed with a VTVM, but the procedure is much slower.

IF alignment of almost all communications receivers is quite conventional (the IF transformers are standardized, and are just like those used in BC sets). The VTVM is connected to the AVC line, the signal is fed to the mixer grid (by clipping the signal-generator output lead to the insulation of the grid wire to avoid loading, etc.), and each stage is progressively aligned, beginning with the detector and finishing with the mixer. Each stage is adjusted for maximum reading on the VTVM.

At this point in the process, the BFO (Beat Frequency Oscillator) should be aligned. This is merely an additional RF oscillator, operating about 1 kc off the IF frequency. Its output is coupled into the last IF stage, usually by a very small "gimmick" capacitor which consists of a wire looped over the last IF tube

• *Please turn to page 64*

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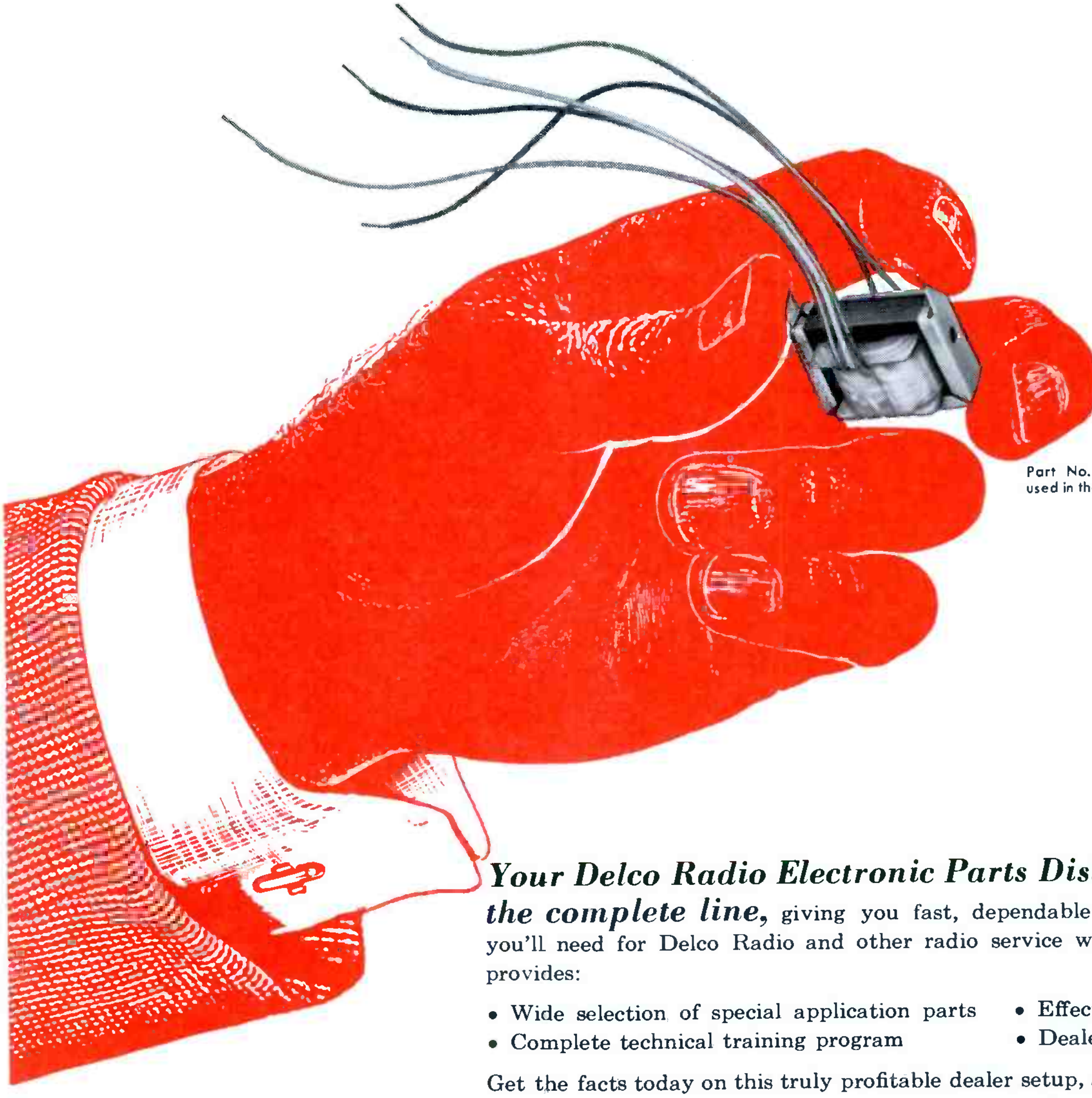

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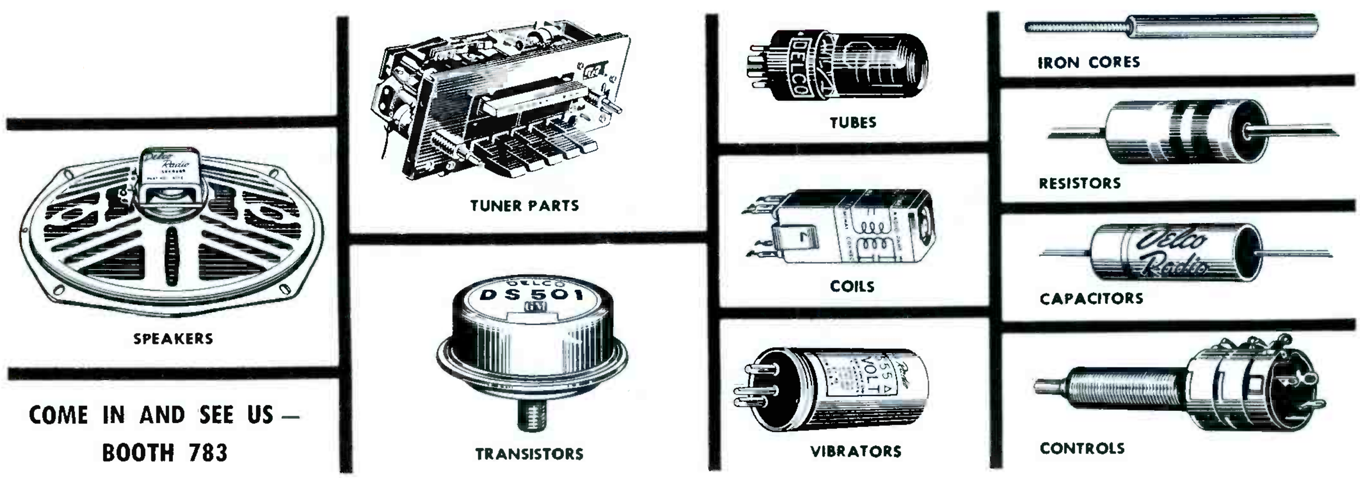


questions and answers on...

What is the resistance range of the special compensation resistors found in 110° yokes?

These units are temperature-compensating elements called *thermistors*, and generally measure 20 to 27 ohms cold and 3 to 4 ohms hot.

Can I change a 70° receiver to use a 90° picture tube by installing an equivalent 90° yoke?

When you make a conversion of this sort, you are making a change which will enable the receiver to scan the new tube without neck shadow; but you will increase the scan to the required 90° only if you increase the power to the vertical and horizontal windings of the yoke. Although most 90° yokes are slightly more efficient than their 70° counterparts, this benefit is small — usually amounting to about 1" scan on a 21" tube. Therefore, if you change only the yoke, you should rightly expect to obtain a 70° picture on the 90° tube. This will usually make the raster appear to be narrow by about 1" to 1½" on all sides. This can be overcome in many cases by merely adjusting height, vertical linearity, drive, and width — but the condition really proves the need for more power to obtain greater deflection.

What trouble symptoms might simulate a defective yoke?

The serviceman can often be fooled by displays on the screen which at first may look like trouble in the yoke. One, for example, is where the width of the raster appears to be slightly narrower at the bottom than at the top. This slight keystoning effect *can* occur due to an open boost filter capacitor on the supply line to the vertical-output section. Interesting side effects of this trouble are that the vertical-linearity control may act as a brightness, width, and high-voltage control, and settings of the brightness control can change the shape of the raster. Don't let indications like this or the ones shown in symptoms 4, 13, and 14 steer you to pulling the yoke — or your hair.

What test is recommended to determine whether the yoke or flyback is defective?

Resistance measurements will seldom detect a partial short in a winding of either the yoke or flyback unless the component is open or severely shorted. Provided the serviceman understands the operation and limitations of certain specialized test instruments such as yoke and flyback checkers, they can be used in making quick and relatively accurate tests. Another approach, which has been successful in every case, is direct substitution. Either unit can be proven defective by substituting an equivalent winding from a yoke of known good quality for the original. For all practical purposes, a yoke winding is considered to be equivalent when its inductance (measured in millihenries) is equal to that of the original within ± 20%.

What is the effect of an error in the yoke connection which leaves out half of a sweep winding?

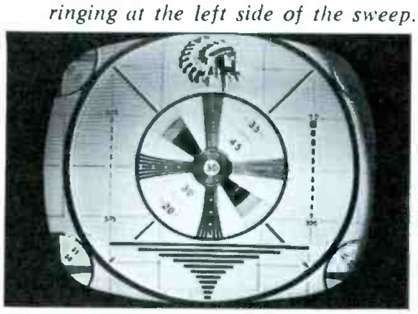
In the case of the vertical windings, this would produce a keystoning effect similar to that pictured in symptom 9, with the exception that the pattern would not be folded over at the top or bottom as shown. Leaving out half of the horizontal winding, another keystoning effect would occur as illustrated by symptom 10. Here too, however, a complete pattern will result with no foldover or drive line.

What about resistor and capacitor networks when replacing a yoke?

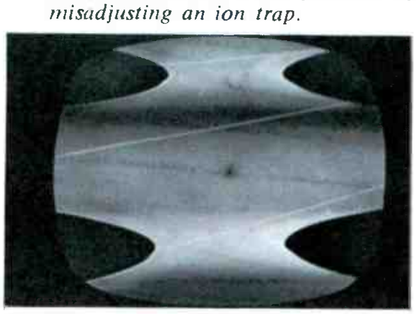
Damping, neutralizing, and balancing components are definitely a part of the flyback - to - yoke matching arrangement and, in most cases, should be used to duplicate the original circuit. There may be eighty or more different "anti-ring" networks used on a single basic yoke design. If such a component is left out or the wrong value employed, you'll probably encounter troubles such as those shown in symptoms 1 or 7.

1. A fixed, wavy distortion on the left side of the screen indicates interaction between yoke windings. This so-called "crosstalk" results when the yoke is not properly damped.

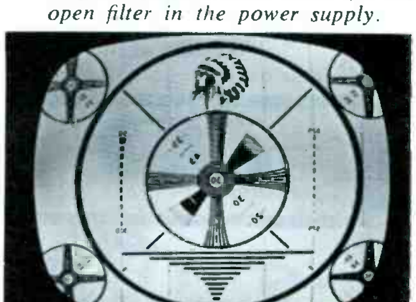
2. A great reduction in vertical sweep with slight keystoning will usually occur when one of the vertical windings is open. Note too the severe ringing at the left side of the sweep.



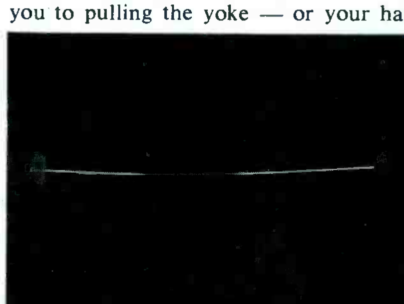
3. If neck shadow cannot be corrected by centering, make sure the yoke is positioned as far forward as possible. Never try to solve this problem by misadjusting an ion trap.



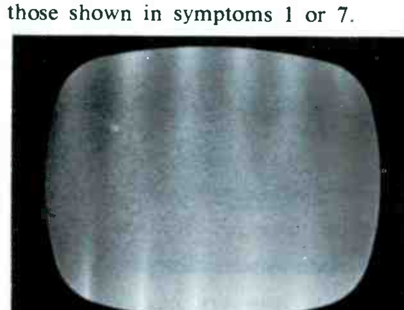
4. This pattern might be mistaken for yoke trouble, but actually it was due to 120-cycle modulation in the horizontal output circuit. Look for an open filter in the power supply.



5. The only thing wrong with this pattern is that sweep is from right to left. Connections of the horizontal windings are reversed. Also check connections of damping capacitor.



6. A single horizontal line on the screen may indicate that both a vertical yoke winding and the damping resistor are open. This trouble usually results because of a direct short.



7. Light vertical streaks in the raster point to excessive ringing in the yoke. The installation of correct values for damping components will usually correct this condition.

DEFLECTION YOKES

What should be done about the 100K-ohm resistor often found across the bottom or low-RF half of the horizontal winding?

This component (which may be shown schematically as either the top or bottom winding) has caused servicemen untold hours of lost time. The reason is that this resistor is usually of a one-watt size, and as it overheats it has a tendency to drop in value. When this happens, it also draws more and more power from the flyback circuit, which in turn causes several indirect symptoms. The most time-consuming is probably the loss of AGC in certain models. The yoke is about the last place the serviceman would expect to find the source of such a trouble. Some manufacturers recommend that this resistor be removed, but in a few areas, this has resulted in AFC trouble, especially in fringe areas. If you find that the original circuit calls for a resistor in this application, use a two-watt or larger — but if no ill effects appear, leave it out.

Can a parallel-connected yoke be replaced by a series-connected type?

This can be done successfully if you are able to determine the inductance value of the parallel arrangement. The parallel inductance will always be somewhat higher than one half the rating of each coil, due to the mutual inductance introduced by the core material. For instance, if the parallel yoke uses coils which singly measure 20 mh, placing them in parallel will result in a total or overall inductance of approximately 12 mh. These yokes can therefore be replaced in most cases by a series type measuring 12 mh and the addition of a horizontal damping network.

How many yokes would it be necessary to stock in order to provide an "equivalent" for day-to-day test purposes?

Most of the 4,000 plus yokes in use today can be temporarily replaced with six to ten selected units.

Can I choose a replacement yoke by comparing color codes or terminal numbers?

Don't even think about it! There are no standards for color codes or terminal numbering in the manufacturing of yokes due to certain supply problems. One TV maker, for example, used a total of 21 wire-insulation colors for a yoke having the same part number! The safest wiring method to follow is to connect the windings of the new yoke exactly as the equivalent windings of the original yoke were connected.

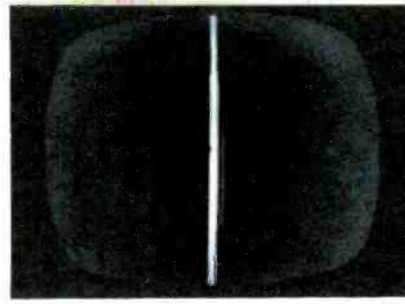
What is the metallic band around the neck of the picture tube that slides in and out of the yoke?

This collar-like device is a width control. The metal sleeve acts as a shorted-turn type of absorption unit between the yoke windings and the neck of the tube. Depending on the extent of insertion, the sleeve takes energy from the yoke and controls width by varying the amount of energy left to deflect the beam. Remember, the metal sleeve is physically and electrically separated from the horizontal windings by the thickness of varnish on the yoke coils, unless special precautions have been taken to insulate the yoke or the sleeve itself.

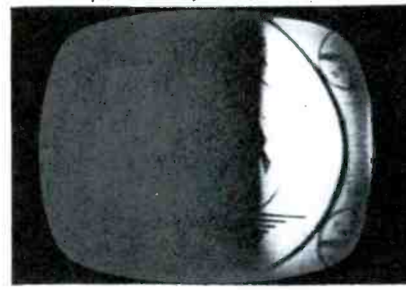
Is the resistor connected between the center tap of the horizontal yoke winding and the flyback part of the "anti-ring" network?

Yes, this circuit returns the yoke center tap to an electrical center on the flyback. The resistor is used to avoid overheating due to any unbalanced condition. Frequently, these circuits will not employ a capacitor across the high-RF winding; therefore, care should be taken when installing yokes with pre-wired networks to remove or correct the value of this component. If the original flyback or yoke shorted, this resistor may have "cooked-out" and should be replaced to avoid ringing trouble.

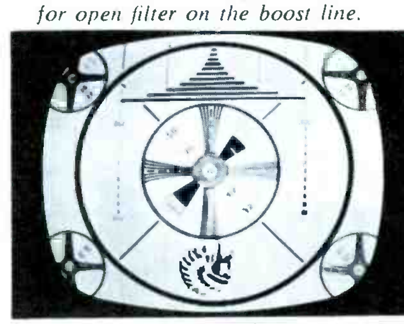
EDITORS' NOTE: Questions and answers used in this article were adapted from PTM-3 published by Triad Transformer Corp.



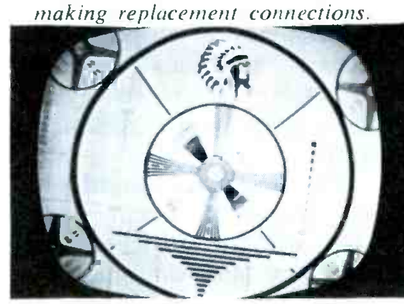
14. Instead of suspecting the yoke on this one, check the yoke return circuit first — especially the DC blocking capacitor. Loss of this much sweep normally results in no raster.



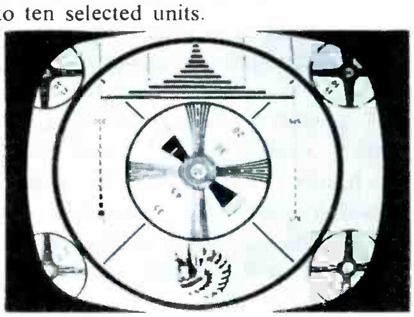
13. Here's an odd-ball symptom, but you'll find it isn't yoke trouble. It's due to horizontal energy reaching the vertical-blanking network. Check for open filter on the boost line.



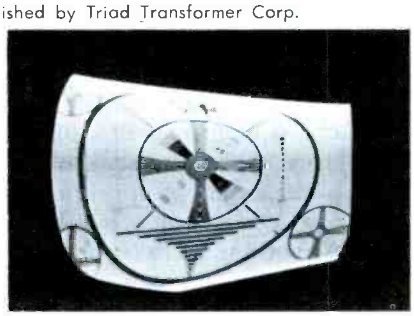
12. If you end up with this situation, merely reverse connections to the vertical yoke windings. Always use the original circuit as a guide when making replacement connections.



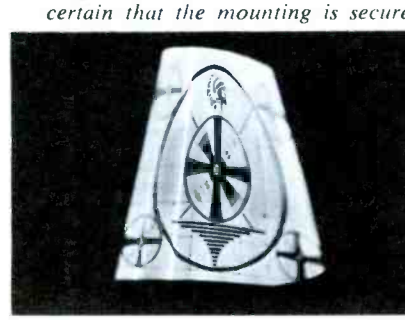
11. Example of a titlted raster. As a final step in yoke replacement, always rotate the yoke until the scanning lines are horizontal; then make certain that the mounting is secure.



8. If you have to stand on your head to view the pattern correctly, then you better reverse the connections to both the vertical and horizontal coils. Watch those damping components.



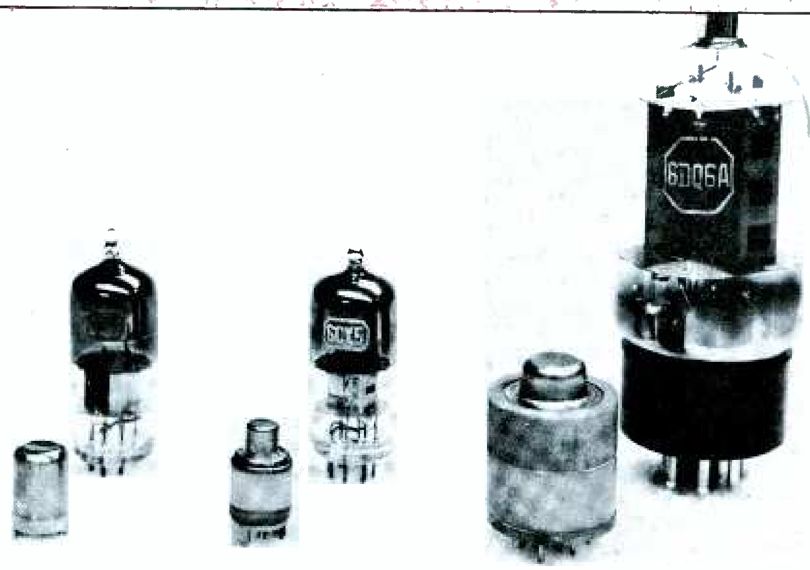
9. A yoke with a shorted vertical winding will invariably produce a keystone effect of this nature. Note the foldover condition existing at both top and bottom of the pattern.



10. A typical example of keystoning caused by a short in the horizontal yoke. A reduction in height may also accompany this trouble, particularly if the vertical is boost powered.

servicing NEW DESIGNS

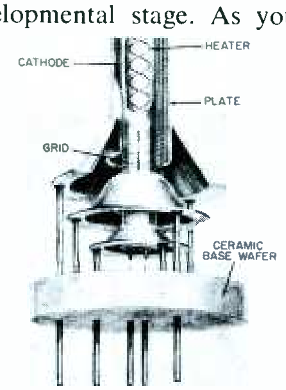
by Thomas A. Lesh



More Efficient Tubes Are On Their Way

Tube manufacturers are by no means ready to abandon vacuum tubes as "has-beens"; instead, they are taking drastic new steps to make tubes more rugged and efficient.

The latest move toward tube improvement has been made by RCA, with the announcement that *Nuvistors* (the tiny metal tubes shown above) are well along in the developmental stage. As you can see, these units are only a fraction of the size of their conventional counterparts; what's more, they're encased in a metal shell instead of a glass envelope. The small, lightweight elements inside the shell are solidly supported at the lower end by individual bases fastened to tripod mounts.



RCA - NUVISTOR TRIODE (DEVELOPMENTAL)

This type of construction makes *Nuvistors* easy to manufacture to close tolerances by a highly automated process. As a result of small size and precision construction, the new tubes are said to have many advantages over regular types—including much lower plate-power requirements and greater resistance to mechanical shock.

Although critical military and industrial equipment will claim a large share of the new-style tubes, some of them may be appearing in television sets within a couple of years. According to RCA, the first TV application of *Nuvistors* will probably be in VHF tuners and horizontal-output stages.

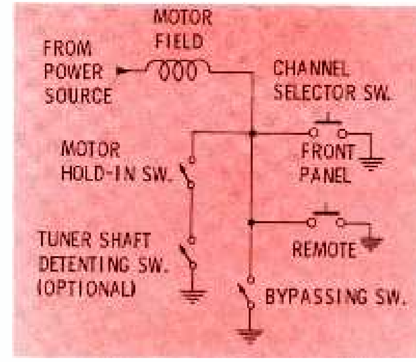


Fig. 1. Diagram of switch circuits in a typical automatic tuning device.

Motorized Tuners

Automatic tuning devices used in various brands of TV sets are so different from one another mechanically, the serviceman may not notice how similar they are in basic principles of operation. Actually, all automatic tuners are more or less alike from an electrical standpoint. Take a look at the schematics of several; you'll find they all closely resemble Fig. 1. If you keep this fundamental circuit in mind, you'll be able to service unfamiliar tuning mechanisms more easily because you'll know what general features to expect.

In a typical automatic tuner, the power circuit of the tuning motor includes four or five switches with functions that can be summarized as follows:

Normally, all are open, and the motor power circuit is incomplete.

To start motor: Operator presses one of the channel-selector buttons —either on the front panel or on a remote-control unit. This action completes the power circuit by grounding one side of the motor field.

To keep motor running: As soon as the motor is energized, a hold-in switch is automatically closed so that power will continue to reach the motor after the operator releases the push button. In many sets, the hold-in switch is controlled by a cam which opens the contacts as soon as the tuner shaft reaches an "on-channel" position, thereby stopping the motor. Some other receivers have two hold-in switches in series. One is closed by the motor armature, due to the magnetic attraction of the field coil when power is applied. This switch will stay closed as long as the motor runs; therefore, an additional cam-operated switch is needed to open the motor circuit when the tuner reaches a detent position. This second switch and its cam are mounted on the tuner shaft, often at a considerable distance from the motor.

To stop at desired channels and bypass others: Since the motor is de-energized each time the tuner shaft arrives at a detent position, the automatic tuning system (as described thus far) is able to rotate the tuner only one channel at a time. The mechanism would be much more useful if it could automatically seek out the few active channels on the dial and skip all inactive ones. To accomplish this, a bypassing switch is placed in parallel with the other motor switches. Rather than being a single unit as shown in Fig. 1, it is actually a *group* of switches or cams (one for each channel position), all controlled by a programming board on the back or front of the cabinet. Exact layout of this board varies greatly from model to model, but there is always some means of presetting the mechanism to tune in any desired combination of channels.

The bypassing switch may be a device which prevents the regular hold-in switch from opening on certain channel positions, or it may be a separate switch that closes only when the tuner arrives at a position that is to be bypassed. In either case, the effect is the same — uninterrupted operation of the motor while passing through unwanted channels.

General Electric Chassis U3

Now that we have a little better understanding of automatic tuners in general, we shouldn't have much trouble in figuring out the operation of the new General Electric unit in Fig. 2.

One of the first things you'll notice about this receiver is that it has a ring of 13 front-panel buttons (one for each channel position) instead of the customary single button for automatic channel selection. When the viewer presses the button corresponding to the channel he wants to receive, the tuner rotates directly to that channel without stopping at any intermediate positions. This "direct dialing" is accomplished by a motor-switch mechanism unlike any other in current use.

The parts of this switch are plainly visible in Fig. 2. Fastened to the shaft of each push button is a spring clip. When a button is pressed, its clip is forced into contact with the metal drum, thus completing a motor circuit through the stationary contact that rests on the drum surface. The push-button assembly and the drum both rotate with the tuner shaft as it turns. When the tuner reaches the desired position, the projecting clip strikes the stationary plastic block at the top of the drum. This causes it to snap out of contact with the drum, breaking the motor circuit.

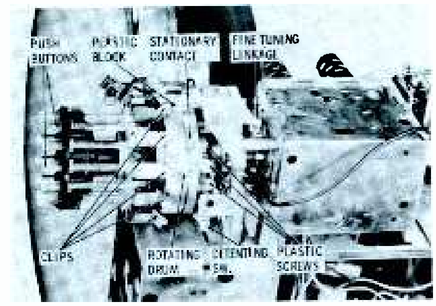


Fig. 2. Details of automatic tuner used in the General Electric Chassis U3.

No separate hold-in or bypassing switches are required for front-panel operation of this tuning device, since the clip and drum stay in continuous contact with each other until the clip hits the plastic block. However, it is necessary to equip this unit with additional switches to allow satisfactory remote - control operation. Since the drum circuit is not activated when the motor is started from a remote position, some provision must be made for supplying power to the motor after the remote push button is released. For this purpose, the circuit includes two switches wired in series — exactly as shown in Fig. 1. An armature switch is mounted on the motor,

• *Please turn to page 52*

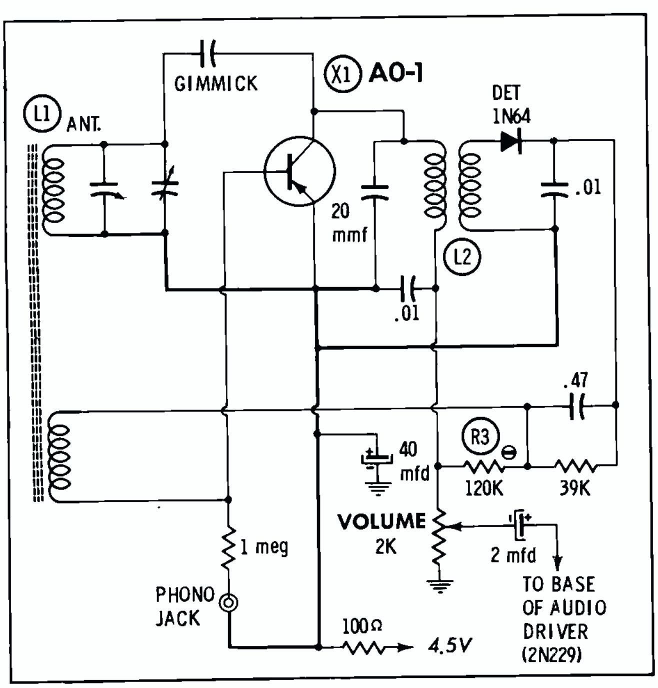


Fig. 3. Reflex stage in Regency TR-22 radio amplifies both RF and AF; works on tuned-radio-frequency principle.

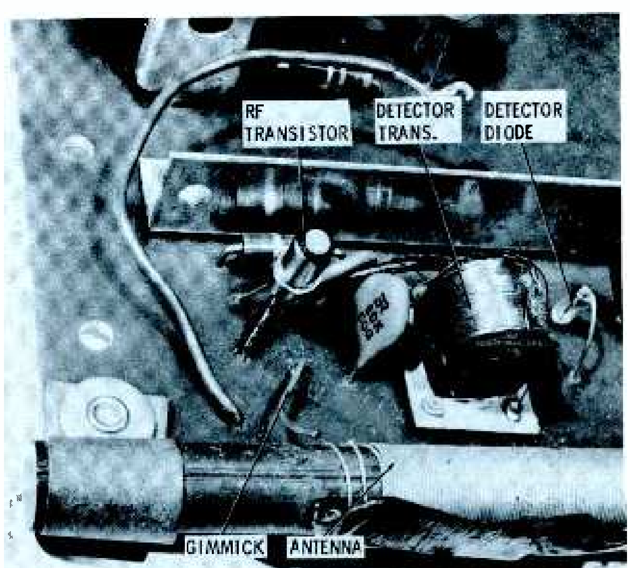


Fig. 4. Physical relationship between antenna coil and gimmick wire affects RF alignment; wax seal "fixes" antenna.

SERVICING INDUSTRIAL ELECTRONICS

PART 15—BY MELVIN WHITMER

DIELECTRIC HEATING APPLICATIONS

Have you ever felt the warmth of diathermy? If so, you may remember the sensation of evenly distributed heat. The diathermy machine is a familiar example of a class of instruments known as *dielectric heaters*. In actuality, it is a radio-frequency oscillator which uses the body as part of a coupling capacitor. Pads, placed on each side of the body section to be heated, are the capacitor plates, and *you* are the dielectric! The radio-frequency signal thereby passes through the body, causing a series of molecular movements for each complete cycle. The molecules rub against each other as they try to align themselves with the direction of the alternating electrostatic field, and this molecular friction produces heat.

The electronic oven operates on the same principle, although the heat generated is much more intense. It distributes heat evenly throughout the food to be cooked, instead of merely warming it from the outside as a conventional oven does. As a result, heat reaches the center immediately and cooking time is greatly reduced.

An important industrial use for dielectric heating is in the preparation of semiconductor materials. For instance, silicon is formed into useful crystals for transistors and diodes by heating the raw material evenly and at a controlled temperature. The photo at the beginning of this article shows an operator watching the dielectric heating process in a typical silicon crucible (Merck and Co.). A diagram of a crucible setup for converting raw silicon to a useful crystalline form is shown in Fig. 1. A 25-kw dielectric heater supplies the required RF power. The coupling - and crucible - control equipment is housed in the center cabinet. Crystals are grown by moving the crucible table up and down

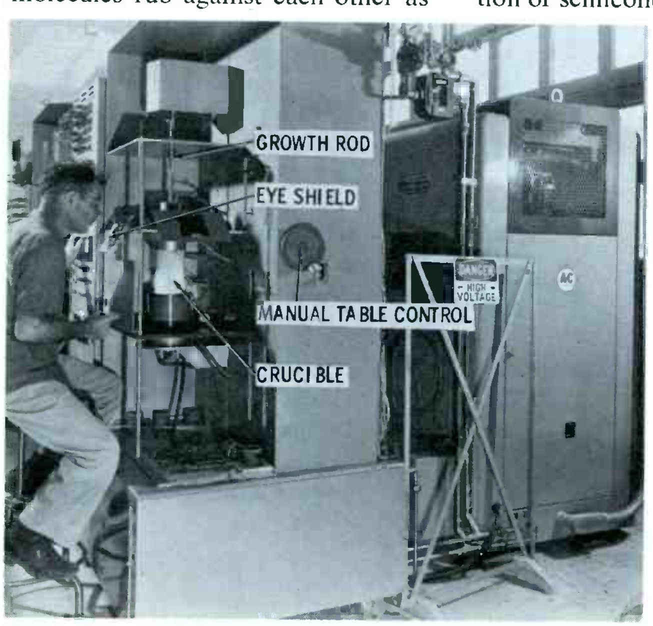


Fig. 1. 25-kw dielectric oven used in the manufacture of silicon crystals operates at a temperature of 1400°C.

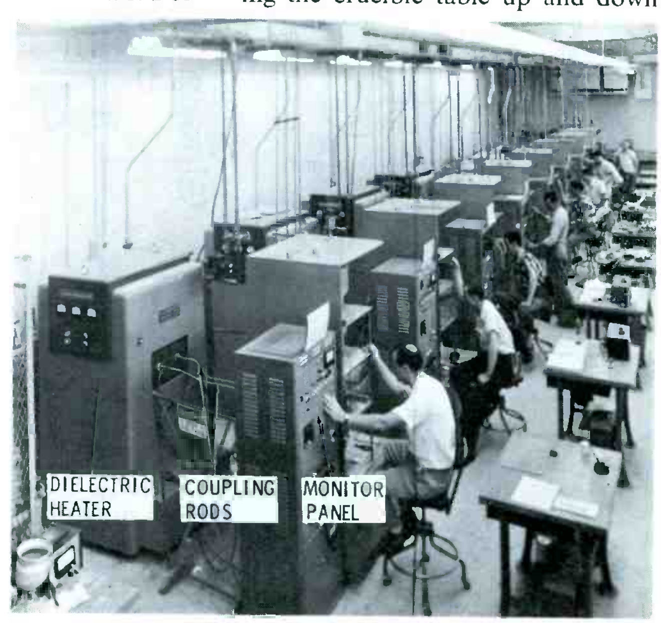


Fig. 2. RF power for this *Allis-Chalmers* electronic heater is supplied to the silicon crucible through coupling rods.

so that the molten silicon alternately touches the growth rod and slowly pulls away from it. Fig. 2 shows the other side of the equipment and the RF coupling rods connecting the heater to the control cabinet. The instrument panel shown in the foreground houses the power, timing, and temperature monitors for the crucible.

Power Supply

Oscillator plate power for large dielectric heaters is supplied by mercury-vapor rectifiers or thyratrons. If the power supply is of the mercury-vapor type, its DC output voltage is regulated by means of a tapped autotransformer which controls the primary voltage input. If thyratrons are used, however, the DC output voltage may be varied in a more direct manner by applying an AC voltage to the thyratron grid. Remember that this grid has control over plate conduction only during cutoff. Once conduction begins, it can be stopped only by lowering the plate-to-cathode voltage. If the grid is negative with respect to cathode when the plate stops drawing current, the thyratron will remain in cutoff until the grid is driven above the firing level.

In thyratron - controlled power supplies, each tube is cut off (and the grid thus allowed to regain control) during every negative half-cycle of the AC input voltage. A phase-shift control in the grid circuit determines the firing time of a thyratron during the next positive half-cycle. Thus, a delayed firing time will result in a shorter conduction time and a lower DC output voltage. A three-phase, thyratron-controlled power supply and control panel are shown in Fig. 3. AC power is applied to the plate caps of the thyratrons, and the cathodes are coupled to the DC output filter network. Since gas tubes generate quite a bit of electrical noise, their heaters must not be operated with the power supply enclosure open.

Control Adjustments

The three meters shown in Fig. 3 indicate oscillator filament voltage, grid current, and plate current. Exact readings depend on the oscillator tube type; however, typical values are 22 volts for filament, 165 ma for grid current, and 1.55 amps for plate current. Grid current is critical, since excessive current may damage the tube and too little current usually results in a loss of oscillation.

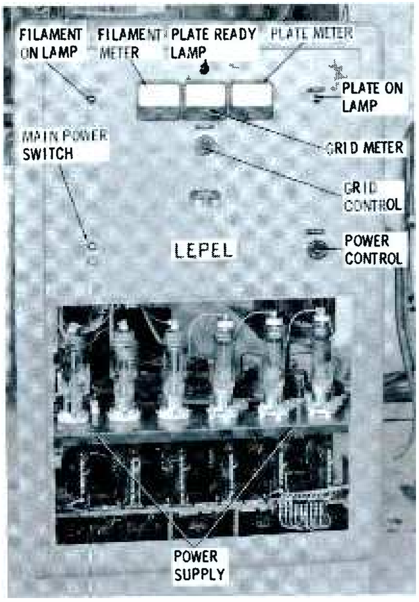


Fig. 3. *Lepel* three-phase DC power supply uses thyratrons for voltage control.

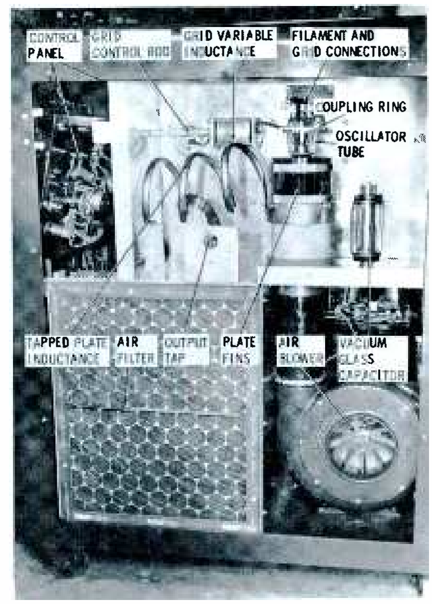


Fig. 4. *Erdco* power oscillator supplies 5 kw of RF power; note cooling system.

Before the main power switch is actuated, the POWER control is set fully counter - clockwise. When power is first applied, current flows through the thyratron and the filament pilot lamp lights. After the customary time delay, the PLATE-READY lamp lights. The operator then slowly rotates the POWER control clockwise while adjusting the grid control to maintain grid current within safe limits. The PLATE ON lamp lights when high voltage is applied to the oscillator. The POWER control is then adjusted until the plate-current meter indicates maximum safe current. If the load impedance is correctly matched to the oscillator plate coil, the POWER control may be advanced to its mechanical clockwise limit without danger of exceeding the maximum plate-current limit of the tube. Load impedance which is too low will cause excessive plate current before the POWER control is fully advanced, while excessively high load impedance will cause low plate current and poor heating.

Oscillator Section

Fig. 4 shows a typical oscillator

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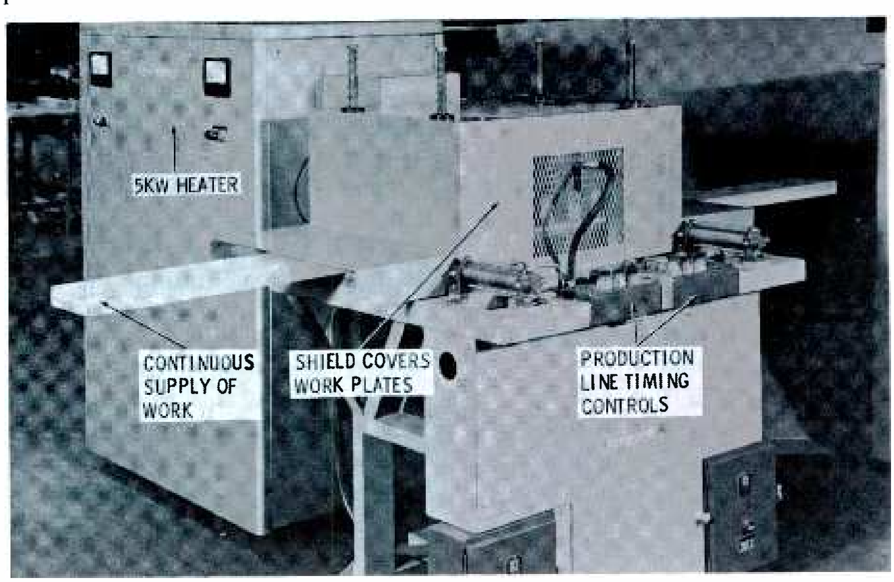


Fig. 5. *Reevelec* C5F heater and press for automated scarf-gluing of lumber.

QUICKER SERVICING

By Calvin C. Young, Jr.

A short time ago, I was consulted about a new receiver. The customer complained that the picture just wasn't clear. While making operational checks on all received channels, I discovered that channel 13 was very nearly perfect, but all other channels were poor. My first thought was that good signals were somehow not getting to the receiver. When this idea was broached to the customer, it was pointed out that the previous set had worked okay on all stations in the same location, even with the same antenna! Fortunately, in this case, the customer still had the old receiver, and actual tests substantiated the customer's statements. This took the wind out of my sails and knocked flat the theory that location or local conditions were affecting reception. Something was ailing the new set, and that something was probably the tuner. (Wonder how many other servicemen have failed to listen to a customer's complaint and have simply blamed poor reception on local conditions when, in fact, the set had a definite trouble?) Armed with the facts, good reception on channel 13, and poor reception on channels 8, 6 and 4, there was only one course to follow —pull the set and check alignment on all channels.

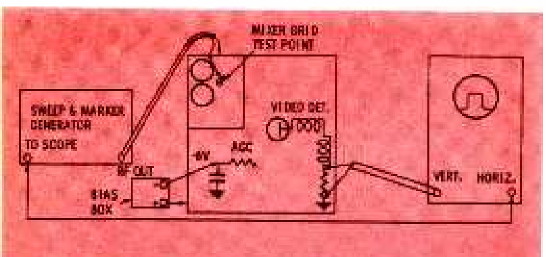


Fig. 1. Setup for testing video IF alignment

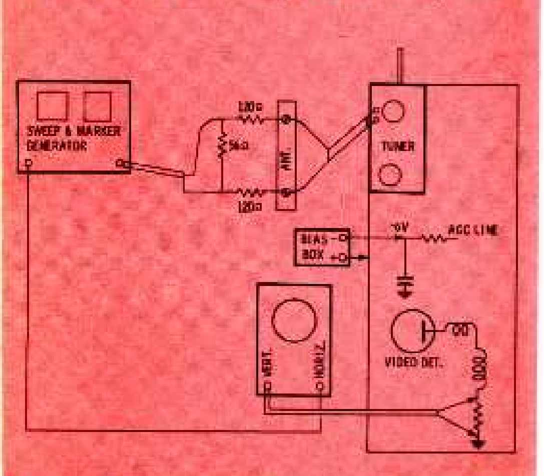


Fig. 3. Setup for testing over-all alignment

Back in the Shop

The first step was to dig out the service literature for the receiver and read the alignment instructions. The data on IF alignment was very thorough, but it was almost void in the tuner department. It only took a moment to connect the test equipment and run an IF alignment check. The hookup in Fig. 1 was employed. With very minor touch-up adjustments, the IF curve was perfect (Fig. 2).

"Not enough variation here to have caused the trouble," I thought. "Guess I'd better test response while feeding the signal into the tuner antenna input." Using the setup shown in Fig. 3, the response curve appeared very nearly like the one shown in Fig. 2 on channel 13, but was deficient Fig. 4) on the other channels. The trouble was now pinpointed to poor tuner alignment on the affected channels.

What To Do

Only two things would cure the

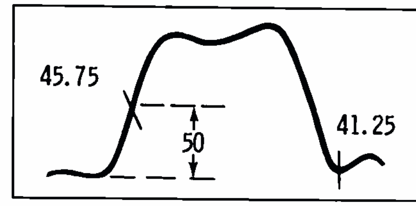
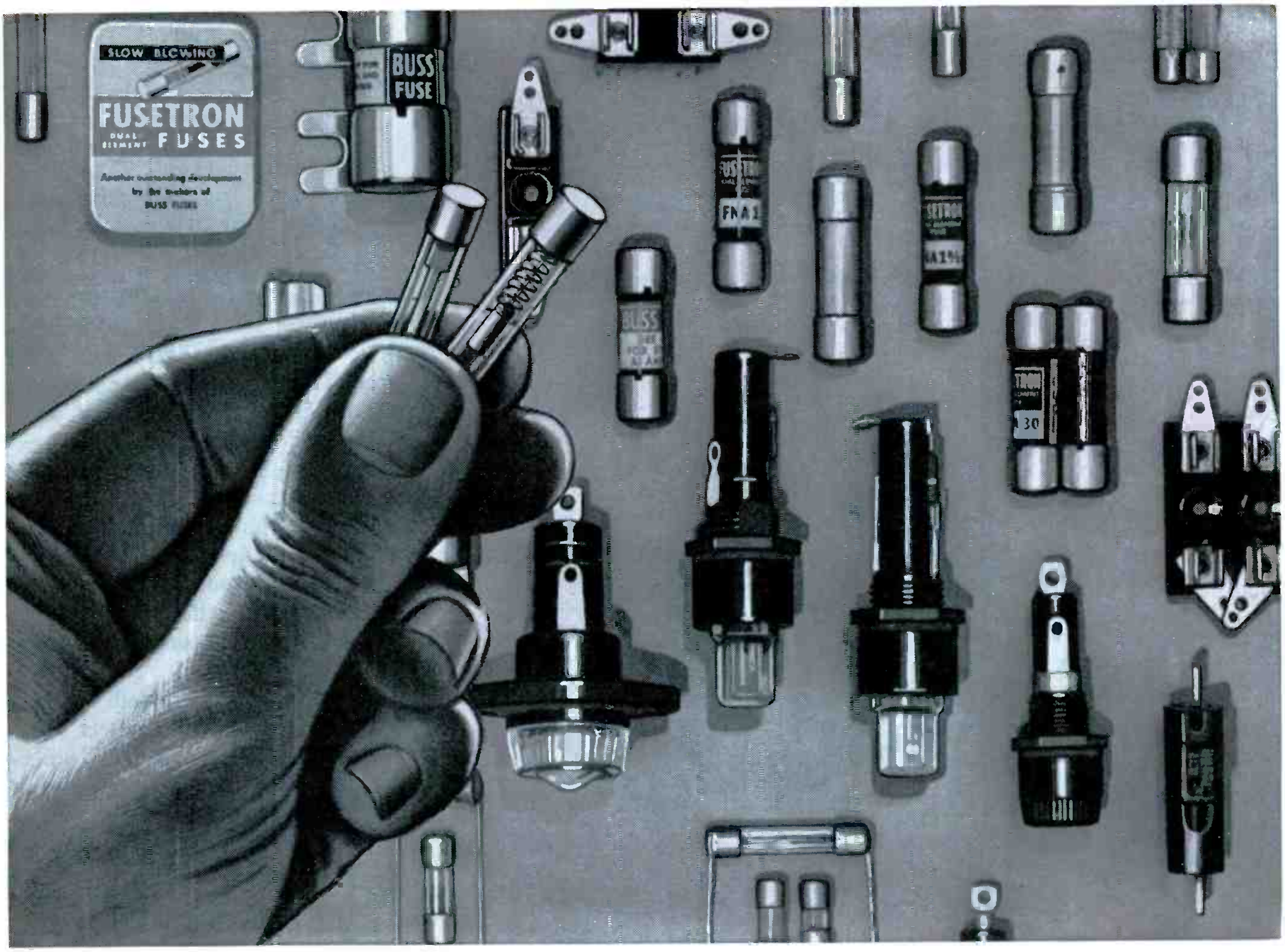


Fig. 2. Normal video IF response curve.

trouble—replace the tuner or realign it. Even though there were no tuner alignment instructions in the service literature, the serviceman decided to try touching up the adjustments for the deficient channels. The tuner shield was removed to expose the wafers and the coils that would require lengthening or compressing. (There weren't any trimmer capacitors on this switch-type tuner.) The next step was to positively identify the various wafer sections and the coils that affected the channels to be adjusted. The front wafer section contained the oscillator coils and wouldn't need any adjustment. The second wafer was identified as the mixer-grid coil, the third wafer the RF-output plate coil, and the fourth wafer the RF-amplifier grid coil, all of which would require adjusting. Since it was known that the individual coils changed from half-turn units to multi-turn units between channels 7 and 6, it could readily be determined that the channel-8 coils were the second set of half-turn coils from the multi-turn coil section (see Fig. 5).

I didn't want to make any more adjustments than absolutely necessary, and since the over-all response (both tuner and video IF) is what really matters, I decided to leave the scope at the video detector and apply the signal at the antenna input. With this procedure, the immediate effect on response will be detected whenever a coil is expanded or compressed. The test equipment setup employed for the original over-all alignment test (Fig. 3) was therefore employed for tuner alignment.

To help keep within the aim of making an absolute minimum number of adjustments in the tuner, a tuning wand was used. If the curve improved when the brass end was brought near the coil, the coil was expanded. Improvement when the iron end was nearest the coil indicated the need for compressing the coil.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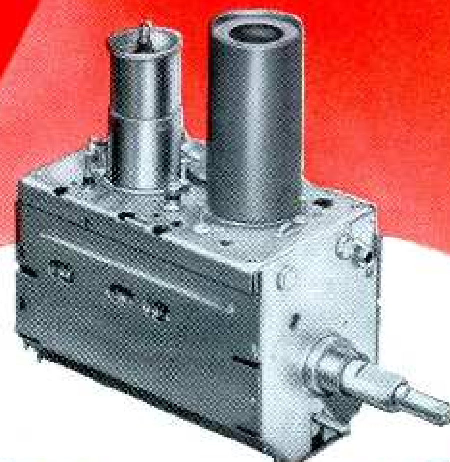

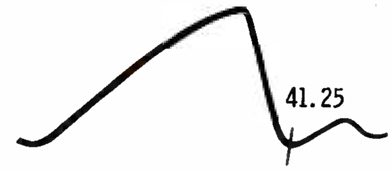

Fig. 4. Poor over-all alignment curve.

For this particular set, a gentle push on the half-turn coils employed in the mixer and RF stages for channel 8 brought the curve into tolerance. The curves on channels 6 and 4 both came up to standard when the three channel-6 coils were expanded slightly. The various coils were adjusted to produce not only the desired curve shape, but also maximum amplitude. Low-band channels had somewhat more gain than high-band channels, the gain progressively increasing as frequency decreased.

Operational checks on all received channels labeled the alignment (sans instructions) a success. This procedure should work for you, too, but be doubly sure the IF section is properly aligned before you start on the tuner.

Replacing Resistors in Series-Filament Strings

The fact that the filament wiring is the simplest circuit employed in a TV receiver has caused many servicemen to overlook its importance. For instance, excessive filament current can shorten tube life. On the other hand, insufficient filament current can cause key circuits to cease operating when tube emission falls off slightly.

A check of a large number of series-filament circuits revealed that the dropping resistors normally employed were of the 5% variety, and having other than standard EIA

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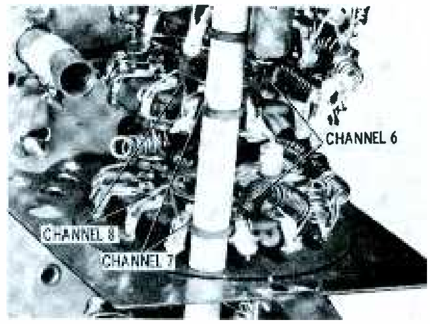

Fig. 5. Transition from multi-turn to half-turn coils between channels 6 & 7.

values—for example, 41 ohms, 51 ohms, 23 ohms, 19 ohms, 13 ohms, etc. Realizing that these resistors might be a little difficult to obtain, I ran some experiments in the lab to determine the effect, if any, on increasing or decreasing these resistance values. Current changes recorded in a set employing the basic circuit shown in Fig. 6 are as follows: Increasing the resistance from 23 to 25 ohms caused filament current to decrease 5 ma; decreasing the resistance to 20 ohms caused the current to increase 5 ma. The wattage actually dissipated under these three conditions was 7.4, 8, and 6.7, respectively, so the 15-watt rating was adequate even when the resistance values were changed. Based on this lab experiment, I think it safe to say that increasing or decreasing any filament-dropping resistor by up to 4 ohms would have no adverse effects.

If the set is to be operated in areas where the line voltage is normally higher than 117V, always use a higher rather than a lower value. The reverse is true if the set is to be operated in areas having low line-voltage levels.

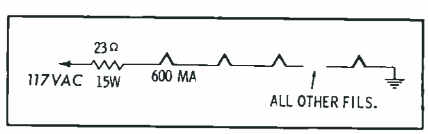

Fig. 6. Basic filament circuit showing the use of a voltage-dropping resistor.

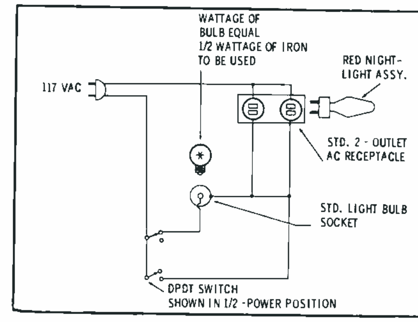

Fig. 7. Tip-saver circuit for pencil-type or other miniature soldering irons.

Tip Saver for Miniature Irons

If you repair tuners, transistor portables, printed-wiring assemblies and other pieces of electronic equipment where a soldering pencil or other miniature iron must be employed, you are familiar with the problem of corroded tips, and waiting while an iron heats up to normal operating temperature. If you desire to overcome both these difficulties, construct the circuit submitted by Stanley Farmer of Grand Junction, Colorado (see Fig. 7). The introduction of the light bulb into the circuit (switch position 1) reduces the voltage applied to the iron by 50%, and allows the iron to idle along half-hot. Flipping the switch to position 2 applies full line voltage to the iron, which will then reach operating temperature in less than 30 seconds. The red night light burns whenever the switch is in position 2, indicating that the iron is being operated at rated temperature. Under half-power, this pilot bulb will glow only faintly, if at all. ▲

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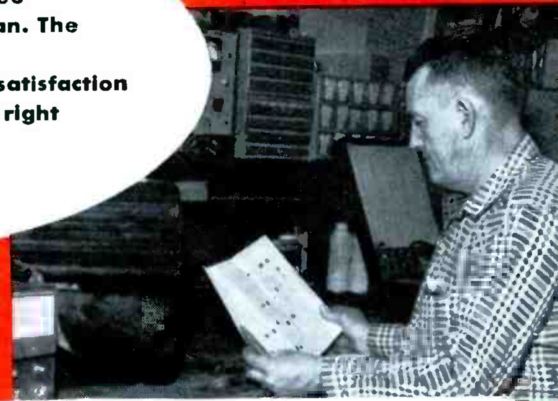

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NOTES on test equipment

informative reports from the lab

by Les Deane

Pick A Card!

The piece of equipment shown in Fig. 1 represents one of the newest trends in automatic tube testing. Produced by the RCA Electron Tube Div. of Harrison, New Jersey, the Model WT-110A eliminates the necessity for setting up numerous switches and controls when testing vacuum tubes.

Using a hole-punched card (4⅛" x 7⅝") for each tube type, this instrument actually "thinks for itself" by automatically selecting the correct socket connections and test voltages when the card is inserted in the provided slot.

Specifications and features are:

1. Power Requirements—105/125 volts, 60 cps; power consumption approx. 50 watts; line fuse and calibration control on panel.
2. Tube Tests — interelectrode leakage and shorts indicated by neon lamp; quality based on transconductance read directly from 4½" meter calibrated RENEW — ? — GOOD; gas and grid emission indicated on separate meter scale; special high-resistance leakage and low-value gas tests provided for certain tubes; over 200 prepunched and indexed cards supplied with instrument.
3. Control Panel — four common-type test sockets with six additional adapters available, all sockets screw-mounted and replaceable; two steel pin straighteners for both 7- and 9-pin miniature tubes provided.
4. Other Features — operating instructions inside detachable lid; active card magazine capacity 350, with a total storage capacity of 700 cards; vinyl-plastic case with metal corners measures 13¼" x 17¼" x 6⅝", weight with card set approx. 25 lbs.

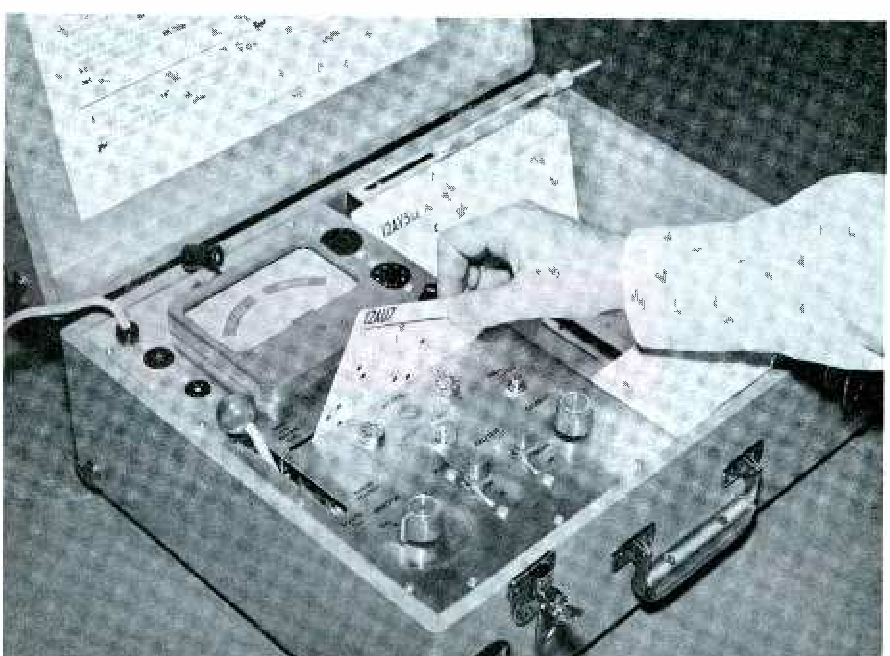

Fig. 1. RCA's Model WT-110A speeds tube checking by reducing setup time.

Since operation of the Model WT-110A involves the use of computer-type information cards rather than a roll chart and a bank of levers and switches, I found it to be an unusual and very interesting tube tester. The outstanding feature is, of course, the use of individual punch cards to automatically select the operating parameters. To give you an idea of the test procedure, let's take a look at each step in sequence.

Following instructions printed inside the lid, I set the selector switch located in the lower-left corner of the panel to a position labeled P. Next, I selected the card matching the tube type under test, positioned it in line with the panel slot, and swung the card up and over into the slot as shown in Fig. 1. Making sure that the card was seated correctly, I then pulled the power lever down and inserted the tube in the appropriate socket.

To check for shorts, I rotated the selector switch to its three other positions and observed the neon lamp in the center of the panel. Switch positions are P (plate), G2 (screen grid), G1 (control grid), and K (cathode). Naturally, if the lamp glows steadily or flashes when the tube is tapped, a short is indicated and the tube should be discarded without further testing.

The next step is a check of transconductance. Setting the selector to its CAL OR QUALITY position, I held the CAL/TEST lever up and adjusted the line voltage. With the meter needle resting on the CAL mark, I then released the CAL/TEST lever and read the quality of the tube on the RENEW — ? — GOOD scale of the meter.

Completing the test by checking for gas, I flipped the selector switch to its GAS position. After noting the meter reading on the linear (0 to 10) scale, I then moved the CAL/TEST lever down to the GAS position and checked to see if the needle moved to the right of its original position. The amount of needle movement in this direction indicates the relative gas content of the tube.

After becoming familiar with the card index system and the simple test procedure, I found that tubes could actually be tested in a matter of seconds. I also noted that while similar sections of multipurpose tubes are checked individually, they

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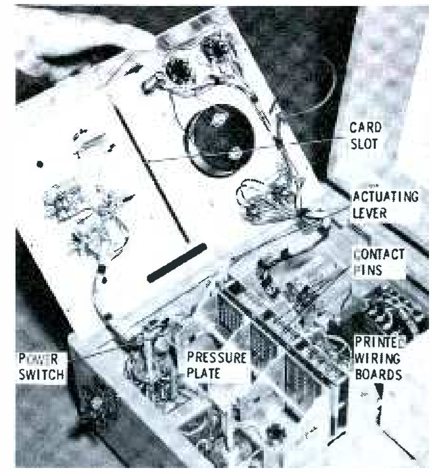

Fig. 2. Special card switch consists of several contacts on two printed boards.

require only a single punch card. Tubes with dissimilar sections require two different cards, but only one gas test of either section need be performed.

To show you the "innards" of a punch-card tester, I partially removed the front panel of the Model WT-110A (see Fig. 2). The matrix or card-switch assembly is made up of two fixed printed-wiring boards and a perforated pressure plate. This plate is moved back and forth by the manual actuating lever. Voltage supply lines and test-socket leads all complete their connections through three banks of small contact pins between the two wiring boards.

Without a card in the matrix, all pins make contact, and all circuits are complete. When a card is placed between the pressure plate and the front printed board, and the actuating lever is pulled down, all pins except those which line up with holes in the card are kept from making contact. The circuits completed through the holes provide the proper socket connections and test voltage.

The test cards are made of durable plastic and are indexed in the "captive" file by numerical-alphabetical order, according to tube type. Those supplied with the instrument are for the most popular tubes currently used in radio and television receivers. Incidentally, the cards may be cleaned with a mild solution of soap and water should they become soiled with continued use.

The card file may be kept up to date by two different methods. Prepunched cards for certain tube types other than those furnished in the initial set are available at reasonable cost through parts distributors. The

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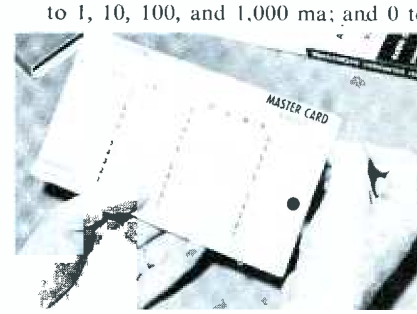
other method is to obtain blank unpunched cards from the distributor and prepare your own cards from punching information furnished by the company. (This process is illustrated in Fig. 3.)

Streamlined VOM

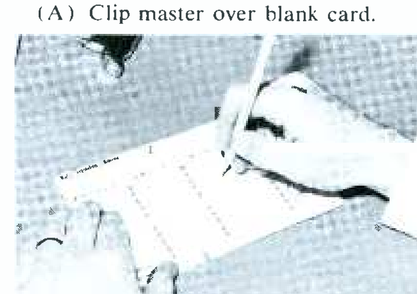
A new volt-ohm-milliammeter has recently been introduced by Hickok Electrical Instrument Co. of Cleveland, Ohio. Shown in use in Fig. 4, the Model 457 has a slanted meter face which permits the instrument to be read more easily and with greater accuracy while in a flat position. With functions and ranges well suited to the serviceman's needs, the meter comes equipped with test leads and instruction manual, but minus batteries.

Specifications and features are:

1. DC Voltmeter—ranges 0 to 3, 15, 60, 150, 600, and 1200 volts; sensitivity 20,000 ohms/volt; 38-ua meter movement.
2. AC Voltmeter—ranges 0 to 3, 15, 60, 150, 600, and 1200 volts rms; sensitivity 1,000 ohm/volt; full-wave rectification with frequency compensation.
3. DC Ammeter—ranges 0 to 50 ua; 0 to 1, 10, 100, and 1,000 ma; and 0 to



(A) Clip master over blank card.


(B) Inscribe desired holes on blank.

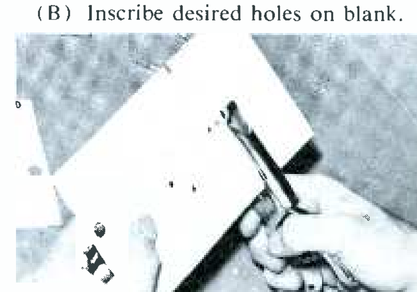

(C) Punch holes with accessory punch

Fig. 3. A do-it-yourself method for making your own punch cards for the tester

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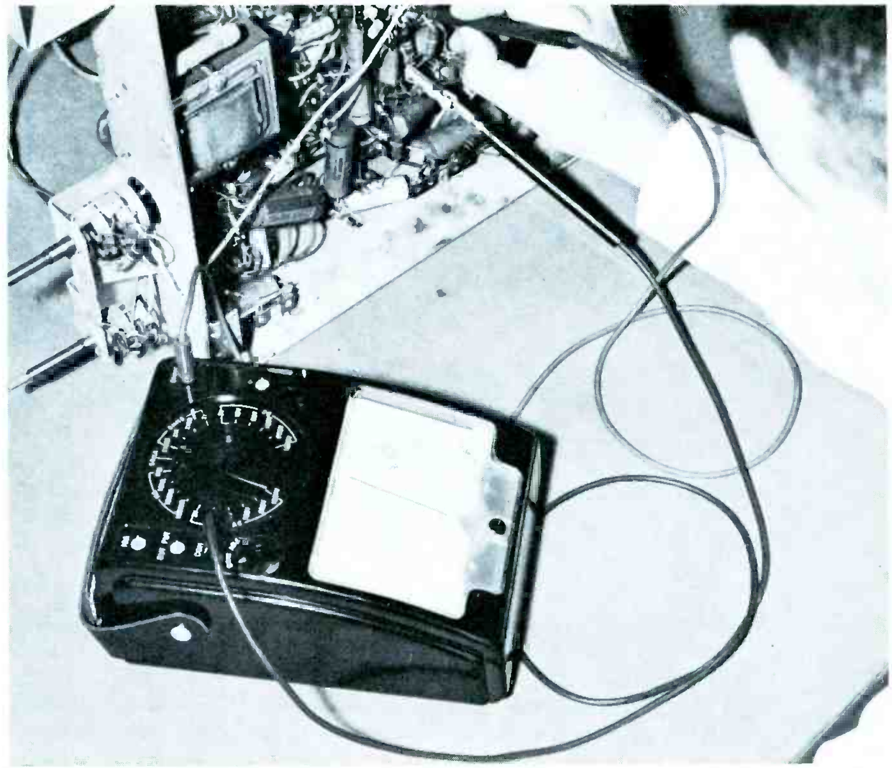

Fig. 4. Hickok VOM lies flat on the bench with meter scales facing operator.

10 amps on separate panel jack.

4. Ohmmeter—0 to 100 megohms in 4 ranges of R X 1, 100, 1K, and 100K; center-scale indications of 5, 500, 5K and 500K ohms; zero-ohms adjust provided on panel; circuit operates on 1.5- and 30-volt batteries.
5. DB Meter—5 usable ranges corresponding to AC voltage selected; readings from −18 to +57 db obtainable; direct-scale reading from −18 to +11; zero db = 1 milliwatt across 600 ohms; special output jack provided with DC-blocking capacitor.
6. Size and Weight—6" x 8" x 3¼", 3¾ lbs.

I employed a sample Model 457 in a number of conventional VOM applications and found its accuracy satisfactory for radio and TV troubleshooting as well as for audio and industrial work. Speaking of audio work, I also found that the AC and db measuring circuits are frequency compensated for greater accuracy over the audio range.

From the close-up in Fig. 5, you can see that the instrument has a single selector knob for all functions and their various ranges. The 5" meter is placed on an eye-line slope, with its protective glass flush-mounted against the case. Six separate calibrated scales provide direct readings for all functions except those requiring a multiplier and output measurements in excess of +11 db. Correction factors for db readings are printed in a chart in the lower-left corner of the meter.

Since much of my time is spent in the examination of test equipment, I'm often called upon to check ac-

Fig. 5. Model 457 is battery-powered, has DC input of 20,000 ohms per volt.

curacy, limits of sensitivity and other characteristics of service instruments. I thought, therefore, that you might be interested in one simple method I sometimes use to check the DC-voltage indications of a meter like this. The procedure, which involves use of a dry cell and a few resistors, is not only helpful when familiarizing yourself with a new instrument, but also aids in keeping a running record of a meter's operating reliability. By this, I mean that a meter's accuracy should be compared to some standard when first used, and then periodically tested by the same standard for any discrepancies.

As a standard voltage source for checking DC meter scales, I have often employed a small battery of the type usually found in the service shop. Since battery potentials are subject to some variation, however, I prefer the mercury type because of its relatively long shelf life and voltage tolerance of 2% or less. The 22½-, 30-, and 45-volt batteries used to power portable radios will usually do the trick—provided, of course, their outputs are up to snuff.

Checking out the Hickok meter with a 30-volt unit, I found I could directly measure the battery voltage on both 60- and 150-volt scales. To take readings on the 15- and 3-volt scales, I made use of the same battery and the simple voltage divider illustrated in Fig. 6. The 30-volt battery potential Eb will divide across R1 and R2 in accordance with their respective resistances. Incidentally, since accuracy is of

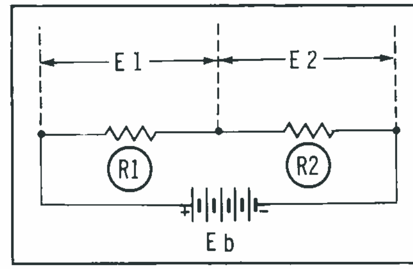

Fig. 6. Simple resistive voltage divider for checking a voltmeter's accuracy.

the utmost importance, always use precision-type resistors having a tolerance of 1% or better in this application.

Selecting a voltage division to provide 5 volts for checking the 0 to 15 volt range, I chose resistor values to obtain 5 volts across R1 and the remaining 25 volts across R2. When dealing with values that cannot be immediately calculated in your mind, you can determine the proper resistance ratio by use of the following equation:

$$\frac{R1}{R2} = \frac{E1}{E2}$$

With E1 equal to 5 volts and Eb equal to 30 volts, E2 must be 25 volts. Since E2 is 5 times the value of E1, the resistance of R2 must be 5 times the value chosen for R1. To obtain a reading on the 15 volt scale of the Model 457, I chose values of 1,000 ohms for R1, and 5,000 ohms for R2, and then measured the 5-volt drop across R1.

Checking a 2-volt reading on the 0 to 3 volt range, I employed a 4,000 ohm resistor for R1, and 56,000 ohms for R2. The ratio in this particular case was 14 to 1. The reason for not measuring directly across an ordinary 1.5-volt cell in this test is because such batteries often have tolerances as high as 10%.

When selecting resistances for a test of this kind, remember not to use too small a value or the load on the battery may be too great and its voltage output will drop. Conversely, if you make the values too high, the internal resistance of the meter may affect your calculated ratio and you'll end up with erroneous indications. To avoid this trouble, try to keep the meter impedance at least ten times greater than the total circuit resistance. For the 20,000 ohm-per-volt Hickok instrument, this would be about 60,000 ohms on its 0 to 3 volt range. ▲

Shop Talk

(Continued from page 18)

As you move back, less and less signal will be required from the generator. If, at any point, this is not found to be true, check the tube first, then the element voltages, and finally, if need be, the other components in the immediate circuit.

In the RF stages, which include the RF amplifier and mixer, the same technique applies. AM generators in this range are quite plentiful because the FM band falls between the low and high VHF television channels.

Once it is recognized that FM receivers will respond to AM test signals, even the screwdriver approach becomes feasible. This test method, long popular in AM receiver service, is based on the fact that when the grid of a tube is suddenly grounded to the chassis (Fig. 1), a pulse of voltage is developed which produces an audible sound in the speaker. By grounding the grid of each stage, in turn, as you work back from the speaker to the antenna, you can frequently uncover a stage that is totally inoperative. For stages that do not provide sufficient gain, or ones which introduce distortion, this method of testing does not provide conclusive results. In its place, however, it is useful.

Signal injection can also be utilized to uncover open IF screen-grid-bypass capacitors. Open or partially open capacitors in this application can cause a loss of gain or, in certain cases, extraneous oscillations. To test the screen-grid circuit for an open capacitor, apply the AM signal to this element through a .01-mfd DC blocking capacitor as shown in Fig. 2. If the bypass capacitor is OK, no sound will be heard from the speaker because the capacitor will present a low-impedance path to ground for the signal. However, if the bypass is open, the signal will modulate the electron beam in the

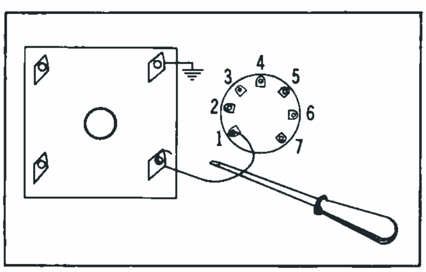

Fig. 1. Grounding grids with a screwdriver is a type of signal injection test.

tube, reach the plate circuit, pass through the system and cause sound to be heard from the speaker. The same approach can be utilized in the RF stages (RF amplifier and mixer) as well as in the audio section. In each instance, the appropriate signal frequency should be employed.

Alignment of the IF and RF stages can also be carried out with an AM signal generator and a VTVM or VOM. The proper procedure is recommended in every PHOTOFACT Folder covering an FM (or AM-FM) receiver. The method is reliable and, if the circuits are operating normally, the end result will be as good (for all practical purposes) as that obtained with the use of an FM sweep generator and oscilloscope.

It is generally an excellent idea to check the alignment of every FM receiver you service. The frequencies in both the RF and IF stages are high enough so that a certain amount of misalignment with time and usage can almost always be expected. In the IF system, the most critical feature is balance of the detector, particularly the secondary of the transformer in this stage. This balance is doubly important if the receiver is operated in a weak signal area.

At the front end of the receiver, the most critical factor is the oscillator frequency. The most noticeable effect of a shift in oscillator frequency is the appearance of the various stations at points slightly removed from their corresponding dial readings. This does not particularly disturb over-all receiver operation, but it is a source of annoyance to the user, particularly if he is hunting around for a new station. Before you return a set to its owner, always bring the stations in line with the scale markings.

Weak tubes should always be replaced, even though the effect of a

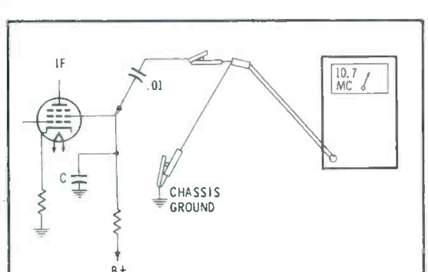

Fig. 2. Using signal injection to test screen-bypass capacitor in FM IF stage.

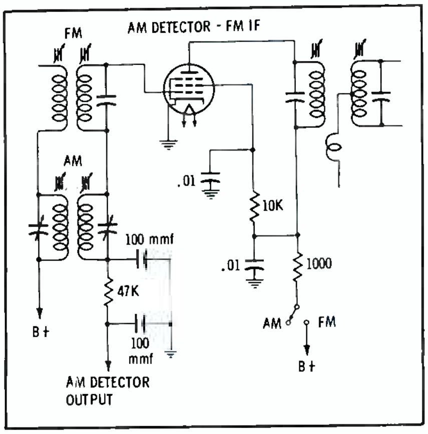

Fig. 3. B+ is removed from IF or limiter stage to convert it to AM detector.

weak tube may not be noticed when a receiver is operating under strong signal conditions. Of all the tubes in a receiver, the low-voltage rectifier is the one in which low emission has the most immediate over-all effect. Next in importance come the RF amplifier and detector tubes.

Most FM receivers also possess an AM tuner section, and this can help in localizing the source of any trouble that may afflict the FM system. When AM-FM combinations are encountered, check reception on both bands. If AM signals are received normally but the FM output is absent, distorted, or weak, you know that the power supply and audio sections are working normally. You also know that at least one IF stage is normal because it is common practice to use all or part of the IF system for both signals. It is also current practice to use a second IF tube as the AM detector. This is done by removing the plate and screen voltages from this tube (Fig. 3), and letting the control grid and cathode act as a diode. If AM reception is satisfactory, we can assume this second IF tube is OK, although a defect in the plate or screen circuit will prevent FM signals from passing through.

By the same token, if neither the AM or the FM sections respond, the trouble is probably located in a stage common to both systems. Of course, there are some combination receivers where the AM and FM signals remain completely separate, never using any stages in common. However, even here only one power supply will be found. The important thing is to recognize which stages are used in common and which are not. ▲

THE TROUBLESHOOTER

ANSWERS YOUR SERVICE PROBLEMS

Hybrid Auto Radio

A Ford Model 74BF automobile radio is trying my patience. This set, which is from a 1957 Ford, has four tubes and an output transistor. It sometimes plays for hours without trouble, but the sound usually dies out a few minutes after the radio is turned on. The owner says that the on-off switch has to be clicked several times in order to get the radio playing again. Once in a while, he can bring it back to life by simply stepping on the brake pedal. The set also is apt to conk out when any one of the push buttons is pressed.

I have checked the antenna circuit, tubes, capacitors, resistors, and printed wiring, but have not found any defects.

A. ATTANASIO

New York, N.Y.

Mechanical shock evidently plays a large part in stopping and starting the radio's operation. For this reason, I would say that the trouble is very likely to be an intermittently open connection. Voltage measurements, made while the set is on the bench, might help you to locate a stage that is cutting in and out of operation.

In cases where you can restore sound by flipping the on-off switch back and forth several times, grid blocking often turns out to be the source of the trouble. An abnormally high resistance (or intermittent open circuit) from grid to ground in one stage can cause the input coupling capacitor to charge so heavily that the grid is driven far beyond cutoff. Disturbing circuit operation by some means (for example, by interrupting the power) often allows the capacitor to discharge until the stage becomes unblocked and normal operation is resumed. Hybrid tube circuits would seem likely to develop grid blocking fairly easily, since these tubes can be cut off by driving the grid only a few volts negative with respect to the cathode. If you can restore operation by merely touching one of the control grids with a meter probe, grid blocking is probably occurring. This condition could be linked with AVC trouble.

The defect in this set might possibly be in the output transistor. If you substitute a new one, be sure to make the bias adjustment as directed in the service manual.

Overdriving and Snow

My problem is a snowy and overdriven picture on a Zenith Chassis 19Y22. I've changed all video and AGC tubes, and have checked tuner and AGC voltages, but everything seems normal. Grounding the AGC line helps to some extent, but the picture still overdrives regardless of contrast setting.

T. R. FAULK

Owensboro, Ky.

Start by checking the operating voltages of the IF stages to see if there are any abnormalities which could be causing one of these circuits to be overdriven. I would be especially suspicious of the second stage, which is not AGC-controlled. If the IF strip is being overloaded, you would have too much output signal amplitude at the video detector. This would lead to an overproduction of AGC voltage, tending to bias the tuner so heavily that snow would appear in the picture. The increase in AGC voltage would probably not cut down the input signal strength enough to compensate for the overloading.

The salt-and-pepper effect in the picture may not be true snow; i.e., it may not be due to excessive bias on the RF amplifier. Overdriven stages sometimes operate with a high noise level, giving roughly the same effect as snow. If you can't find trouble in the IF or AGC circuits, have a look at the video output—your entire problem might be contained within this stage.

Horizontal Retrace Blanking

I recently had an experience with a brand-new 1959-model RCA TV set that should be of interest to your readers. No raster was visible, in spite of the fact that the CRT was receiving high voltage and had a lit filament. When the grid and cathode voltages of this tube were measured, they were found to be almost as high as the boost B+ potential. A defect in the vertical retrace network was suspected, but none could be located.

I finally discovered that this set also

has a horizontal retrace blanking circuit that consists of a secondary winding on the width coil connected in series with the CRT grid lead. There was a high-resistance short between this winding and the primary of the coil. Since no replacement part was yet available locally, I made a temporary repair by simply removing the defective coil from the CRT grid circuit. (This is easily done by unsoldering both leads from the secondary winding and connecting them directly together.) The effect upon picture quality was not noticeable.

RALPH C. BAUGHMAN
Akron, Ohio

You have come forth with a good idea for temporarily putting this set back into operation. At least, you found a way of keeping the customer happy until you located a new width coil.

This circuit is used in RCA Chassis KCS122. Another new chassis, the KCS121, has a slightly different arrangement in which the secondary winding of the width coil is connected into the CRT cathode circuit instead of the grid circuit.

CRT Arcing

Arcing occurs in the neck of the picture tube on a Motorola Chassis TS-534. Is there any possible cause of this condition, other than a bad picture tube?

FRANK J. RICKUS
Philadelphia, Pa.

Nope! Sorry to break the bad news, but the arcing is due to a defect in the gun structure, or to gas within the picture tube.

Scope Depth

Now that the short-neck CRT has become widely used in TV sets, why can't this feature also be applied to oscilloscope tubes? Present scope cabinets are so deep from front to back that it's often hard to find a place for them on the shop bench. If a shelf is made large enough to accommodate a scope, it's much too big for the other instruments and a lot of space is wasted.

THOMAS F. STUMPF
Buffalo, N.Y.

You can save only an inch or two in cabinet depth by modifying the electron gun to permit a shorter neck length. Any further shortening of the tube has to be done by increasing the deflection angle so that the screen can be brought closer to the deflection plates. Since oscilloscope CRT's are electrostatically deflected, an increase in sweep angle presents serious problems not encountered with those using electromagnetic deflection. Wider sweep can be obtained only by increasing the voltages applied to the deflection plates, and these voltages are limited by the maximum ratings of the tubes employed in the deflection amplifiers.

If you're badly cramped for bench room, a scope with a 3" screen would be your best bet. It takes a minimum of space, but still provides satisfactory viewing.

Servicing New Designs

(Continued from page 29)

and a detenting switch rides on a cam clamped to the tuner shaft.

The bypassing switch on this tuner (also necessary for efficient remote - control operation) is mounted on a complex mechanical linkage that automatically regulates the setting of the fine-tuning capacitor. This linkage swings back and forth when the tuner shaft is rotated, coming to rest in different positions on different channels. These various fine-tuning settings are established by a ring of plastic screws (acting as cams), which project from the rear side of the drum assembly and are individually adjustable by rotation of the front-panel push buttons.

One contact of the bypassing switch is mounted on the movable portion of the fine-tuning linkage, while the other is stationary. During normal fine-tuning action, these contacts never touch each other because the movement of the linkage is relatively slight. But if the plastic screw for any channel is backed all the way into the drum housing, the linkage is permitted to move through such a wide arc that the contacts of the bypassing switch can close. When this happens, the tuner is prevented from stopping on the affected channel.

When a General Electric U3 receiver with remote control is installed or moved to a new area, the bypassing mechanism should be adjusted to suit the owner. The front-panel buttons are simply turned as far as possible in a counterclockwise direction for all inactive channels.

Most parts in this unit are keyed to an extension of the tuner shaft and are not likely to cause trouble by slipping out of position; however, you may come across an occasional complaint of inaccurate tuning as a result of some defect such as misaligned switch contacts. If trouble develops in the tuning mechanism, the source can often be located by careful visual inspection of the unit in operation.

Transistorized TRF

The Regency Model TR-22 radio has four transistors, *all* of which are audio amplifiers! The entire "head end" of this receiver consists of a surface-barrier transistor X1, wired in a reflex circuit and serving as a combined RF and AF amplifier. Don't look for any local oscillator or other features you are used to seeing in superhets, for this radio is an up-to-date version of the good old tuned-radio-frequency circuit.

The RF output of X1 is coupled through L2 to a crystal-diode detector; after demodulation, the signal is fed back to the base of X1 for further amplification (see Fig. 3). The audio output is developed across the volume control, which is in the return circuit from the collector of X1 to ground. From the arm of the control, the signal goes through a 2-mfd capacitor to an audio driver stage and from there to a push-pull output circuit.

A portable phonograph, Model RP-3, is included in the same cabinet with the radio. Four Size-D dry cells furnish power for a small motor which drives the turntable at 33, 45 or 78 rpm. A turnover cartridge (with two sapphire needles) feeds its output to a phono jack in the base circuit of X1. From this point, the phonograph signal passes through the same circuits as the demodulated radio signal.

If you are not familiar with transistor circuitry, you may be somewhat puzzled by the way the phono jack is wired. The "low" side doesn't go to a conventional ground connection — instead, it returns to the plus terminal of the battery!

This arrangement is easily understood if you know the operating requirements of p-n-p transistors. In these units, the DC voltage at the collector must be negative with respect to the DC emitter voltage. For X1 in the TR-22 radio, the proper voltages have been obtained by returning the collector to the negative side of the battery (which happens to be grounded) and returning the emitter to the positive side.

Note that "ground" is a common reference point for DC only. As far as the AC signal path through X1 is concerned, the emitter is at the "low" side of both the input and output circuits — in other words, it's common to both. In this respect, it corresponds to the cathode of an ordinary tube circuit. We are so accustomed to seeing tube cathodes at or near ground potential that we are inclined to be suspicious of a topsy-turvy circuit that seemingly has the wrong side grounded. However, the arrangement shown in Fig. 3 causes no operating difficulties.

The DC base voltage of X1 should be a few tenths of a volt less positive than the emitter voltage. This correct value of bias is maintained by a voltage divider across the battery, consisting of three resistances in series — the volume control, fixed resistor R3, and the internal base-to-emitter resistance of X1. Since the last-named resistance is only a small part of the total, the voltage drop between the base of X1 and ground will be much greater than between the base and emitter. The value of R3 varies from receiver to receiver in order to compensate for differences between individual AO-1 transistors.

For maximum radio sensitivity, X1 is operated in a "controlled regeneration" stage; that is, positive feedback is maintained just below the level at which the circuit will break into oscillation. If one of these receivers should give trouble because of oscillation at some point in the tuning range, it will probably be necessary to touch up the RF alignment. Briefly, the procedure is as follows: The radio is tuned to the high end of the broadcast band, and the "gimmick" wire (Fig. 4) is bent toward the ferrite-core antenna to produce oscillation—then backed off until it ceases. At the low end of the band, the entire antenna rod is slid to the right until oscillation occurs, and then drawn to the left again in order to stop the oscillation. These two adjustments may have to be "rocked in" for best results. A wax seal is factory-applied to the antenna to keep it from shifting out of position during normal handling, and the same (or similar) treatment should be applied after field alignment to insure that the job will be a lasting one.

'58 Designs Affect '59 Servicing

Have you been servicing quite a few '58-model TV sets lately? Probably so, since some of these receivers (first introduced in the fall of 1957) are nearly two years old. You've undoubtedly noticed they often differ from older receivers in electrical as well as mechanical features. Some of these changes add up to definite design trends which will have important effects on your future servicing work. To give you a clearer over-all view of the direction in which TV circuit design seems to be progressing, we've made a detailed survey of all 1958 television chassis. Some of the resulting figures may really surprise you.

Among all 1958-model TV sets—

Slightly more than half have 110° deflection. Most of the others have a new type of "short-neck" 90° CRT which requires no ion-trap magnet.

About 3 out of 4 use a crystal diode as a video detector; but Emerson, Hoffman, Packard-Bell, Philco and Silvertone generally have a diode section of a tube (-AM8 or -AS8) in this stage.

Only 1% have two sound-IF stages. A few per cent have none at all.

40% use a -DT6 tube as a quadrature-grid sound detector. Usage has doubled since '57! Another 24% employ a -BN6 (gated-beam) tube in another type of quadrature-grid detector circuit. Several top brands of '58 receivers, including General Electric, Hoffman, Packard-Bell, Silvertone, and Sylvania, are equipped with ratio detectors; many Emerson, Muntz and Philco sets have sound discriminators.

Over one-fourth use a -BU8 tube in a noise-limited AGC and sync circuit. 18% of other sets have conventional-type keyed AGC circuits; an additional 18% have simple (RC-type) AGC networks including an area switch or control.

More than 80% use a vertical multivibrator that includes the output tube as part of the oscillator circuit. (Usage is 20% greater than in '57.) The most important remaining users of vertical blocking oscillators are General Electric, Magnavox, and several private - label brands.

1 of every 4 has a pulse-width horizontal AFC circuit. Principal users are Emerson, RCA, Silvertone, and certain private-label sets.

Fully 80% use a -DQ6 or -DQ6A tube in the horizontal-output stage.

60% still feature some form of width adjustment — coil, potentiometer, or sleeve. Almost a fourth of the '58 sets have a horizontal-drive trimmer or potentiometer. A re-

ceiver frequently has one of these features but not the other.

The vast majority use boost B+ as a plate-voltage supply for the vertical oscillator. Boost has several other applications, too. It goes to the plate of the vertical output tube in 27% of sets; to the horizontal oscillator or discharge tube in 27%; to the quadrature-grid sound detector in 22%; and to the screen of the AGC-keying tube in 10%.

Only about 5% (mostly portables) use 450-ma series-string tubes. Another 53% use series-heater tubes drawing 600 ma. The remainder have parallel heaters.

Median value of high voltage is slightly over 14 kv. Few sets have high voltage under 12 kv or over 17 kv.

30% have a fuse in series with the B+ lead to the damper to protect horizontal-sweep components. Two-thirds have some type of protection for the low-voltage supply —B+ fuse, fusible resistor, circuit breaker, or power-transformer primary fuse. Less than 10% have fused filament circuits.

These figures are our estimates based on quantities of individual sets produced with a given feature — not merely the number of different chassis designs including that feature. Much of the information will apply fairly closely to '59 TV sets, since the electrical differences between '58 and '59 chassis are relatively slight in comparison to differences between '57 and '58. Most important '59 trends appear to be increases in the use of 110° picture tubes and power transformers.

Planning To Move?

If so, notify us by the 15th of the month to assure uninterrupted delivery of PF REPORTER.

Be sure to include both your old and new address. (Or better yet, enclose a current mailing label with your new address.) Send to:

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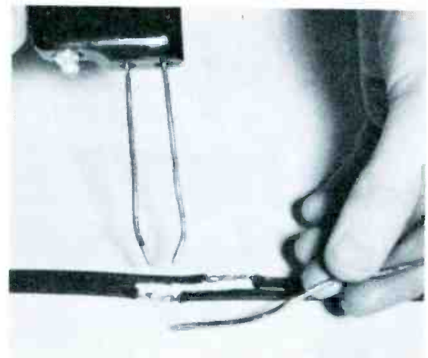
TIPS for TECHS

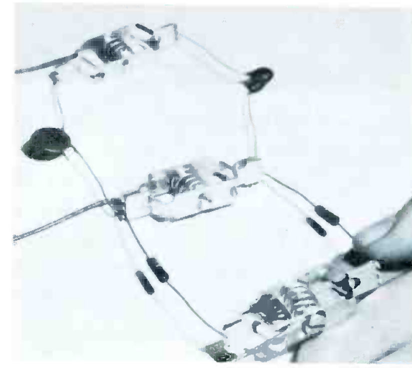


Soldering By Current Flow

By removing your gun's regular soldering tip and replacing it with two electrodes fashioned from a couple of 5″ lengths of #8 solid copper wire, you can solder by current flow. Using this technique, the work becomes part of the gun's tip, and current flowing through the work heats it faster and permits you to solder heavy work much more efficiently.

One typical problem solved by this soldering method is outdoor soldering. By touching the electrodes to the wire on either side of the joint, the joint itself will become heated and thus cold wind won't be able to rob the work of as much heat as it otherwise would.

File the end of each electrode to a slight point and tin by allowing them to touch together long enough to heat.

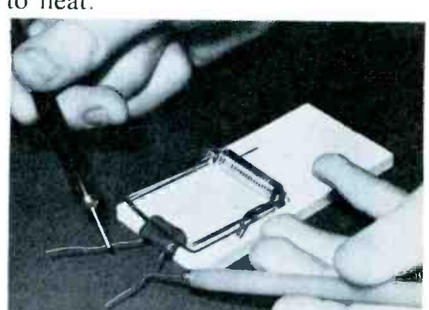


Clips for Temporary Circuits

When you want to set up a simple integrating filter or any other type of simple circuit just for temporary use, save time by using Mueller #22 dual clips as shown. These solderless connectors allow you to set up a breadboard circuit and tear down again in just a jiffy. You can substitute parts readily to obtain the exact circuit you desire.

Silence Those TV Noises

In electronics gear, a buzzing transformer or resonant panel that vibrates annoyingly can be effectively silenced with auto undercoating. Brush on a coat or two, but be sure to allow sufficient drying time between coats if you apply more than one. You can obtain a can of the undercoating quite inexpensively at most any auto parts store.



Mouse Trap Is Service Aid

A small mouse trap like the one shown is a mighty handy "gimmick" to keep around the service shop. You can use it to hold a part still while testing or soldering, or you can attach it to the shop wall with a woodscrew and use it as a clip board for holding notes, price tags, service data or diagrams. It's a good wall hanger for a pair of test leads, too.

Tape Tab Aids Fuse Removal

Ever have trouble removing a tubular fuse from its clip in a crowded location, such as the high-voltage cage? Sometimes it's even difficult to reach with a fuse puller. Before you install a new fuse in such location, make it easier to remove next time by wrapping a strip of clear Scotch Tape around the fuse as shown. Loop the tape around the fuse and put both ends together to form a tab.

"Liquid Wrench" for Antennas

Those of you who don't carry a bottle of rust solvent in your toolkit are obviously doing things the hard way when it comes to antenna maintenance. There just isn't a better way of loosening rusted screws and nuts, so why waste time and make antenna work harder for yourself? See to it that your kit always has at least one bottle of this work-and-time-saver.

Mattress for the Truck

An inflated air-mattress can be quite a handy item to carry around in the TV service truck. You can use it to set TV sets on to absorb sharp jolts when driving over rough roads. Or, you can wedge it in between two sets to keep them from marring each other. (Nothing hurts a customer more than to see a couple of cabinet scratches that weren't there before!) Of course, you want to make sure that helper of yours won't be using it for mid-afternoon snoozing!

Save That Transistor!

If you accidentally solder the leads of a replacement transistor into the circuit the wrong way, chances are that you'll ruin it when the equipment is turned on. To make sure this doesn't happen, mark each individual lead by slipping a short length of colored spaghetti over it. Set up a color code of your own, such as yellow for emitter, black for base and red for collector. If you can't find spaghetti small enough, remove the insulation from some #20 hookup wire.

Portable "Tool Box"

When you have to check out a long antenna lead-in for breaks or other troubles, a heavy toolbox is much too cumbersome, especially during trips up and down the ladder. A neat easy-to-carry "tool box" for the purpose is a photographer's gadget bag. Just toss all the tools you'll need into the bag and sling it over your shoulder. You'll find it easier to handle than a tool box.

Industrial Electronics

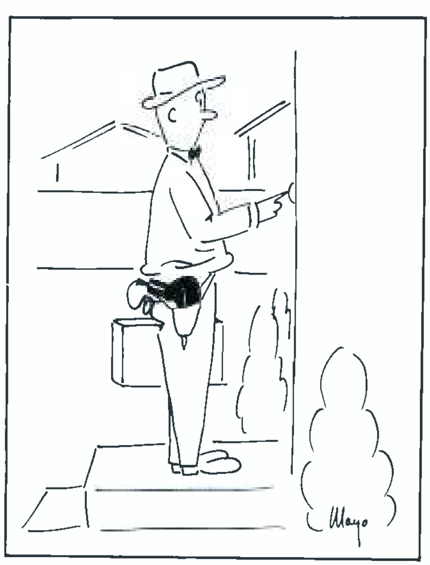
(Continued from page 31)

used in a 5-kw heater. The oscillator operates at 13 mc, using a tuned-grid, tuned-plate circuit. The grid is tuned by a variable inductance. The complete grid-signal path includes the capacitance existing between the internal grid structure of the tube and a coupling ring placed over the glass envelope. Grid bias is developed across an RF choke (not shown), which is connected to the grid terminal at the top of the glass envelope and returned to ground through the grid-current meter. The plate circuit is tuned by shifting the position of the output tap on the plate-load inductance. A fixed glass capacitor and the capacitance formed by the work complete the tuned plate circuit.

The tube is cooled by an air stream passing over the plate fins and then the glass envelope. Sudden changes in air temperature are evened out by heat transferred from the plate fins in order to reduce strains caused by uneven glass temperatures.

The blower draws air through a fiberglass filter. Clogged filters reduce air flow, and insufficient air flow can damage an expensive oscillator tube. When servicing dielectric heaters, *always* check the air filters. This is more important for good customer relations than cleaning the picture tube on a television service call.

Oscillator resonance can be checked only when work is placed between the two output plates. The test may be made with a grid-dip meter while power is off, or else with



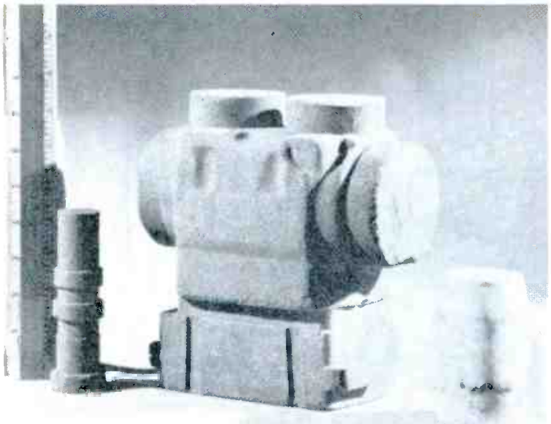


Fig. 6. Height variation permissible when using 9″ spacing between plates.

a wavemeter while reduced power is on. In drying operations, resonance is maintained by automatic feeding; that is, the work moves slowly between the plates at whatever pace is needed to maintain an unchanging dielectric constant in the heating area.

Gluing Lumber

Short pieces of lumber had been considered waste material until "rapid gluing" (dielectric heating used to dry and "set" the glue) enabled lumber processors to produce standard-length lumber from them. After all the standard lengths of first-grade lumber have been cut, the leftover short pieces are fitted together and glued. These pieces are fed to the heater on a conveyor belt. Fig. 5 shows a setup for continuous-feed drying used in production-line sawmills. Constant movement of wet glue and boards between the heating plates maintains the dielectric property required for resonance.

Load-Impedance Matching

A useful rule of thumb for match-

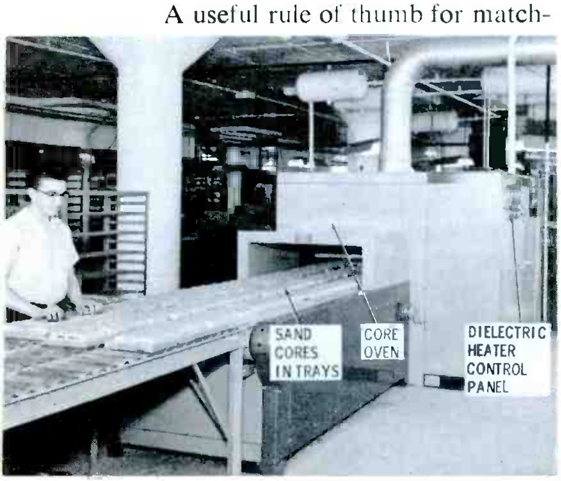


Fig. 7. 25-kw *Allis-Chalmers* "Foundromatic" heater for drying sand cores.

ing load impedance to the power source in a dielectric heater relies on visual and audible indications. The impedance-matching network is similar to a voltage divider, and improper coupling between oscillator and heating plates causes too much voltage across one part of the divider. If the load receives too much voltage, an arc is formed across the heating plates. Coupling impedance must then be increased to reduce the voltage across the load and thereby eliminate the arc. If coupling impedance is too high, insufficient power is coupled to the load and an arc is formed in the oscillator circuit.

Between these extremes of arcing in the load or in the oscillator, the operator should find a coupling value which provides optimum heating without arc-overs.

Sand-Core Drying

Arc-over is a special problem when objects vary in height or shape but are heated simultaneously. Fig. 6 shows several of the shapes encountered in sand-core drying for casting molds. Arc-over is prevented by limiting the variation in object height and placing the "hot" plate well above the highest object. With a limit of 7.5″ for object height, the plate is set 9″ above the conveyor belt.

The larger items absorb most of the available heat energy at first, but they take progressively less as they dry out. As a result, small items begin drying later than large ones —and all object sizes tend to dry at about the same time.

Fig. 7 illustrates a typical sand-core drying setup. Dried cores are shown coming out of the oven on a conveyor belt. In this instance, they are uniform in size and held in trays to provide easy handling. The oven is enclosed to protect personnel from high voltage, not to retain heat. A second function of the oven enclosure is interference shielding. The oscillator frequency is stable under load conditions, but may change when the load is removed. This shield prevents objectionable radiation.

Electronic Sewing

"A Stitch in Time Saves Nine." Plastics are sewn by heating the

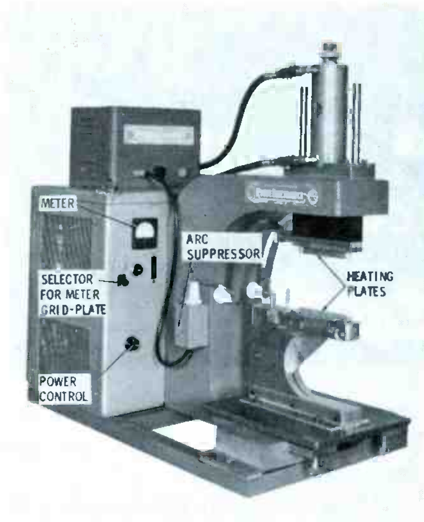
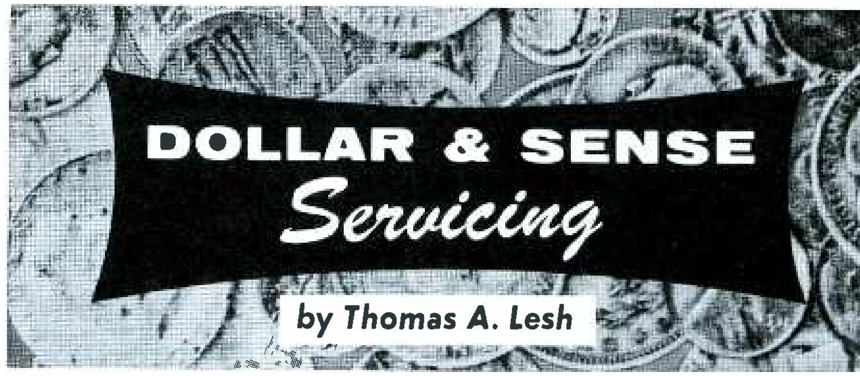


Fig. 8. ***Reevelec electronic sealer with air-operated press and arc suppressor.***

bonding surfaces under pressure. This type of sewing not only saves "nine", but eliminates *all* stitches. The instrument shown in Fig. 8 bonds the tongue and places simulated stitches on plastic boots. Arc-over, which could reduce the plastic to a cinder, is eliminated by an arc suppressor (dummy load). Power takes the path of least resistance, which lies through the plastic when the jaws of the unit are closed. However, as the jaws open, the resistance through the work exceeds the resistance through the dummy load. Power therefore passes through the dummy load and does not try to arc through the air and plastic to ground. ▲

"But why should you have feeling of insecurity—you're well paid and have plenty of work."



Never loan a clunker-owner a non-clunker loaner . . .

If you have a few old small-screen sets that you loan to customers while their receivers are in the shop for repairs, don't worry about the possibility that shortcomings in these sets might reflect on your technical ability. Actually, you're better off if the CRT has quite a bit of mileage on it, the picture is slightly blurry, and sync is on the jittery side. You can excuse the deficiencies of these sets by saying you haven't had time to give them a thorough overhaul—but the truth is that you can't afford to let a temporary substitute outshine the customer's own set. He's probably forgotten how his set performed before it broke down; when you bring it back, he can't help using the loaner as a standard for comparison. After extensive repairs, his own TV had better look good!

$ & ¢

Calculated Risk. Whenever service-shop owners get together, one perennial source of debate is the problem of getting paid for work after it has been completed. What do you do when the set owner lets you think he will pay cash, and then suddenly puts on a long face and says he's broke?

Several of the students at the NARDA School of Service Management (held in March) reported success in using two different remedies for the bad-debt problem. The milder of these two schemes involves accepting post-dated checks for partial or total payment of service bills. If a customer refuses to pay when the set is delivered, he is encouraged to write out a check and date it two weeks to a month later. This system was said to be effective in a surprisingly high percentage of cases; the customer usually makes a bank deposit on his next payday, and the check doesn't bounce.

If you decide to try this idea, be sure to investigate your state laws applying to passers of bad checks. There may be a statute that will help you enforce payment.

Of course, post-dated checks still have an element of risk. If you'd rather take a firmer approach to the credit situation, visit a lawyer and have him draw up a simple chattel mortgage to be printed on the back of the service ticket. Get the customer to sign this, and you can legally take away his set if he doesn't pay the bill. His signature on the invoice itself is not sufficient to give you this legal right of confiscation.

$ & ¢

Help Stamp Out Gossip. One of the great benefits of television is that it gives people a wealth of subjects for idle chit-chat. Folks nowadays are talking more about the networks and less about the neighbors.

Keep those sets working; the reputation you save may be your own!

$ & ¢

What a Difference a Word Makes. Tired of continually trying to justify the "labor" charge on service bills? Rickbeil's TV shop in Worthington, Minn., found this item much easier to explain to customers when the word "service" was used instead of "labor" on the invoice form. The non-technical public tends to think of "labor" in terms of a routine part-changing job worth about $2 an hour, but "service" somehow implies a more thorough, high-quality job that deserves a greater reward.

Communications Receivers

(Continued from page 24)

socket. (So, if you find a loose wire, don't cut it off; it may be the BFO coupling!) Feed an unmodulated signal at the IF frequency into the mixer, turn the BFO on, and set the pitch control in the center of its range. Now adjust the BFO transformer to produce a pleasing beat note (about 1,000 cps), and its alignment is complete.

Aligning Crystal Filters

The alignment of sets using crystal filters in the IF section is much more critical, although not necessarily more difficult. Here, the crystal itself furnishes the frequency standard, and the signal-generator frequency must match it. The output indicator and signal generator are connected as before, and the generator is tuned to the vicinity of the proper frequency. Then, it is tuned very carefully through the IF frequency. (Make sure the crystal filter is switched on and, if the crystal switch has three positions, OFF-BROAD-SHARP, that it is set to BROAD position.) A sudden sharp increase in the output reading indicates that the signal generator is exactly on the crystal frequency. With the generator exactly tuned, the crystal is switched out of the circuit and you are ready to proceed with the actual alignment. When alignment is completed, switch the crystal back in. This should result in a sudden increase in the reading if the alignment is good.

Aligning IF's which have crystal filters is much easier if a scope and swept signal input is used. After the standard alignment is completed, the vertical input of the scope should be

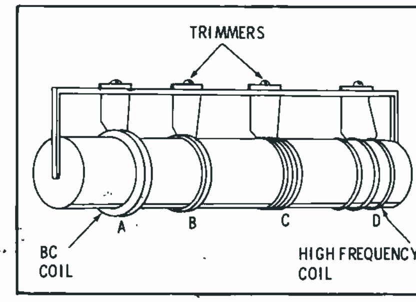


Fig. 3. Single coil form can be used for all bands; large coil is for low band.

connected to the detector output, the output cable of the sweep generator (sweep width about 30 kc) going to the mixer grid. The generator is adjusted to produce a pattern on the scope screen, and the crystal filter is switched into the circuit. The pattern should then resemble Fig. 1. The small hump may be due to either the crystal filter or the signal generator. To identify the hump caused by the generator, move the generator dial slightly; its response curve will "walk" back and forth. Next, move the generator signal to coincide with the response of the crystal. This should result in the pattern rising in amplitude quite a bit, and becoming extremely steep-sided as shown in Fig. 2. Reduce the pattern to a usable level by turning the signal generator gain down. Recheck the settings of the IF trimmers to see if any improvement in IF alignment can be obtained. Check for proper curve shaping; it should be almost exactly as shown, although minor differences in equipment can cause slight variations. When the crystal filter is switched off, the curve should drop in amplitude and widen out considerably, but should not shift in frequency (sidewise). Correct response is indicated when the pattern "jumps up and down" as the crystal switch is actuated.

Calibration and RF Alignment

Even though the IF alignment of these sets is almost conventional, dial calibration and RF alignment are entirely different. Here, once again, let us emphasize the importance of having a full set of service data for the receiver being aligned. In these multi-band sets, a full complement of trimmers and padders, together with slug-tuned coils on some sets, make the actual alignment very easy; however, the technician will often find himself suffering from an embarrassed richness; he'll have so many trimmers he won't know what to do! Using the correct service data, this is an easy job. Without it, life can become complicated indeed! The time saved by not having to hunt trimmers and coil adjustments will more than pay for the small cost of the service information.

Coils and Adjustments

Two major styles of coils are found, depending more or less upon the size and cost of the receiver. In less expensive sets, all the coils in a tuned circuit will be wound on a single form. In better sets, individual coils will be used. The bandswitching arrangement is essentially the same in all sets. Mostly, coils are completely switched, from stage to stage. This setup is shown in Fig. 3. The "tapped-coil" type used in many multi-band BC receivers is not found too often in communications sets.

A typical bandswitching layout (Fig. 4) is shown from the "technician's side," the bottom. In almost all sets, a metal cover is provided, with access holes for making trimmer and padder adjustments. This cover is a part of the shielding, and alignment should never be attempted unless this cover is in place and firmly bolted down.

Coil and Trimmer Identification

Let's assume we have a set for alignment that is similar to the one shown. It has 4 bands: Broadcast, 1.4 to 5 mc, 5 to 15 mc, and 15 to 40 mc. No service data is available; therefore, before beginning the alignment procedure, we must identify the adjustments for the various sections. Fortunately, this is not too hard. There are four major sections; i.e., antenna, RF, mixer, and oscillator. Locating the antenna adjustments is easy; they are always at the back, near the antenna input. Next are the RF adjustments, which can be identified by simply tracing the lead from RF amplifier tube socket to the bandswitch. The mixer adjustments are located by tracing from the mixer grid to the bandswitch, and the last, or front section, goes to the oscillator grid. Using a soft lead pencil, we mark this information on the bottom plate of the receiver, which was removed to let us see the bandswitch and coil assemblies.

Now, which trimmers adjust which bands? Looking at Fig. 4, we can see a decided difference in the physical size of the coils. Bigger coil, more inductance and lower frequency; thus, the biggest coils in each section belong to the BC band. The next largest coils to the next band, and so on down the line. The sections are separated by metal shields. Mounted in each compartment are 7 adjustable capacitors, 4 on the back wall and 3 on the front wall. By circuit tracing, we find that the rear capacitors have two insulated leads going to the coils; the

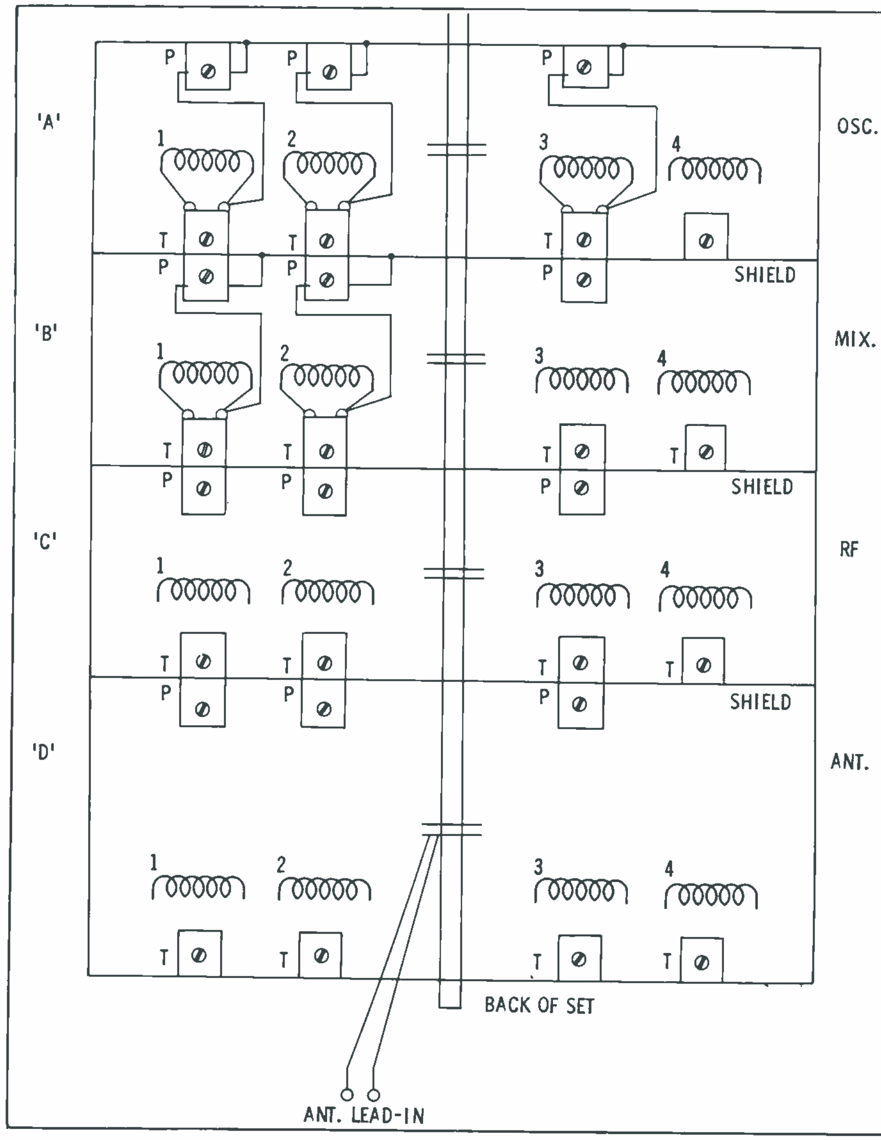


Fig. 4. Bandswitch, coil, and trimmer layout for typical communications set.

front ones have only one lead to the coils, and the other is grounded. Remembering that a "trimmer" is always connected *across* a coil, and is adjusted at the higher end of the frequency band, while a "padder" is connected in series with the ground return of the coil, we can pin these down (see Fig. 5). Also, we can get a clue by looking at the size; trimmers are always *small*, with possibly only two blades, while padders are larger, with many blades and higher capacity. By checking the connections, we determine that this set has all the trimmers mounted on the

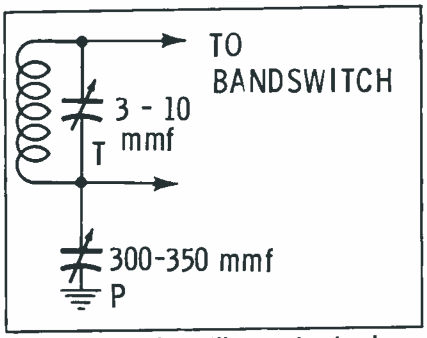


Fig. 5. Typical oscillator circuit showing the location of trimmer and padder.

back wall of each compartment, and the padders are mounted on the front wall. By checking the sizes of the coils, we see that the BC band is on the left side, all the way back; therefore, we mark these holes in the bottom plate with the appropriate frequencies. Trimmers are always used to adjust the high end of each band, and padders the low end. Alignment frequencies are determined by checking the dial scale, selecting the highest and lowest frequencies for each band.

Note especially that each band is provided with a low-frequency adjustment in each stage. This means that the old method of "rocking" the dial while adjusting the low end is not usable in this case. To adjust the low end, the signal generator is set up, the oscillator padder is adjusted for maximum reading, and the rest of the low-frequency adjustments are tuned without moving either the receiver or signal generator frequency-tuning dials. This type of adjustment, of course, gives us far better sensitivity and selectivity at the low end of the dial.

One more difference should be mentioned before we leave this section. Notice that the highest band (15-40 mc) does *not* have low-frequency adjustments as such. This is common practice. Because of the high frequencies used here, coils generally consist of only 4 to 6 turns, and any low-frequency adjustments that are necessary may be made by bending the turns slightly. In most cases, little or no adjustment will be required at the low-frequency end of the highest band.

The drawing shows all capacity adjustments; quite a few of the better sets will use coils with adjustable slugs for low-frequency alignment. The alignment process is the same; mark the adjustments and their frequencies on the bottom plate. This saves time, as you won't have to turn the set over to check the dial for each band.

Calibration

If alignment instructions are available, always follow them for the order of alignment. If this information is not available and tapped coils are used, always begin alignment at the highest frequency and finish with the broadcast band. This order may be used on all sets, although it is not too necessary when separate coils are used. With a well-designed set, there is little or no interaction between stages.

Probably the best general order of alignment would be as follows: Beginning with the highest band, set the signal generator (after checking against WWV, etc.) for the highest alignment frequency and tune the receiver dial to exactly that frequency. (Before doing this, check the set's main dial pointer for proper setting; there will always be a calibration mark at the low end of the dial. Be sure the BANDSPREAD pointer is set at the correct place, either 0 or 100, or at a specified calibration mark. Failure to do this will throw your main dial calibration off seriously. A calibration mark is generally stamped or printed on the bandspread scale.) Adjust the oscillator trimmer for maximum reading on the output indicator. Now, turn both set and generator to the low end of the same band, and adjust padder or coil-slug for maximum. Recheck adjustment at the high end. Reset it if necessary, and then adjust mixer, RF and antenna trimmers for maximum. Return to the low end and set the mixer, RF and antenna padders for maximum. Always set the oscillator trimmer and padder *first*!

When setting oscillator trimmers, be sure you don't get the "image" frequency, which is caused by the oscillator being operated at a frequency below that of the incoming signal. When this happens, there is another dial setting where an IF difference signal is produced. This dial setting always differs from the correct one by double the IF frequency. Thus, if the oscillator were actually operating at 14,545 kc to pick up a 15 mc signal, you could also receive the signal at a setting of 15,910 kc on the set's dial. If there is any confusion as to which of the signals is actually the correct one, check their relative amplitudes. The image will always be weaker than the true signal. (For a positive check, see the alignment instructions. They will specify whether the oscillator works above or below the signal on any given band.)

Obtaining exact frequencies for calibration is best done by checking the signal generator against WWV. Tune in the signal on the receiver itself, say at 10 mc. Now zero-beat the signal generator against this. Of course, the WWV signal itself may be used instead of the generator output. Harmonics are very useful in this type of work; for instance, if a 20 or 40 mc signal were needed, the signal generator could be checked at 10 mc, then the output turned high enough to make the 3rd and 4th harmonics usable. As each band is aligned, check it by tuning in the nearest WWV signal. For maximum sensitivity, make final calibration adjustments, including touch-up adjustments on antenna and RF trimmers, on the "air signal."

Tracking

With calibration complete, the tracking of each band should be checked. This is very helpful in detecting accidental alignment to image frequencies, etc. It is quite possible for each end of a band to be "on the money," and a serious miscalibration to occur in the center. This does not happen too often with better sets, but is common in less expensive models.

One of the quickest methods of checking tracking includes the use of a 1-mc crystal in the signal generator. Set the RF output for 400-cycle modulation and feed it into the antenna terminals of the receiver. The response at each 1-mc interval may now be checked all the way up to the highest band. With a strong signal generator, output has been detected as high as the 30th harmonic! Checking against the WWV signals on each band will help to identify the proper harmonic.

One way of correcting mistracking is to make calibration adjustments lower at the high end, and higher at the low end of the band. For instance, if the band normally covers the range between 15-40 mc, and tracks very poorly in the center, it could be retracked at 30 and 20 mc instead of 40 and 15 mc. This would move the "correct" points closer together, and improve the tracking over the whole band. These can be altered as necessary to achieve the best over-all response. If the tuning capacitors have split rotor plates and the tracking on all bands is poor, the split plates may be bent very slightly to correct mistracking. Only a very small amount of correction can be used, because it will shift the frequency of the other bands by the same amount. If the band has both trimmer and padder adjustments, and small coils, some improvement may be made by shifting the coil-spacing to improve tracking near the center of the band, and then resetting the trimmer and padder.

Final Testing

After all calibration and alignment adjustments have been completed, give the set a thorough air-check on all bands. A little practice in short-wave listening will soon enable you to determine when a set is giving good performance. A study of short-wave reception reports will help you to know just what kind of reception should be expected at any given hour of the day. Certain bands will be very poor in the daytime, but very lively at night—performance on others will be just the reverse. Calibration on the BC band is very simple; just check it against local BC stations whose carrier frequencies are known. They are required by FCC to hold their carriers to within ± 5 cycles, and they serve as very accurate and inexpensive test frequencies. The medium-frequency bands, 1.4 to 4.5 mc, may be easily checked by setting the generator to a known BC frequency and using its 2nd harmonic; i.e., 2900 kc is the second harmonic of 1450 kc.

With a little care and practice in the actual work, and the use of proper methods and equipment, this type of servicing can be very satisfying, as well as profitable. Because of the precision measurements and adjustments required, these jobs command a better price than ordinary alignment work. ▲

PRODUCT report

For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Panels To Modernize Testers (No. 45D)

New front panels, listing the most recently introduced types of TV tubes as well as many widely-used industrial types, have been prepared for the Seco GCT-8 and GCT-5 *Grid Circuit Testers*. These panels may be ordered from the manufacturer for $1 each. Request No. 598 for the GCT-8 or No. 595 for the GCT-5.

Capacitor Kit (No. 46D)

Cornell-Dubilier is furnishing capacitor assortments in metal storage cabinets called *C-D Twin Treasure Chests*. An open section at the top contains 12 *Preferred* twist-prong electrolytics, and four partitioned drawers at the bottom are filled with 16 *Blue Beaver* electrolytics and 73 *PM* Mylar tubular units. Alternate combinations of capacitors are available. Dealer cost is $49.95 for the complete kit.

Phono Cartridge Cabinets (No. 47D)

For compact storage of a dealer's stock of phono cartridges, Jensen has designed "modular" 11" x 11" x 3" steel cases which can be snap-locked together to form cabinets of any desired shape or size. Each case has twin drawers and is sold fully stocked with 18 assorted cartridges in each drawer.

Tube Handbook (No. 48D)

The 1959 edition of the *CBS-Hytron Technician's Handbook* contains detailed data sheets for all common types of radio-TV receiving and picture tubes, as well as condensed data charts for seldom-used and special-purpose tube types. An appendix explains the meanings of symbols and electrical ratings found in the data. Page size is 4½" x 9"; price is $1.85.

Turnover Cartridge (No. 49D)

The Acos *Hi-g*, a British piezoelectric cartridge being sold in this country by Duotone, has built-in RIAA equalization and an output of .8 to 1 volt. Compliance is 4 x 10^{-6} cm/dyne, and tracking force is 2 to 4 grams. Model GPS73-SS ($8.70) has 0.7- and 3-mil sapphire styli; GPS73-S/D ($14.70) has a 0.7-mil diamond and a 3-mil sapphire.

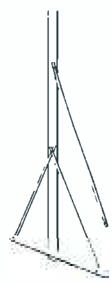
VHF Booster (No. 50D)

A low-noise 6DJ8 twin triode, with new-type "frame-grid" construction, operates as a broadband VHF amplifier in the Blonder-Tongue Model AB-2 antenna-mounted TV booster. The bottom of the weatherproof aluminum case swings down to expose the chassis. Terminals are of the 300-ohm *No-Strip* type, with serrated washers that bite through insulation. The amplifier unit, including remote control box, sells for $54.95.

Speaker Switch (No. 51D)

New Products Co.'s *Sound-Off*, a remote-control device which clips into the speaker circuit of a radio or TV set, has three switch positions — sound cutoff, half volume, and normal volume. Its butyrate plastic case is equipped with two jacks that supply a signal to earphones even when the speaker sound is cut off. Set RCL-1 (with earset) is $12.75; RC-1 (without earset) is $7.95.

Antenna Mount (No. 52D)



The *G-C Telco Tri-Roof Mount* (No. A-8173) is a combination of an aluminum antenna mast and an adjustable tripod-type mounting base. The mount assembly is available either separately at $4.50 or in a complete kit (No. A-328; $9.95) that contains all accessories needed for installation, including lead wire, standoff insulators, "speed nails" and a lightning arrester.

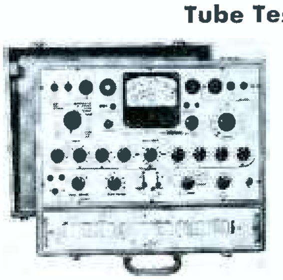
Stereo Switch (No. 53D)

A four-position lever-type switch, Anchor Products HS-234, regulates the inputs to a dual-channel stereo preamp. The OFF position disables the signals; MONAURAL applies the same signal to both channels; STEREO applies two separate signals in normal order; and REVERSE transposes the two inputs. List price is $6.50.

Silicon Rectifiers (No. 54D)

Silicon rectifiers by Arco Electronics are hermetically-sealed "top-hat" units with pigtail leads. Type SR40, designed for use in TV B+ power supplies, has an output current rating of 500 ma and a peak inverse voltage rating of 400V. A number of other types are also available for different applications.

Tube Tester (No. 55D)



The Triplett Model 3444 portable tube tester uses a 5-kc test signal to measure dynamic mutual conductance. Potentials on different tube elements are individually selected by means of multi-position switches. The meter scale has four direct-reading Gm ranges, with full-scale readings of 1,000; 3,000; 10,000; and 30,000 micromhos.

May, 1959

latest JACKSON tube test data

TUBE TYPE	MODEL 648 FIL.	CIRCUIT D.	E.	PLATE TEST	MODEL 115/715/561 FIL.	X.	PLATE	YZ
1S2A	1.4	12	9	38VX	1.4	23467	28	8S
6DZ8	6.3	125 A127	AC389 AC46	25W 48XZ	6.3	-	11 30	4JNS 7KS
18DZ8	19.	125 A127	AC389 AC46	25W 48XZ	19. 19.	- -	11 30	4JNS 7KS
35DZ8	35.	125 A127	AC389 AC46	25W 48XZ	35.	-	11 30	4JNS 7KS

TUBE TYPE	MODEL 49 SEC.	A.	B.	C.	D.	CATH. SHORTS	E.
1S2A	D	1.4	2X	58	0	-	32
6DZ8	P T	6.3 6.3	4 4	 X	367 19	2 8	5 30
18DZ8	P T	19. 19.	4 4	- X	367 19	2 8	5 30
35DZ8	P T	35. 35.	4 4	- X	367 19	2 8	5 30

Latest Chart Form 648-21, 115/715/561-11, 49-5

CATALOG AND LITERATURE SERVICE

ANTENNA SYSTEMS

1D. *RADIO MERCHANDISE SALES* — Wavebooster 1000 series catalog; also, data on *Hurricane Special* and *Monitor* conicals, and *Focus* F-38K powerful indoor antenna.

2D. *SOUTH RIVER* — Descriptive literature on snap-in type chimney and wall mounts featuring the "U" bolt for speedy, one-hand fastening of mast retainers. *See ad page 46.*

3D. *TENNA* — Catalog entitled "Miracle Line of TV Antennas." *See ad pages 22-23.*

AUDIO & HI-FI

4D. *ANCHOR* — Illustrated catalog sheet on hi-fi and stereo components, including new hi-fi stereo switch, custom cable kit and three-way speaker switch. *See ad page 42.*

5D. *ARKAY*—16-page booklet entitled "Let's Talk About Stereo" gives practical information about stereo, including recommended home installations. *See ad page 36.*

6D. *PRECISION ELECTRONICS* — Flyer describing the *Grommes* "Premiere Line" of high-fidelity sound equipment for quality industrial and commercial installations. Includes data on 20, 30, and 50-watt amplifiers, as well as deluxe preamps and booster amplifiers. *See ad page 62.*

7D. *UNIVERSITY* — New Product Catalog containing illustrations and specifications on the world's most complete line of PA speakers and components.

8D. *WEBSTER ELECTRIC* — Descriptive bulletin on 1959 *Ekotape* Tape Recorder and components and *Teletalk* intercom and sound systems. *See ad page 53.*

CARTRIDGES & NEEDLES

9D. *ELECTRO-VOICE* — Bulletin No. 255, "How to Choose and Place Stereo Sound Equipment for the Home." Explains what you should know about stereo. *See ad page 13.*

10D. *ERIE RESISTOR* — Literature on *StERIEo* cartridge. *See ad page 71.*

11D. *FIDELITONE* — Replacement cartridge and needle wall chart, containing cross-reference data for all makes, including the latest stereo types.

12D. *JENSEN INDUSTRIES* — 1959 cross-reference booklet on phono needles. *See ad page 46.*

13D. *SONOTONE* — Specification sheet on unitized ceramic stereo cartridge featuring dual .7-mil needles; also, price list for 75 popular-type electronic tubes. *See ad page 60.*

COMPONENTS (MISC.)

14D. *BLONDER-TONGUE* — New UHF and TV accessories catalogs, forms HAC-100-39 and C-50-39. *See ad page 44.*

15D. *CENTRALAB* — Supplement to "Auto Radio Control Guide," listing replacement data on new push button radio on-off switches used in Chrysler, DeSoto, Dodge, Ford, Hudson, Lincoln, Mercury, Plymouth and Thunderbird 1946-1958 models. *See ad page 49*

16D. *CLAROSTAT* — Catalog No. 59 on control and resistor products. *See ad page 43.*

17D. *GENERAL CEMENT* — Catalog sheet for *Sav-A-Tube* unit. *See ad 2nd cover.*

18D. *P. R. MALLORY* — Capacitor catalog, Form No. 9-140; silicon rectifier catalog, Form No. 9-152. *See ad pages 16-17.*

FUSES

19D. *BUSSMANN*—Bulletin SFH-6 describes new space-saving fuse and fuseholder combination for circuit protection at 300 volts or less. *See ad page 33.*

20D. *LITTELFUSE* — Literature on new indicating 3AG fuse post available in voltage ranges from 2.5 to 250V. *See ad 4th cover.*

POWER SUPPLIES

21D. *ATR* — Descriptive literature on battery eliminators, DC-AC inverters, tube protectors, and other products. *See ad page 12.*

SERVICE AIDS

22D. *E-Z-HOOK*—Convenient reference sheet titled "How to Build the Five Most Useful Scope Probes," with schematics, mechanical component layouts, etc. *See ad page 68.*

23D. *PERMA-POWER* — Catalog sheet illustrating and describing new, low-cost automatic voltage regulator. *See ad page 50.*

24D. *PHILCO* — 5-section Electronic Parts Catalog — totaling 408 pages, a service reference library in itself — cross-referencing parts and accessories for all Philco models as well as most other makes. *See ad page 41.*

25D. *SERVICE INSTRUMENTS* — Mailer describing the 10 most popular Sencore timesavers. *See ad pages 36, 44, 54, 64, 66, 68.*

26D. *VIS-U-ALL* — Handy Tube Substitution Guide for service dealers and technicians. *See ad page 67.*

TECHNICAL PUBLICATIONS

27D. *CBS-HYTRON* — Vol. 2, No. 11 issue of "Tech Tips," entitled "Call-Back Insurance." *See ad page 9.*

28D. *GERNSBACK* — Descriptive literature on Gernsback Library books. *See ad page 40.*

29D. *HOWARD W. SAMS* — Descriptive literature on all Howard W. Sams books covering servicing of radio, TV, hi-fi, etc. Includes data on latest books, "ABC's of Transistors," "101 Ways to Use Your VOM-VTVM," and "Servicing Transistor Radios, Vol. 3." *See ads pages 37, 58, 67, 70.*

TEST EQUIPMENT

30D. *B & K* — Bulletin ST21-R gives helpful information on new point-to-point signal-injection technique with Model 1075 TV "Analyst"; other bulletins describes "Dyna-Quick" Models 500B, 650, and automatic 675 portable dynamic mutual conductance tube and transistor tester, plus Model 400 CRT cathode rejuvenator tester. *See ad page 52.*

31D. *B & M* — 4-page folder describes inductive-winding tester and electronic switch. *See ad page 58*

32D. *DOSS* — Information on the latest in test equipment, including the *Pioneer* 250 Horizontal Systems Analyzer. *See ad page 51.*

33D. *EICO* — 20-page, 1959 2-color catalog describes 65 models of professional test instruments, hi-fi, and "ham" gear in both kit and factory-wired form — shows how to save 50%. *See ad page 55.*

34D. *JACKSON* — Catalog sheet on hi-fi, stereo, and audio test equipment. *See ad page 72.*

35D. *RCA* — Flyer 3F764A on RCA test equipment line. *See ad 3rd cover.*

36D. *SIMPSON* — Radio and TV test equipment brochure "2060" features VOM's, VTVM's, multitesters, etc. *See ad page 61.*

37D. *SPRAGUE* — 2-color folder (M-737) describes the TO-5 *Tel-Ohmike* capacitor analyzer. *See ad page 10.*

38D. *TRIPLETT* — Flyer on new true dynamic conductance tube tester, Model 3444. *See ad page 39.*

TOOLS

39D. *BERNS* — Picture tube repair tool that has 3-in-1 uses. Serves to notch pin and element lead for solid electrical connection; can also be used as screwdriver and channel selector. *See ad page 40.*

40D. *UNGAR* — 1959-60 Catalog featuring the newest in soldering tools and accessories. *See ad page 48.*

41D. *WEN* — Data on the amazing "souped-up" power saw Model 909. *See ad page 66.*

42D. *YEATS* — Descriptive literature on furniture pads and appliance covers and dollies. *See ad page 70.*

43D. *XCELITE*—Latest catalog on complete line of tools for the electronic serviceman. *See ad page 19.*

TUBES

44D. *TUNG-SOL* — 30-page flip-style chart supplies electrical and physical characteristics for most important industrial, special-purpose, and military tubes. *See ad page 63.*

Some straight talk about this picture tube business!

When it's time to replace a television picture tube, a customer is faced with a sizeable investment. Naturally he wants to get what he pays for. Yet, until recently, many expert TV technicians were unable to give absolute assurance that a "new" picture tube just installed was, in fact, "100% new."

RCA believes that—in the best interests of the TV servicing industry—such a distinction should be clear and positive. Picture tubes sold as "new" should be completely new including glass and all parts—new phosphor, new electron gun, new *everything* through and through. And such tubes should be identified as "new."

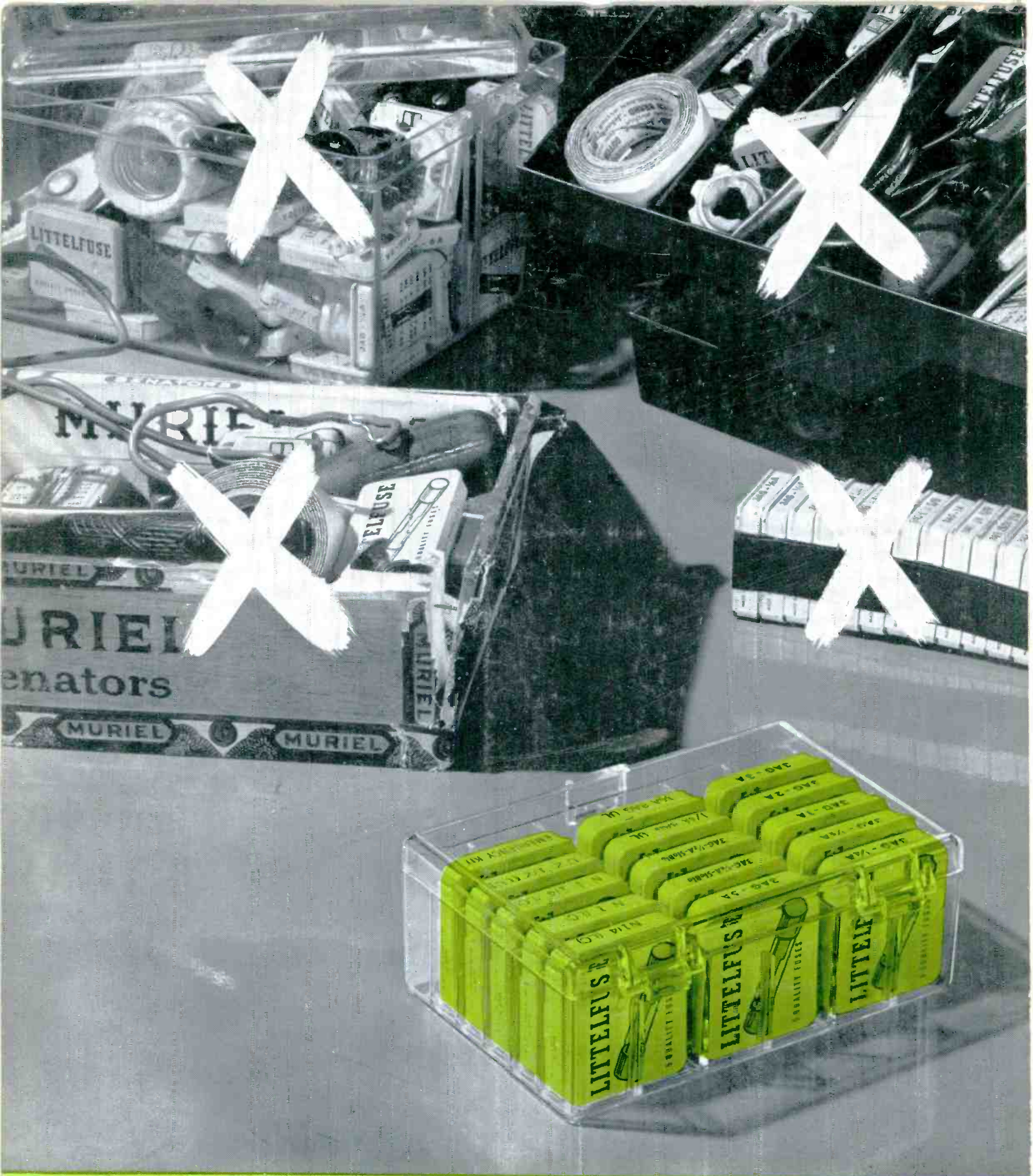
Similarly, any picture tube containing used or reconditioned parts should be identified as "rebuilt." RCA has taken the lead in making such positive distinctions.

Consumers have a great deal of confidence in the TV technicians who service their sets. Greater confidence can be achieved when a consumer knows exactly what he's getting—when he knows that the picture tube he's buying is either new or rebuilt.

Since well-informed customers become better customers, RCA believes that all TV technicians will welcome this opportunity to promote new tubes as "all-new" and rebuilt tubes as "rebuilt." Toward this end, RCA is engaged in a comprehensive, national advertising program. The public is being told the difference between "new" and "rebuilt"—in quality and in optional list prices. And the public is being directed to *you*, the local TV technician, for the final choice of product.

RADIO CORPORATION OF AMERICA

Electron Tube Division ***Harrison, N. J.***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