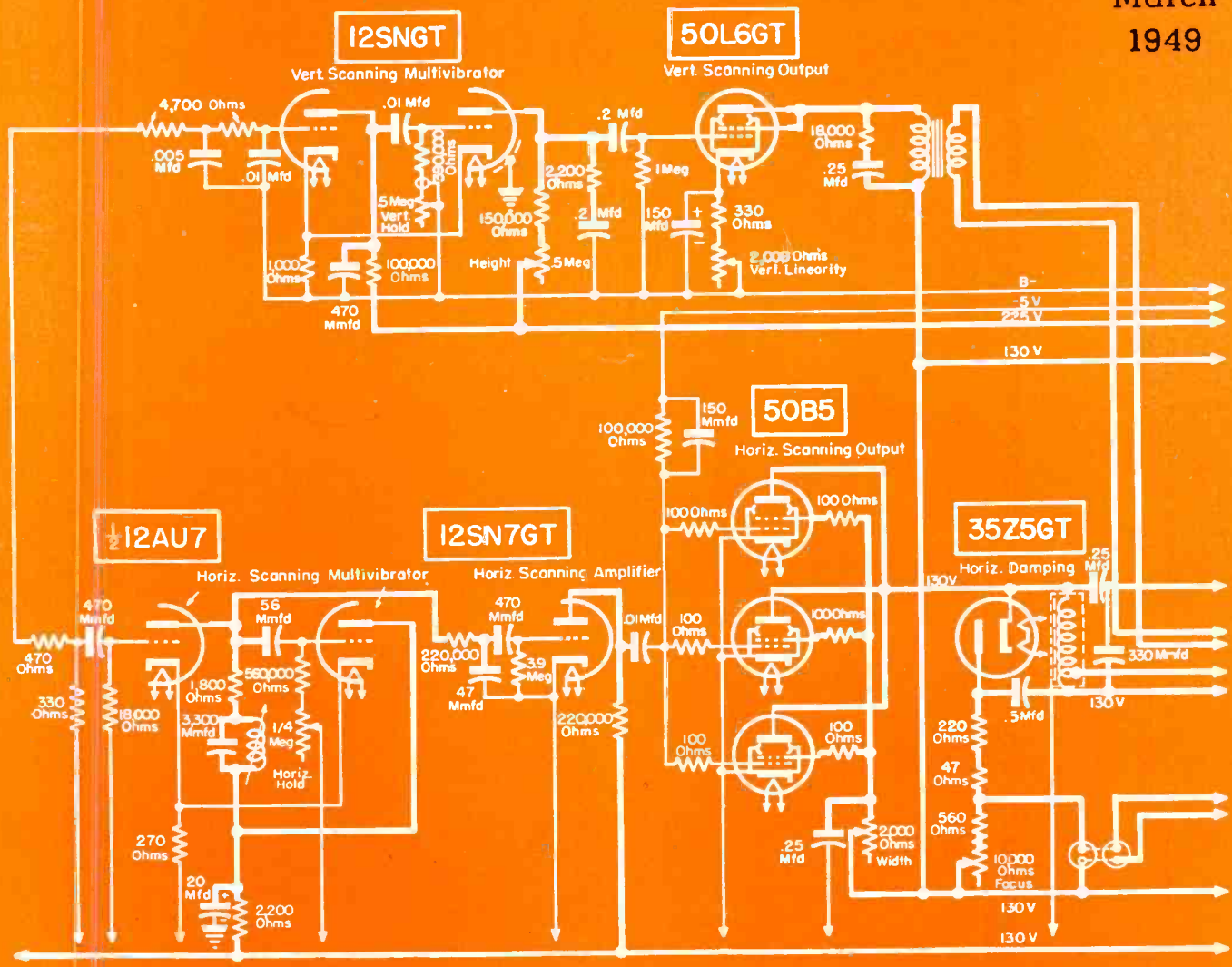
RADIO · TELEVISION · ELECTRONIC

SERVICE

March
1949



Vertical and horizontal scanning system of an indirect viewing type TV receiver.

[See page 2]

THE TECHNICAL JOURNAL OF THE RADIO TRADE

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CAPACITOR MANUAL

FOR RADIO SERVICING

EDITION No. 4

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- complete tables on A to Z radio brands with C-D replacement numbers
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Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey. Other large plants in New Bedford, Worcester, and Brookline, Mass.; Indianapolis, Ind., and Providence, R. I.

1910 CORNELL-DUBILIER CAPACITORS 1949

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AUTO VIBRATORS · TV and FM ANTENNAS

POWER CONVERTERS

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IN RADIO AND TELEVISION TUBE SALES

1949 IS A G-E YEAR!

Electronic TUBES

A big campaign of selling aids paves your path to profits. Something new—and hot—every 60 days!

You can't beat this shop-garment offer. It proves the point when we say G-E dealer helps are "hot." *You make no investment!* Shirts, trousers, jackets, coats—in attractive powder blue with the G-E pocket emblem in orange and dark blue—come to you each week freshly laundered. You rent, not buy! And the low rent is roughly equal to what you might pay for cleaning only.

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G-E tubes are a fast-moving, profitable item because General Electric *works with you* to widen your customer list. This page shows a few of the aids-to-sales furnished you for promotion. There are plenty of others—and brand-new items will join the parade at frequent intervals.

Better tubes aren't built! G-E quality backs up your promotion, makes friends of tube buyers. When you install a General Electric tube, you're selling others later on—to the same satisfied customer, or to persons he refers to you for tubes, parts, or radio-TV service.

Get aboard the tube-profits train! Your nearby General Electric tube distributor will be glad to show you how. Phone or write him today. Or address *Electronics Department, General Electric Company, Schenectady 5, New York.*

You can put your confidence in—

GENERAL ELECTRIC

181-HA3-8850

Vol. 18, No. 3

RADIO · TELEVISION · ELECTRONIC
SERVICE

March, 1949

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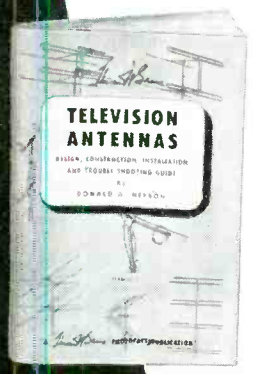
with PHOTOFACT— YOU'RE IN TELEVISION!

You're really IN Television—the *right* way—with PHOTOFACT! Here's the data you need for profitable TV installation and servicing—practical, time-saving, money-making help that keeps you in business—and keeps you ahead of the game. Establish yourself permanently and profitably in TV, with the help of PHOTOFACT. See your Jobber today—take a good look at these authoritative PHOTOFACT publications—then get them and *be in Television!*

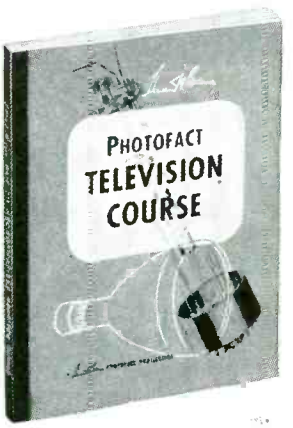


This Practical Television Data Boosts Your Earning Power

TELEVISION ANTENNAS

Design, Construction, Installation and Trouble-Shooting

Now, you can own the *first* practical, down-to-earth guide to everything you need to know about Television antennas. Written by Donald A. Nelson; based on actual experience in the field, involving hundreds of installations made under all sorts of conditions. Shows you what type of antenna to select, how to install it, how to solve troubles. Gives you short-cuts that save time and help increase your installation profits. Chapters cover: receiving antenna principles; antenna construction; analysis of all types of commercial antennas on the market; complete antenna installation data (both outdoor and indoor, including apartment and multiple installations); installation problems and trouble-shooting ("ghosts," interference, etc.). Over 192 pages of easy-to-understand data; 124 clear illustrations. Handy pocket size. This is the book you need if you're *in* Television. Order from your Jobber today. *ONLY* $1.25



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This up-to-the-minute book gives you a *complete, clear understanding* of modern TV principles, operation and practice. Provides the essential background for successful service operations in Television. Main sections cover Cathode Ray Beam Formation and Control; Beam Deflection Systems; Beam Modulation and Synchronization. Includes analysis of Cathode Ray tube construction, camera tubes, voltage supplies, sawtooth generators and their use, sync circuits, control functions, receiving antenna circuits, RF input tuning systems, IF systems, AGC, DC restoration, video amplification, contrast—a complete and authoritative coverage of the entire subject. Includes glossary of terms, full bibliography. 208 pages; profusely illustrated; sturdily bound, 8½x11". A "must" for everyone in Radio! *ONLY*..... $3.00

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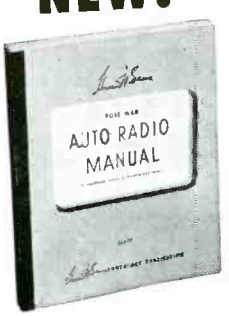
NEW!



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There's big money in servicing auto radios. You can tackle any car receiver when you have a copy of this specialized PHOTOFACT volume in your shop. Covers everything you need to know—gives you complete service data based on analysis of the actual receivers. Covers 100 different post-war models (practically every auto radio made since 1946); represents the products of 24 different manufacturers. More than 300 pages; profusely illustrated; each model treated uniformly, completely, accurately. Durably bound; 8½ x 11". $4.95 At your Jobber now! *ONLY*.....

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the Servicemans Complete Line!

New CT Isolation Transformers

for Safer, More Efficient Servicing

SAFER: Because these new transformers isolate chassis grounds from line grounds, they eliminate the hazard and annoyance of shocks from AC-DC circuits—particularly important in servicing "hot" TV sets.

MORE EFFICIENT: Speeds up servicing—you use the available 125-volt secondary voltage to show up faulty set components that are "borderline" cases. Low secondary voltage helps check oscillator performance.

PROBLEM SOLVER: If the operation of your test equipment or of a customer's set suffers from abnormal line voltage (on 105 volts, many TV sets cut out entirely) then a CT Isolation Transformer is the answer.

SPECIFICATIONS: Male plug, 7-foot cord on primary. Sliding switch sets for 105 volts, 115 volts, or 125 volts, 50/60 cycles. Female plug on secondary provides 125, 115, or 105 volts, depending upon primary switch setting.

THREE SIZES AVAILABLE:

No. IS-50 (50 VA capacity, for use on table models).....List, $9.00

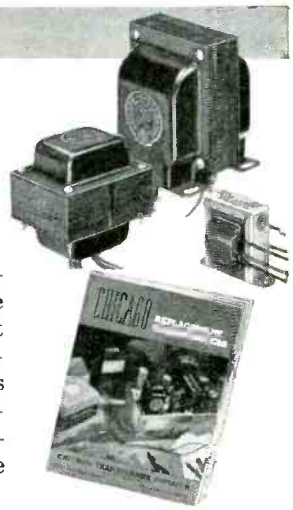
No. IS-150 (150 VA capacity, for use on table and console radios, and smaller TV sets).....List, $21.00

No. IS-250 (250 VA capacity, for maximum all-around servicing, including larger TV sets).....List, $35.00

See your Jobber, or write for descriptive literature

New Replacement Transformer Line

Premium Quality— Yet They Cost No More



The new CT Replacement Line provides servicemen with a wide range of standard ratings that fit the most frequent power and audio transformer requirements. These units are backed by CT's 20 years of manufacturing experience. Yet CT quality *costs no more.* Just check these typical listings:

Power Transformer No. PH-70B. 350-0-350 v. a-c, 70 ma d-c; filaments 5 v., 3 amps and 6 v. C-T, 2.5 amps; horizontal shield mounting.....List Price, **$7.30**

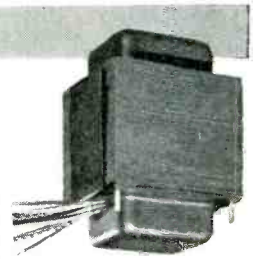
Filter Reactor No. R-650. 6 henrys, 50 ma d-c, 300 ohms d-c resistance; clamped frame mounting.....List Price, **$1.65**

Universal Output No. RO-303. Single or push-pull plates (2500 to 14000 ohms) to 2/4/6/8/15-ohm voice coil; 40 ma pri. d-c; 8 audio watts output; clamped frame mounting.....List Price, **$2.75**

See Your Jobber. Write for Complete Descriptive Catalog and Prices

Television Transformers

to fit today's leading TV circuits



TP-365

Because Chicago Transformer is the largest single supplier of transformers to the Television industry, you gain the advantages of "Original Equipment" components when you buy Chicago TV Transformers. Available now, the four units described here are part of a complete new line, soon to be announced.

TV Power Transformer No. TP-365. Designed to supply 405 volts d-c with two 5U4G's to an 80 mfd condenser input. Copper shorting band around core reduces external magnetic field; cuts image distortion to a minimum.

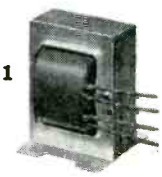
Pri.: 115 v., 60 cycles
H.V. Sec.: 362-0-362 v., a-c, .295 amps d-c
Fil. No. 1: 12.6 v., 5 amps, C-T
Fil. No. 2: 5 v., 2 amps
Fil. No. 3: 5 v., 6 amps

Exact equivalent to R. C. A. Type No. 201T6. List Price, **$26.00**

TFB-1

Horizontal Scanning Output Transformer No. TFB-1. Couples horizontal output circuits to horizontal deflection yoke. Provides high pulse voltage which, when rectified, supplies anode of picture tube. Also has rectifier filament winding.

Exact equivalent to R. C. A. Type No. 211T1. List Price, **$11.25**



TSO-1

Vertical Scanning Output Transformer No. TSO-1. Couples vertical output tubes to picture tube deflection yoke.

Pri. Impedance: 19,000 ohms at 30 v., 60 cycles, 13 ma d-c
Ratio, Primary to Secondary: 10 to 1

Exact equivalent to R. C. A. Type No. 204T2. List Price, **$5.90**

TBO-1

Vertical Blocking Oscillator Transformer No. TBO-1. 60-cycle unit for creating the vertical sweep "saw-tooth" voltages required in conventional circuits.

Pri. Inductance: 1.15 hy ± 20% at 3 v., 1000 cycles
Pri. Leakage Inductance: 8 mh + 25%, −15%
Ratio, Primary to Secondary: 1 to 4.2

Exact equivalent to R. C. A. Type No. 208T2. List Price, **$3.10**

Also available—exact replacement transformers for the television sets of other nationally known manufacturers. See your Jobber. WRITE FOR COMPLETE CATALOG.

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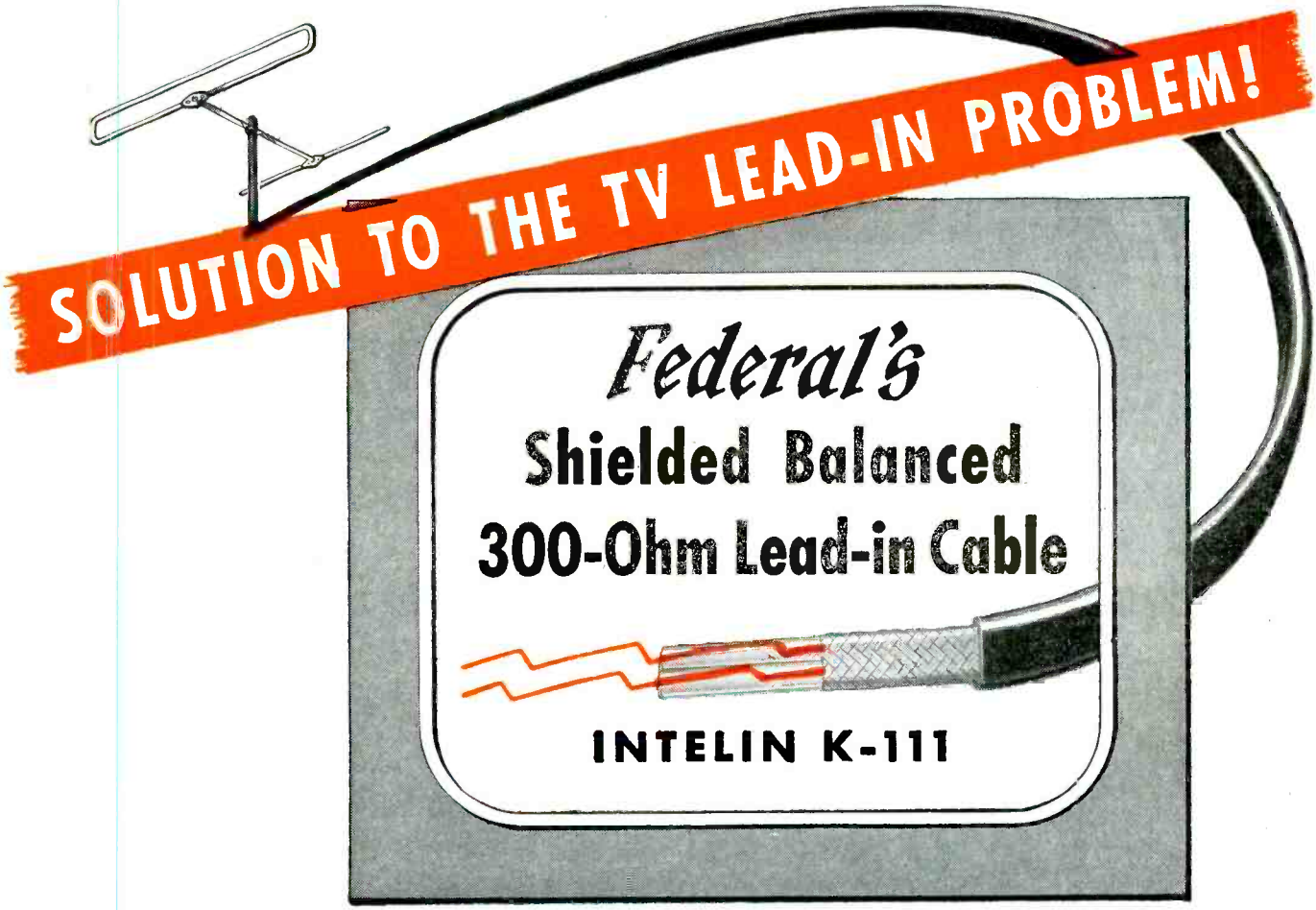
SOLUTION TO THE TV LEAD-IN PROBLEM!



Minimizes Noise, "Snow" and "Ghosts" Due to Transmission Line Pick-Up!

A MAJOR ADVANCE IN TELEVISION TECHNIQUE

Developed by FEDERAL
Offered Only by FEDERAL
Patent Pending
AVAILABLE IMMEDIATELY

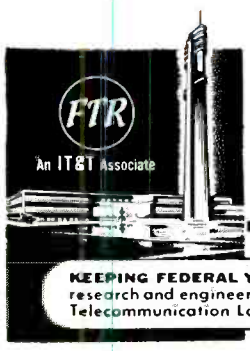
Here is the development for which the industry has been waiting.

It is a *shielded*, balanced 300-ohm line—Intelin K-111—developed and produced by Federal—and only by Federal.

Tests have given positive proof that Intelin K-111 goes far toward solving the lead-in problem that has been a major obstacle to television progress. K-111 protects against transmission line pick-up of ignition, streetcar fluorescent light diathermy and practically every other type of noise, "snow" and "ghosts" which interfere with picture clarity. This new lead-in won't pick up re-radiation from nearby lead-ins in urban areas. In rural areas, where signal strength is weak, Intelin K-111 provides greatly improved reception by reducing the noise level.

Now manufacturers can obtain a lead-in that *protects* the quality performance they build into receivers of 300-ohm input impedance. Antenna kit makers can greatly improve their products. And, by changing to Intelin K-111, servicemen can call a halt to many of the customer complaints that take the profit out of service policies.

Intelin K-111 is also recommended for a pick-up-free connection between antenna post and input stage of FM and TV receivers—and for test equipment and other HF applications. For information, write to Department D-156.



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ON THE INSTALLING OF TV and FM RECEIVER ANTENNAS

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Everything you want in a VTVM. Shatterproof solid plastic meter face, automatic meter protection in burn-out proof circuit, push pull electronic voltmeter circuit assuring maximum stability. Linear DC and AC scales. AC and DC full scale ranges of 3V-10V-30V-100V-300V-1000V. A total of 24 ranges. Isolated DC test prod for signal tracing and measurements of voltage while instrument is in operation. An ohmmeter section accurately measuring resistance of 1/10 ohm to one billion ohms with internal battery. Extremely high input resistance 11 megohms on all ranges DC and 6.5 megohms on AC. All these features and many more are the reasons hundreds of radio and television schools are using Heathkit VTVM's and recommending them to all students. Like all Heathkits, the VTVM kit is complete, 110V. 60 cycle power transformer, 200 microamp meter, tubes, grey crackle cabinet, panel, test leads, 1% ceramic precision divider resistors and all other parts. Complete instruction manual. Better start your laboratory now.
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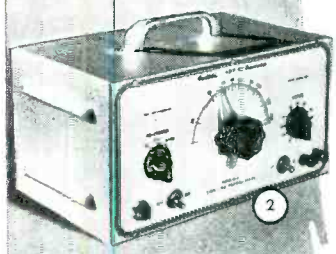

2 Heathkit SINE AND SQUARE WAVE AUDIO GENERATOR KIT

The ideal instrument for checking audio amplifiers, television response, distortion, etc. Supplies excellent sine wave 20 cycles to 20,000 cycles and in addition supplies square wave over same range. Extremely low distortion, less than 1%, large calibrated dial, beautiful 2 color panel, 1% precision calibrating resistors, 110V. 60 cycle power transformer, 5 tubes, detailed blueprints and instructions. R.C. type circuit with excellent srability.
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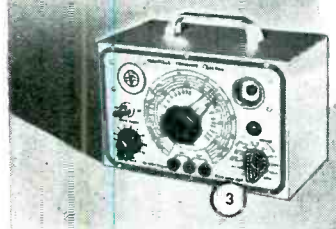

3 Heathkit CONDENSER CHECKER KIT

Checks all types of condensers, paper mica — electrolytic — ceramic over a range of .00001 MFD. to .000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage of 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill.
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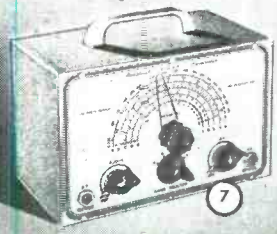
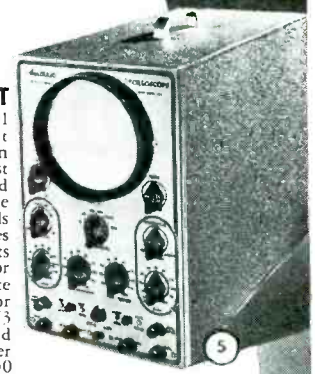


5 The NEW 1949 HEATHKIT 5-INCH OSCILLOSCOPE KIT



New improved model of the famous Heathkit Oscilloscope. Building an oscilloscope is the finest training for television and newer servicing technique and you save two-thirds the cost. All the features and quality of instruments selling for $100.00 or more. Supplied complete with cabinet, two color panel, 5BP1 tube, 2 5Y3 tubes, 2 6SJ7 tubes and 884 generator tube. Power transformer supplies 1000 volt negative and 350 volt positive. Sweep generator 15 cycles to 30 M. cycles. Has vertical and horizontal amplifiers. Oil filled filter condensers for long life. Complete blueprints and instructions included.
Shipping weight 25 pounds.
Express only..... **$39.50**

6 Heathkit FM AND TELEVISION SWEEP GENERATOR KIT

A necessity for television and FM. This Heathkit completely covers the entire FM and TV bands 2 megacycles or 230 megacycles. The unit is 110V. 60 cycle transformer operated. Uses two 6J6 tubes, two 6C4 tubes and a 6X5 rectifier. An electronic sweep circuit is incorporated allowing a range of 0 to 10 MC. A sawtooth horizontal sweeping voltage and phase control are provided for the oscilloscope.

The coils are ready assembled and precision adjusted to exact frequency. As in all Heathkits, the best of parts are supplied, Mallory filter condenser, zero coef. ceramic condensers, all punched and formed parts, grey cackle cabinet, 5 tubes, test leads, etc. Better get it built now and be ready for the FM and TV business. Shipping Wt. 6 lbs... **$24.50**

7 Heathkit SIGNAL GENERATOR KIT

Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V. 60 cycle transformer operated power supply.

400 cycle audio available for 30% modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Ship. Wt. 7 lbs..... **$19.50**

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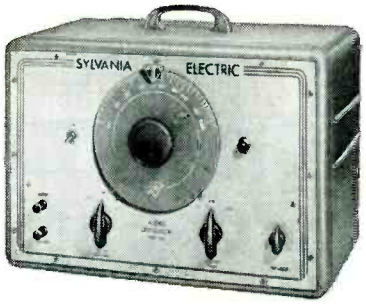

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SERVICE

Selling Your Service

Tv and the accelerated improvements in the sound field, particularly the long-playing phono and tape and wire developments, have not only accented the immediate earning possibilities in installation and service, but the solid future which exists. The latter phase, fortunately, is receiving concentrated attention on many fronts, it being well realized that *looking ahead* is always a wise policy.

Building for the future demands a program, a program which will help sell you and your services. But one factor is all-important in this plan, and that is sincerity. For a sincere plan is a sound and honest one which can't help but work. A service group in the Middle West proved this point recently. The boys in this shop, handling television and sound service, set up a plan involving contact with their customers every sixty days by phone, letter or postcard, with a reminder that they are *at your service*, just in case the picture isn't as crisp as it might be, or the audio isn't up to par.

Though these messages were and are directed, in the main, to those with whom service contacts have been made and it would be expected that many unnecessary and unprofitable service calls would result, there were and there are very few such calls. The folks seem to realize that here is a shop which is willing to help and should not be called on unnecessarily. Before instituting this plan, the boys studied the reason for TV recalls very carefully and found that usually the so-called troubles were due to unfamiliarity with the TV controls, due, of course, to hasty operational instructions. Thus careful and complete instructions during installation became the initial factor in the service-selling program of this shop. And it was soon found that these informed TV owners rarely called and when they did there was really trouble in the set or antenna system.

The sixty-day contacting has served to inspire confidence, establish this shop as a cooperative, conscientious and dependable source of installation and service with technical know-how, and stimulate many new contacts for new business.

The plan for the future which these boys believed in has become a basis of many success stories in service today. Local conditions may vary the exact program the shops can use, but the boys all have the same idea, *planning for tomorrow.*

Viewing Distances

One of the most debated TV subjects is the viewing distance.

It seems as if there are several schools of thought, some believing that the distance should be 4:1 or four times the height, and others say the 8:1 ratio is proper. Still another approach was expressed recently by a professor of opthalmalogy, Dr. Walter F. King of the University of Buffalo, who declared that the accepted distance is now considered to be ten times the diameter of the screen. Citing as an example, he pointed out that if you are looking at an 8" screen, the ideal distance would be 6½' away.

Dr. King, who offered these data during a lecture on "Your Eyes on Television" at the university, declared that the position and height of the screen are extremely impotrant factors in viewing, too. He said that the screen should be placed either at eye level or below the horizontal, for it is a known fact that the eyes perform seven-eighths of our seeing below the horizontal level. It is because of this factor that when receivers are placed far above eye level, excessive eye strain usually results, particularly, when viewing for any length of time.

Loudspeakers

A Move to combat the use of surplus type loudspeakers, released by the military and produced in the main for restricted communications use, is being studied by many in the industry.

These speakers are not capable of even nominal quality reproduction. Their frequency range in most instances is from about 50 to 3,000 cycles and in many cases, even as low as 100 to 1,500 cycles. There is no doubt that there are instances in which these speakers can be used with some satisfaction where narrow frequency response can be tolerated. But the installation of these speakers in home receivers or phono units can only result in poor quality output and certainly dissatisfied customers.

To The Rescue

The Dynamic Demonstration principle, applied so successfully to AM and FM, has now been introduced into TV, with a complete and operating thirty-tube receiver spread out to present a giant *operating blueprint.* The unique development, conceived by John Meagher, nationally known television specialist of the RCA tube department, has every component and circuit of the conventional TV receiver spread out on a 3½' high by 5½' wide panel and superimposed on a background circuit drawing. The demonstrator has been arranged into ten functional sections which permits a step-by-step study of the *rf* section amplifier, *rf* oscillator and converter, sound *if* amplifier, audio amplifier and loudspeaker, picture *if* amplifier, video amplifier, sync amplifier, vertical oscillator and deflection output, horizontal deflection and high voltage, horizontal oscillator and power supply.

Most of the components such as capacitors, resistors and tubes are of the plug-in type and when removed, can serve to indicate an actual servicing problem, with the resulting difficulties appearing in most instances as a trouble pattern on the screen.

At present, only one board is in existence and that is being used for a series of special clinic lectures. It is hoped, however, that many more will be built for use at associations, clinics and schools, who will certainly find this demonstrator a very handy and useful guide in disclosing just what makes TV sets tick.

The TV Surge

The Surprising Strides made by television in '48 were recently described by RMA prexy Max F. Balcom as an epic achievement in industry. Addressing the Town Meeting of Radio Technicians at Los Angeles, Balcom pointed out that it is difficult at this stage to estimate the size of TV, but there is no doubt that this industry within a few years will rank with the largest in the country.

According to Balcom, it seems probable that in '49 well over half of the industry's income will come from television receivers.

Quite a record of progress for an infant industry!—L. W.

Alignment of

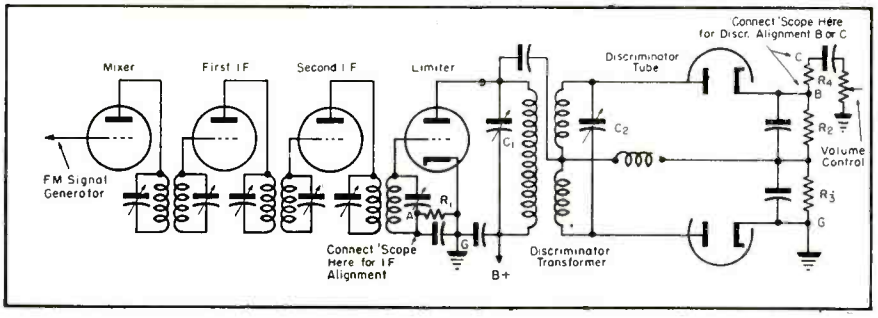


Fig. 1. Typical *if* and discriminator stages in an FM receiver.

WHEN FM RECEIVERS were first introduced, the circuits featured almost universally an *if* amplifier, limiter (necessary to remove amplitude modulation from the frequency modulated signal), and Foster-Seeley type of discriminator. Typical *if* and discriminator stages in a receiver of this design appear in Fig. 1.

In aligning this type receiver the FM signal was fed in at the first detector at the proper *if* frequency and, in general, the deviation adjusted to approximately 200 kc either side of center frequency. The 'scope was first connected to the limiter load resistance, *A*, and alignment made of the *if* and limiter stages, resulting in a response curve as illustrated in Fig. 6. The broadness of the curve was determined by the band-pass characteristics of the *if* stages and varied from one set to another. Alignment was employed to secure a maximum vertical deflection of the response curve consistent with symmetrical sides.

After the *if* and limiter stages were aligned, the 'scope was then reconnected to the discriminator load resistance at *B* and the discriminator primary and secondary were then adjusted to give a curve as illustrated in Fig. *2a* or *b*. An incorrect adjustment of the primary would result in a non-linear trace between *A* and *B*. (Fig. 8, p. 33). and an incorrect secondary adjustment would result in traces as illustrated in Fig. 9 (p. 33). This completed the alignment of the *if*, limiter and discriminator stages.

Generator Operation

There is one factor in connection with the alignment which is often confusing to many Service Men.

For technical reasons, beyond the scope of this article, it is advisable to generate a frequency modulated signal by heterodyning an unmodulated variable frequency oscillator, which in most cases is the main variable oscillator of the signal generator, against a fixed frequency-modulated oscillator and from properly designed mixer circuits, take the desired frequency modulated output. In most signal generators the frequency-modulated oscillator operated at approximately 50 mc.

To generate the standard FM *if* of 10.7 mc, the variable oscillator was adjusted to 10.7 mc above or below the fixed frequency modulated oscillator. In the case being considered, we would probably set the main oscillator at 10.7 mc below 50 mc, or at 39.3 mc.

Considering potential errors in generating a frequency in this manner, we might conceive of an error of as much as 1% in the main variable oscillator. This could result in a frequency error of 1% of 39.3 mc, or .393 mc.

Assuming that there might be a similar error in the frequency-modulated oscillator, here again, there could be a potential error of .5 mc. If, by some chance, these two errors were in such a direction as to be additive, the potential error might be a total of .393 plus .50 mc, or almost .9 mc. At 10.7 mc, this error of .9 mc would represent an error of over 8%.

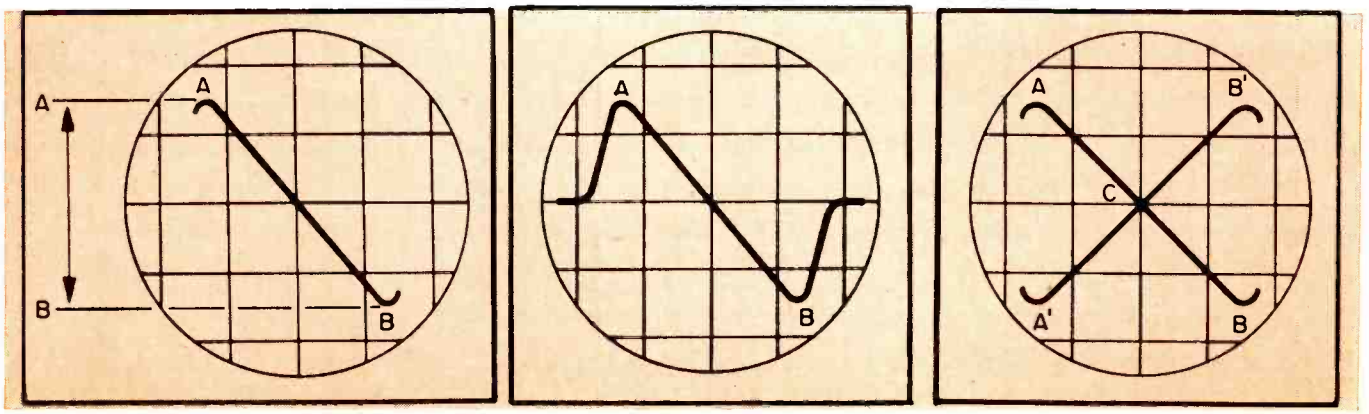
Some Service Men have made a practice of roughly aligning the *if* stages first with a regular amplitude-modulated signal which, of course, should be well within an accuracy of ±1% at 10.7 mc, or .10 mc, and then making the final alignment using an FM signal. When the FM generator is first connected up for this final adjustment, the frequency should be adjusted in the vicinity of 39.3 mc until the response curve is centered on the screen, regardless of whether the main dial is indicating exactly 39.3 mc or not.

As the Service Man becomes familiar with a particular signal generator, he will soon learn what errors, if any, exist and then can automatically set his main tuning dial to the frequency which will give him the exact frequency desired.

Now to return to FM alignment. As the manufacturers of FM receivers

Fig. 2*a* and *b* (below, left and center). Response curves resulting when 'scope is reconnected to the discriminator load resistance at point *B* and the discriminator primary and secondary adjusted.

Figs. 3 *a* and *b* (below and left, page 13. *X* type of pattern. In *a* is a pattern of a 200-kc sweep, and in *b* a pattern of a 400-kc sweep.



FM RECEIVERS

Use of 'Scope and FM Signal Generator in Alignment of FM Receivers With Limiter and Discriminator Stages and Ratio Detectors.

by R. D. HICKOK and W. A. WEISS
President *Chief Electronics Engineer*
The Hickok Electrical Instrument Company

gained experience in receiver alignment, new circuits were developed and new techniques were also found which, in many cases, resulted in faster and more accurate alignment of these receivers. One major change in FM circuit design occurred with the development of the ratio detector. This circuit resulted in the possibility of elimination of the limiter stages, since this type of detector is virtually responsive to only frequency changes or frequency modulation, and essentially independent of amplitude changes or amplitude modulation. Also, this ratio type discriminator circuit produces a *dc* voltage in proportion to the strength of the incoming carrier wave. This can be used to supply *avc* voltage to the *if* and *rf* stages. (It is not the intent of this article to probe the relative merits of the two types of detection as both types find uses in FM receiver design.)

Ratio Detector Alignment Procedure

In aligning ratio-detector FM receivers, the following procedure is generally followed. A frequency-modulated signal generator is first fed in at the grid of the last *if* amplifier tube, V_1 at *A*; Fig. 10 (p. 32). A decoupling resistor of several hundred ohms should be connected between the generator output and this point. The signal generator is then set to produce an FM signal of the proper *if* frequency and deviation adjusted to about 200 or 300 kc, total, that is, 100 to 150 kc either side of center frequency.

The vertical input to the 'scope is generally connected at either *B* or point *C*. In some cases, it may be connected to the high side of the volume control although a certain amount of phase shift may be encountered by such a connection in some types of receivers.

With this connection, a formula may be used to determine whether or not the signal generator and 'scope being used may have suitable characteristics to properly display a discriminator response curve.

This formula states that the deflection in inches on the 'scope screen will be approximately equal to three times the signal generator output in millivolts, divided by the 'scope sensitivity in millivolts required per inch deflection. As an example, let us assume a case of a 'scope[1] which has a sensitivity of 25 millivolts (0.025 volts) per inch and a signal generator[2] which has a maximum FM output voltage at, for example, 10.7 mc, of about 20 or 30 millivolts. The expected deflection in inches would then be, assuming 30 millivolts output for the generator, 3 x 30/30, or three inches.

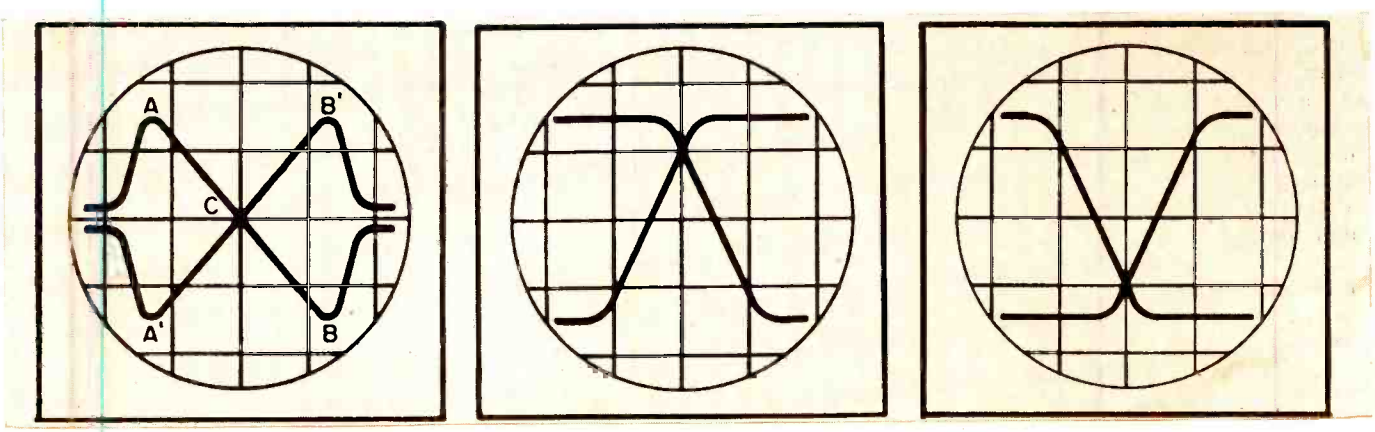
There are some 'scopes which do not have 30-millivolt sensitivity, and thus the use of such 'scopes would result in much less expected vertical deflection of the pattern. In fact, if the sensitivities were as low as 500 millivolts, which is common in some 'scopes, it is necessary to follow generally another discriminator-stage alignment procedure.

If the 'scope has provisions for only a 60-cycle sinusoidal horizontal sweep, proper alignment would result in a pattern as indicated in Fig. 2*a* (200 kc sweep from generator), or 2*b* (400 kc sweep). If the scope also has provisions for a 120-cycle linear sweep,[3] then it is possible to obtain what is known as the *X* type of pattern as illustrated in Fig. 3*a* (200 kc sweep), or 3*b* (400 kc sweep).

Correct alignment when using 60 cycles sinusoidal horizontal sweep, as illustrated in Fig. 2*a* or *b* should be obtained by an adjustment of the primary of the ratio discriminator

(*Continued on page* 32)

[1]Hickok 195A or 195B. [2]Hickok 288X.
[3]Hickok 195A, 195B or 505 (Serial 11-11157 and up).



Figs. 4 and 5 (below, center and right). Incorrect alignment of the discriminator secondary produces patterns of the type shown here.

THE USE OF THE CIRCULAR viewing areas of picture tubes, which has become recently a feature of several TV receivers, has introduced many interesting phases of circuit design and application. Last month Robert Wakeman presented an extremely comprehensive discussion of these phases and provided an explanation of the characteristics of the various types of viewing areas. This month, coverage of the subject is continued with an analysis of the Zenith TV models which employ the circular viewing areas of picture tubes.

These are 28-tube chassis (28F20, 28F21, 28F22) using 10″ and 12″ type tubes. Circuit features include *agc* and turret tuning with replaceable channel strips.

In these chassis are a 3-stage *rf* shelf which has a 6AG5 *rf* amplifier, 6AG5 converter, and a 6J6 *rf* oscillator. The 6J6 twin triode functions as two separate oscillators, one for channels *7* to *13* and the other for channels *2* to *6*. The oscillator frequency can be changed approximately 1 mc by offset tuning slugs which are attached to a fine tuning shaft.

Turret Tuner

The turret tuner provides a method of obtaining contact between the various channel strips and the *rf* shelf. The stationary contacts are a part of the *rf* shelf. Guides are provided which properly position the strip contacts prior to their entry into the stationary assembly.

The Sound IF Channel

The local oscillator beats against the incoming *rf* signal and produces a sound *if* of 21.3 mc. This signal is coupled through a 21.3-mc series resonant trap into the sound *if* amplifier. A small inductance offers a common coupling between the series trap and the sound input coil. The series resonant trap has a very low impedance at the 21.3-mc frequency, but offers a high impedance to the picture *if*. It thereby serves a dual purpose in that it passes the sound and rejects the picture *if*. The sound *if* is amplified by a 6AU6 first sound *if* amplifier and 6AU6 second sound *if* amplifier. The

(*Continued on page 37*)

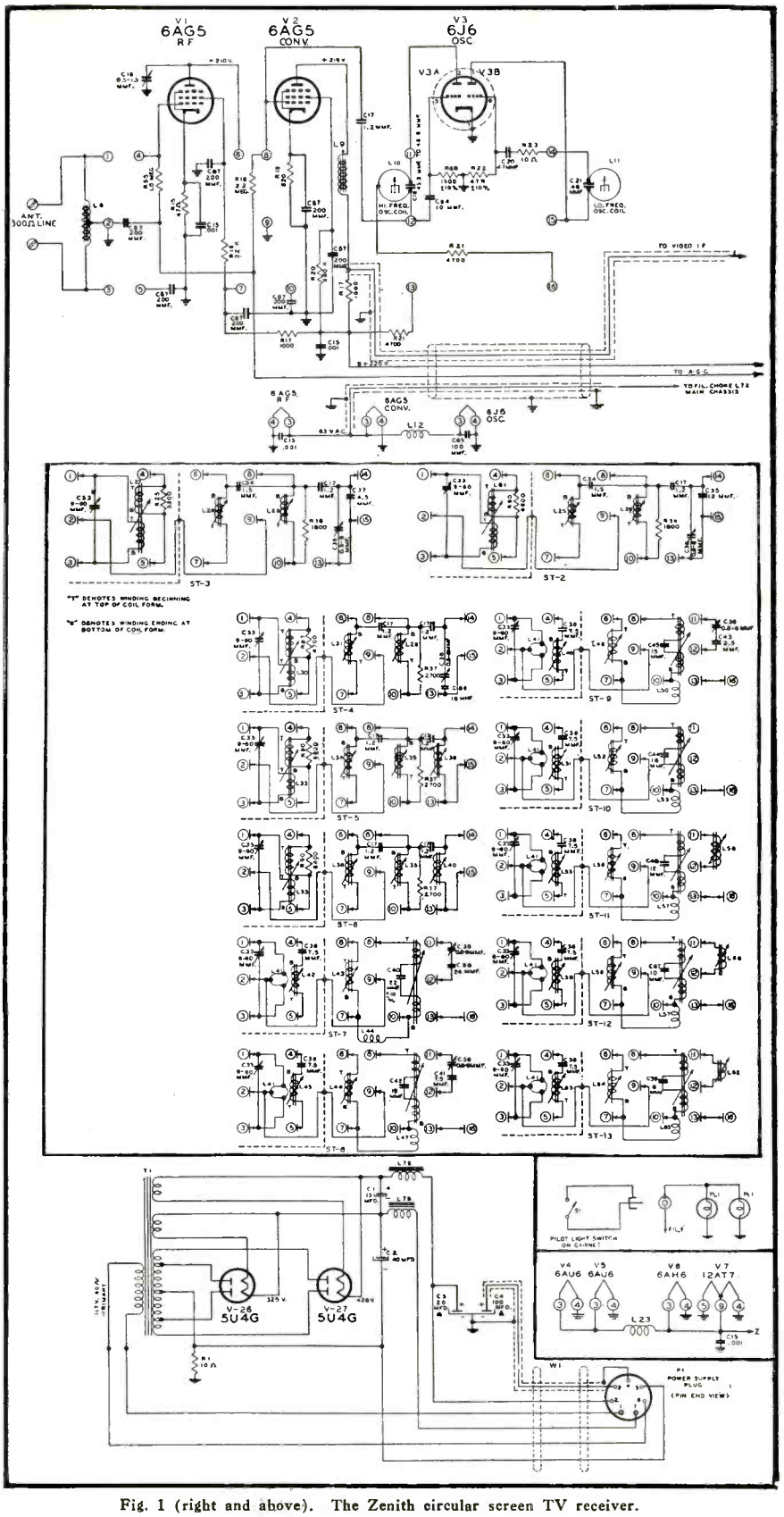
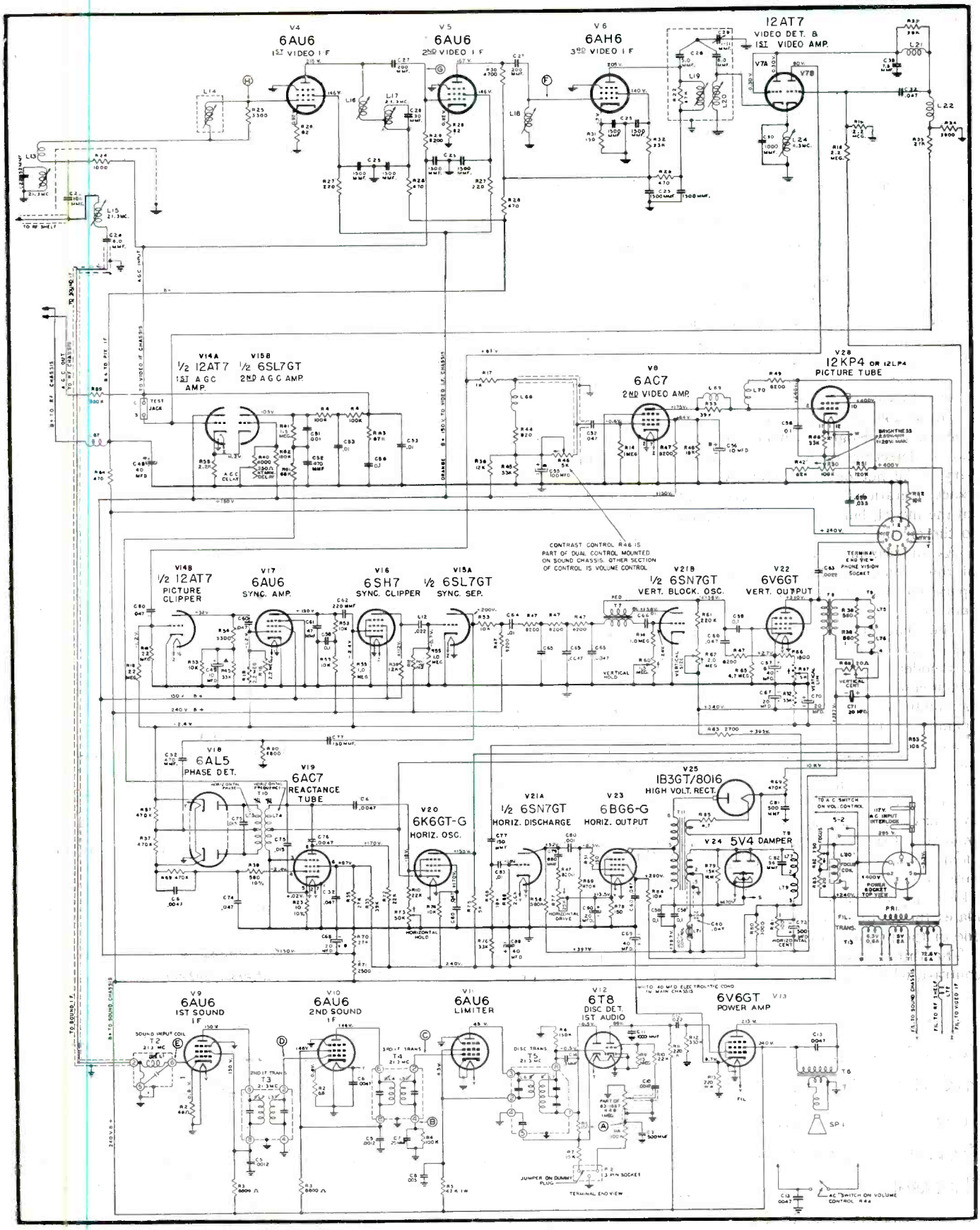


Fig. 1 (right and above). The Zenith circular screen TV receiver.



Those TV Controls and Adjustments

by ALLAN LYTEL

Temple University Technical Institute

TELEVISION SERVICING involves many different methods of approach in determining the cause of improper operation. In most cases, the fault described by the user bears little relation to the actual trouble. When the complaint involves no picture, the trouble may be anything from lack of sync to a loss of the high voltage.

Experience has shown that it is wise to show the user what the controls will do, and what he may expect from the misuse of the controls. A customer with a good understanding of the controls and their function will be in a better position to tell an actual fault from a misadjustment.

To be able to explain control functions, a knowledge of which will also aid in detecting troubles. it is necessary to be not only familiar with the exact operational duties of every dial on the model, but how they are related to the circuit.

As an example, let us take the case of the Philco 48-1001 which has five operating controls and five adjustment controls.

The channel selector is, of course, the major control to understand. In this model it is a large rotating switch, which connects the proper coils for the *rf* amplifier and oscillator for each channel. This also changes the antenna so that the proper dipole is on the proper channel. These separate coils, for the *rf* and oscillator, may be removed and replaced if needed. Then we have a backround control, which changes the average *dc* bias on the picture tube which brings up the picture and has no effect on the sound. This is a 250,000-ohm unit and it regulates the voltage applied to the cathode of the picture tube.

The third important control is the contrast, which, in this case, is a 1,000-ohm unit in the cathode of the video output stage, a 7C5. Amplification of the video signal depends upon this knob and hence the extent of the gray range depends upon this control.

Then we have the all-important *volume* control. In this set, the output of the FM detector, a 6AL5 discriminator, is taken across a 2-megohm control. Thus the audio applied to the grid of the *af* amplifier is determined by this knob and there is no effect upon the picture.

The *off-on*-tone control is the last basic unit, which has an *on-off* switch as part of this control. The *ac* is applied when the knob is first turned. The rest of the rotation varies a 5-megohm pot which is in series with a capacitor as the audio tone control.

Now let us probe the five service adjustments on this set: Focus, vertical hold, horizontal hold, height, and vertical linearity.

In the focus adjustment is a 20,000-ohm resistor which varies the amount of current flowing in the focus coil.

The vertical hold, the improper setting of which will usually result in the picture not moving either up or down across the tube face, is a 100,000-ohm pot, and is a part of the vertical sweep generator circuit. This pot changes the frequency of the 6SL7.

Like the vertical hold, the horizontal hold adjusts the free-running frequency of the horizontal sweep generator. In this set, it is a 2,200-ohm unit in the grid circuit of the 6SL7. An improper setting must be watched carefully, since this is one of the cases where there will be no picture for other adjustments unless the horizontal hold is correct.

The height adjustment, a 250,000-ohm unit in the cathode of the vertical sweep generator, is also an extremely important control to watch. By changing the amplification in this circuit the vertical size is determined in relation to the horizontal size. The proper aspect ratio is obtained through the use of this control.

The vertical linearity control is a 5,000-ohm unit in the cathode of a 6K6GT vertical output tube. By changing the characteristics of the tube's operation various pictures may be found. The correct one will have the greatest possible vertical uniformity.

There are seven other controls in this model which require study during operational checkup.

The first of these are the horizontal linearity controls. In this Philco model there are three on the rear of the chassis, which are used for the adjustment of the picture so that it is uniform in a horizontal sense. Linearity *1* is a coil L_{505}, linearity *2* is a 10,000-ohm control, and linearity *3* is also a 10,000-ohm control. All of these are part of the horizontal output circuit.

Then we have a beam-bender, a 50-ohm control, which changes the amount of current flowing through L_{501}, which is the beam bender coil. There is also an adjustment of the beam bender coil itself which must be positioned for maximum brilliance on the picture tube.

The next control which warrants attention is the width control, a ganged

(*Continued on page* 34; *typical patterns appear on page* 18)

Complete Familiarity With Every Control and Adjustment in the TV Set and the Various Circuits Involved, Essential During the Installation and Service Call, Facilitates Presentation of Operational Instructions to the Set Owner, Assures Absolute Picture Control and Streamlines Trouble Tracing Through Picture Pattern Observations.

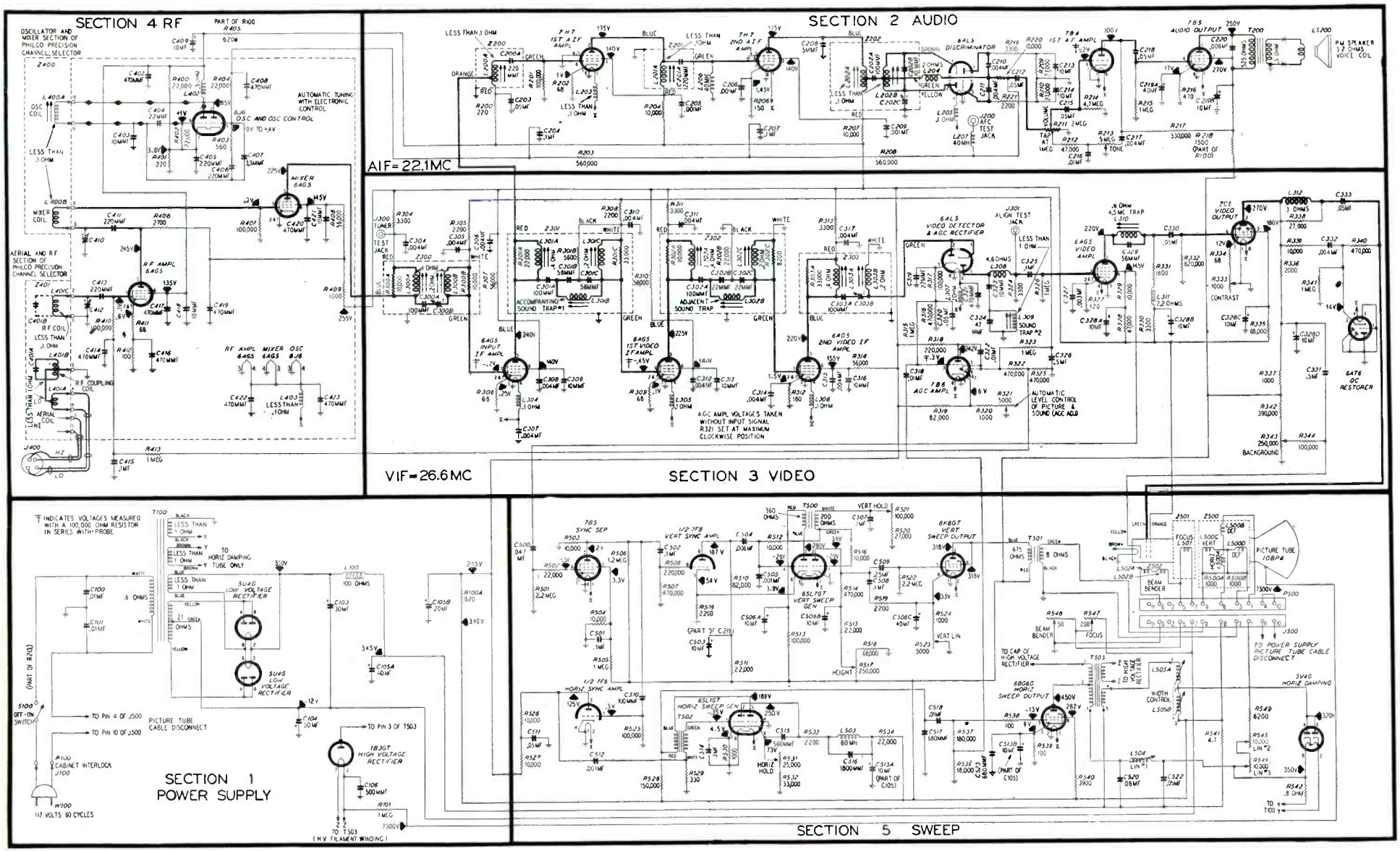


Fig. 1. Circuit of the Philco 48-1001 TV receiver which was used as a basis of circuit analysis in this article.

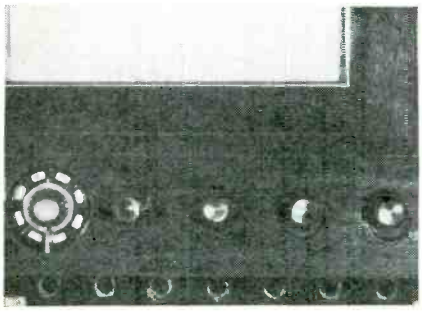


Fig. 2. Operating and adjusting controls on the Philco 48-1001.

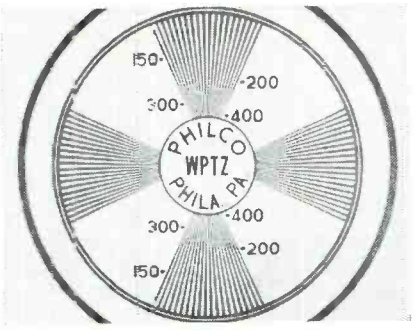


Fig. 3. Normal test pattern.

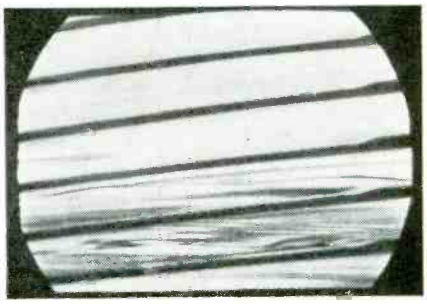


Fig. 4. Picture resulting from an improper setting of the horizontal hold.

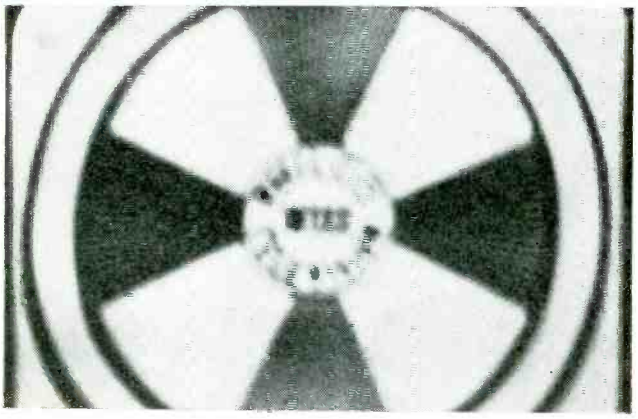


Fig. 5. Picture which results when focus is improperly adjusted.

Fig. 6. Picture with the aspect ratio incorrect due to height.

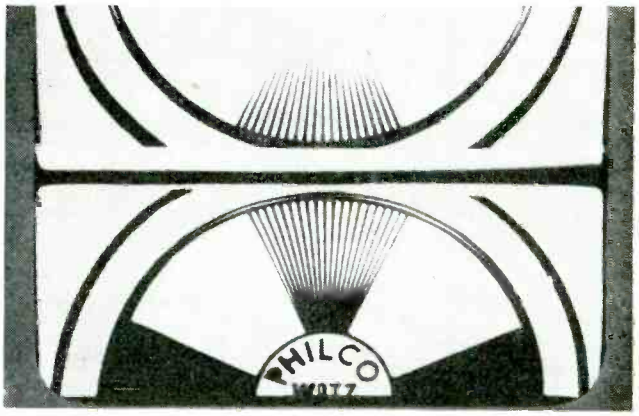
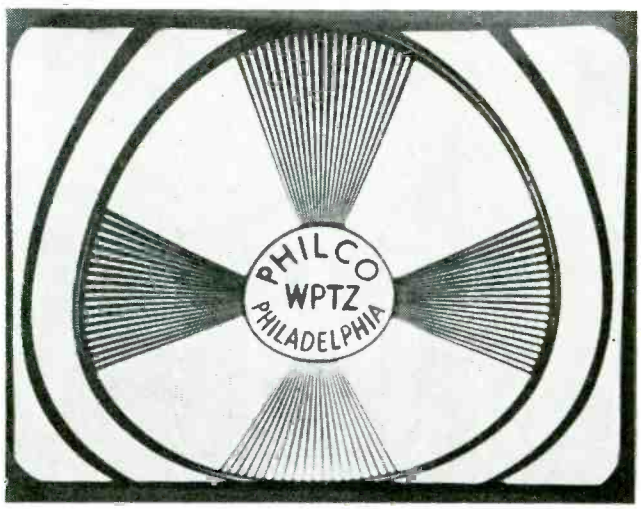


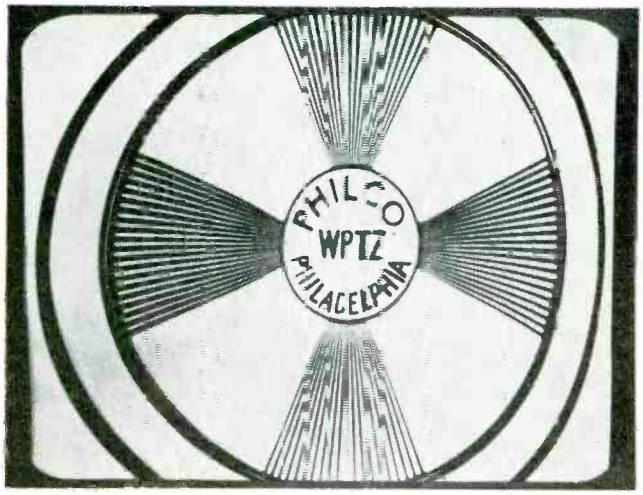
Fig. 5a. Vertical hold maladjustment picture.

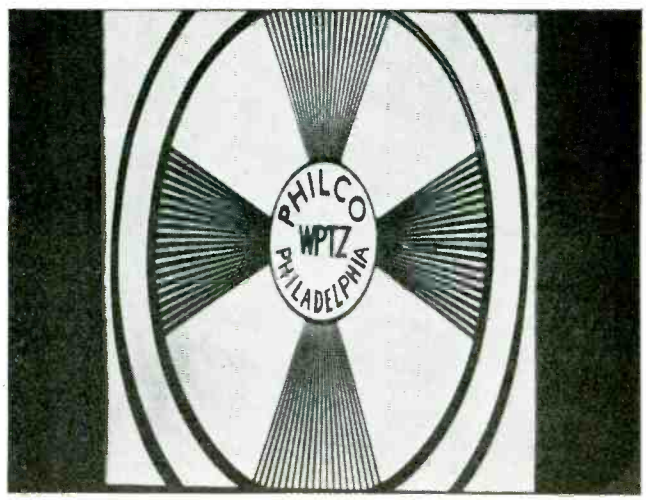
Fig. 7, below. Incorrect vertical linearity picture.

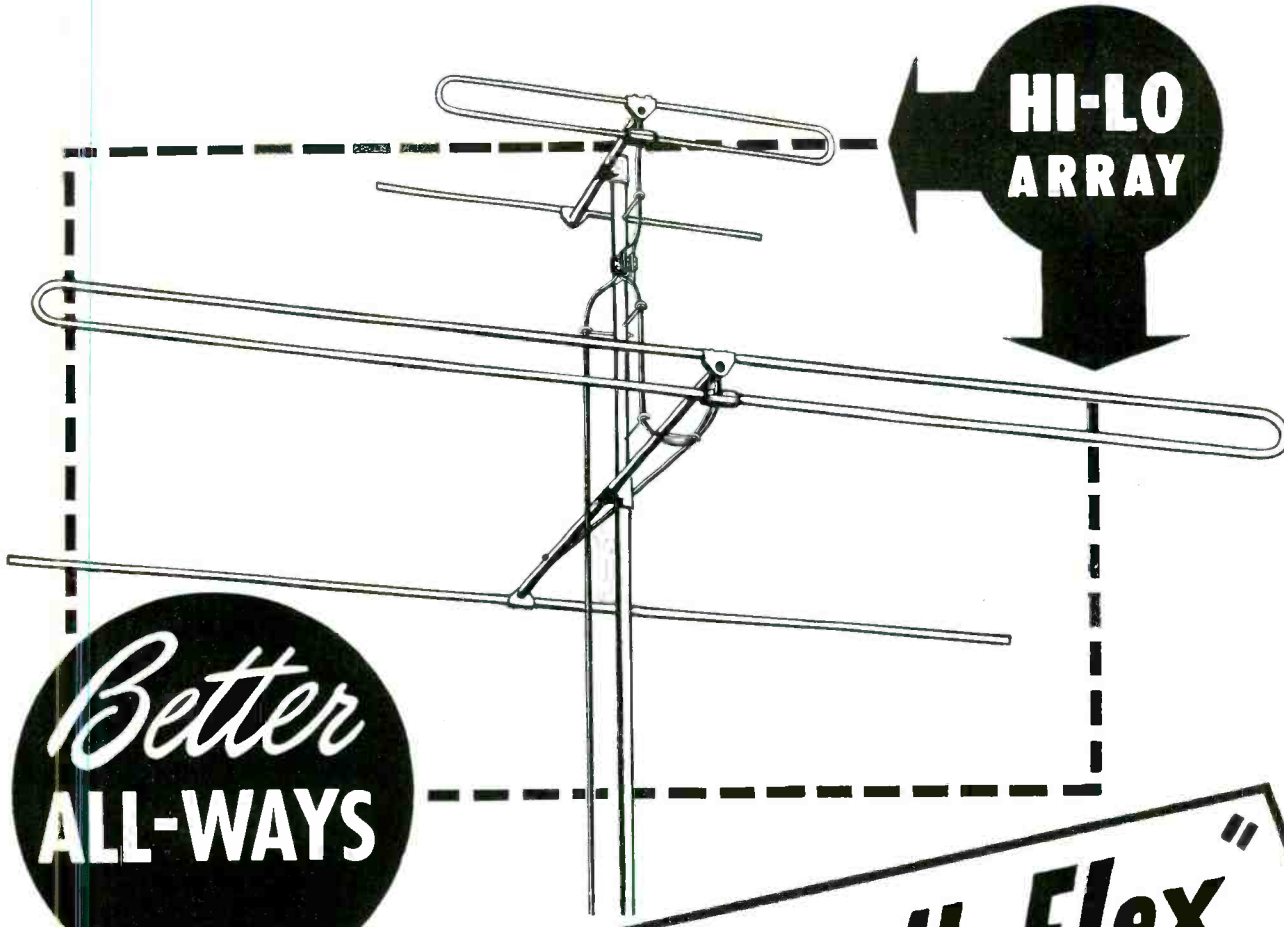
Fig. 8, below. Maladjustment of the horizontal linearity will cause this type of picture.

Fig. 9, right. Change in current flow in the horizontal deflection coil will cause a change in the horizontal aspect ratio and will cause a picture as shown.









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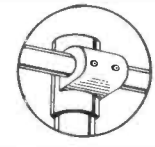
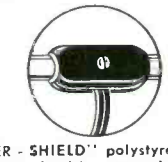
CLEVELAND 2, OHIO
MANUFACTURERS OF THE FAMOUS RED SEAL VIBRATORS

No "assembly puzzles" with Radiart's "SIMPLI-FLEX" design. No degree in engineering or truck-load of tools needed — absolutely no loose hardware. One minute assembly, one man installation!



High strength, well engineered design of more than ample safety factor, with simple, sturdy all aluminum castings, elements, and heat-treated support masts for PERMANENT installations.



"WEATHER - SHIELD" polystyrene terminal block encloses lead-in connections and protects from all weather conditions! Keeps electrical performance at maximum.

TV Receiver Production Changes

Picture Tube Mask Change in G. E. 801/802, Improving Tube Focusing in G. E. Projection Models 901/910. Alternate Audio IF Transformers in Admiral 30A1. Changes Which Will Remove Microphonics in 30A1.

by DONALD PHILLIPS

Picture Tube Mask Change in G.E. 801/802

THE 48-SQUARE-INCH mask may be converted to a larger size 52-square-inch mask by replacing it with a new mask.[1] In some cases to get the additional width, it may be necessary to replace the original horizontal sweep output transformer with a new horizontal sweep output transformer[2]

Picture Tube Interchange in G.E. 801/802/803

Picture tubes, 10FP4 and 10BP4, are interchangeable mechanically. Electrically, these tubes may be interchanged by adding an ion trap assembly[3] to the 10BP4 tube[4]. The 10FP4 does not require the ion trap. Therefore, when the 10FP4 replaces a 10BP4, it is only necessary to discard the ion trap assembly.

Improving Tube Focusing in G.E. 901/910

In these projection models, the mechanical adjustment of tube positioning for optimum overall focus is a function of the tube position in respect to the corrector lens and spherical mirror. Any shimming of the tube mounting bracket in a vertical position to allow the tube to be adjusted through the range of focus should never be used as an actual necessity. Inability to adjust the tube mount through the range of focus indicates a serious misalignment elsewhere in the optical system. Two points should be followed to assume best tube focusing.

(*1*) The sweep deflection yoke should be mounted so that cover of the yoke is pressed against the lower edge of rubber lining in the tube clamp. The dimension from yoke cover to edge of the metal tube clamp should be approximately ¼".

(*2*) The tube should be inserted through bottom of yoke assembly and tube raised vertically until yoke sleeve is pressing against the bell of the picture tube. Then the tube should be clamped firmly in place, tightening the ¼"-20 screws.

Alternate Transformer for Admiral 30A1

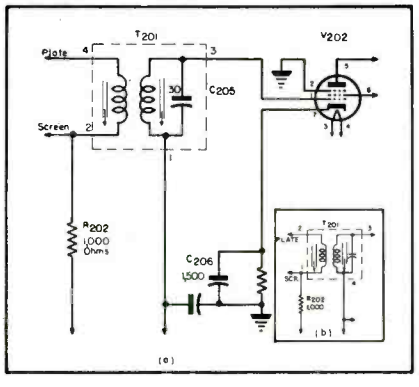
In early production the first audio *if* transformer (T_{201}) was a type 72B44. In later production a type 72B58 was substituted; Fig. 1. Since this transformer can be detuned by vibration during shipment, the slug in these units was sealed with glyptal.

In the event that alignment adjustment is necessary, a few drops of solvent should be applied to the glyptal around the slug. The slug will be free a short time after application of a solvent. Alignment adjustment can then be made in the usual manner.

Several types of solvent can be used on glyptal. Lacquer thinner or amyl acetate (banana oil) are commonly used types.

[1] G.E. RDM-011.
[2] G.E. RTO-048.
[3] G.E. RET-001.
[4] SERVICE, May, 1948.

Fig. 1. In *a* appears the wiring diagram for the first audio *if* in the Admiral 30A1 TV receiver using the early production transformer, 72B44. In *b* appears the revised circuit for the 72B58 transformer which was substituted in later production of receivers.



Removing Microphonics in Admiral 30A1

Microphonics have been a source of trouble in several 30A1 TV receivers in the field. These chassis using the 94C8-2 tuner (identified by chassis and model numbers ending in *S or SN*) have given the most trouble in this respect. The following circuit and mechanical changes have been found to eliminate this microphonic condition:

(*1*) A microphonic 6J6 *rf* oscillator tube should be checked by substitution.* It may be necessary to try several tubes as microphonics are characteristic of this particular tube type.

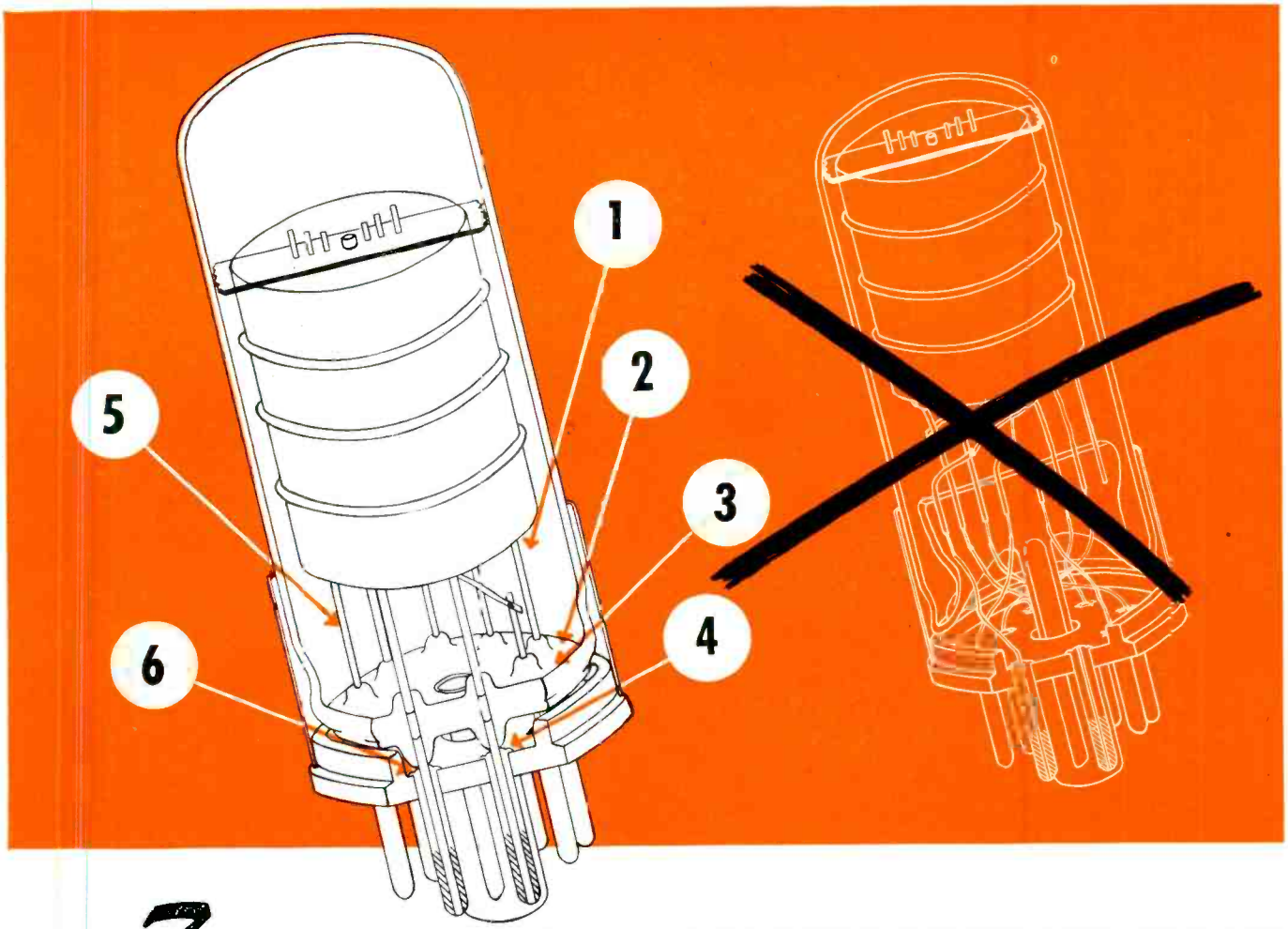
(2) The tube socket saddles and oscillator tube shield bracket should be spot-soldered to the tuner chassis.

Steps *1* and *2* also apply to, and will eliminate the microphonics in the majority of 30A1 chassis using tuner 94C9-2. (The 94C9-2 tuner uses a 6C4 oscillator tube rather than a 6J6; chassis using tuner 94C9-2 can be identified by chassis and model numbers ending in *T* and *TN*.)

(*3*) Microphonics can often be eliminated by shockmounting the speaker. The speaker should be removed from its mounting. Then the chip-board should be cut away from the speaker mounting holes sufficiently to allow insertion of a rubber grommet taking care not to cut the speaker cone. The chip-board can then be cut away all around the frame of the speaker

(*Continued on page 26*)

*Substitutions or adjustments in the oscillator circuit will make realignment of the oscillator necessary.



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3 LESS INTERNAL LEAKAGE
Wider lead spacing

4 NO BASE SHORTS
Direct, non-flexible connections

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7 EASIER TO STOCK AND SELL

One Raytheon *Bantal* takes the place, without shielding, of either the ordinary GT or metal equivalent. Made in eight popular types — 6SA7GT — 6SJ7GT — 6SK7GT — 6SQ7GT — 12SA7GT — 12SJ7GT — 12SK7GT — 12SQ7GT. Ideal for replacement in sets or equipment requiring tubes of great mechanical strength and dependability for long trouble-free service.

**These are not the only advantages of the Bantal Tube. Space does not permit enumerating them all.*

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TV Receiver Visual Alignment Techniques

Part IV . . . Bendix 235 TV Video and Sound IF Alignment Procedure

by **LESTER L. LIBBY**

Chief Engineer

Ohmega Laboratories and Kay Electric Co.

IN THE PREVIOUS installment[1] of this series we described the first four steps of the procedure to be followed in making a preliminary alignment check of the Bendix TV receiver (model 235), and there was illustrated an accurate picture of the overall response curve which should be encountered with a properly-aligned set (Fig. 5). This response curve shape is determined primarily by the video *if* amplifier alignment adjustments, with the *rf* amplifier selectivity characteristic playing only a minor part in influencing the overall response. This latter effect is true because the selectivity curve of the *rf* section of the receiver is appreciably broader than that of the *if* section, as is conventionally the case in most television receivers.

The Fig. 5 curve of the previous installment,[1] applies where the receiver local oscillator fine tuning control is adjusted to the point where the 81.75-mc birdie produced by the twelve-channel crystal-controlled *rf* sound-carrier marker generator[2] is minimized or completely absorbed by the action of the sound trap. If the sweeping oscillator[3] is momentarily turned off under these conditions, the tone modulation of the marker generator should become audible in the speaker of the TV receiver. Since this modulating tone is applied to the marker oscillator as amplitude modulation, the resulting audible tone in the speaker of the receiver will actually go through a minimum value when the signal is properly tuned into the center of the discriminator curve. If the sound *if* amplifier is correctly aligned with respect to the sound trap in the video *if* amplifier, the minimum point of the audible tone will occur at the same setting of the fine tune control for which the marker birdie is absorbed in the center of the trap.

Video and Sound IF Alignment Procedure

If the preliminary alignment check reveals that the response curve shape of the receiver is not normal, the following video *if* alignment procedure should be followed:

(*1*) Remove the 10BP4 picture tube from the chassis.

(*2*) Disable the *agc* circuit of the receiver by placing a jumper from the *agc* amplifier grid (pin 4 of V_{15B}) to the junction of R_{28P} (contrast control) and R_{122}; see schematic, previous installment.[1]

(*3*) Push channel *12* or *13* button on receiver, using whichever one has no station transmitting in that area.

(*4*) Set the contrast control to produce 2.5 volts of *if* bias as measured with a *vtvm* from terminal *Q* to chassis.

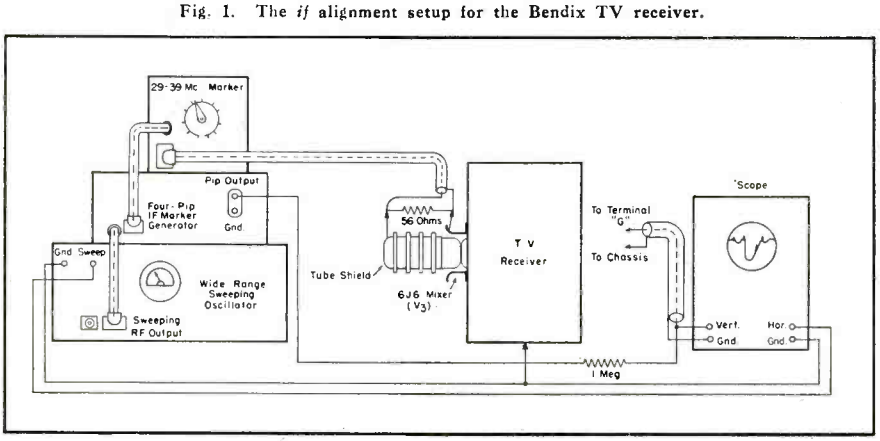
(*5*) Connect the wide-range sweeping oscillator,[3] the crystal-controlled *if* quadruple marker pip generator[4] and the 29 to 39-mc tunable *if* marker generator[5] in tandem as illustrated in Fig. 1, and connect these units to the 'scope and to the receiver as shown. It will be noted that the *if* signals are applied to the receiver by pulling the mixer tube shield up away from the grounding clips and connecting the terminated coaxial cable between the shield and one of the ground clips. This couples the *if* energy into the mixer plate circuit without measurably altering any of the circuit capacitances.

(*6*) Set up the sweeping oscillator for a sweep width or excursion of approximately 15 mc and a center frequency of approximately 34 mc, with the attenuator knob adjusted to give from about one-third to one-half of maximum output. Adjust the vertical gain control of the 'scope for a deflection sensitivity of about two inches per volt. A response curve should now be visible on the 'scope screen,

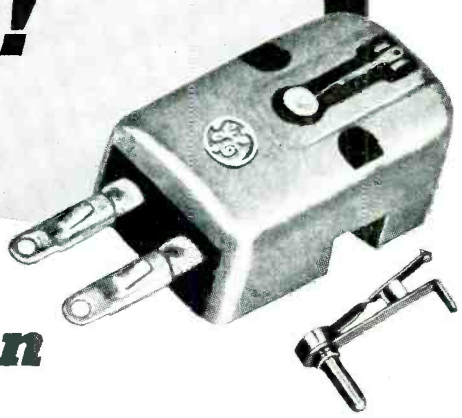
(*Continued on page* 40)

[1] SERVICE; January, 1949.
[2] Mega-Marker, Sr.
[3] Mega-Sweep.
[4] Mega-Pipper.
[5] Mega-Marker.

Fig. 1. The *if* alignment setup for the Bendix TV receiver.



has a new meaning now!



Stylus Replacement Often

WHEN the big attraction hit town they hung the "Standing Room Only" sign—it meant overflow business.

It still means that, but the big attraction now drawing overflow business for distributors and dealers is the G-E Variable Reluctance Cartridge with the Replaceable Stylus.

Why? Because record fans who know their records best wanted the finest reproduction possible. The G-E Variable Reluctance Cartridge gave them just that. To secure peak performance they often replaced the cartridge when the stylus was only slightly worn.

Now, with the Replaceable Stylus, cartridge replacement is no longer necessary. In four easy steps the cartridge can be removed from the tone arm, the stylus changed and listening pleasure increased.

Economy is the big feature but this redesigned cartridge has many other advantages. Smaller in size, it can be adapted to many more tone arms. Higher lateral compliance provides more faithful tracking, hence better fidelity. Frequent stylus replacement reduces record wear and adds hours of top listening pleasure. Needle talk and needle scratch are negligible, giving cleaner, finer reproduction.

Best of all, the cartridge is available for either the new LP records with 1 mil stylus or for conventional records with the 3 mil stylus.

The counter sized dispensing unit for greater sales—7¾" long, 5½" wide, 4¾" high at the back.

Now for the *Big Extra* to step up sales! A neat dispensing unit for the counter with two cartridges and six stylii recessed in a gold-flocked panel to catch the eye. The entire unit is finished in an attractive blue and has a compartment in the rear for additional stock. It is a silent salesman that keeps selling. See your distributor right away for details.

For complete information on Variable Reluctance Cartridges and Replaceable Stylii write to: *General Electric Company, Electronics Park, Syracuse, New York.*

You can put your confidence in—

GENERAL ELECTRIC

Servicing Helps

Connecting LP Adopter to Philco Receivers Using Beam-of-Light Reproducers.

by P. M. RANDOLPH

IN THE NOVEMBER AND DECEMBER, 1948, issues of SERVICE appeared a discussion of the *lp* system and a variety of circuit applications were shown. Omitted however were a few special type circuits, featured in such receivers as Philco, using the beam-of-light cartridge. Data describing how the *lp* can be used in these models have just been received from J. J. King of the Philco service division and are offered this month.

The *beam-of-light* unit has a low audio voltage output compared to crystal-cartridge type phonos. This was adequately compensated for by the low noise level and minimum record wear which are achieved with this method of reproduction. Low audio voltage output in the beam-of-light reproducers was also compensated for by the addition of a preamp circuit, found in every model Philco receiver using the type of reproducer. An input transformer was also used as a matching device for this low impedance photo-cell and the higher impedance input of the audio amplifier.

The output voltage of the microgroove record player reproducer is approximately .75 volt and therefore does not need a pre amp. When connecting the *lp* record player to sets using the beam-of-light principle, this preamp circuit must be bypassed. If bypassing is not effected, severe distortion and over loading will be encountered due to the amplification of the larger *lp* reproducer voltage.

Adapter Kit

For connecting the *lp* unit[1] to all types of receivers, there is an adapter kit[2] which consists of a three prong receptacle, slide switch, shielded input lead, shielded output lead and a ground lead all assembled on a small bracket suitable for mounting in a cabinet or on a chassis. The three prong receptable serves as the input for the *lp* record player, while the shielded input lead (input *1*) serves either as the input from the detector stage of the receiver, or as the input from the standard phono in radio-phono installations. The shielded output lead carries signal from the adapter to the audio amplifier.

To connect the *lp* unit to such Philco models as the 41-608, 41-609, etc., the coupling capacitor should be lifted from the high side of the volume control and the *lp* slide switch and input plug, parts of the kit, inserted between the audio coupler and the high slide of the volume control. When wiring this circuit into the receivers, precaution should be taken in the placement of the input and output wire shields. These shields should be grounded as close to the regular phono shield ground as possible, which should be close to the low side of the volume control.

When the aforementioned method of installation is used both the 7C6 phonograph preamp tube and the 7B5 light beam oscillator are in operating position. This will have no effect upon the reproduction of the *lp* unit because the output of the 7C6 is automatically grounded when the switch is in the *lp* position.

[1]Philco M-15. [2]Philco 45-1594.

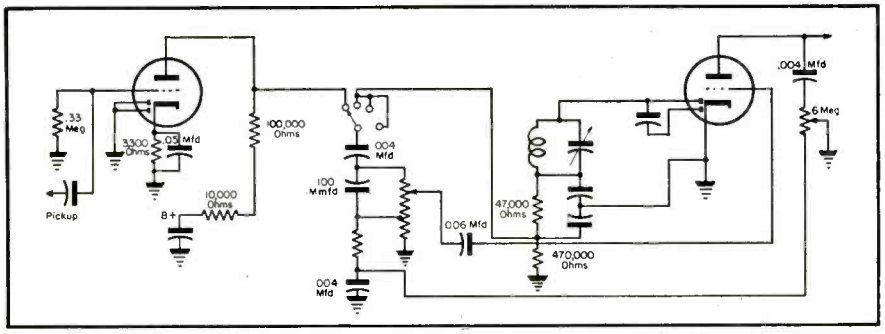


Fig. 1. Audio circuit of Philco 41-609.

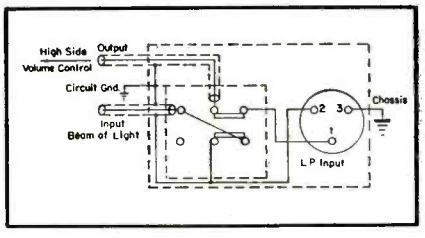


Fig. 2. *LP* adapter switch kit installed.

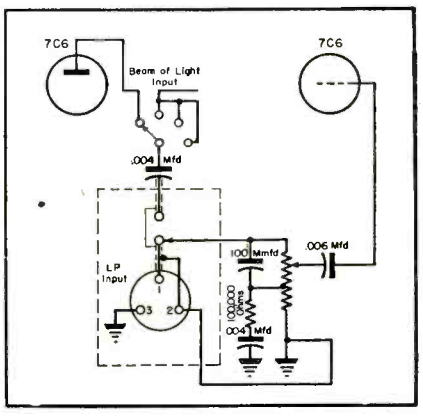
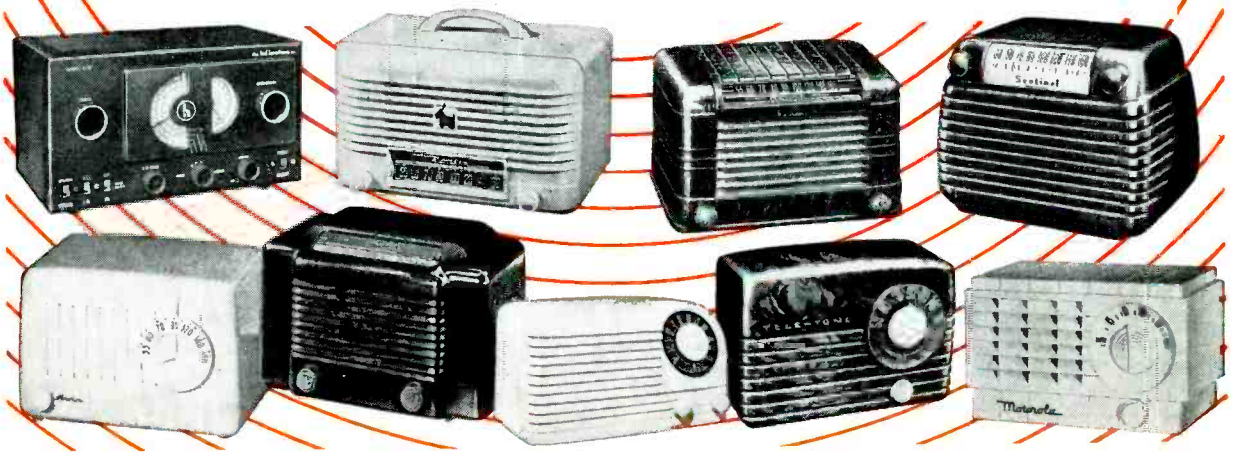


Fig. 3 (right, top). Physical layout of the adapter switch connections.

The ALL-AMERICAN FIVE and HYTRON go together

Build a better mouse trap and the word gets around—but fast. Same with Hytron a-c/d-c tubes. Many years of experience. Many millions of tubes. Constant engineering co-operation with dozens of prominent radio set manufacturers. All help make Hytron a-c/d-c tubes better. Make it natural to think of Hytron when you think of the All-American Five.

The lowly a-c/d-c tubes must pack a heck of a lot of performance—at a price. Hytron tubes do. They offer the special advantage of being built to the strictest requirements of leaders in the small set field. GT or miniature—you, too, will find Hytron a-c/d-c tubes your best choice.



SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921.

HYTRON

RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

Reflector System TV Model

[*See Front Cover*]

IN THE SER-CUIT section, last month, appeared an analysis of an indirect viewing type TV receiver, produced by Sparton.

The vertical and horizontal scanning system of another type of indirect view model, developed by Stewart Warner, appears on the cover this month.

This model, AVC1 and AVC2, uses 25 tubes and metal-backed picture tubes, the 10FP4.

Feeding the vertical and horizontal scanning multivibrator inputs is a 12AU6 sync clipper.

The output of the 35Z5GT horizontal damping tube is fed into a *B* supply booster rectifier, another 35Z5GT.

The cathode of one-half of a 12AU7 *dc* restorer cathode follower is connected to the cathode of the picture tube, the input of his half at the 12AU7 being fed by a 12AU6 video amplifier. A 12AU6 is also used as a sound *if* amplifier-limiter, which feeds into a 19T8 dynamic limiter, sound discriminator and sound amplifier, which in turn is fed into a 50L6GT output.

Four 12AU6s are used as *ifs*. A 6BH6 serves as a *rf* amplifier and a 6J6 as a mixer-oscillator.

The receiver can be used for *ac* or *dc*, a polarized relay being used for *dc* operation and two banks of selenium rectifiers for *ac* operation.

•

Production Changes

(*Continued from page* 20)

until it is down flush with the frame. The speaker can finally be remounted with the grommets in place.

(4) Short, washer-shaped lengths of rubber tubing can be slipped over the chassis mounting angle brackets to provide shockmounting of the chassis. Control shafts and knobs (particularly on the sharp tuning control) should be checked to make sure they clear the escutcheon or front panel of the cabinet.

(5) A variable dielectric (rotor disc) can be used to change the capacity of sharp tuning capacitor, C_m. Except for factory or service adjustment, both plates of this capacitor are stationary. The rotor disc should rest against grounded plate *A* of C_m throughout the adjustment range of the *sharp tuning control*. Under no circumstances should the rotor disc come in physical contact with the capacitor plate next to the grounded plate.

If the rotor disc does not rest against the grounded plate, the front of the tuner chassis should be grasped with a pair of pliers and sprung out (away from the turret assembly) slightly until the rotor disc does rest against this plate. The *sharp tuning shaft* and rotor disc all move forward when this is done.

The retaining washers should be checked to see that they press firmly against the rotor disc, keeping the plane of the disc perpendicular to the shaft. If the retaining washers are not holding the rotor disc securely, they should be pressed together carefully with a pair of long-nose pliers.

The two capacitor plates involved in this repair should be parallel and spaced between 1/64″ and 1/32″. This assures maximum tuning range of the *sharp tuning control*. If this spacing is incorrect, adjustment screw should be loosened to permit plate movement. This screw should be tightened carefully since the threads in the insulating block can be stripped out *very* easily by excessive pressure.

(6) Microphonics can result from oscillations in the audio *if* system. This can often be cured by checking lead dress, shortening leads wherever possible.

NEWS

A. S. GARTNER NOW WITH C-D

Alfred S. Gartner, formerly assistant sales manager under W. C. Harter, general sales manager of the Solar Manufacturing Corp., has joined Cornell-Dubilier as assistant to Arthur Williams, sales manager of the capacitor manufacturing division.

* * *

SYLVANIA PROMOTES H. G. KRONENWETTER

H. G. Kronenwetter, formerly advertising production manager for the Sylvania radio division has been appointed manager of advertising production for the lighting fixture, lamp, radio, electronics and international divisions of Sylvania Electric Products, Inc.

* * *

RADIART SALES APPOINTMENTS

W. Bert Knight Company have been named Radiart reps in the Southern California territory.

E. L. Berman Company will serve as Radiart reps in the North California territory.

* * *

TUNG-SOL EXPANDS

Tung-Sol Lamp Works, Inc., have expanded their Chicago facilities and moved from 111 N. Canal St., Chicago 6, to a new location at 351 East Grand Avenue, Chicago 11, Ill.

* * *

HOUSE OF TELEVISION CATALOG

A 12-page catalog with data on a *multi-vision screen* (magnifying lens), *tele filter* (filter), *plasticlean* (cleaner), and *signal kleer* accessories including antennas, indoor antennas, mounting hardware, wave traps, attenuator and matching pads, and matching transformers, has been prepared by The House of Television, Starrett-Lehigh Building, New York 1, N. Y.

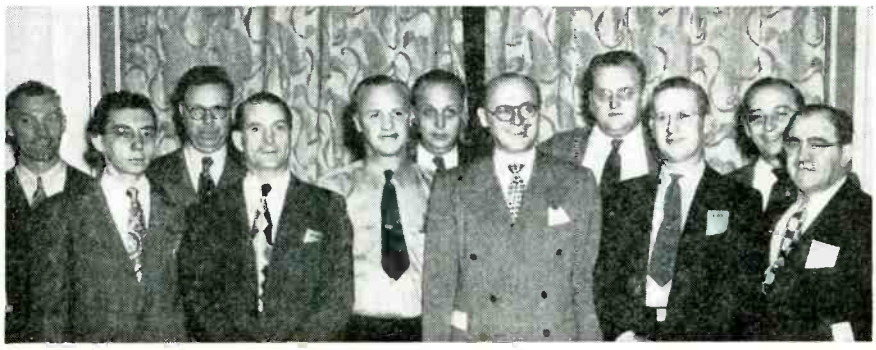
* * *

LIPPITT BECOMES TACO CHIEF ENGINEER

Kendrick H. Lippitt has been named chief engineer of Technical Appliance Corporation, Sherburne, N. Y.

Lippitt was formerly with George C. Davis, broadcast consultant in Washington, D. C.

ASSOCIATIONS



At a recent John F. Rider lecture meeting of the Mid-State Radio Service Men's Association, Harrisburg, Pa. Left to right (back row): Eugene Lauer, Paul W. Smith, L. B. Smith, W. Deardorff and Vance Beachley of the MSRSMA and Robert Miller of the D & H Distributing Company, who sponsored the meeting. Front row, left to right, Donald Waller and J. Sweeney of MSRSMA, John F. Rider, and Marc Houtz and F. J. Schmidt of MSRSMA.

AR-TSNY

LES GRAFFIS, assistant service manager of Bendix Radio, presented an extremely interesting talk on television receiver trouble shooting during a recent television lecture meeting of the Associated Radio-Television Servicemen of New York.

Graffis described in detail the functions of the various circuits in a television receiver and explained how this information can be applied in localizing troubles.

Cooperating in this lecture was Milt Lichtenstein of Burlingame Associates, who demonstrated a Supreme video generator, which provides a pattern for checking linearity, particularly useful when there is no pattern on the air. At subsequent television lecture meetings, Hickok and Sylvania demonstrated their special TV test equipment. A report on these meetings will appear on this Association News page next month.

FRSAP

AT A LUNCHEON in Harrisburg of the Federation of Radio Servicemen's Association of Pennsylvania, Philco was presented with the annual FRSAP award for their contributions to the progress of the radio service industry. The award was presented by Leonard Helk, president of the Lackawanna Radio Technician's Association to James M. Skinner, Jr., vice president

Leonard Helk, president of the Lackawanna Radio Technicians Association, presenting the FRSAP plaque to James M. Skinner, Jr., of Philco.

in charge of service and parts at Philco.

In attendance at the luncheon were David Krantz, chairman of the Federation Association and president of PRSMA; Thomas E. Clarkson, president of the Mid-State Radio Servicemen's Association; Kenneth Kenyon, general manager of the Philco service division; John Pell, manager of Philco TV service; Ray Robinson, supervisor of Philco TV field service; Wayne Shaw, Herb Snyder and Ed Donnelly of Binghamton, New York; J. T. Sweeney, Ed Phillips, John Maguire, Paul O'Hare, Burt Weisman, Vance Beachley, C. H. Arthur, Fred Schmidt and Marc Houtz of Harrisburg; R. G. Devaney, Stanley Myers and S. Winiarski of Philadelphia; J. B. Renville and T. P. Lucas of Wilkes-Barre; Carl Smith, Phil Marchioni, William Mosteller, A. H. Guild, R. A. Stout and R. S. Dittman of Williamsport; Ben DeYoung, Ithaca, N. Y.; Max Leibowitz, New York (ARTSNY prexy); Paul Wendell of Howard Sams; J. T. Morgan, Pittsburgh; John Rader of Reading, Robert Reidy and H. D Keiderling.

Demonstrating the Philco TV and FM visual alignment generator at the FRSAP meeting . . . left to right: Ed Phillips, service manager; John A. Blessing, Philco distributor for central Pennsylvania; James M. Skinner, Jr., vice president of Philco; ye editor; John Pell (at controls of generator), Philco TV service manager, and Kenneth Kenyon, general manager Philco service division.

TEN YEARS AGO

From the Association News Page of SERVICE, March, 1939

NINETEEN RSA CHAPTERS won Rider's Volume IX service manuals in the 1939 renewal dues contest. Fifteen of the chapters scored 100% renewals. . . . Sam Harper of the Clough-Brengle Company discussed "Present and Future Possibilities of the Serviceman" at the first annual banquet meeting of the Allentown Chapter at which Ed Pond was toastmaster. At a previous meeting, chapter officers were elected: president, Kenneth Keck; vice president, Thomas Glose; secretary, H. H. Filman; and treasurer, J. A. Muthard. . . . Harry Spencer presented a talk on the construction and use of a vacuum-tube output meter at a Binghamton, New York, Chapter meeting. At a subsequent gathering Ed Connelly described a device which provided an audible indication of cutoff in an intermittent receiver. . . . Leon Van Buskirk, vice president of the Binghamton Chapter, was vacationing in Florida. . . . R. Perron, of the Clough-Brengle Company, addressed the Boston Chapter on "Dynamic Testing of Radio Sets." At the same meeting Raymond Wyman displayed a panel with the old and new in tubes, including diodes and multi-purpose types. . . . Arthur Hatton of the Electrical Apparatus Company, in Boston, presented a talk on "Ceramic Capacitors" before the Bridgeport Chapter. . . . George Devine of G. E. appeared before the Chicago Chapter and discussed the Armstrong system of frequency modulation. At a later meeting of this chapter D. von Jenef, of Million Radio and Television Labs, described a signalizer. . . . Alex Plakadis was elected chairman of the Cleveland Chapter. Ed George was named vice chairman; Thomas Holmes, secretary, and Nate Dishler, treasurer. . . . L. S. Hicks, of Thordarson, addressed the Danville Chapter on "Transformers in Service." . . . Gene Payton of the Decatur Chapter was married. Lester Dunscomb of this chapter became a father.

At the FRSAP luncheon in Harrisburg . . . top row: Ben De Young, treasurer of the Empire State Federation of Electronic Technicians; Robert W. Reidy, vice chairman, FRSAP, and John G. Rader, secretary-treasurer of FRSAP. Bottom row: James M. Skinner, Jr.; David Krantz, FRSAP chairman, and Max Leibowitz, vice president of the Empire State Federation of Electronic Technicians and president of AR-TSNY.

THIRD EDITION HYTRON REFERENCE GUIDE

A six-page tube reference guide with pertinent characteristics on 91 tube types, data and basing diagrams for all miniatures announced to date, regardless of make, has been announced by Hytron Radio and Electronics Corp., Salem, Mass. Also listed are similar larger prototypes.

Available at Hytron jobbers, free of charge, or direct.

* * *

A. F. HELLERT JOINS N. U.

A. F. Hellert has been named eastern division manager for National Union.

Hellert was formerly with International Detrola.

* * *

CHARLES ROBERTS NOW WITH AIR KING

Charles Roberts has been appointed advertising and promotion manager of Air King Products Co., Inc., Brooklyn. Roberts was formerly sales promotion head of the Zenith Radio Corp. of New York and previously was advertising and promotion manager of MGM records.

* * *

JFD 12TH TV/FM ANTENNA-INSTALLATION FORUM

The twelfth session of the JFD national TV/FM antenna installation forums, initiated a year ago, was conducted recently by A. J. Friedman, JFD chief development engineer, at the Scranton Chamber of Commerce auditorium, in cooperation with the Lackawanna Radio Technicians Association of Scranton and Fred P. Purcell, distributor.

The next antenna forum will be held under the auspices of the Radio Technicians of Springfield, Mass., on April 4th.

* * *

SAMS 1948 RECORD CHANGER MANUAL

A 400-page 1948 *Record Changer Manual* (volume 2) has been announced by Howard W. Sams & Co., Inc., 955 N. Rural St., Indianapolis 6, Indiana.

Volume 2 feature *exploded view* diagrams for forty-six changers. Includes detailed operational and adjustment instructions, trouble shooting check-charts, and keyed photographs and diagrams.

New types of *lp* mechanisms and their associated pick-up, stylus and cartridge requirements, are also offered. Price, $6.75.

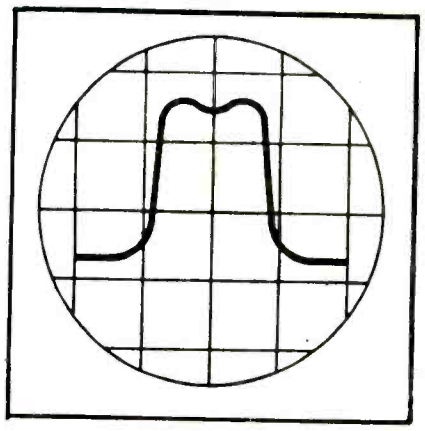


Fig. 6. Response curve resulting in a ratio detector circuit when a sinusoidal sweep is used for horizontal deflection.

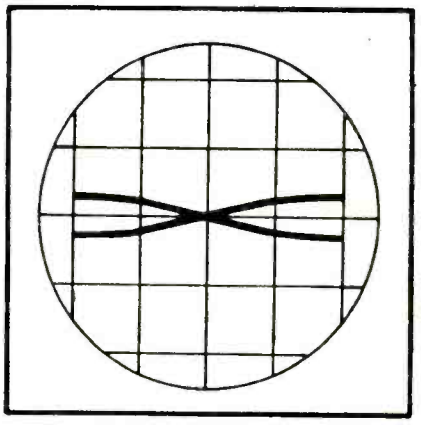


Fig. 7. Smaller *X* pattern resulting from perfectly aligned discriminator stage.

FM Receiver Alignment

(*Continued from page* 13)

transformer until a pattern of maximum height, between *A* and *B*, is obtained. Then the secondary is aligned to obtain as straight a curve or line as is possible between *A* and *B*, readjusting the primary if necessary.

It has been our personal experience that with most discriminator stages better and faster alignment can be obtained by the use of a relatively narrow (200 kc) sweep. In the case of certain discriminator transformers the use of a wider sweep has given evidence of misalignment. It is an established fact that in actual operation the discriminator does not operate at a sweep width greater than 150 kc total.

Of course, the primary or secondary, or both, may be either tuned by iron-core inductive slugs or by trimmer capacitors.

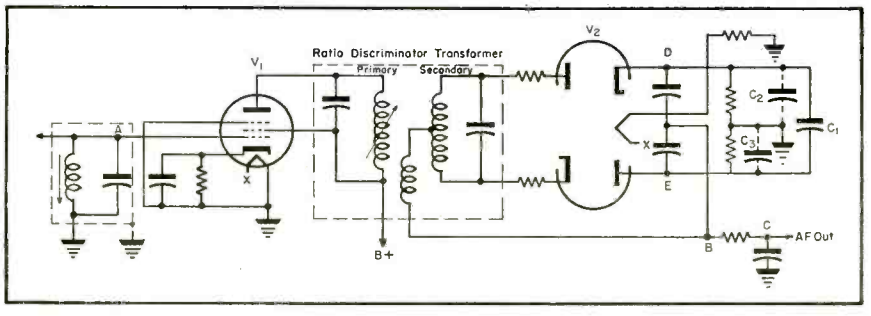
In using a 'scope which has provisions for 120-cycle linear sweep, the proper adjustment, as previously noted, will be obtained when the pattern as illustrated in Fig. 3*a* or *b* is observed. In alignment, using this type of pattern, the primary is first adjusted to obtain maximum vertical deflection between *AB* and *A'B'*. The secondary is then adjusted until the crossover point, *C*, comes exactly in the center of the screen. Incorrect alignment of the secondary will produce patterns as illustrated in Fig. 4 or 5.

Once the correct alignment of the discriminator stages has been affected, using 120-cycle sweep as illustrated in Fig. 3*a* or *b*, a still further check can be made on the alignment.

It has been found, for instance, that a perfectly aligned discriminator stage results in two smaller *X* patterns (Fig. 7), as the signal generator frequency is varied above and below the center frequency at which the curve of Fig. 3*a* was obtained. It was also noted that these smaller *X* patterns, at about .4 mc each side of the center frequency, would be of the same amplitude and shape, provided that the circuits were properly aligned. This test proved to be a quick and highly accurate method of determining correct discriminator adjustment.

In ratio-type detectors it is possible to obtain a response curve, as illustrated in Fig. 6, by utilizing the

Fig. 10. One type of ratio detector circuit.



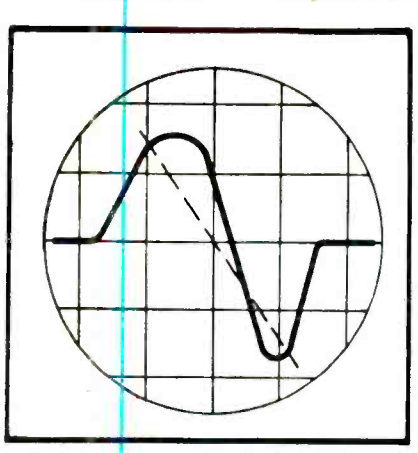
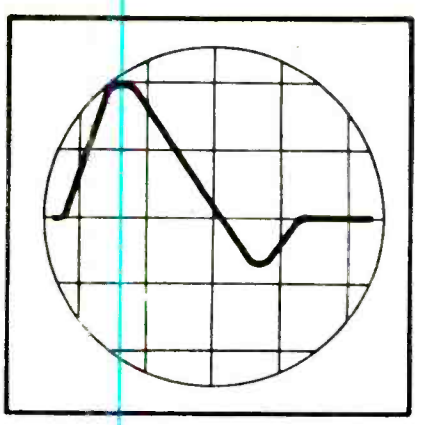


Fig. 8. Incorrect adjustment of discriminator primary results in a non-linear trace as shown here.

60-cycle sinusoidal sweep for horizontal deflection and disconnecting electrolytic capacitor C_1, or C_2 and C_3, as some circuits use two capacitors in place of one, and connecting the vertical input to the 'scope at points *D* or *E*. The secondary of the discriminator transformer cannot be properly aligned with such connection but it is possible to align the primary or, if the signal generator is being fed in at some point in the *if* strip farther back toward the converter, the *if* stages can be aligned for a symmetrical maximum amplitude pattern, as indicated in Fig. 6.

Fig. 9. Incorrect discriminator secondary adjustment results in the patterns illustrated.



* * *

C-D CATALOG

A 56-page catalog, No. 163, describing motor-starting and motor running capacitors has been released by the jobber division of Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey. Contains interchangeability tables with instant selector indices and *replacement* tables.

Eight sections cover: Motor part numbers (alphabetical listing); motor part numbers (numerical listing); cross index of C-D replacements (numerical listing); replacements; technical information; C-D catalog listing; interference filters; service mikes.

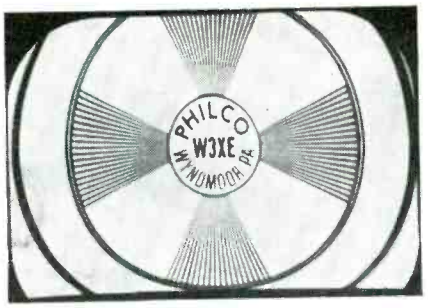


Fig. 10. When the picture is not centered properly in the vertical sense, a picture like that shown above will appear. The movement of the ring in a horizontal direction will correct this defect.

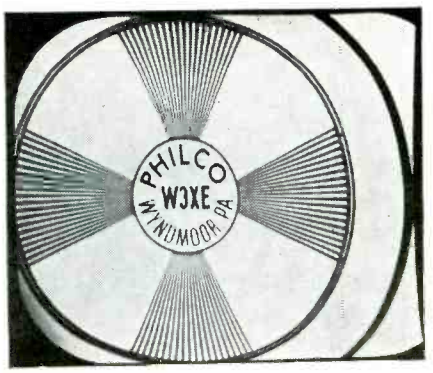


Fig. 11. Here we have a distorted picture due to improper horizontal centering, although the vertical centering is correct. A proper adjustment would be a vertical change in the magnetic ring.

TV Controls

(*Continued from page* 16)

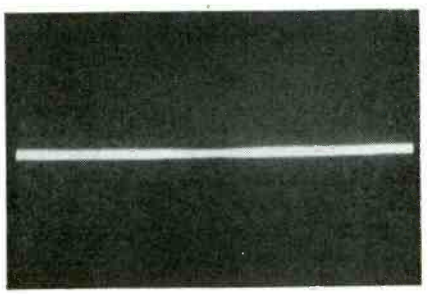
adjustment for L_{503A} and L_{503B}, which changes the current flow in the horizontal deflection coils. A change in current flow will mean a change in the horizontal aspect ratio. Incidentally, there is a considerable difference between a misadjustment of the width and horizontal linearity controls. The width control always changes the aspect ratio of the picture or the relation of the height to the width of the picture.

There are three other adjustments on the chassis. Two of these are vertical and horizontal centering, controlled by moving the magnetized ring around the picture tube. There are two metal adjustments on this ring which provide means for moving the ring and hence the picture. When the ring is moved vertically the picture moves horizontally and when the ring is moved horizontally the picture moves vertically.

The third control is the *agc* amplifier adjustment, a 5,000-ohm unit in series with the cathode of the 7B6 *agc* amplifier. This adjustment provides the correct operating point for the amplifier.

One last adjustment in this model is available through the front panel after the channel-selector knob has been removed. This is the *local-oscillator-coil* trimmer which changes the core of the oscillator coil of the particular channel being tuned in. Sound signals are used for this indication and the greatest sound volume is desired on each channel.

Fig. 12. Vertical sweep defect type picture.



Test Bench Servicing

A knowledge of the picture tube indications is the most single important single factor in rapid and accurate repair work. A great deal of valuable time can be saved if the receiver is

given a preliminary check before it is tagged to await repair.

The power supply, or *ac* input, can usually be suspected when the set is completely dead; when there is no raster or sound when the set is turned on. This defect is one of the most simple to locate because of the general indications. Lack of both the sound and the picture, when the power supply is found to be in proper order, is another common problem. This trouble is in the *rf* section, for this is the common section to both the sound and picture. Sound defects alone soon limit themselves to the sound section alone.

Troubles in the picture circuit are rather easy to trace to the picture section, but this is not enough to allow digging in to the receiver. The picture section is quite complex and further examination of the picture, or what there is of a picture, quite often leads to a localization of the defect. Antenna trouble caused by many factors, will often cause a ghost-type picture. This is usually due to improper installation, leadin lines, etc. In the shop, where the antenna must be proper, this picture should be sharp.

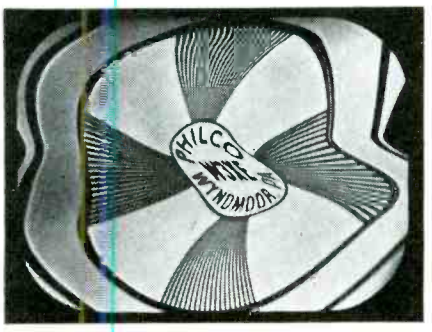
Where the vertical sweep is defective, a horizontal bar will appear on the picture-tube screen. The trouble will be usually found in the vertical sync amplifier, sweep generator, sweep output, or the deflection coils. At this point the use of test equipment is recommended. If the set is to be put aside for later work, the trouble is almost pin-pointed for a quick repair job.

Power supply filters have unusual effects on the entire receiver; there are so many circuits that have a common filter that the effects of improper filter action are wide-spread. Hum in the horizontal deflection coils due to defective electrolytic filters will cause picture distortion and result in a weird picture as shown in Fig. 13.

If the *agc* is set correctly the picture may not have enough gain and appear

(*Continued on page 36*)

Fig. 13. A hum in the horizontal deflection coils will cause a picture like this.



(*Continued from page 35*)

quite dim. This assumes that the picture is normal but weak, and the sound is normal. The usual cause for this picture is a lack of gain in the video section, either due to a tube or a circuit component. The picture tube alone can cause this where this tube has a defect. This picture also can be caused by a weak signal, but the sound then also would be weak.

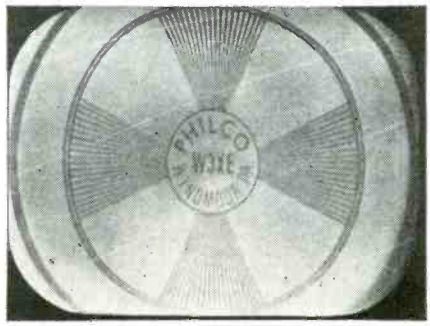
A sound in the picture, which causes a wavy picture with ripple-like sound bars, indicates improper use of the traps, a microphonic tube, or a misaligned oscillator. These sound bars may be caused by any one of the three faults depending upon the circumstances. If the traps have been touched and the defect then shows up the traps are certainly the source of trouble. The same reasoning applies to the oscillator and the microphonic tube.

A beat pattern of an interfering signal causes narrow weaving lines to appear on the picture. The best test for the presence of interference is another receiver near the defective receiver. Whenever there is a doubt as to the possibility of this case, the picture of a nearby set should be compared to the receiver in question. An improperly adjusted 4.5-mc trap will also cause this pattern.

Comparing receivers in the same vicinity has been found to clear up many complaints of the user. This is also an excellent method for the installation crew to learn of special problems of a given area. The author has seen cases where area factor was the last to be checked. After many tests it was found that all of the receivers in this same area had, for instance, the same weak signal trouble. It is not always possible to show the customer another set in the same region, but the test should be attempted if at all possible.

Two other defects are quite apparent from a picture tube; one is defocusing and the other is the lack of horizontal sync. The lack of proper

Fig. 14. Lack of picture gain usually results in a weak picture such as shown below.



focus, when the focus control is not at fault, indicates any of several troubles in the focus circuit. The voltage may be of the improper value, or there may be a fault in a component.

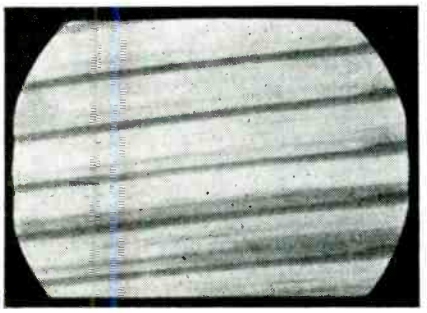
Lack of sync calls attention to either the sync separator or the horizontal sweep circuits. Again this means that the hold control itself may be operating in the proper manner, but the control may be at fault itself. A picture that moves or tears in a horizontal manner is said to lack horizontal sync.

Credits

The author is grateful to the Philco Corporation for their help in supplying the photographs, circuits and test procedure information.

*Pictures used as examples may not always represent the exact pictures the troubles cited will cause. These views have been obtained by making improper adjustments on the Philco model and photographing the results.

Fig. 15. Picture due to unstable horizontal sync.



Ser-Cuits

(*Continued from page* 14)

output from the third *if* transformer is coupled to the grid of the limiter tube where amplitude variations and noise are removed by driving the tube into plate current saturation so that the input to the discriminator is free from amplitude variations and noise. The discriminator converts the frequency changes into audio, the audio being removed from the full discriminator load, amplified by the 6V6 power amplifier and reproduced by the speaker.

Because the TV sound channel is frequency modulated, the *if* amplifier must be aligned with a FM signal generator to obtain proper band pass with gain.

The Picture IF

The picture *if* stages consist of a 6AU6 first picture *if*, 6AU6 second picture *if*, 6AH6 third picture *if*, and a 12AT7 video detector, first video amplifier and noise clipper. In coupling the converter to the first picture *if*, the cable capacity has been made common to the converter plate and first *if* grid by virtue of the inherent interelectrode and stray capacities.

The degree of coupling between the primary and secondary of the third picture *if* transformer depends on the setting of a 1-11 mmfd capacitor. The *if* voltage at the plate of the 6AH6 is divided across a pair of 5 and 6-mmfd capacitors and the 1-11 mmfd unit, and the *if* voltage applied to the grid of the video detector depends on the reactance ratio of the two capacitors. An increase in the capacity of the 1-11 mmfd unit lowers the applied voltage to the grid, while a decrease in capacity increases this voltage.

The 4.5 mc difference between picture and sound *if*s may produce an undesirable voltage into the video amplifier creating a condition where sound could appear in the picture. The 4.5 mc trap in the cathode circuit of the first video amplifier eliminates this possibility.

Gated AGC

The purpose of the automatic gain control is to feed back a negative volt-

(*Continued on page* 38)

age to the grids of the *rf* and *if* amplifier tubes to automatically control their gain. Strong signals do not overload the receiver because they develop considerable feedback voltage and reduce the sensitivity of the receiver. Weak signals feed very little voltage to the grids and the sensitivity of the *rf* and *if* stages is at maximum.

With ordinary *avc* circuits, as used in broadcast receivers, the average of the rectified signal voltage is taken from the detector and fed back to the *rf-if* grids. With a TV receiver it is impossible to use the average signal because the amplitude is constantly changing with picture content. The components in the video signal which have a relatively constant amplitude are the sync pulses. These are maintained at a level approximately 20 to 25% above the blanking and video level. Because the amplitude of the sync pulses is relatively constant, they are used to control the gain.

Ordinary methods of *agc* have certain disadvantages which have been overcome by using the gated system. If the automatic gain control is not gated, it remains open to noise impulses which can have an amplitude as great, and in some cases, greater than the sync pulses. The average voltage developed by the noise pulses creates a false *agc* voltage where the noise rather than the signal can be the controlling factor.

The *agc* circuit used in this model consists of a cathode follower (one-half of a 12AT7), and a cathode coupled grounded grid amplifier (one-half of a 6SL7GT), which obtains its plate voltage (15.75 kc sine wave) from the horizontal oscillator. The sync pulses which are applied to the grid of the 12AT7 are negative with respect to its cathode. As the sync pulse amplitude increases, with an increase in signal input, the grid is driven more negative resulting in less plate current flow and consequently less voltage drop across a cathode resistor. Since the bias of the 6SL7GT is developed across this resistor, the reduction of the voltage drop causes this tube to conduct more current which in turn leads to the development of additional negative feedback voltage for application to the *rf* and *if* grids.

[To Be Continued]

ECA FM/TV Sweep Signal Generator

Perhaps the most important piece of test equipment for broad-band alignment is a FM signal generator.

In Fig. 2 appears the circuit of a generator which features a continuous

wide frequency coverage of 2 to 227 mc, without band switching of coils or capacitors, employing the beat frequency method. The circuit consists of a 6C4 variable oscillator beating against a fixed frequency, constant amplitude, 6J6 reactance tube and modulated oscillator, and combining their outputs in a 6C4 mixer tube. A frequency of 114 mc was chosen for the fixed frequency oscillator and the variable or beat frequency oscillator was designed to cover a frequency range from 37 to 120 mc.

Various methods may be used to frequency modulate an oscillator. In some signal generators, motor driven modulators are used, others employ electro-mechanical means and finally reactance tube modulation. In this instrument the latter type is used. The 6J6 power-line frequency-controlled reactance tube sweeps the 114-mc fixed frequency oscillator to above and below center frequency at double the 60-cycle power line frequency or 120 times per second. Sweepwidth in mc is controlled by a panel mounted sweepwidth control which covers a range of approximately 500 kc to 10 mc.

The signal generator provides a horizontal synchronizing sawtooth voltage for the 'scope's amplifier. A front panel control corrects minor phase shifts. If generator synchronizing voltage is used, the 'scope coarse-frequency control must be set to off position. The 'scope horizontal amplifier control expands the trace on the 'scope screen for proper width. Height of trace is controlled by the 'scope vertical amplifier knob. If the horizontal synchronizing voltage of the generator is used, super-imposed image traces of the selectivity of discriminator curves are shown on the screen, with the base line retained. It is possible to use the 'scope's internal synchronizing circuit.

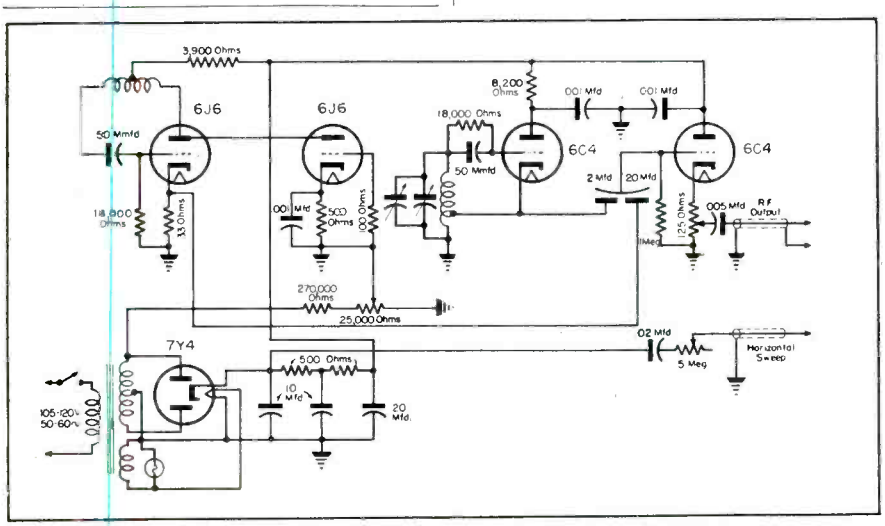


Fig. 2. The ECA FM/TV signal generator.

TV Alignment

(*Continued from page 22*)

along with the four marker pips which are superimposed on the pattern by the action of the quadruple pip generator. These pips mark the points on the sweep at which the frequencies of 30.125, 31.625, 36.125 and 37.625 mc occur, and these frequencies are respectively the adjacent channel picture *if* carrier, the associated channel sound *if* carrier, the associated channel picture *if* carrier and the adjacent channel sound *if* carrier points.

(*7*) Adjust the 29-39 mc *if* marker generator to 34.5 mc, with its output level control set so that the resultant *birdie* on the response pattern is visible but not large enough to overload the receiver circuits. Using a non-metallic alignment screwdriver, tune the adjustment slug of *if* coil L_{29} (Fig. 2), to produce maximum deflection of the birdie away from the base-line point of the response curve.

(*8*) Set the *if* marker generator at 32.9 mc and adjust the tuning slugs of *if* coils L_{14} and L_{24} to produce maximum deflection of the birdie from the base line.

(*9*) Set the *if* marker generator at 35.7 mc and adjust the tuning slug of *if* coils L_{20} and L_{28} for maximum deflection of the birdie from the base line.

(*10*) Temporarily turn down the variable *if* marker generator and, referring to the 37.625-mc pip of the crystal-controlled quadruple pip generator, adjust the tuning slug of *if* coil L_{21} for maximum deflection of the pip from the base line and then adjust the tuning slug of *if* trap coil L_{22} for minimum deflection of the pip from the base line. By maximizing or *peaking* L_{21} and then minimizing or *dipping* L_{22} there is achieved a sharp trapping action for the adjacent channel sound *if* carrier, while still maintaining the proper slope value of the remainder of the response curve.

(*11*) Set the variable *if* marker generator at 35.7 mc and re-peak L_{23}. This is necessary because there is some inter-action between the adjustments of L_{22}/L_{21} and the adjustment of L_{23}.

(*12*) Temporarily turn down the variable *if* marker generator

and, referring to the 31.625-mc pip of the four-pip generator, adjust the tuning slug of *if* coil L_{26} for maximum deflection of the pip from the base line and then adjust the tuning slug of *if* trap coil L_{28} for minimum deflection of the pip from the base line. In peaking L_{26}, the first peak, which is encountered when bringing the slug out from its innermost position in the coil, is used since instability may result from using the wrong peak.

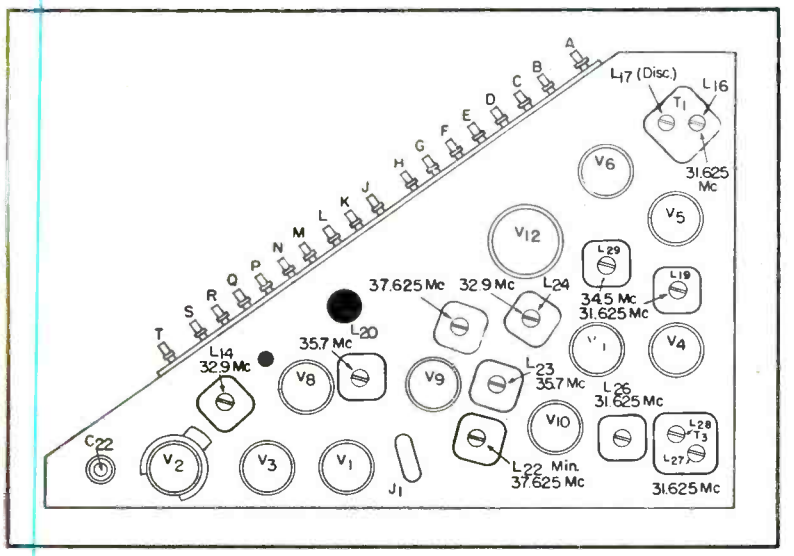
(*13*) Set the variable *if* marker generator at 32.9 mc and re-peak L_{24}.

(*14*) Set the variable *if* marker generator at 31.625 mc and, with a *vtvm* connected between receiver terminal *A* and ground, and with the sweeping oscillator momentarily turned off, peak the adjustment slugs of sound *if* coils L_{16} (within T_1), L_{19} and L_{27} (within T_3). Keep the output level of the *if* marker generator adjusted for a *vtvm* reading of less than –5 volts *dc*.

(*15*) Connect the *vtvm* between terminal *B* and ground. Short the output of the coaxial cable connected between the mixer tube shield and ground, and note the meter reading. This is the discriminator zero reference level. Remove the short from the coaxial cable and allow the 31.625-mc signal from the *if* marker generator to come through, with the sweeping oscillator still turned off. Adjust the tuning slug of L_{17} (within T_1) to zero reference level after finding the sharp cross-over point of the discriminator. Disconnect the *vtvm*.

[To Be Concluded in April Issue.]

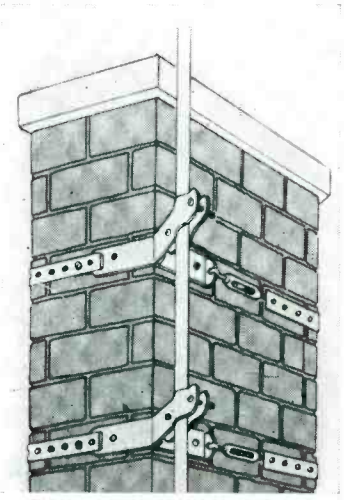
Fig. 2. Top view of the *rf-if* chassis.



New TV Parts . . . Accessories

METALACE CHIMNEY MOUNT

A two-piece chimney type antenna mount, model CMA, designed to allow any spread between mast brackets, has been announced by the Metalace Corp., 2101 Grand Concourse, New York 53. Supplied in preassembled form, with a turnbuckle and a 12' roll of strapping attached to *each* of the two mounts. Accommodates masts of ¾" to 2½".



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TRANSVISION SWEEP SIGNAL GENERATOR

A sweep signal generator, model No. SG, which features coverage from 0-227 mc with no band switching, variable sweep width from 0-12 mc, and a calibrated built-in marker generator, has been announced by Transvision, Inc., New Rochelle, N. Y.

Has directly calibrated markers: 20-30 mc for trap, sound and video *if* alignment; unmodulated *rf* signal to provide marker pips simultaneously with the main variable oscillator, and a phasing control.

* * *

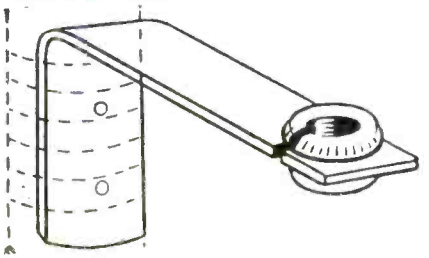
RADIART *SIMPLI-FLEX TV* ANTENNAS

A line of *Simpli-Flex* antennas, which may be built up from simple dipole to multiple-stacked, all channel arrays as required, has been designed by the Radiart Corp., 3571 W. 62, Cleveland 2, Ohio. Conversion kits are available to add to original basic installations where changing conditions make it desirable to increase utility and effectiveness.

BRACH STANDOFFS

A stand-off has been announced by the L. S. Brach Mfg. Corp., 200 Central Avenue, Newark, N. J. May be mounted with screws to a side wall, with self-tapping screws directly to the antenna mast, or taped onto the mast.

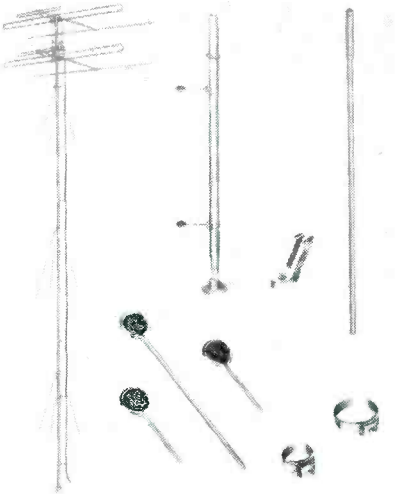
Standoff may be used with either twin leadin or coax cable, and is available in two sizes: 376, with a 3" arm and 377, with a 6" arm.



AMPENOL TV ANTENNA ACCESSORIES

A line of TV antenna accessories, which includes screw-eye and polystyrene standoff insulators, and extension masts has been announced by the American Phenolic Corp., 1830 South 54 Avenue, Chicago 50, Ill.

Screw-eye insulators, with polystyrene inserts, are designed for both flat and round twin-lead or coax and other cables not over ½" in diameter. Polystyrene standoffs are for 300-ohm flat twin leadin indoor applications.



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JFD INDOOR TV/FM ANTENNA

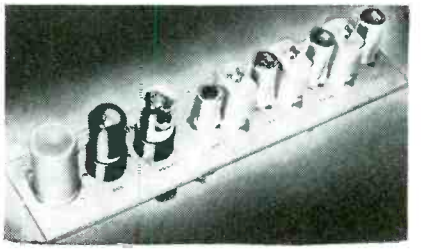
An indoor TV/FM antenna, the *Tele-Vee,* has been announced by JFD Manufacturing Co., Inc., 4117 Ft. Hamilton Parkway, Brooklyn 19, New York. Preassembled and supplied with a 10' length of 300 ohm twin lead.

* * *

MEISSNER TV COMPONENTS

A 12-channel *rf* tuner, video *if* strip and audio *if* strip are now available from the Meissner Manufacturing Division of Maguire Industries, Inc., Mt. Carmel, Ill.

Video strip uses three 6AG5 *ifs,* a 6AC7 video amplifier, 6AG7 video amplifier, 6SN7GT *dc* restorer and sync separator and a IN34 crystal. The audio *if* strip has two 6AG5 *if* amplifiers, one 6AG5 *if* amplifier and limiter, a 6AL5 frequency detector, 6SN7GT audio amplifier and 6V6GT power amplifier.

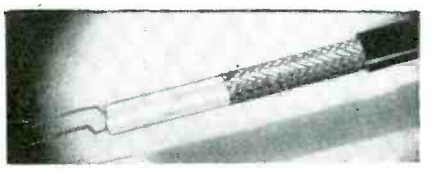


Audio IF Strip

* * *

FTR 300-OHM SHIELDED LEADIN

A 300-ohm shielded, balanced line, Intelin K-111, has been developed by Federal Telephone and Radio Corporation, East Newark, New Jersey.



Ceramic Capacitors[1]

Design and Application Notes on Miniature Component Used in Many Sections of TV and FM Circuits.

THE TV receiver, with its extremely high picture-tube voltages, increased heat radiation due to the many tubes required and appearing on smaller and smaller chassis, operation on the higher frequencies, and involved circuitry, has altered, in the main, many component design concepts. As a result many new types of parts have been developed. And many parts, originally designed for the military and other specialized applications to meet conditions similar to those present in a TV receiver, are now finding extended acceptance, in modified forms, in the television set, too.

An interesting example of the latter situation is the ceramic capacitor, which was first introduced about a decade ago and used extensively during the war.

The basic element of this type of capacitor consists of a ceramic dielectric with electrodes of silver fired directly onto its surfaces. Mechanically, therefore, this capacitor is extremely stable due to the rigidity and fixed dimensions of the ceramic itself, and the impossibility of any movement between this dielectric and the electrodes. The electrical characteristics of the capacitor therefore are solely dependent upon the molecular nature of the ceramic dielectric itself.

Most ceramic capacitors are tubular in shape, since this form best adapts itself to economical manufacture, and at the same time is usually the most advantageous shape for application at very high frequencies. Flat plates are also used, either in rectangular or disc form, which permits stacking to obtain high capacities.

A typical tubular dielectric is ⅛" in diameter, ⅝" long and has a wall thickness of about .020". One silver electrode is applied to the inner surface of the tube, the other electrode to the outer surface. Insulating space of about 3/64" is left between the two electrodes. This example is cited to illustrate the simplicity of this type of capacitor, which results in low inductance even when conventional wire

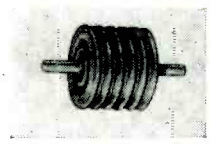
[1]From data prepared by the engineering department of the Erie Resistor Corp.

Table 1
Four typical classes of ceramic capacitors.

Class	Dielectric Constant	Typical Maximum Capacity for Moderate Size of Tubular Unit, Mmfd	Q Range	Temperature Characteristic
A ...	Approx. 30	120	400 to 1,000	Temperature coefficient of capacity near zero.
B ...	6 to 85*	360	400 to 1,000	Temperature coefficient of capacity a predetermined amount, between +100 and −750 parts per million per degree C.
C ...	6 to 85*	360	400 to 1,000	Temperature coefficient of capacity any value between +100 and −750 parts per million per degree C.
D ...	400 to 2,000	5,000	30 to 100	Variable. Capacity may decrease as much as 50% or increase as much as 20% as temperature is varied between −55° C and +85° C.

*Dielectric constant varies with temperature coefficient. In general, the higher the negative coefficient, the higher the dielectric constant.

leads are attached to each end. In addition, this construction permits special units to be built for bypassing at high frequencies by feeding one lead wire in the circuit through the center of the tube, reducing the inductance path to ground to almost zero.



High-voltage type ceramic capacitor.

Feed-thru type ceramic capacitor.

Specific Applications

Oscillator tank capacitor used with permeability tuning: In this application the temperature coefficient is critical, since set will drift off-tune during warm-up if proper value is not used. Capacitors used here are class *A* or *B* type (see Table 1) and in most cases represent the total capacity in the oscillator circuit. In making replacement, a temperature coefficient as close as possible to original must be used, and the unit must be replaced in same position in set to insure its being subjected to same temperature rise.

Rf circuit tank capacitor used with permeability tuning: Same considerations as in the foregoing case but to a lesser degree. Slight drift in resonance can usually be tolerated, but too great a deviation from temperature coefficient of original capacitor should not be made.

Oscillator compensator capacitor across air variable to compensate for temperature variations in other components: This is a common application, and in most cases a class *B* type, having a nominal temperature coefficient of –750 parts per million per degree C, and a small capacity, is used. Use of a lower coefficient will require a higher capacity to obtain the same compensation, with resultant loss in station coverage because of higher tuning capacity minimum. Every effort should be made to replace with the same coefficient and capacity value, although a slight deviation in capacity can usually be tolerated.

If tank capacitors for permeability tuned if transformers: Class *A* or *B* types are used here, and generally will have a temperature coefficient near zero. However, where push button tuning is not provided, temperature drift is not quite so important and it will be found that to save space maximum coefficient of –750 parts per million is quite often used in the smaller sets. On push button tuned sets exact replacement should be made, on other sets some moderate deviation in capacity and temperature coefficient can usually be tolerated.

Antenna, oscillator and other rf coupling: In this case class *C* or *D* types are used. If the circuit indicates that coupling application is such as to affect tuned circuits to any extent, class *C* types should be used.

Rf bypass capacitors:[2] Depending upon capacity required, class *C* or *D* types are used. Since ceramics are marked with their nominal temperature coefficient, such marking will be found on any capacitor requiring replacement, but it need not be replaced with the same coefficient as long as its function is that of bypassing.

Now in use on many vhf receivers are feed-through types[3] with outer electrode soldered to bushing inserted in panel, inner electrode soldered to lead wire passing entirely through capacitor, and stand-off types[4] for bolting directly to chassis around tube socket with short lead wire to socket terminals. Now in the pre-production stage, tube sockets will soon be available with ceramic dielectric bypass capacitors built in, the tubular ceramic element surrounding socket clip and vacuum tube pin. In this way shortest possible *rf* path to ground will be provided.

Ceramic capacitors are inherently adapted to high voltage applications, not only because of the insulating properties of ceramic materials, but also because the dielectric can be so formed as to provide its own corona shield. An example of this is one type[5] now available for TV power supply filtering.

Ceramic capacitors are not limited to fixed types. By using flat dielectrics, silvered on one side and ground flat and smooth on the other, trimmer capacitors are made by applying a flat ground semicircular rotor against the ground side of the dielectric.

Ceramic tuning capacitors are now under development, employing the same principles as the trimmers, but with the necessary refinements to provide accurate tracking and calibration. These are expected to provide all the advantages of the air types, but will require much less space, a two-gang unit being only about one-half inch deep overall. Such capacitors can be expected to be used first in pocket receivers.

[2]Erie GP types. [3]Erie 362. [4]Erie 323 and 324. [5]Erie 410.

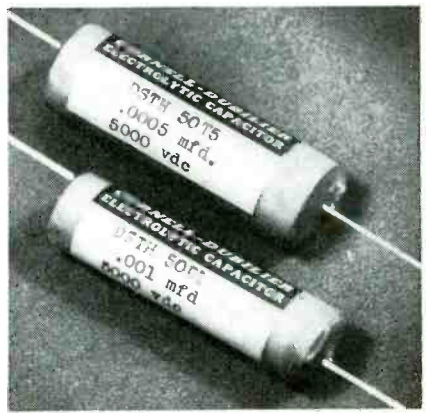
Additional data on TV component design and application appears on pages 42, 43 and 46 of this issue.

C-D TV ELECTROLYTICS

Type DSTH double-case type electrolytics, in capacities from .0005 to .05 and in voltage ratings from 3,000 to 5,000 *dc*, have been announced by Cornell-Dubilier Electric Corp., 333 Hamilton Boulevard, South Plainfield, N. J.

Capacitor elements are enclosed in two separate concentric completely wax-sealed cardboard cases. Dykanol impregnated, kraft paper dielectric.

Also available from C-D are type BRHV electrolytics in hermetically sealed aluminum containers, in 8 to 16-mfd values, 500 to 700 working voltage and 650 to 850 surge voltage.



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MERIT TV REPLACEMENT TRANSFORMERS

A line of TV replacement transformers is now being manufactured by Merit Coil and Transformer Corp., 4427 N. Clark St., Chicago 40, Ill.

Line includes in several types, power transformers, vertical output transformers, vertical blocking oscillator transformers, horizontal blocking oscillator transformers, filter chokes, filament transformers (for amplifier, amateur and industrial use) driver transformers (to couple driver plates to amplifier grids), etc.

* * *

SPRAGUE TV ELECTROLYTICS

A line of television replacement electrolytic capacitors (type TVA and TVL *Twistlocks*) is now available from distributors of the Sprague Products Company, North Adams, Mass.

Electrolytics are said to be designed to stand up under the extremely high temperatures, high ripple currents, and high surge voltages encountered in television receivers. Included in the listing are 93 ratings comprising the units said to be most needed by Service Men.

Complete description of capacitors appears in Sprague bulletin M-429.

New Parts, Accessories

ALLIANCE 33⅓/45 RPM RECORD PLAYERS

Two slow-speed record player phonomotor units, a 33⅓ and 45 rpm dual-speed single-play record player assembly and a single-play 45 rpm record player assembly have been developed by Alliance Mfg. Co., Alliance, Ohio.

* * *

UTC INPUT TRANSFORMERS

An input transformer for matching low impedance microphones, pickups, etc., to high impedance circuits, has been developed by United Transformer Corporation, 150 Varick Street, New York 13, N. Y.

The unit matches any source from 50 to 500 ohms impedance to grid. Housed in a die-cast case with a standard jack receptacle for low impedance plug-in. The output connections are brought to a standard plug for the high impedance input side of the amplifier.

Further information available from Ben Miller, UTC sales manager.

* * *

ASTATIC CERAMIC ELEMENT MICROPHONES

The Astatic Corporation, Conneaut, Ohio, has announced that every crystal model Astatic microphone, with the exception of a few special types, now is available in look-alike piezoelectric ceramic-element models.

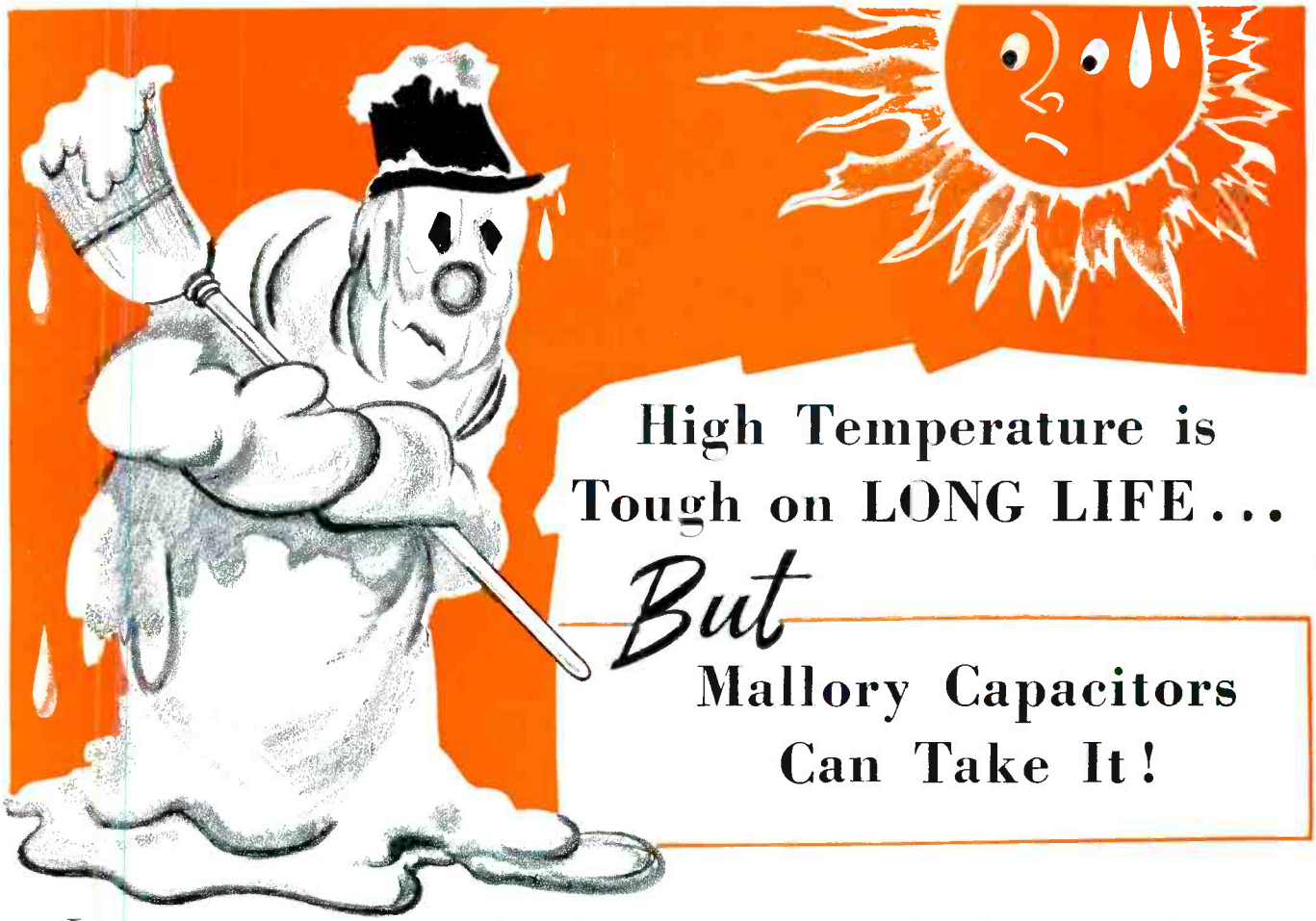
Astatic Cardinal microphone, available with such accessories as a desk holder, hang-up hook and stand adapter, now available in crystal and dynamic as well as ceramic models.

JOTS AND FLASHES

TOWN MEETINGS continue to be of significant interest to the Service Man. At the recent Town Meeting of Radio Technicians in Atlanta, Service Men from eight states, including Georgia, Florida, North and South Carolina, Tennessee, Mississippi, Louisiana and Alabama, attended. At a subsequent Town Meeting in Los Angeles the attendance was excellent too. Appearing at this meeting were John F. Rider, who covered antennas; James T. McAllister of RCA Service Company, who discussed TV service in the home with existing test equipment, D. J. Drommerhausen, service manager of Hoffman Radio who analyzed basic TV test equipment, and Caywood Cooley, chief instructor of the Philco training program, who described the composite TV signal. . . . Dr. W. R. G. Baker, G. E. vice president, declared recently that the G. E. receiver billing in '49 at the retail level will exceed $650,000,000 for some 200,000 receivers. . . . B. T. Setchell is now president and chief electronics engineer of Setchell Carlson, Inc., New Brighton, Minnesota. A. P. Setchell is vice president and office manager; D. C. Carlson, secretary-treasurer and chief engineer, and D. L. Johnson, sales manager. . . . Leonard Electronic Supply Company, 106 W. South Second Street, Roanoke, Virginia, is now a Sylvania Electric distributor. . . . James D. McLean has been named manager of the industrial division of Philco. . . . Robert Wallace has been appointed sales manager of Zenith Radio Distributing Corp., 912 West Washington Blvd., Chicago. . . . Howard J. Mandernach, manager of the New York district of the electronics department of G. E., died recently. . . . The second annual National Television and Electrical Living Show will be held at the Chicago Coliseum, September 30, 1949. Harry Alter is chairman of the show. . . . The second issue of the John F. Rider jobber and distributor house organ was released recently. . . . J. C. van Groos, west coast rep for the Superior Electric Company of Bristol, Conn., is now located at 1436 North Serrano Avenue, Hollywood 27, Calif. . . . A. R. Thibau, 402 Manufacturers Exchange Building, Kansas City 6, Missouri, is now sales rep for Clarostat and will cover all of Kansas, Nebraska, Western Missouri with the exception of Jefferson City, and Iowa with the exception of Waterloo, Cedar Rapids, Sioux City and Fort Dodge. . . . A multiple tape recording system has been announced by the Minnesota Mining and Manufacturing Company, St. Paul, Minnesota. The instrument can reproduce 48 hour-long recordings. Reels have 600' of tape and a playing speed of 3¾" per second. . . . Vinyl plastic records for the 45-rpm system, in seven colors (red, green, yellow, blue, cerise and other hues), have been announced by RCA. . . . Allen B. DuMont Labs recently presented a TV servicing seminar for their New York dealers and Service Men. E. A. Merriam, head of the television service control section, and Ernest A. Marx, general manager of the receiver sales division, conducted the sessions.

ADVERTISERS IN THIS ISSUE

SERVICE INDEX—MARCH, 1949



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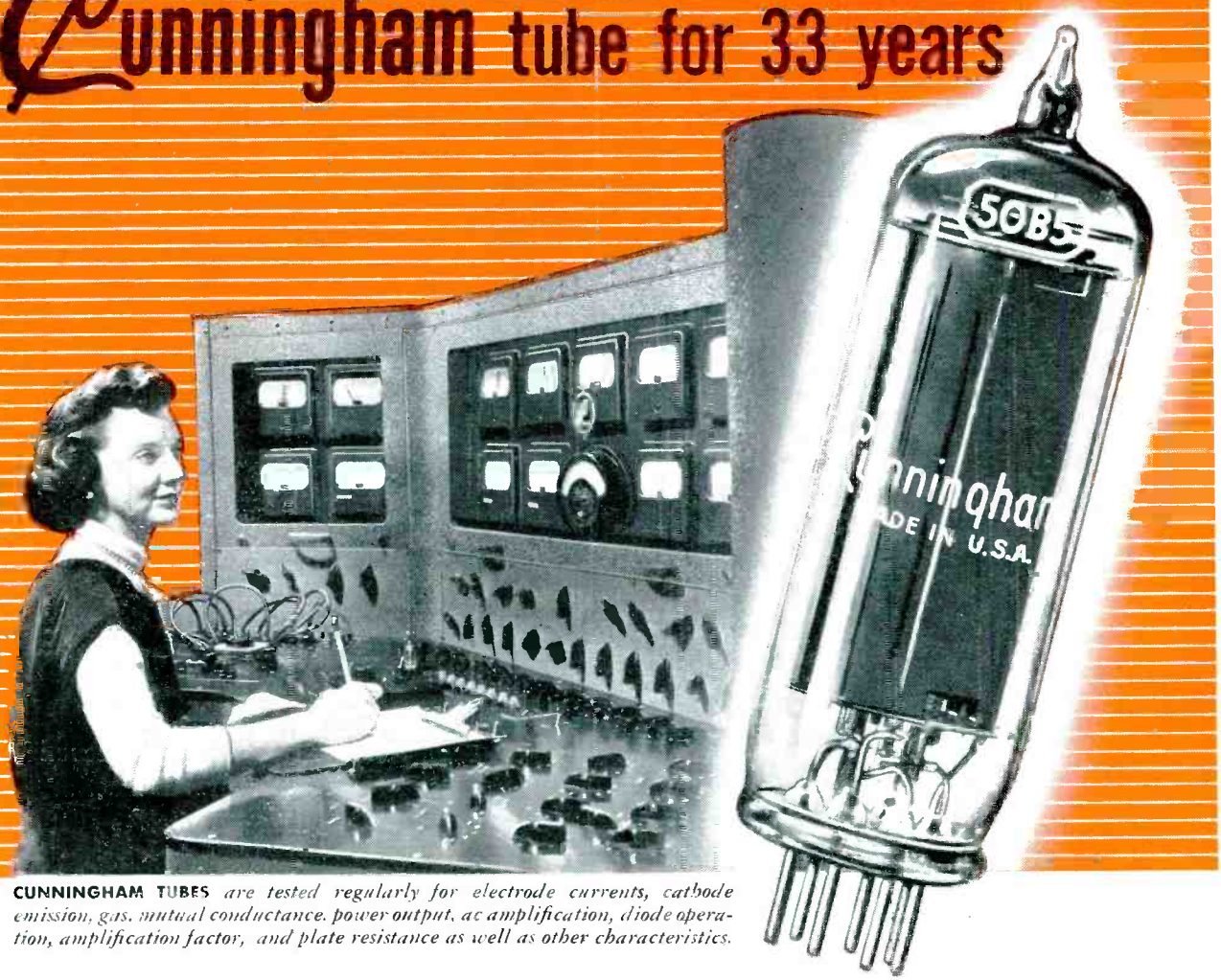

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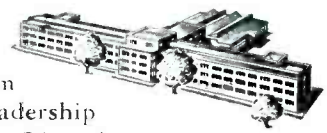

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