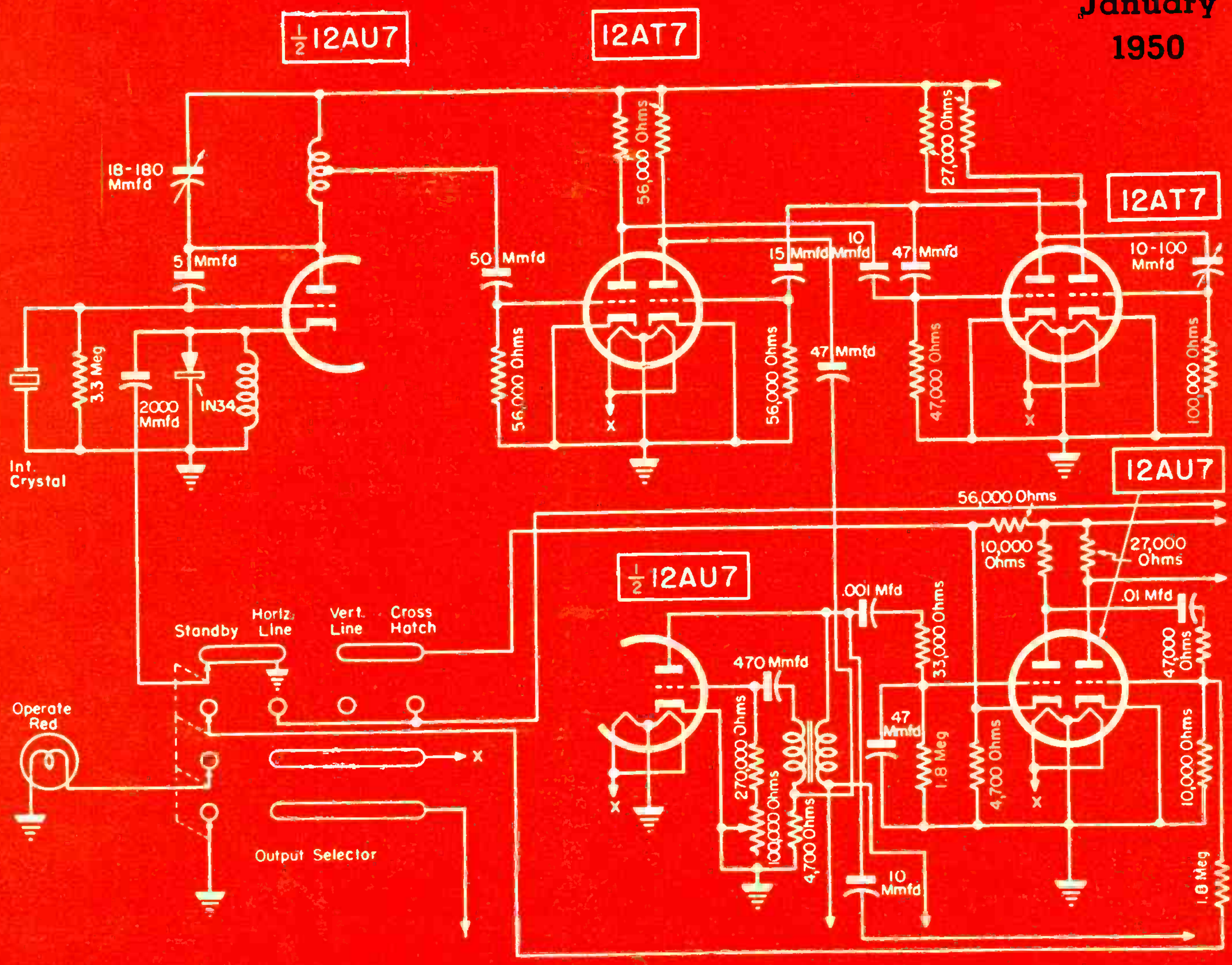
RADIO · TELEVISION · ELECTRONIC

SERVICE

January
1950



Input system of cross-hatch generator which serves to provide controlled linearity patterns.

[See page 2]

THE TECHNICAL JOURNAL OF THE RADIO TRADE

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- **"TV Interference . . . Causes and Remedies"**
- **"TV Picture-Tube Voltage and Signal Systems"**
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- **"Taking Complete Receiver Performance Data"**

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Vol. 19, No. 1

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SERVICE

January, 1950

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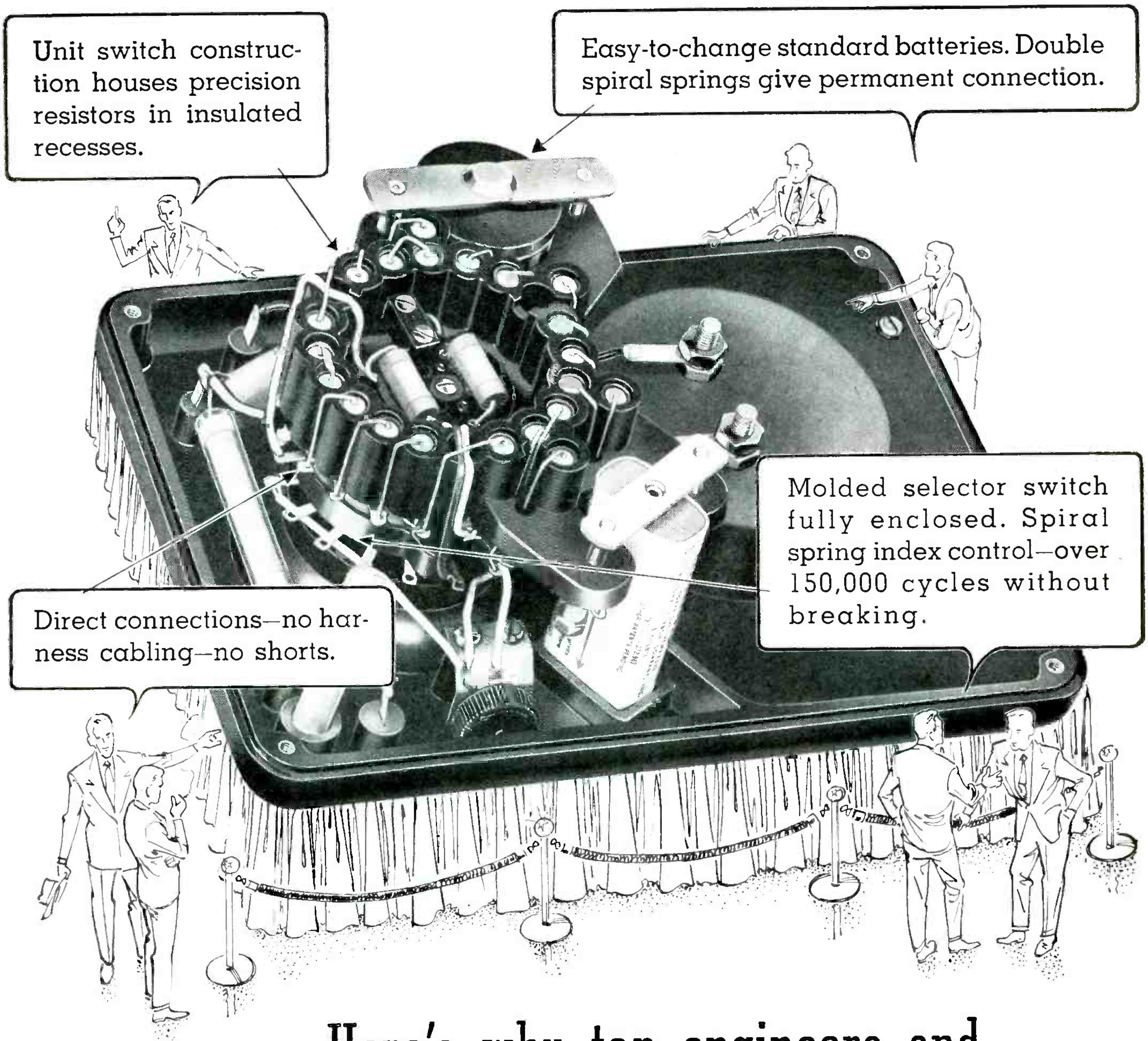

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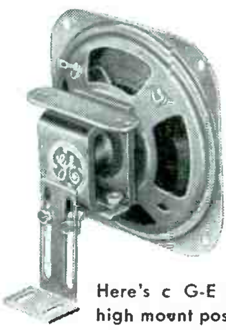
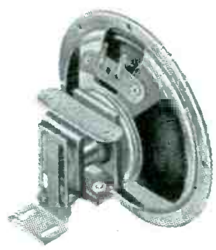


Here's a G-E 4″ unit in high mount position. Note how bracket eliminates an awkward blocking job, helps turn out neater, cleaner work.



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Hundreds of these readers are *your potential customers*. These humorous ads, running in the cream of the nation's publications, help assure you a *steady stream of new customers* and greater profit.

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THe Healthy Road Ahead

THAT LUSTY WORK-SCHEDULE, earmarked for every Service Man in the months to come, and probed in these columns last month, received quite a helping hand from a TV broadcaster in New York a few weeks ago, via a full page ad, which bluntly admitted the important function of the Service Man.

Said this broadcaster in an appeal to viewers: "Are you getting every television station that your receiver is supposed to bring to you. . . . Remember your TV set is made to show you everything on all channels *clearly, vividly* and *faithfully*. . . . Right now all the television stations allowed to New York are on the air, so don't risk missing any one of them. . . . If you are missing any of the attractive programs that are on the air, you're not getting all the stations that your set was made to give you—what it was *guaranteed* to give you. . . . So why not get in line with our channel and every other channel, today. . . . Here's how—it's simple and economical; it's going to make home an even nicer place to go to. It's going to bring you hours and hours of greater fun, relaxation and enjoyment. It's going to get you *everything* your TV set was made to bring you. . . . All you have to do is call your local Service Man—hundreds of accredited and highly-trained experts are listed in your telephone directory. . . . Remember—a slight adjustment to your *antenna* or *tuning controls* may be all that's needed to bring you everything your set was made to bring you, including the wonderful show on our station."

Quite a tribute to the Service Man broadcasters feel the boys can do for them!

Additional evidence of the growing TV market appeared in an RMA receiver production report, issued a short while ago, which showed that nearly 2,500,000 receivers were produced during '49, bringing total production since the war to 3,500,000 units. The report also revealed an interesting trend; most of the receivers coming off the line from now on will be with the larger-type picture tubes. More than 58 per cent of the sets produced in November alone used the 12½-inch type and almost 19 per cent used the 16-inch size and larger.

Here are important figures . . . figures which should prove quite valuable in planning for the days to come.

Installation-Service Charges

RATES for the installation and service of TV models, a controversial subject for years, appear to be well on their way to reaching a standardized level.

Thanks to a detailed study by a leading manufacturer, a program has been evolved covering, in particular, three types of installations which have been found to be most prevalent.

In one plan provision has been made for a complete installation, instruction of the customer, parts and tube protection including the picture tube for a year and unlimited service for ninety days, for which two types of charges can prevail: $22.95 for a built-in antenna model and $39.95 for an outdoor antenna model of the 10-inch variety. After this period there's a preferred flat-rate charge of $5.75 per call for service-as-needed. For receivers with 12½-inch tubes the charges have been set up as $24.95 and $44.95, respectively, and for the 16-inch models, $29.95 and $49.95, repectively. For those who want one year's parts and tube protection and unlimited service, a charge of $45.00 for a built-in antenna receiver has been prescribed, with the outdoor antenna installation being charged at $65.00 for 10-inch models.

The survey conducted by this company indicated that the flat-rate for each service-call approach was one which most television set owners seemed to prefer.

Everyone is indeed grateful for this practical plan, which provides an effective pricing pattern.

Does TV Damage the Eyes?

THE ALL-IMPORTANT QUESTION of TV and the eyes, long a debated topic, has received one of its most thorough analysis in a booklet recently prepared by Benjamin Rones, a physician, for the National Society for the Prevention of Blindness.

Dr. Rones notes that for ocular comfort . . . "It is important to have steadiness of the picture and a minimization of light bands and other interferences." He suggests proper adjustment of the fine-tuning and focus controls as one solution.

Room lighting is also quite important, according to this expert. He points out that the constant shifting of the eye from a bright to a dark background causes considerably more work of the eye muscle, and therefore quicker fatigue. This, he says, can be avoided by indirect lighting of the room. Describing the type of screen which is preferable for best viewing Dr. Rones says that P4 screen, generally used, has been found to be most suitable, since it has a color composition which appears white to the eye, producing a minimum of fatigue. In addition it is so balanced as to minimize flicker effects.

The clarity of the image is, of course, extremely important. Commenting on this point Dr. Rones says: "Since the strength of the received signal is generally universally proportional to the distance of the receiver from the transmitter, it naturally follows that receiving sets placed beyond the normal service area will not receive a good signal and consequently the picture will be *grainy* and indistinct and conducive to eye fatigue."

This point accents the importance of the antenna, which when properly installed, with perhaps the aid of a a booster, can be usually the solution to the location problem, even in those areas beyond the normal service range.

Standard Brands

WITH THE GROWTH OF TV and the increased demand for servicing, involving quantities of components and accessories, it has become more essential than ever to use only quality parts and allied equipment to secure those all-important guaranteed results. This practice, in the shop and in the field, is a vital responsibility of every Service Man to the millions of set owners throughout the country.

You'll find such quality parts and accessories advertised in the columns of SERVICE every month by manufacturers with outstanding technical-progress reputations. You'll find these standard-brand producers always cooperative, willing to help out with those installation and servicing problems.

In talking or writing to these folks, it will help them and you, too, and we'll be quite grateful, if you'll note that you saw their advertisement in SERVICE.—L. W.

Connecting MASTER

Fig. 1. Rooftop of multiple dwelling cluttered with TV antennas.
(*Courtesy National Antenna Corporation*)

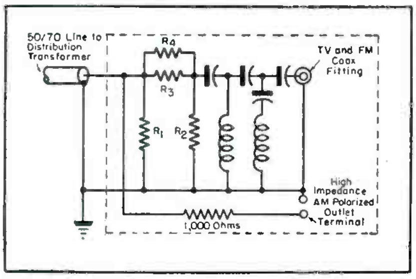
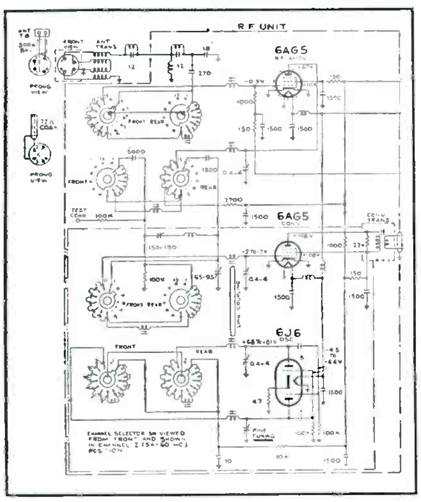


Fig. 2. Circuit of master antenna outlet unit.

Fig. 4. Front end of the RCA 8T270 series which provides for a 72-ohm and 300 ohm line input.



EXPERIENCE HAS shown that indoor TV antennas, whether they are of the portable or built-in type, will normally provide satisfactory results only in those locations where there are strong signals from nearby television stations which have an unobstructed path to the indoor antenna.

Actually, in multiple dwellings such as apartment houses and hotels, the clear path and strong-signal advantages have been found to be of little value to the indoor affairs. For in these dwellings there are steel girders used for structural supports and metal lath in the walls to form a base for plaster work, which serve as wave obstructors. Fundamentally, television waves are like light (quasi-optical) which will not bend or penetrate through metal structures and will also be attenuated by dielectric materials such as brick, plaster, etc. This condition represents a fundamental law, like the law of gravity or Huygen's astronomical principles, and are not subject to changes as long as we employ the present standards of TV transmission. Generally, therefore, external TV antennas will be a permanent necessity for most multiple dwellings where tenants desire to view a majority of the TV channels in the area. However, the use of external antennas by all tenants of multiple dwellings has its problems. As shown in Fig. 1, a maze of antennas on the rooftop of a multiple dwelling can make the location a hazardous area in the event of a fire, ruin the appearance of the building and in addition, prompt complaints from tenants because of *rf* interference on channels 5, 11 and 13 in the New York City, Chicago, Los Angeles and Baltimore-Washington, D. C. areas, or on channel 6 in such areas as Philadelphia where channels 3 and 6 are in operation. The proximity of antennas may also produce undesirable loading effects which upset antenna adjustment.

The reason for the *rf* interference becomes obvious when the video and audio carrier, and local oscillator frequencies for channels 2 to 13 are considered. We find that when the local oscillators of the TV receiver are tuned to channels 2, 3, 7 and 9, *rf* signals are radiated on channels 5, 6, 11 and 13, respectively, which couple to other TV receivers through proximity of open transmission lines or antennas.

The foregoing illustration indicates that, for interference-free reception in most multiple dwellings, another approach to antenna installations is necessary. The amplified type of master antenna system has been found to provide the solution to the problem.

The majority of the realtors in the New York City areas have begun to realize that a master antenna system offers a practical means of assuring tenant satisfaction and increasing the appeal and value of their properties.

In N. Y. City architectural circles,

Fig. 3. Signal path conditions. In *a* appears an illustration of the paths of direct signals. The transformer sees only a 10 db outlet attenuation to the receiver. There is no attenuation on the secondary side of the transformer T_A for direct signals. The drawing in *b* illustrates the path of signals reradiating into the master antenna system from the local oscillator of receiver No. 1. The attenuation between outlets for the reradiated signals is 40 db plus the attenuation of the coax cable used to connect outlets to the transformer. The transformer has a —20 db isolation to the reradiated signal and each outlet has a 10 db attenuation. Arrows indicate the path of reradiated oscillator signal from receiver No. 1 tuned to Channel 2.

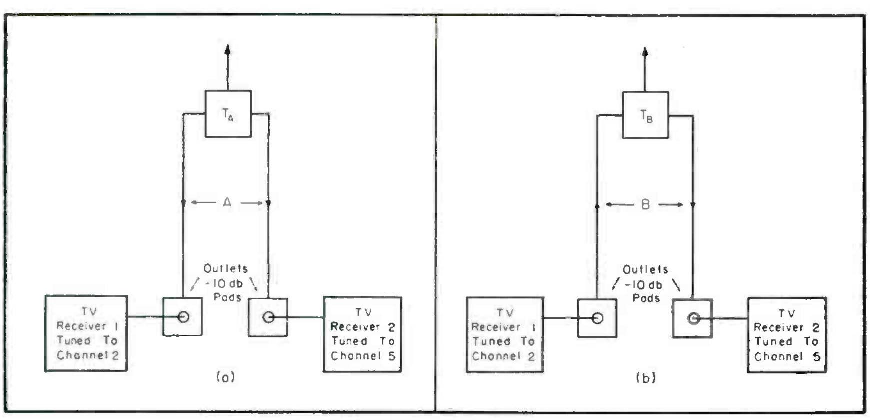
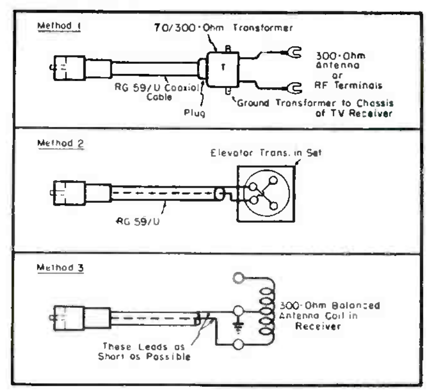


Fig. 5. Three methods used to connect receivers to master antenna systems. The *ac/dc* type of TV, FM or AM receivers cannot be connected to the system unless the power line is isolated from the receiver with an *ac* isolation transformer.



TV Receivers to ANTENNA SYSTEMS

Practical Methods Used in Variety of Multiple-Dwelling Installations Involving 72 and 300-Ohm Input Systems.

by IRA KAMEN

Manager, TV Dept.
Commercial Radio Sound Corp.

television master antenna outlet facilities are being given the same consideration as provision for heat, light, plumbing and other necessary services.

From building plans now being processed it appears as if the master-antenna idea is destined to spread nationally. Coupled with programs to provide national distribution for the streamlined-rooftop installations, Service Men will soon find themselves involved in a new profitable antenna-installation business.

Of particular importance in the master-antenna system installation is the connection between the receiver and the outlet device. Familiarity with the circuits of these units have been found very helpful.

The outlets, which are fed from coaxial lines emanating from distribution transformers of one system[2], terminate the coaxial lines in their own impedance (50 or 72 ohms) by virtue of a pi pad in the outlet.

In addition to properly terminating the coaxial lines, whether or not a set is connected to the outlet, the pad attenuates the received signal ten decibels. When further attenuation is required, a resistor, R_3 (Fig. 2) may be removed from the outlet circuit and the outlet attenuation increases to 15 db.

The importance of this outlet attenuation is apparent when one considers that it is necessary to isolate the TV receivers from each other to preclude *rf* interference and interaction.

In Fig. 3 appears two figures detailing the interference and interaction problem and cures.

In (a) of this drawing we note how the desired direct TV signals are attenuated only 10 db from the final distribution transformer to the outlet devices which supply signals to receivers *1* and *2*.

In (*b*) we find the case of a receiver (*1*) which is tuned to channel *2* and its local oscillator is reradiating an interference signal on channel 5. The interfering signal (from receiver *1*) sees the 10-db attenuation of its own outlet, 20-db attenuation due to a circuit action of a transformer[1] (T_A) and another 10 db of attenuation due to the outlet device which feeds TV receiver *2*, plus the attenuation of the cable between the outlets.

Since there is at least 40 db of attenuation between any two outlets, and let us say TV receiver *1* is radiating 10,000 microvolts of interfering channel-5 signal into its outlet, less than 100 microvolts (10,000/100 = 100:1 voltage ratio or 40 db) will appear at the antenna terminals of TV receiver *2*.

It is a fact that the 100 microvolts of interfering signal will not appear on the TV receiver *2* screen, since it will be swamped by 3,000 microvolts of direct signal for all TV channels provided at the antenna terminals of all TV receivers connected to this type of

(*Continued on page* 33)

*The master antenna system referred to in this paper is described in detail in the Ira Kamen-Lewis Winner book, *TV . . . FM Antenna Installation*. This system has been installed in many New York City buildings, including the Hampshire House, Hotel McAlpin and Hotel Shelton.

[1]RCA MI 6875 [2]RCA Antenaplex.

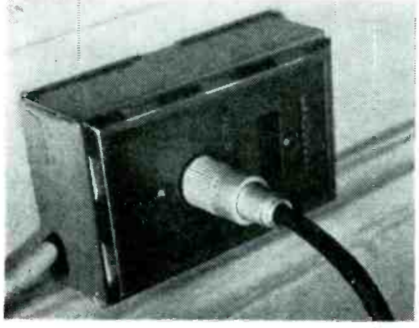


Fig. 6. Master-antenna outlet installed in the Park Lane Hotel, New York, on a surface mounted wiremold box above the molding. (*Courtesy RCA*)

At the signing of contracts providing for the installation of master-antenna system outlets for 1,000 apartments in the Schwab House, 40 and 715 Park Avenue, New York City. Standing, left to right: Alexander Fisher, president of Commercial Radio Sound Corp.; Ira Kamen, and Samuel A. Seaver, realtor. Seated, left to right: Frank Folsom, president of RCA; Francis Kleban, realtor, and Julian Roth, architect, of Emery Roth and Sons.

Servicing Helps

How to Provide Series-Filament Continuity When Picture Tube Is Removed . . . Germanium Diode Application . . . Eliminating Parasitic Oscillation in Horizontal Output Circuit . . . Identifying and Eliminating Various Types of TV Interference.

by M. A. MARWELL

INSUFFICIENT HORIZONTAL sweep width in the G. E. models 805, 806, 807, 809, 817, 818 and 821, which has been found due to a parasitic oscillation in the type 19BG6 horizontal sweep output tube, can be corrected by connecting a 47-mmfd 500-v mica capacitor[1] from pin *7* of the 19BG6 tube to a ground lug of an existing terminal board on the adjacent side apron.

Series Filament Continuity on Removal of Pix Tube

When it is necessary to perform alignment, measure socket voltages, or trouble shoot a TV receiver, it is desirable to remove the picture tube for convenience as well as a personal safety precaution. In receivers with series lighting of the filaments, the removal of the picture tube breaks the continuity of the heater circuit for all tubes and a substitute resistor or suitable filament element must be used to restore continuity. A defective 6SN7GT tube, with a good heater, has been found suitable for this purpose.

To prepare the 6SN7GT, all base pins are sawed or clipped off, except *7* and *8*. These are the filament pins and it will be found that they will insert readily into the *crt* socket pin openings *1* and *12*. This will reestablish the continuity and provide proper voltage division on the filament strings.

The keyway on the altered 6SN7GT will not line up with the keyway slot in the *crt* socket; however, it will not interfere with the insertion of the tube into the socket.

Germanium Diode Symbol and Marking

The germanium crystal diode is used in many of the current TV receivers for two different circuit applications: (*1*), video detection and (*2*), *dc* restoration at the picture tube grid. This diode is symbolized by a polarity marking on the case, the plus mark corresponding in function to the plate of the rectifier tube. The other terminal is equivalent to the cathode.

TV Sources of Interference[2]

Television reception is subject to interference from various sources. Shortwave, FM and amateur stations, diathermy equipment, and other television stations in the area are possible sources of interference to good reception. Either the fundamental frequency or a harmonic of the fundamental frequency may cause trouble in either the video or sound channel.

The video-*if* response of Philco TV models covers the range of frequencies between 22 and 29 mc, these being the extreme limits. The sound-*if* amplifiers will pass a signal as low as 21 mc; therefore, the interference limits can be said to be 21 and 29 mc.

There are seven conditions which may cause interference:

(*1*) Any signal which will beat with the local oscillator to produce a beat frequency between 21 and 29 mc can cause interference. For example, the frequency of the local oscillator for channel 3 is 87.85 mc. This frequency minus 21 mc is 66.85 mc, and the oscillator frequency minus 29 mc is 58.85 mc. Thus, any signal with a frequency between 58.85 and 66.85 mc will beat with 87.85 mc to produce a beat frequency between 21 mc and 29 mc and may interfere with reception of channel 3.

(*2*) Any *rf* signal whose harmonic will beat with the local oscillator to produce a beat frequency between 21 and 29 mc may also cause interference. For example, the frequencies which have second harmonics that interfere with channel 3 lie between 58.85 mc over *2* and 66.85 mc over *2*. In areas where a strong local transmitter is operating, harmonics up to the eighth harmonic may be troublesome. For channel *3*, 58.85 and 66.85 mc may be divided by any whole number up to eight to find the interfering frequency limits.

(*3*) Any extremely strong signal with a fundamental frequency or harmonic frequency that falls in the range of 21 to 29 mc may find its way into the *if* amplifiers and cause interference.

(*4*) Any image-frequency signal may produce interference. The limits of image frequencies for any channel fall between 21 mc plus the local-oscillator frequency and 29 mc plus the local oscillator frequency. For example, the local-oscillator frequency for channel *3* is 87.85 mc. This frequency plus 21 mc is 108.85 mc; the oscillator frequency plus 29 mc is 116.85 mc. Thus, any frequency between 108.85 and 116.85 mc is an image for channel *3*, and may beat with the local oscillator to produce an interfering signal between 21 and 29 mc.

(*5*) Any signal with such a frequency that the harmonic falls in the

[1] Stock No. UCU-1020.

[2] Based on data supplied by Philco.

image-frequency range is also a possible source of interference.

(*6*) Any signal with a frequency within ± 8 mc of the local-oscillator frequency will beat with the desired signal, and may produce an interfering beat signal between 21 and 29 mc. For example, such frequencies for channel *3* would be between 79.85 (87.85 minus 8 mc) and 95.85 mc (87.85 plus 8 mc).

(*7*) Any signal which will beat with the second harmonic of the local oscillator to produce a beat frequency between 21 and 29 mc is also a possible source of interference. For instance, the second harmonic of the local oscillator for channel *3* is 175.7 mc (87.85 mc times 2). Any frequency between 146.7 mc (175.7 minus 21 mc) and 154.7 mc (175.7 minus 21 mc) will beat with the second harmonic of the local oscillator to produce an interfering beat frequency between 21 and 29 mc. Also, any frequency between 196.7 mc (175.7 plus 21 mc) and 204.7 mc (175.7 plus 29 mc) will beat with the second harmonic of the local oscillator to produce a beat frequency between 21 and 29 mc, and may interefere with reception on Channel *3*.

Identification of Interference

If the interference falls in the video channel and appears on the picture-tube screen, the local oscillator may be tuned higher in frequency, so that the video *if* signal is passed through the sound channel. If the source of interference is a radio station, it may be identified when it announces its call letters.

Signal-Generator Use

An accurately calibrated signal generator may be used to produce an audible beat with the interfering signal. The frequency of the signal generator when zero beat is obtained will be the frequency of the interference.

Elimination of Interference

In most cases, interference can be greatly reduced or completely eliminated without seriously affecting the television signal. This may be accomplished by installing a wave trap across the antenna terminals of the receiver. The wave trap should have an extremely low impedance to a signal of the interfering frequency, and a high impedance to the frequency of the desired televison signal. With such a circuit the unwanted signal is effectively shorted across the transmission line before it reaches the receiver, but the

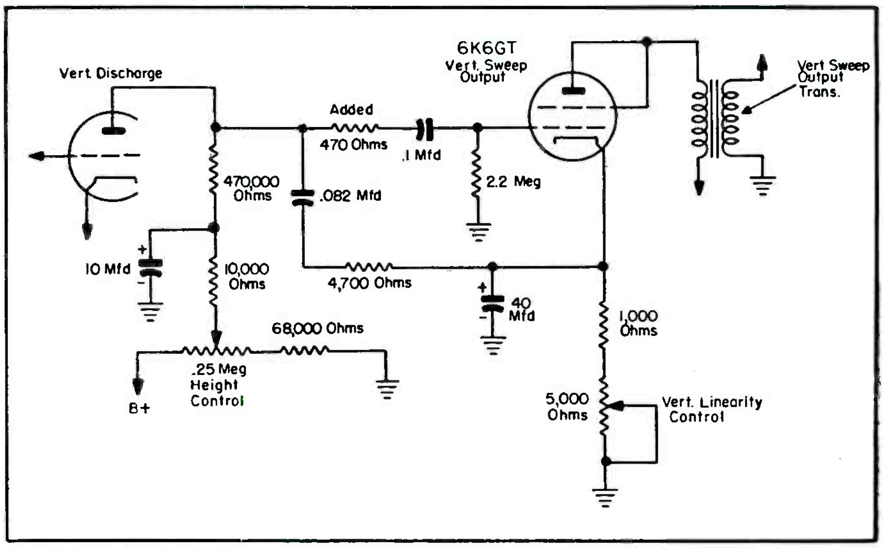


Fig. 1. Circuit which can be used to reduce vertical sweep radiation in Philco receivers.

desired signal is practically unaffected by the presence of the wave trap.

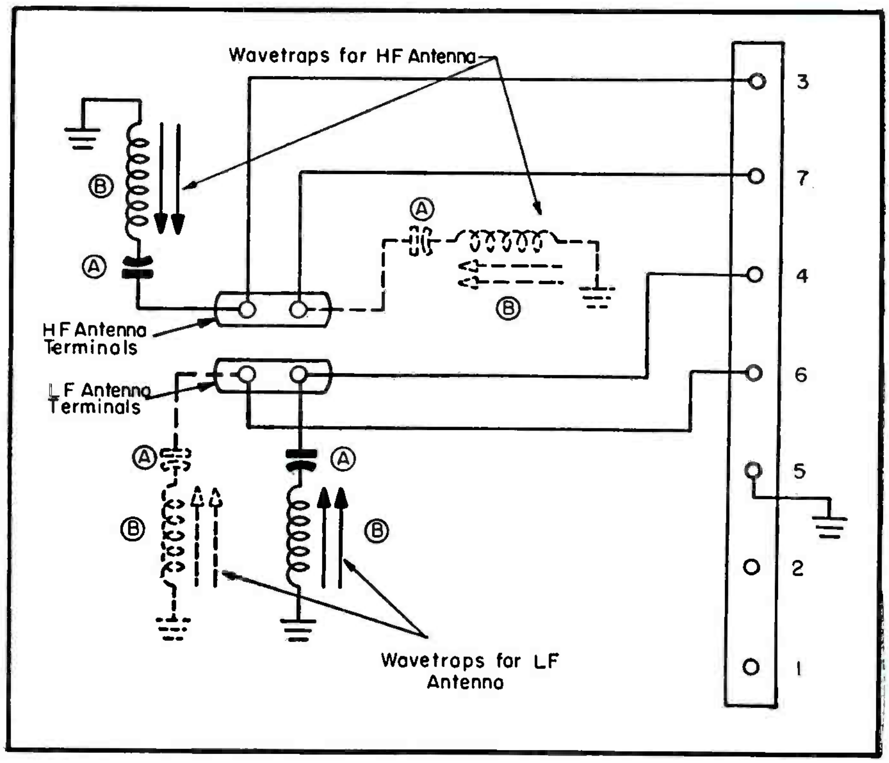
Half-Wave Lines

A half wavelength of transmission line, shorted at one end, offers a low impedance at the other end of the frequency at which it is resonant. This half wave section makes an effective wave trap. However, at the lower television frequencies, a half wavelength of line may prove to be too long to be practical. In this case, a similar effect may be produced by using a quarter wavelength of line with an open end.

Series-Resonant Circuits

For interference at the sound *if* or video *if* frequencies, a series-resonant circuit of lumped reactances is recommended for shorting out the unwanted signal. The *Q* of such a wave trap should be high, so that the desired signal is attenuated as little as possible.

Fig. 2. Wave-trap connections for eliminating interference at the *if* frequencies in Philco models. *A* and *B* represent high *Q* coils with a tuning core and 56-mmfd fixed-ceramic-type capacitors; item *A* is Philco part No. 62-056409001 and item *B* is Philco part No. 32-4302. The dotted line components indicate the series-resonant circuits which are connected to the leads farthest from the *rf* grid, while the solid-line components indicate the series-resonant circuits which are connected to the leads closest to the *rf* grid.



SER-CUITS

Circuit Features of Westinghouse H-223 TV Receiver. Analysis of the Sync-Separation System in the G. E. 817 and 821 Models.

TV Models, with unconventional circuits, have become quite prevalent during the past few weeks. In one model, for instance, produced by Westinghouse (H-223), the *if* system is quite different in that it uses a *common if* setup.

In the conventional type TV receiver, the video and audio *rf* carriers are converted into their respective *if* frequencies in the mixer stage of the *rf* tuner. They are then separated, usually at the plate of the mixer or the first *if* stage, and the audio and video components are amplified and detected in separate channels. Every effort is made to keep the audio component from appearing on the grid of the picture tube. This is usually accomplished by the use of traps in the video *if* system, and, in some cases, the video amplifier.

With the *common if* system, the audio and video carriers are converted to their respective *if* frequencies in the same manner as in the conventional system. However, the two *if* signals are not separated into different *if* channels at this point. Instead, they are amplified in a *common if* amplifier, and both signals appear at the video detector. Since audio and video carriers are originally transmitted 4.5 mc apart and this separation is accurately maintained by temperature-controlled crystal oscillators in the transmitter, the two *if* signals appearing at the video detector are separated by exactly 4.5 mc. In addition to the function for which it is named, the video detector serves as a mixer for the two *if* signals. The mixing of the audio *if* carrier with the video *if* carrier produces a 4.5-mc beat signal that is frequency modulated in accordance with the audio *if* carrier.

The manner in which the 4.5 mc beat signal is obtained can be likened to the mixer action in the superhet receiver. The incoming video *if* signal serves in lieu of a local oscillator and beats against the incoming audio *if* signal to produce the sum and difference frequencies at the output of the video detector. Since the sum frequency will fall far outside the pass-band of the video amplifier, it can be disregarded. This leaves only the difference frequency of 4.5 mc to be considered.

After passing through the video amplifier, the 4.5 mc signal is fed to a 4.5 mc audio *if* amplifier, which amplifies the signal sufficiently to drive the ratio detector. An audio amplifier raises the output of the ratio detector to a level suitable for exciting the speaker.

RF Tuner

The *rf* tuner, consisting of the *rf* amplifier, mixer, and a *hf* oscillator assembled as a complete unit, amplifies the received signals and converts the audio and video carriers to the correct intermediate frequencies.

Transformer coupling between the antenna terminals and the *rf* amplifier provides a correct impedance match. In addition to providing the correct impedance match between the transmission line and the grid of the *rf* amplifier, the transformer presents a high impedance at low frequencies, thereby tending to eliminate interfering, low-frequency signals such as broadcast, etc.

The *rf* amplifier grid and plate circuit, along with the mixer grid circuit, are tuned by incremental inductances. As the channel selector switch is rotated toward the higher frequency channel positions, the inductances are progressively shorted and the circuits are resonated to the desired frequency.

The oscillator tuning circuit consists of separate inductances that are switched in and out of the circuit as the channel selector switch is rotated.

A 6C4, operating in a modified Colpitts circuit, serves as the *hf* oscillator. Its output is injected into the mixer grid circuit through a 1.5-mmfd capacitor. Rectification of the circuit provides part of the bias for the mixer tube, and the remainder of the bias is supplied by contact potential.

Agc voltage is applied to the grid of the *rf* amplifier tube. This voltage controls the gain of the tube and keeps the picture contrast relatively constant under variations in signal strength. In addition, it tends to prevent blocking on very strong signals.

The IF Amplifier

The *if* amplifier unit is a stagger-tuned impedance-coupled affair, stagger-tuning providing the required pass-band without resorting to complicated over-coupled transformers or *M-derived* and other types of filters. The plate load impedances are peaking coils, each of which is tuned to a different frequency. Interstage coupling is obtained through capacitors in a manner similar to that used in resistance-coupled audio amplifier. Since there are only four tuned circuits in the system—there are no traps—alignment has been found to be relatively simple. To maintain relatively constant video and audio output under varying signal strengths *agc* voltage is applied to the first two stages.

In early production of this chassis, a trap (L_{310} and C_{304}) was inserted between the mixer plate and the grid of the first *if* amplifier. This trap was provided to prevent the *hf* oscillator voltage from *leaking through* to the grid of the *if* tube. In later production, however, the same result was accomplished by changing the length and dress of the mixer plate lead, and the trap was deleted.

All stages of the *if* amplifier have *LC* isolation networks in their heater circuits. These traps prevent interaction between stages and coupling of the *if* voltages into other stages of the receiver through the heater—cathode capacitance of the tubes and the common heater line.

The *if* amplifier has been so designed that the video *if* carrier appears at

(*Continued on page* 35)

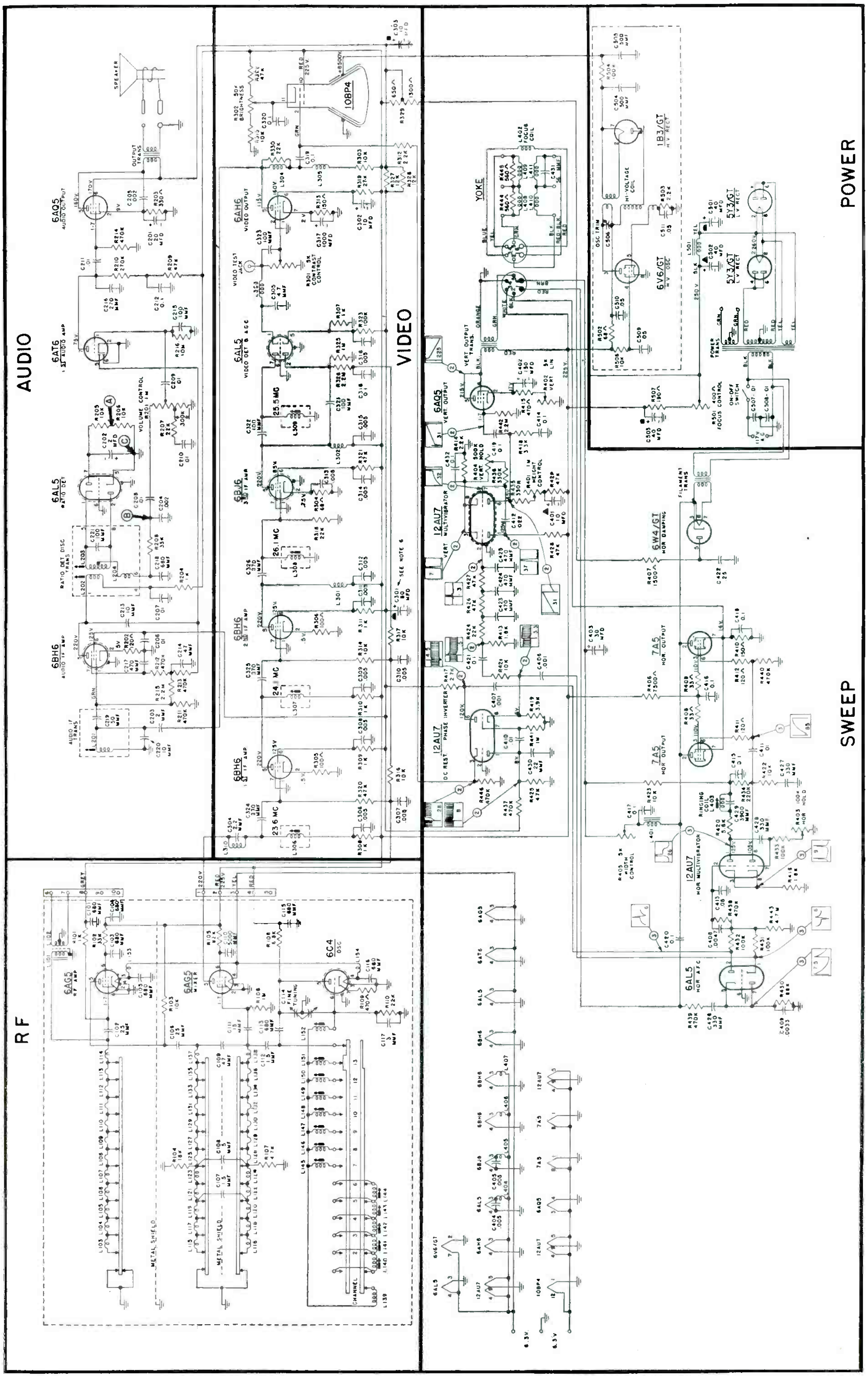
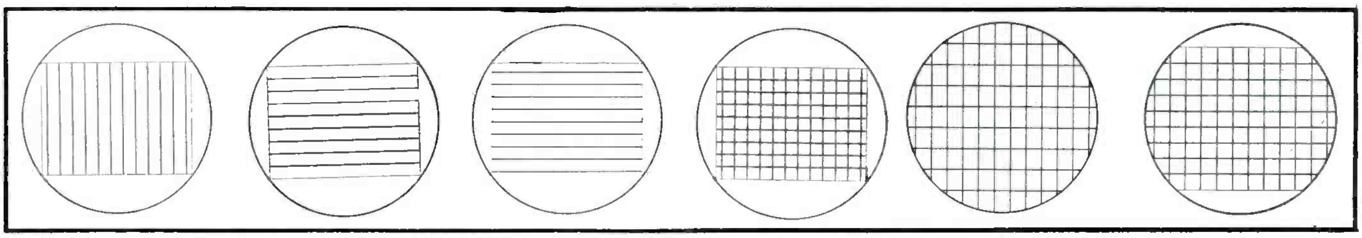


Fig. 1. Circuit of the Westinghouse H-223 twenty-one tube TV model which features a common *if* chain.

Fig. 2. Patterns obtainable with generator, left to right: Vertical-line arrangement; horizontal-line results indicating how the pattern may differ in position, depending on how the receiver locks in with the applied signal; cross-hatch output for a 3:4 aspect ratio; cross-hatch result for a 3:1 aspect ratio (full screen or circular type of picture), and cross-hatch pattern of a truncated circle type of picture.



TV Cross-Hatch Generator

[*See Front Cover*]

by ALLAN LYTEL*

Temple University Technical Institute

In TV receiver alignment, the TV tube pattern is very important. Unfortunately, transmitters are not always on the air when the patterns are required and some alternate means of creating a pattern for the alignment job becomes necessary. From the labs of one manufacturer has come a generator[1] affording a pattern of cross-hatch characteristics which can be utilized effectively for alignment. Provision has been made for the application of a signal to the picture tube which may be either horizontal line or vertical line in structure, or a combination of the two, resulting in the cross-hatch pattern.

There are 12 vertical lines and either 8 or 9 horizontal lines for the standard 4:3 ratio picture size. Either of these signals or both is available via an *output selector witch.* Output voltage from a cable connector is variable between 50 and 5000 microvolts, with the modulating frequencies of the *rf* signal being crystal controlled.

The screen of the television receiver is provided with the cross hatch pattern when the output signal from the generator is applied to the receiver's antenna terminals.

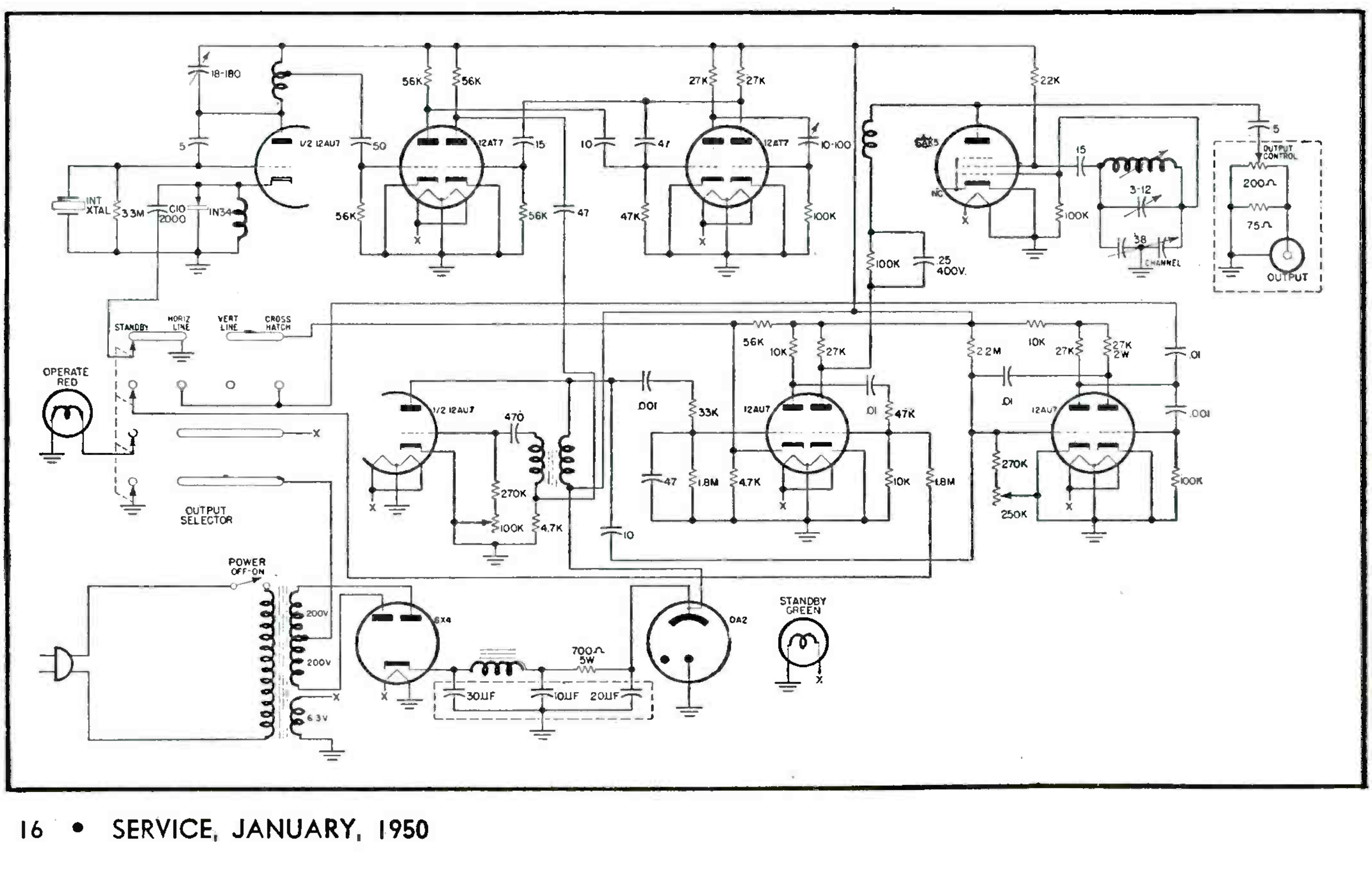
The pattern may be used to check receiver sensitivity, 60-cycle hum in the horizontal deflection circuits, and particularly the alignment of such controls as horizontal and vertical linearity, drive, horizontal and vertical width, height, hold and horizontal *afc.*

The circuit features two fundamental oscillators, one of which is crystal controlled operating at 219.24 and a Colpitts *rf* oscillator. The *rf* oscillator is tunable for any channel between 2 through 5 inclusive, or between frequencies of 50 and 90 mc. By means of two multivibrators and a blocking oscillator, the crystal output frequency is divided and provides the previously mentioned 12 vertical bars and 9 horizontal bars.

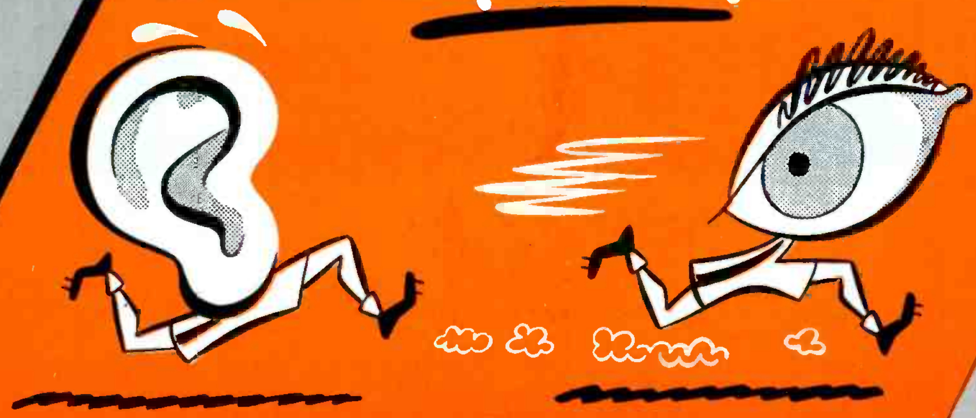
[1]Hickok 620.

*Author of *TV Projection and Enlargement.*

Fig. 1. Complete circuit of Hickok model 620 cross-hatch generator illustrated in part on the cover of this issue.



THE EYE IS QUICKER THAN THE EAR



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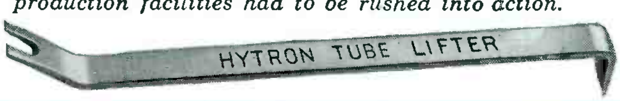

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PHONO *installation and service*

THE RECENT holiday season saw the wide distribution of uniquely designed toy-type radio-phonos as well as play-talk type units for the juvenile audience.

Because of the particularly constant use this equipment is expected to be subjected to, there will undoubtedly be quite a demand for servicing, soon.

In view of these possibilities the circuits of these models have been secured and are presented on this page, this month.

In Fig. 1 appears the radio-phono setup (G. E. 4SJ3A1) which is a four-tube affair with a 12SA7 converter, 12SQ7 first audio, 50L6GT power output and a 35Z5GT rectifier, Using a 5¼″ *pm* speaker, the output is about ½ watt.

Two types of toy record players are illustrated in Figs. 2 and 3. The Fig. 2 system (G.E. 186-3A) uses a 50L6 amplifier and a 35Z5 rectifier, while in the Fig. 3 arrangement (G.E. 4SJ2A1) a 25L6 is used as an amplifier with a 65-ma selenium rectifier. The 50L6 unit, a table-model, has a 4″ *pm* speaker, and the 25L6 unit, a console arrangement employs a 5¼″ *pm* speaker.

High-impedance crystal pickups are used in each of the three models.

In Fig. 4 appears the circuit of the playtalk device (G.E. 4SJ4A1) which has a 25L6 power amplifier, 6SC7 voltage amplifier and a selenium rectifier. Recording on a paper disc is provided via a magnetic head and a 3½″ speaker.

Cobra Pickups

Pickup repair, normally not too complex a procedure where dynamic or crystal types are involved, can be quite difficult when the cobra models come on the scene.

The operation of the cobra pickup is considerably different from the crystals and dynamics. These pickups generate audio power, while the cobra controls power generated by an *rf* oscillator, detector and audio amplifier. The oscillator operates at a frequency of 2.5 mc. Modulation is accomplished by changing the energy losses in a tuned circuit. These losses may be represented by an equivalent resistance in series with the reactance of the coil. The ratio of the resistance to the reactance determines the efficiency of Q of the coil. The amplitude of the *rf* voltage developed across this coil by an oscillator will vary with changes in Q.

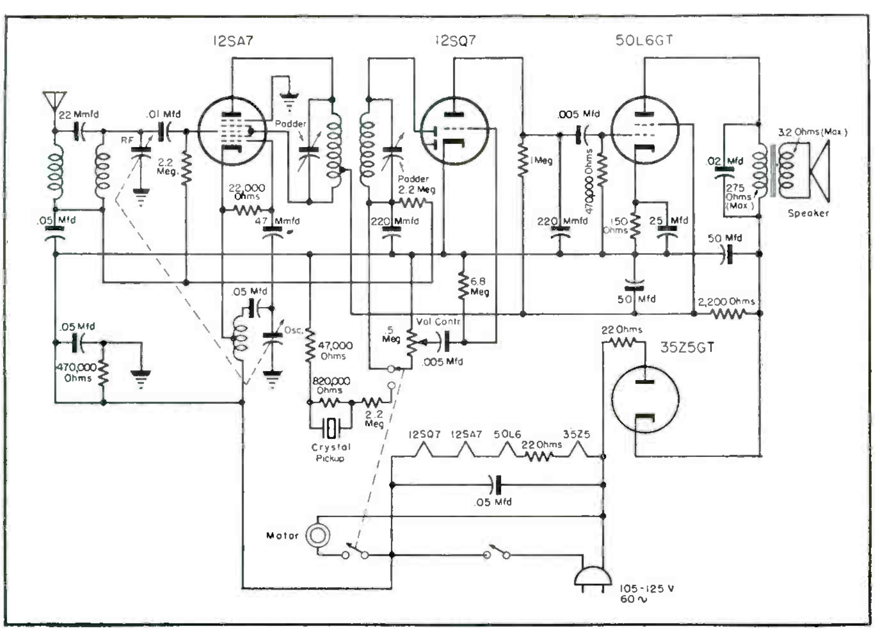
Oscillator-Preamp Chassis

The grid coil and other components of the oscillator are mounted on an oscillator-preamp chassis, while the plate coil is in the needle cartridge with a vane and needle assembly. The coil is fixed and has 40 turns of No. 40 wire (approximate *dc* resistance 2½ ohms). The vane, stainless steel, in the field of the coil, is spot welded to an osmium-iridium tipped stylus.

Stylus-Vane Operation

Any movement of the stylus will cause a corresponding movement of the vane. As the stylus and vane follow the modulations in the record, changes in the mutual inductance between the vane and coil occur. When the vane is at rest, a constant *rf* voltage appears across the plate coil. As the vane is set in motion and reaches its greatest outward swing from the coil, the result is a low mutual inductance, low reflected resistance, higher Q, and a higher *rf* voltage across the coil. In the vane's greatest inward swing the result is a high mutual inductance, high reflected resistance, lower Q and a lower *rf* voltage. Thus we find that the amplitude of the *rf* voltage which appears across the coil will vary with changes in Q, satisfying the condition for amplitude modulation. The position of the vane changes both the Q and L of the coil. Changes in L shift the frequency slightly, and a certain amount of frequency modulation is

Fig. 1. Circuit of G. E. 4SJ3A1 toy radio-phono consolette.



Circuit Features of Toy Type Radio-Phonos, Record Players and Paper-Recording-Disc Playtalk Units . . . How to Build a Crossover Network.

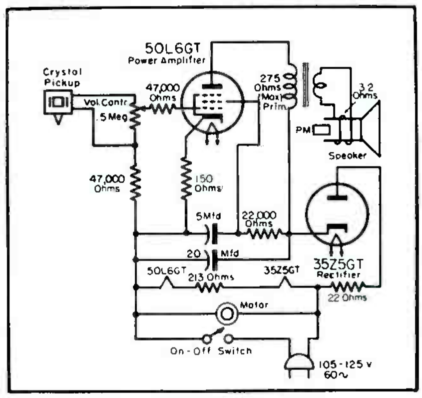


Fig. 2. Circuit of G.E. model 186-3A toy record player.

by KENNETH STEWART

present, but since there is no frequency discrimination it remains undetected.

Grid and Plate Coils

Since the grid and plate coils are part of a single tuned circuit, any variations of amplitude of the *rf* voltage brought about by the changes in *Q* across the plate coil will also appear across the grid coil, causing a shift in the average plate current through the plate-load resistor across which the audio output voltage is developed. Plate-bend detection takes place since only the positive half of the grid swing causes an increase in the average plate current. These changes in the average plate current appear as audio voltage across the plate load resistor.

Filter Provision

The 2.5-mc *rf* voltage and the audio voltage both appear at the plate (pin 6) of the oscillator triode. A resistive-capactive arrangement serves to filter out the *rf* voltage, allowing only the audio component to be fed to the grid (pin 4) of the amplifier triode where it is amplified, fed through a shielded lead to the audio amplifier of the receiver and reproduced by the loudspeaker.

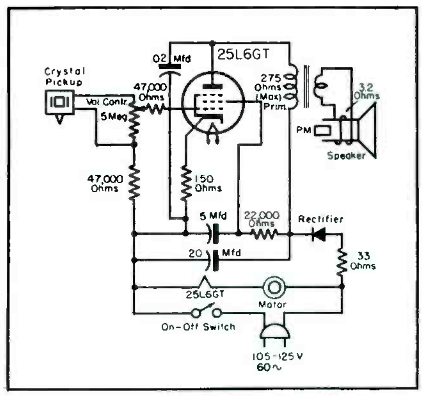
Three-Speed Motor-Drive Mechanism

In the latest radio-phono models produced by Zenith, 3-speed mechanisms are being used. In operation, when the speed control lever is turned to the 78 rpm position, an idler wheel is driven directly from the phono motor shaft. When the speed control lever is turned to 33⅓ position, the entire bushing assembly is rotated in a counter-clockwise direction. This removes the phono motor shaft from the idler wheel and instead places a right hand 33⅓ rpm speed reduction bushing in contact with the idler wheel. The phono-motor shaft, through the media of a rubber drive belt, then drives the 33⅓ speed reduction bushing, which in turn drives the idler wheel. When the speed-control lever is turned to the 45-rpm possition, the entire bushing assembly turns clockwise. The 45 rpm speed-reduction bushing is then in contact with the idler wheel. The phono-motor shaft, via a rubber drive belt, then drives the 45 rpm speed-reduction bushing, which in turn, drives the idler wheel.

Crossover Networks[1]

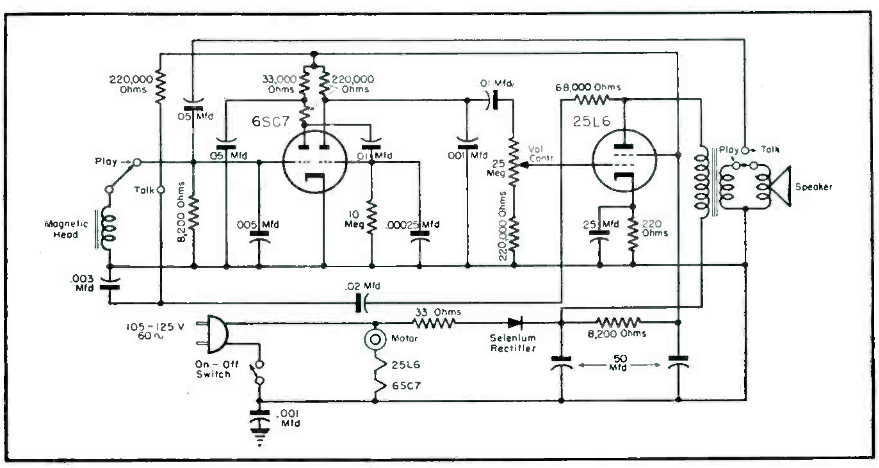
In high-fidelity installations, using woofers and tweeters, crossover networks are extremely important. The network normally serves two purposes. Since the average 12-15″ cone speaker is capable of excellent response to approximately 1,000 cycles without distortion and *cone breakup*, dividing networks select this top frequency and make it the upper limit of operation for the cone speaker. The tweeter on the other hand, is designed for optimum performance *above* the 1,000 cy-

Fig. 3. Circuit of consolette type toy record player, G. E. 4SJ2A1.



[1] Based on notes supplied by the Racon Electric Co.

Fig. 4. Circuit of paper-recording-disc playtalk type unit developed by G. E., type 4SJ4A1.



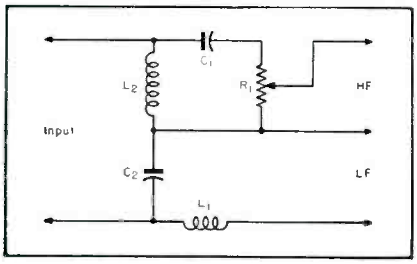
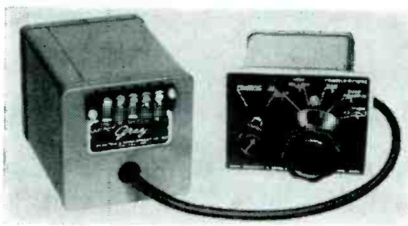
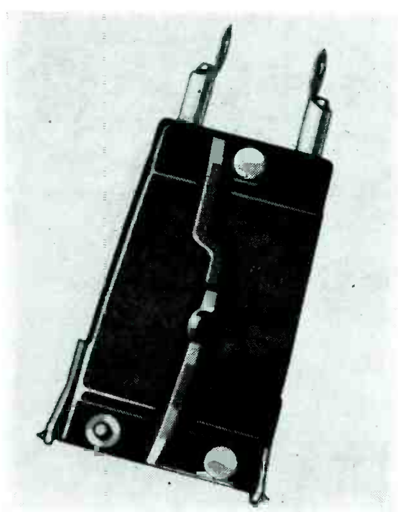


Fig. 5. Circuit of crossover network.

Five-step equalizer which compensates for *hf* deficiencies in records providing flat response to a heavy roll-off for worn records. Selection of 150 or 250 ohms' output impedance afforded.
(Courtesy Gray Research and Development Co., Inc.)



Miniature-type cartridge (19/32" wide by 1" long) with a tracking pressure of 7 grams, developed for used with 33⅓, 45 and 78 rpm records.
(Courtesy Webster Electric Company)



cle range. The circuit design of the network is such that all these frequencies should be reproduced by the tweeter only. The other purpose of the network is a protective one. Usually the very fine diaphragm and featherweight voice coil suspension of the tweeters are unable to withstand the extreme excursions caused by the frequencies below 1,000 cycles. Although the driver unit used in some tweeters[2] are capable of response to 250 cycles, it would be overloaded by frequencies below 1,000 cycles due to insufficient horn loading. The acoustical cutoff of the tweeter itself lies below 700 cycles thereby avoiding undesirable phase shifts through the crossover range.

Dividing Network Circuits

The circuit of a dividing network appears in Fig. 5. It consists of a low-pass and a high-pass filter. Various values for L_1, L_2, C_1, C_2, and R_1 are tabulated in table 1. The most popular impedance speakers (4, 6, 8, 10, 12 and 16 ohms) have been accounted for in the values. The crossover frequency will vary in individual cases from 990 to 1,085 cycles. The adjustment in crossover frequency eliminates fractional values of capacitors, so that no difficulty in purchase should be entailed.

Balancing Potentiometer

The values for the balancing potentiometer R_1 were determined for the condition where the tweeter is approximately 6 db more efficient than the cone speaker, which is about normal for average cones. Since the division of power into the cone and tweeter will vary as a function of the impedance of the cone speaker, R_1 provides an effective method of proper balance. A resistor of the semi-variable 10-watt type has been found ideal for this application since it may be pre-set and set at the optimum operating position. Impedance changes resulting from this adjustment will not effect any noticeable difference in performance.

[2]Racon models.

Coil Turns

The number of turns required for L_1 and L_2 in table 1 have been predicated on a winding form 1¼" in diameter with a winding space ¾" long. Using No. 16 enameled wire, it will be found that 13 turns per layer will be required. The 1¼" winding form should be non-metallic and can be purchased in the form of a dowel stick. The sides of the winding form can be three inches square or circular pieces of ⅛" masonite, wood or stiff bristol board. The sides should be nailed to the winding form with brass brads. To simplify the winding process, a 3/16" or ¼" hole may be drilled through the completed winding form and a 2" round head bolt inserted. It should be screwed firmly in place with a lock-washer and nut, and inserted in the chuck of a hand drill. The hand drill should then be set firmly in a vise and each inductance wound. The bolt, nut and lock washer should be be removed. One pound of wire will be found sufficient for both coils of any combination shown in table 1, with the exception of the last one, which will require 1½ pounds.

Need for Paper Capacitors

Paper capacitors must be used for C_1 and C_2. Electrolytics must not be used nor any type bearing positive or negative markings at its terminal. Since there will never be more than 25 volts across them even at 30 watt levels, their cost becomes relatively low and they may be purchased with voltage ratings from 50 volts up.

Phasing Requirements

Phasing of the cone speaker and tweeter is necessary so that sound waves emanating from the two sources will reinforce rather than cancel each other. The equipment should be turned on and using radio or recorded musical programs, careful listening tests should be made. Sit across the room from the loudspeakers and have a second person alternately switch the two leads to the tweeter. Maximum output will be obtained when the speakers are in proper phase. It is also advisable to make listening tests across the arc of sound projection to make sure no hollow patterns exist, which is an indication of out-of-phase operation.

Table 1: Values of dividing network components as a function of cone impedance and a nominal crossover of 1000 cycles.

Output and Cone			L_1		L_2		
Impedance	C_1 (mfd)	C_2 (mfd)	(mh)	turns	(mh)	turns	R_1
4 ohms	32	50	.5	112	.3	90	6 ohms
6 ohms	22	35	.8	140	.5	112	10 ohms
8 ohms	16	25	1.0	160	.65	130	12 ohms
10 ohms	13	21	1.3	175	.8	140	15 ohms
12 ohms	11	18	1.5	200	.97	155	20 ohms
16 ohms	8	13	2.0	212	1.3	170	25 ohms

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Test Result: ***EXCELLENT!***
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Test Result: ***EXCELLENT!***
Especially designed flexible leads resist breaking or pulling out even when handling is extremely rough.

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SC4911

TV Receiver Production Changes

Vertical Size Modification, Separate Picture-Tube Filament Winding Addition and Buzz-Modulation Correction in G. E. Receivers. Improved HV Power Supply and Picture-Tube Circuit Alterations in Westinghouse Models.

by DONALD PHILLIPS

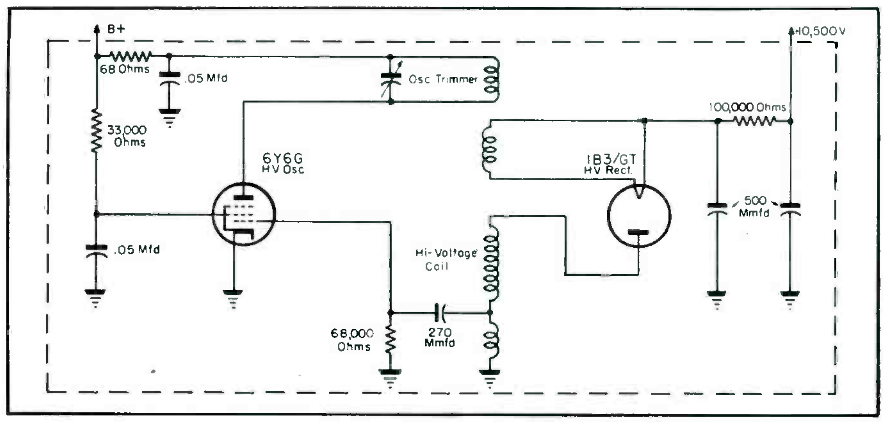
INSUFFICIENT PICTURE HEIGHT, experienced with the vertical size control on the G.E. 901 and 910, has been corrected, and the range extended about four inches by shunting R_{118} (2.2 megohm) with another 2.2-megohm resistor or replacing R_{118} by a 1-megohm resistor. R_{118} is one of the plate charging resistors in the vertical sweep generator tube circuit located at the rear of the chassis.

Separate Filament Winding For Picture Tube

On the G. E. models 811 and 814, the picture tube is heated by a separate filament winding on the power transformer and a 1-megohm resistor is connected between filament and the cathode of the picture tube socket. This arrangement was used to provide a more conservative voltage relation between filament and cathode, since the resistor places these two elements at the same B+ potential. In the model 810, however, the picture-tube filament was provided by the same filament winding that supplied the low voltage rectifier tube, 5Y3GT. Thus, the filament of the picture tube was at a higher B+ voltage than the cathode. Although it was still within tolerance, this arrangement was believed to be a possible cause of trouble and therefore the circuit used in the 811 and 814 has been included in all 810 models.

Buzz Modulation

In the G.E. models 802 and 803, a sharp low-frequency audio buzz, which sounds similar to 60 cycles sync pulse reproduction, and noted particularly on channel 13 reception, has been isolated to the filament lead that connects to the head-end switch wafer. The trouble, apparent only when tuned to the station, can be corrected by making the following alterations. The supply filament lead at the point where it connects the *rf* head and switch wafer (second from rear), must be disconnected. This filament lead runs between V_{20} and the *rf* head-end switch, S_1. Then a choke consisting of self-supporting No. 18 insulated wire must be made up, by close winding 8 turns around a ¼" rod. The choke is slipped off the rod and connected in series with the filament lead and the point of the switch where the lead was originally connected. A 5,000-mmfd ceramic capacitor is then connected between the junction of the choke and filament supply lead, to the lug on which C_{147} is grounded. The ground end of this capacitor is connected as close as possible to the ground end of the lug where it assembles to the switch back plate. The leads on the choke and capacitor must be short.



Circuit of high-voltage power supply included in late production models of the Westinghouse H-242, with a 6Y6G *hv* oscillator used in place of a 6V6GT.

Westinghouse HV Supply Changes

In late production of Westinghouse model H-242, a V-2150-31A chassis with a modified high-voltage power supply has been included. A 6Y6G high voltage oscillator tube has been used in this new setup instead of a 6V6GT, and the circuit changed accordingly; Fig. 1.

Noise Effect Reduction

In the Westinghouse V-2150-31 and V-2150-31A chassis the third *if* amplifier screen dropping resistor (R_{348}) was designated 100,000 ohms in the service notes. However, in early chassis a 47,000-ohm resistor was used. In chassis containing this 47,000 ohms re-

(*Continued on page* 31)

Wire-Recorder Servicing

Service Notes on Sears Roebuck Equipment: Speed Variation Control . . . Bias Voltages and Their Effect on Quality and Erasures.

by MAX ALTH

In servicing a wire recorder, there are many unusual problems to consider. For instance, the mechanism which controls constant speed of the wire over the recording head requires careful checking. A stroboscopic disc placed over the turntable that doubles as reel and record turntable, can be used for this purpose.

If there are any variations in speed, the cause must be checked back through a series of rubber drive pulleys through to the motor itself. This requires a disassembly of the pulley train and a check for freedom of rotation, oil and flat spots on the rubber drive wheels. The idler pulley tension must be checked carefully, too, as this is very critical. If the tension is too great, the pulley is too tight and there will be rumblings in the recording. Accordingly, the motor will only start with great difficulty, sometimes not at all. If there is insufficient tension, there'll be wows in the recording because of slippage.

Piano as Note Standard

A piano will be found very handy for checking, a recorded note serving as an excellent guide for speed analysis.

Winding of the wire smoothly on the drum must also be considered in servicing. A guide activated by a heart shaped cam controls this operation. The *head* oscillates in a vertical plane. Its gyrations equal the width of the spool or drum upon which the wire is wound. If this action is not centered in relation to the drum, the wire will pile up on one side. The head can be centered by removing or adding shims beneath the toe of the upright upon which the head rides. This upright is found beneath the panel of the recorder, and is in a vertical position.

This upright should also be checked for possible burrs or other obstructions, such as dirt. It should be cleaned and polished with 00 sandpaper. The entire upright should also be covered with a layer of light grease.

It is important to make certain that the long spring that pulls the head downward has sufficient tension to easily do so; the spring action must be positive, the spring tension should not be too great, and not bind the slider against the support.

If the layer of wire on the spool is too wide for the spool, or too narrow, the heart-shaped cam will be found to be malformed. The larger the cam the wider the winding, and vice versa. It is possible to file an overly large cam down to size, but it is better to replace this part.

The oscillating action of the head is also important. If it is not right the wire will not wind up properly and will snarl and possibly break. Also, minor speed changes will result as the wire slips around.

On the electrical side of the recorder we find that we have the problem of bias and erasure voltage to consider as well as the recording signal.

The bias voltage is a 25 to 40-kc signal impressed upon the wire by means of a coil wound around one-half of a horseshoe magnet. Its frequency is unimportant, but occasionally this frequency will heterodyne with that of the *if* frequency of the associated receiver. When this occurs a small, fixed mica capacitor can be soldered across the bias oscillator coil to lower its frequency.

There is little chance of there ever being too much bias voltage. However, there is good chance that the bias voltage may be too low, and there'll be erasure trouble. When the bias is too low, the recording will not be completely erased. The result is heard during the playback as background interference.

Also, if the bias voltage is below normal, the recording signal will be slightly distorted, and below normal volume.

Bias voltage can easily be measured with a *vtvm*. In cases when a meter is not available, there are some alternate test methods possible.

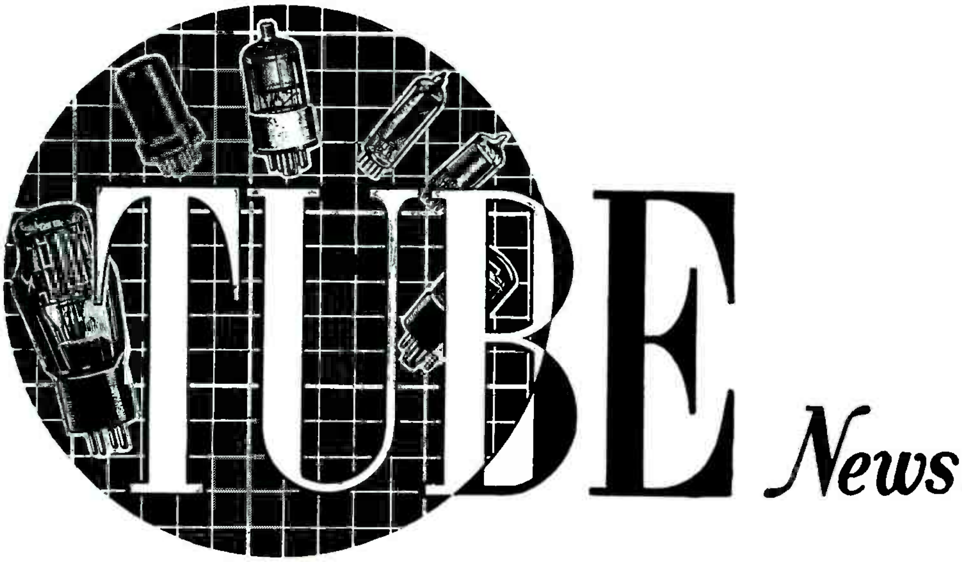
The wire should be erased completely by running it through the recorder, in record position, but with the recording mike input turned all the way down. This length of wire should be played back for a check on whether the erasure is clean; there shouldn't be a sound.

If after recording on this wire, taking care to keep the recording signal within the prescribed limits, the resultant record is low and distorted, the bias voltage can be considered below par. If the record is clear but low, the recording voltage is too low.

If the reel used has been used before and perhaps magnetized at too high a level, a normal bias voltage will not erase it completely with one pass over the head. The test results therefore may be deceptive, and should be watched carefully.

The output from a wire recorder is very low, on the order of one millivolt. It is important therefore that the amplifier is up to par, and have sufficient gain.

The recording head itself is not subject to any problems uncommon to ordinary coils. Opens and shorts which may occur can easily be located with an ordinary ohmmeter.



Application Characteristics of New TV and FM Tubes: 6BN6, 1V2, 6CB6 and 6AU5GT.

by L. M. ALLEN

THE PAST WEEKS have seen the announcement of a variety of FM and TV type tubes with many unusual properties.

An interesting example of this production trend is the 6BN6,[1] the internal construction of which is shown in Fig. 1.

This tube, a miniature beam tube, was designed primarily to perform the combined operations of a limiter, discriminator, and audio-voltage amplifier in FM receivers.

The 1V2

Another recently announced tube, with unusual characteristics, is the 1V2,[2] a half-wave rectifier of the single-ended type for use in compact, high-voltage, pulse-operated rectifying systems. In voltage-doubler circuits, it has been found particularly suitable as a rectifier of high-voltage pulses produced in the scanning system, for magnetically deflected 10- and 12-inch picture tubes.

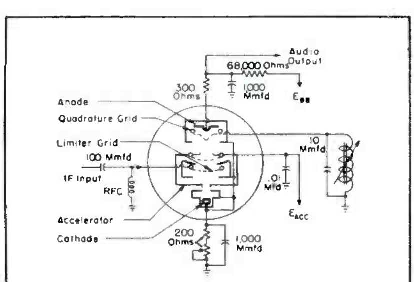
The 1V2 has a filament operating at 0.625 volt and requires about 0.18 watt. The low filament power permits the use of a small size and lightweight rectifier transformer.

The base pins of the tube fit the noval 9-pin socket which may be mounted to hold the tube in any position. In providing the adequate low-leakage insulation required in 1V2 sockets, designed with a cylindrical center shield, it is necessary to remove the center shield. In addition, the socket clips for pins 1, 6 and 7 are usually removed to reduce the possibility of arc-over and minimize leakage.

When the filament voltage is measured, it is recommended that a thermal *rms* voltmeter be used. The meter and its leads must be insulated to withstand 15000 volts and the stray capacitances to ground should be minimized.

The high voltages at which the 1V2 is operated are very dangerous. All circuit parts where this tube is used, which are at high potentials, are being enclosed on the chassis, and *interlock* switches used to break the primary circuit of the high-voltage power supply when access to the equipment is required.

Typical circuit and internal construction of 6BN6 miniature beam tube.



The 6CB6

Another new type TV tube is the 6CB6,[2] a sharp-cutoff pentode of the 7-pin miniature type, designed especially for video *if*-amplifier service at about 40 mc. Its design also permits use as an *rf* amplifier in *vhf* television tuners.

Featured in the 6CB6 is a high transconductance combined with low interelectrode capacitances, and separate basepin terminals for grid No. 3 and cathode. The separate terminals permit the use of an unbypassed cathode resistor to minimize the effects of regeneration.

The 6AU5GT

For horizontal-deflection amplifiers the 6AU5GT[2] has been developed.

The tube is a high-perveance, beam power amplifier of the single-ended type. It features a low mu-factor, high plate current at low plate voltage, and a high operating ratio of plate current to grid-No. 2 current. A power supply of 250 volts, or less, is all that has been found necessary for receivers us-

(*Continued on page* 31)

[1]G. E.
[2]RCA.

Use of Tube Curves to Diagnose Circuit Performance

How Tube Curves Can Serve to Predict Possible Circuit Problems and Solutions. Typical Cases Involving Beam-Power Amplifier and Phase Inverter Cited.

by EDWARD M. NOLL

Instructor in Television
Temple University

DIAGNOSIS OF CIRCUIT performance, when a limited amount of information is available, can often be perfomed by the construction of dynamic load lines on the characteristic curves of the tubes used in the circuit.

Beam-Power Amplifier Problems

To diagnose performance of a stage which uses a pentode or tetrode, the effects of the screen grid must first be evaluated. Thus, in the amplifier of Fig. 1, not only is it necessary to consider the plate characteristic curve (Fig. 2), but curves of the same tube operating as a triode-connected system, Fig. 3.

To find the operating point it is first necessary to know the screen voltage, which can be found from the triode-connected curves. This information can be obtained in the following manner:

(*1*) The plate-current axis of the triode-connected curves of a pentode or tetrode represents total space or cathode current (sum of plate and screen grid) for a given plate voltage and grid bias. Therefore, if the ratio of screen-to-plate current is known, the plate-current axis can be very conveniently recalibrated in terms of screen current. The ratio of screen-to-plate current can be conveniently obtained from the tetrode curves of the same tube. It is preferable, for the very best accuracy, to find this ratio somewhere near the operating plate voltage, although approximate results can be obtained by finding the ratio at most any point, because variations in the ratio are very slight except at very low plate voltages. A ratio at 150 plate volts (Fig. 2) has been taken to illustrate this problem. This ratio was found by finding the zero bias plate current, point *C*, and zero bias screen, point *D*.

$$\text{Ratio } A = \frac{I_{sg}}{I_p} = \frac{12.5}{177.5} = .071$$

(*2*) The fractional part of the total cathode current, which is screen current, can be represented as

$$\frac{I_{sg}}{I_p + I_{sg}} \times I_k$$

This can be expanded to the form

$$\frac{\dfrac{I_{sg}}{I_p}}{1 + \dfrac{I_{sg}}{I_p}}$$

Now if *A* represents the ratio of screen-to-plate current, screen current can be found by applying the formula,

$$I_{sg} = \frac{A}{1 + A} I_k$$

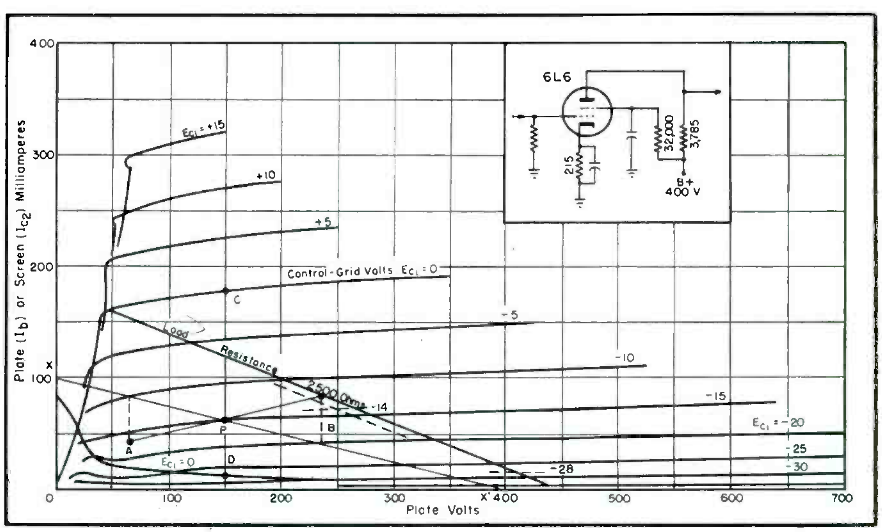
Thus the triode-connected curves can be recalibrated with a simple substitution. The 200-ma point on the total current (identified as plate current) axis of Fig. 3, therefore, also represents a screen current of

$$I_{sg} = \frac{.071}{1 + .071} \times 200 \text{ ma} = 13.2 \text{ ma}$$

This procedure recalibrates the entire scale for screen current.

(*3*) After the screen current calibration, a screen load line is drawn with a slope in accordance with the value of the screen resistor. One point, of course, is the supply-voltage point

Figs. 1 and 2. In Fig. 1 appears a 6L6 tetrode amplifier and in Fig. 2 the plate characteristics of the 6L6. In this plot the load line has been corrected to compensate for the effects of rectification with large signals.



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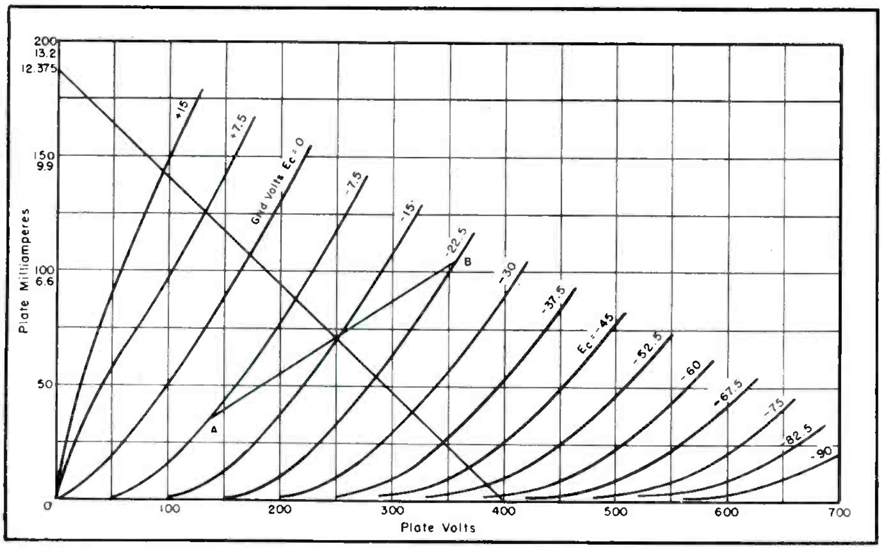

Fig. 3. Operating results obtained from a triode connected 6L6.

points for the cathode line AB:

$$\text{Point } A \quad \frac{10 \text{ v}}{230 \text{ ohms}} = 43.5 \text{ ma and}$$

$$\text{point } B \quad \frac{22.5}{230 \text{ ohms}} = 87 \text{ ma}$$

(*8*) Intersection of the plate and cathode lines locates the operating point. Conditions of operation can be found with procedures discussed in previous installments.[1]

(*9*) The accuracy of the operating point can be traced by:

(*a*) Noting the similar operating bias of -15 on both curves (Figs. 2 and 3).

(*b*) A check of the voltage E_p equals $E_{bb} - I_p R_L - E_c$ or $E_p = 400 - (62.5 \text{ ma} \times 3785) - 15 = 149$, which parallels the value indicated on the curve at the operating point.

(*c*) Another check on the screen voltage E_{sg} which equals $E_{bb} - I_{sg} R_{sg} - E_c$ or $E_{sg} = 400 - (7.1 \text{ ma} \times 32000) - 15 =$ approximately 250 v

on the plate-voltage axis. A second point can be obtained by assuming a screen-voltage change (plate voltage on Fig. 3). However, screen and plate voltage are the same (under assumption of triode connection) and to find a corresponding change in screen current, the following equation is applied:

$$\Delta I_{sg} = \frac{\Delta E_{sg}}{R_{sg}} = \frac{400}{32{,}000} = 12.4 \text{ ma}$$

(*4*) The next step involves the drawing of a cathode line with a slope corresponding to a 215-ohm cathode resistor, or

$$\text{Point } A = \frac{7.5 \text{ v}}{215 \text{ ohms}} = 35 \text{ ma and}$$

$$\text{Point } B = \frac{22.5}{215} = 105 \text{ ma}$$

(*5*) The point of intersection of the screen and cathode lines represents the screen voltage which exists when the stage is tetrode connected with values as shown in Fig. 1. To find the operating characteristics of this stage, it is necessary to use tetrode curves of the 6L6, with a screen voltage constant of 250.

It is important we realize that true operating conditions are only found when the correct screen-voltage constant is used. Up to this point of the procedure our calculations have served to find the operating screen voltage.

(*6*) After the correct screen voltage set of curves is obtained, the plate load line is drawn from the supply voltage point on Fig. 2. For the example under consideration this line (XX^1) will have a slope corresponding to 4,000 ohms.

(*7*) A cathode line is then drawn on this curve. Inasmuch as screen and plate current flows in the cathode resistor, it has a higher effective value than if plate current flowed alone. The effective increase in cathode resistance is a function of the ratio of screen to plate current. In our example this ratio is 0.071 and the effective resistance must be 7.1% higher than actual value, or

Effective cathode resistance =
$R_k (1 + A) = 215 (1 + .071) = 230$ ohms

This value is used in calculating

One difficulty arises in pentode and tetrode calculations after the operating screen voltage has been found by assuming triode conditions. Unfortunately no set of curves is available for this value of screen voltage. This is particularly the case for conventional *rc* amplifiers which operate with rather low screen voltages. The characteristic curves provided for most *rc* tubes have a screen voltage constant which is too high and are therefore useless. Approximate results, close enough for most practical design, can be found after recalibrating the given curves for a new value of screen voltage. This is permissible because plate current is a function of screen voltage and grid bias and not plate voltage.

To recalibrate, four steps should be followed:

(*a*) First, we must find the ratio of the screen-voltage constant (of set of curves) to the calculated operating screen voltage.

(*b*) Then the plate-current axis can be recalibrated by multi-

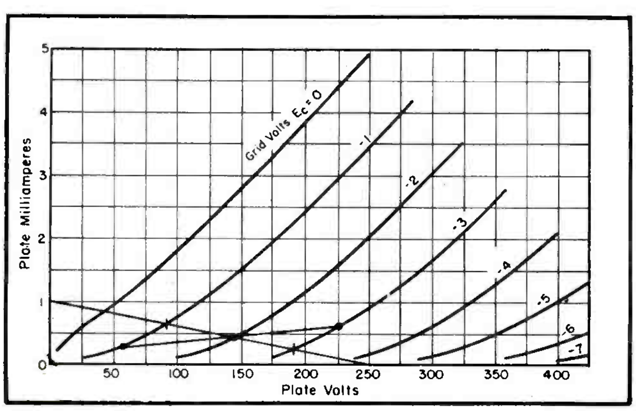

Fig. 4. Dynamic curves of a phase inverter.

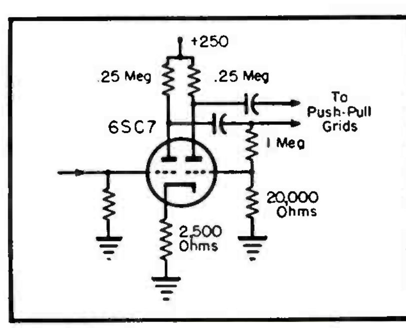

Fig. 5. A phase-inverter circuit.

plying values by the foregoing factor.

(*c*) Bias curves are now recalibrated by multiplying each one by the same factor.

(*d*) The plate voltage axis must not be altered.

Phase Inverter Constructions

Phase inverter plots can be made very simply by using plate load and cathode lines. The most important factor is to consider both tubes' currents, whenever they flow through a common part. In the circuit of Fig. 5 the cathode resistor is common to both sections of the phase inverter and therefore the cathode bias developed across it, is the result of two currents flowing through it.

To plot characteristics, four steps should be followed:

(*1*) First a load line of 250,000 ohms is drawn. When the plate resistor is so much higher in value than the cathode resistor the effects of the cathode resistance on the plate load is insignificant and need not be considered.

(*2*) Next a cathode line, with a slope of 5,000 is drawn. Although the cathode resistor is only 2,500 ohms, its effective resistance is twice as much because of the presence of both sections' plate current.

(*3*) Operating point will be found at $-2E_c$, I_o 4 ma, and E_p 148 volts.

(*4*) If a 2 volt peak-to-peak signal is applied to the input of the phase inverter a 100-volt signal will appear at the plate of the first section according to the plate-load line plot. This signal, in addition to being applied to the grid of a succeeding stage, also excites the grid of the second section of the phase inverter. A voltage divider with a value of 1 megohm and 20,000 ohms divides this voltage down to 2 for a similar excitation of the second grid to produce equal amplitude but opposite polarity output at the plate of second section.

[1]SERVICE; November and December, 1949.

[**To Be Continued**]

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Tube News

(*Continued from page 26*)

ing this new tube type, only one 6AU5GT in a suitable circuit being required to deflect fully a 10BP4, a 12LP4, or any other similar picture tube having a deflection angle up to about 60° and operating at an anode voltage up to 12 kv.

Production Changes

(*Continued from page 23*)

sistor, it may be possible to reduce noise at the *crt* grid by increasing the value to 100,000 ohms.

Horizontal Drift Correction

In late production models of the G. E. 810 and 811 the blocking oscillator coil (T_{18}) was mounted below the chassis rather than on top of the chassis to reduce the amount of horizontal oscillator drift.

RADIART SERVICE PLAQUE AWARDS

Distributors and the service plaques they received from Radiart jobber sales manager Milton S. Roth, at the recent Minnesota Gopher conference. Left to right: Roth, Ward Jensen of Lew Boun Co., Ray Daly of Power City Radio, Leonard Tesdell of Iowa Radio Corp., each of whom are fifteen-year distributors, and Mav Kirkeby, Radiart rep.

ASSOCIATIONS

PRSMA

THE CROSS-HATCH generator, described in this issue by Allan Lytel, was the subject of a talk by John Stimson, sales and service manager of the Hickok Company, at a recent meeting of PRSMA held in the auditorium of KYW.

Stimson revealed how the pattern generator and auxiliary equipment can be employed in TV alignment and trouble shooting.

PRSMA's efforts to assist Service Men and dealers in coordinating their activities in television servicing, were described by David Krantz, president of the association, recently. Krantz pointed out that the PRSMA program accents the importance of using the services of competent, fully-equipped TV service organizations. He indicated that accredited lists of qualified video Service Men have been compiled and are being supplied upon request.

Krantz also stated that a drive is on to improve the technical standards of TV service groups to assure maximum satisfaction not only to the dealer, but to the consumer and manufacturer.

ARTSNY

MAX LEIBOWITZ was reelected president of the Associated Radio-Television Servicemen of New York, at a recent election meeting held in New York.

At a subsequent meeting, Leibowitz announced that a special series of radio and TV courses have been programmed by the N. Y. City Board of Education in conjunction with the association. These courses, which were expected to begin during the early weeks of January, will cover all aspects of radio and television, from the rudiments of the art to the most advanced stages. Lectures will be given by members of the N. Y. City school system staff, who are thoroughly familiar with the type of information Service Men require. A small fee is being charged to cover the cost of equipment and other incidental expenses.

Advance registration for the courses indicates that there'll be a record turnout at each session.

The special series of television lectures being co-sponsored by ARTSNY and ESFETA, have been well received by the members of the association. Leibowitz believes that the combined TV lecture program and school series will provide association members with an exceptionally thorough training in modern television servicing.

TEN YEARS AGO

From the Association News Page of SERVICE, January, 1940

RTG OF BOSTON held its annual meeting. George Feldman, past secretary of the association, left the group to join the U. S. Army. . . . The Texas Radio Service Association held a dinner-demonstration-floor show at the Chaparral, Dallas, Texas, which featured a talk by E. G. Perkins of the Supreme Instrument Corporation, covering *New Service Procedure For Today and Tomorrow*. . . . H. A. Fillman was elected president of the Lehigh Valley Radio Service Association. Other elected officers included: S. P. Gruit, vice president; R. P. Abbott, secretary; Russell Buss, financial secretary and J. A. Muthart, treasurer. R. P. Abbott, association secretary, announced plans for the Third Annual banquet, which was to be held at the Hotel Allen.

STANDARD COIL PRODUCTS 1,000,000 TV TUNER

Glen E. Swanson, president of Standard Coil Products Company, Inc., of Chicago, Los Angeles, and Bangor, Michigan (right), receiving the millionth 12-channel TV tuner recently produced, from John R. Johnson, plant superintendent of the Los Angeles factory.

A substantial portion of the TV sets made in '50 are expected to include the *Standard* tuner, according to Standard Coil officials.

The company which began as a coil manufacturer in '35 in a loft over a store in Chicago,, now have over 3,000 employees and five manufacturing plants.

President G. E. Swanson; vice president R. E. Peterson, and secretary-treasurer J. O. Burke originated the business.

Master Antennas

(*Continued from page* 11)

master antenna system. Should further isolation be necessary, an extra 5 db of isolation can be obtained by removing R_3 from the outlet feeding a high-level reradiating receiver. More attenuation in the outlet device feeding a TV set whose oscillator reradiation does not offend other receivers is not recommended as it reduces equally the desirable direct TV signals and the undesirable reradiated TV signals from other receivers. Therefore, nothing is gained.

Isolation between TV receivers connected to outlets fed from separate transformers is considerably more than 40 db and therefore little or no interference can be expected between TV receivers connected to outlets or separate transformers.

The filter in the outlet device is of the high-pass type which rejects any signals induced into the system which are in the *if* band of 21.25-27.25 mc. The capacitors in the outlet filter all prevent an *ac/dc* type of television set from pumping back any power voltages into the coaxial line.

A 1,000-ohm resistor in the outlet circuit, which taps the coaxial line end of the outlet ahead of the high-pass filter enables AM signals to be taken from the system to a separate polarized outlet receptacle.

FM signals also pass through the high-pass filter and are available from the same coaxial fitting which is employed for connecting television receivers.

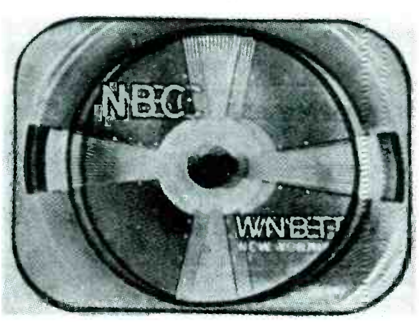
Connecting TV, FM and AM Sets to System

TV receivers on the market today have either 75 or 300-ohm input impedances or both, as in the case of the 1949-1950 model RCA front end shown in Fig. 4.

In Fig. 5 appears a composite drawing which shows the various circuit arrangements for connecting both 75 and 300-ohm TV and FM receivers

(*Continued on page* 34)

Fig. 7. Pattern illustrating marred reception due to direct pickup, first image being received via the air and second by way of coax cable.



Master Antennas

(*Continued from page 33*)

to the coax fitting and the recommended method of connecting AM standard broadcast receivers to the polarized fitting on the master-antenna system outlet plate.

A photo of an installed outlet is shown in Fig. 6.

In developing the master-antenna system[2], illustrated in part, in Fig. 6, engineers selected an output outlet impedance of 50/75 ohms. This impedance was selected because of the leading ghost and FM interference problems which occur in urban strong-signal areas.

In the leading ghost problems we must consider the basic fact that in any coax transmission system the TV signals have a slower speed of propagation than in air. This means that if the TV receiver picks up an appreciable signal directly from a TV station, with respect to the amount of indirect delayed signal received from the antenna or antenna system, the direct (via air) signal pickup may cause a leading ghost problem which may mar the picture as shown in Fig. 7.

Therefore, it is obvious that if a master antenna system in a strong signal area is to be completely free of direct pickup, the 300-ohm open transmission line which acts as an indoor antenna, must be removed from the TV receiver antenna input circuit.

Fig. 8 shows a typical receiver in which a 70/300-ohm trifilar matching transformer[3] has been installed on the TV reciver chassis where the 300-ohm transmission line has been removed, and the coax line from the outlet run directly into the transformer. The installation of this transformer further precludes local oscillator interference from radiating into the antenna system. Tests have shown that, radiation from TV receiver local oscillators, to a great extent, is of *push-push* nature, so that they balance out when connected to the coax line through a trifilar transformer.

Another type of 70/300-matching transformer connected to a television receiver is illustrated in Fig. 10.

Removing the 300-ohm so-called *balanced line* between the *rf* and external-antenna terminals also reduces the possibility of FM interference pickup due to lack of image rejection in the TV receiver, since only the controlled FM signals from the master antenna system are available at the outlet and none will appear on the antenna terminals due to direct pickup in the TV receiver.

A typical hookup of a 75-ohm TV receiver to a master antenna system appears in Fig. 11.

Incidentally, the connection of the coaxial cable to one side and ground of a 300-ohm TV receiver input, as shown in Fig. 5, is not recommended unless the antenna coil is easily accessible for direct connection.

[2]RCA Antenaplex. [3]RCA MI 6876-2.

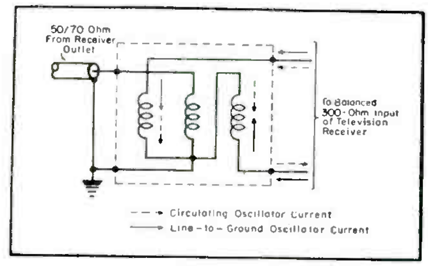


Fig. 9. Circuit of coax line connection to 300-ohm trifilar transformer, which illustrates why oscillator currents are cancelled in this system.

Fig. 10. A TV receiver with another type of impedance-matching transformer.

Fig. 8. TV receiver with a 300-ohm input and trifilar matching transformer installed to eliminate direct pickup from 300-ohm twin lead.

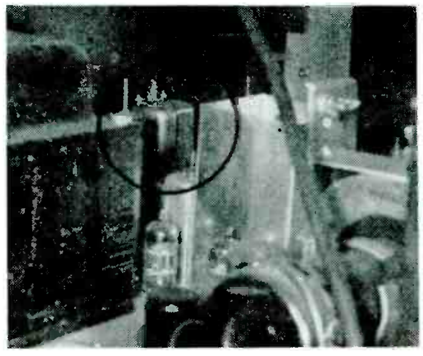
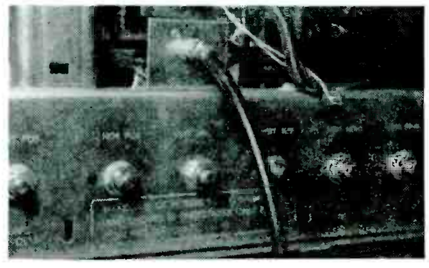


Fig. 11. Connection of a 75-ohm receiver (DuMont) to a coax cable coming from a master-antenna system outlet.



Ser-Cuits

(*Continued from page* 14)

the 50% (6 db) point on the *if* response curve, while the audio *if* carrier appears at a point 26 db below the video *if* carrier or at the 2.5% point. As a result, the amplitude of the audio *if* carrier is much less than that of the video *if* carrier at the video detector. This condition is essential for two reasons: First, the audio *if* signal must be of very low amplitude at the grid of the *crt* to prevent picture distortion; and second the audio *if* amplitude must be low in comparison with the video *if* amplitude in order that the characteristics of the 4.5 mc beat response from the two signals will be determined chiefly by the audio *if* signals and fluctuations in the video *if* signal will have less effect upon the 4.5 mc beat response.

Video Detector and AGC

The video detector is a diode type similar to those used in AM receivers. The *if* signal is applied to one plate of a 6AL5 twin-diode. On the positive portions of the video *if* signal, the diode conducts and current flows up through a contrast control to the cathode of the diode. This current develops a voltage across the contrast control, and the voltage varies with the modulation on the signal. The setting of the contrast control determines the amount of the signal that is applied to the grid of the video amplifier which, in turn, determines the voltage amplitude applied to the picture-tube grid.

At the same time as the video detector is performing the foregoing function, it serves as a mixer for the video *if* and audio *if* signals. The resultant 4.5 mc frequency-modulated beat signal appears across the contrast control along with the video component.

The other diode section of the 6AL5 serves as an *agc* rectifier. The *if* signal is also applied to the plate of this section. On the positive portions of the signal the diode conducts, and current flows down through a 3,000-ohm resistor developing a negative voltage at the junction of this resistor and a 2,200-ohm unit. This voltage is applied to the tubes under *agc* through a delay network composed of the 2,200-ohm resistor and a .1-mfd capacitor. Each stage under *agc* is decoupled from the *agc* line by resistor-capacitor networks to prevent interaction between stages.

A delay bias of approximately one volt is applied to the cathode of the

(*Continued on page* 36)

Ser-Cuits

(*Continued from page* 35)

agc rectifier by a pair of 1,000 and 100,000-ohm series-dropping resistors. The purpose of this delay bias is to prevent the *agc* from becoming operative until the signal strength has reached a predetermined amplitude. This assures maximum sensitivity of the receiver on weak signals.

Video Amplifier

The video amplifier in this model is a single-stage amplifier utilizing direct coupling between the video detector and the control grid of the amplifier. If capacitive coupling were used, the coupling capacitor would have to be large to pass the 60-cycle vertical sync pulses. If the capacitor were large enough to pass the sync pulses, the time constant of the *rc* network, formed by the coupling capacitor and the contrast control, would be too long, and the amplifier would be highly susceptible to noise pulses. The direct coupling method is therefore used to provide better low-frequency response and, at the same time, to make the system more immune to noise.

High-frequency response is improved by the use of two series peaking coils. These coils tend to isolate the output capacity of the 6AL5 video detector from the input capacity of the 6AH6 amplifier, and the output capacity of the 6AH6 amplifier from the input capacity of the picture tube, so that the capacities are effectively in series rather than in parallel. Since the high-frequency response is a function of the shunt capacity in the circuit, effectively placing the tube capacities in series—thus lowering the shunt capacity—we have an increase in high frequency response. A further improvement of high-frequency response has been affected by the use of a shunt peaking coil and a 100-mmfd coupling capacitor. The shunt-peaking coil is self resonant at a frequency higher than the highest frequency desired to be passed. As the frequency increases, the load impedance increases, and this tends to compensate for the attenuation caused by the tube and stray shunt capacities. The coupling capacitor provides a low-impedance path around the contrast control for the high frequencies and also a form of high frequency *boost*, especially at the lower settings of the contrast control. A series peaking coil, in the plate of the amplifier, is dampened by a 22,000-ohm resistor to prevent the development of transients that would adversely affect the picture.

The video amplifier is designed to have a sharp cutoff in the vicinity of 3.5 to 4 mc to attenuate the 4.5 mc beat frequency, so that it will have no visible effect on the picture. Although the 4.5 mc beat is 26 to 32 db down on the video-amplifier response curve and its amplitude is not great enough to have any appreciable effect on the grid of the picture tube, the signal is still strong enough to excite the grid of the audio *if* amplifier. The attenuation of the 4.5 mc beat is further increased by the action of the audio if transformer, which is effectively a series-tuned circuit shunting the plate of the video amplifier. This series-tuned circuit provides a low impedance path from the plate of the video amplifier to ground for the 4.5 mc signal, and at the same time sufficient voltage is developed across the audio *if* transformer winding to excite the grid of the audio *if* amplifier tube.

[To Be Continued]

●

G.E. 817 and 821

In our analysis of this 12″ type TV set last month[1], the *rf* amplifier, con-

[1]SERVICE; December, 1949.

verter and oscillator; video and audio *if* amplifiers; and the video detector and amplifier were discussed. Another section of the receiver which merits comment is the sync separation circuit. In the *T* version illustrated last month, amplification and shaping of the sync pulses and their separation (clipping) from the composite video signal have been accomplished by two clippers. Partial clipping of the sync pulse from the video signal is performed by a 6AL5 diode. This tube also performs the function of the *dc* restorer for the video amplifier output to the picture tube. With the polarity of the sync pulses of the composite video signal being negative-going, as applied through a capacitor, the diode conducts on negative peaks of the composite video signal resulting in negative polarity sync pulses developed across a 47,000-ohm resistor. When this signal is applied to one half of a 12SN7GT phase inverter, the signal is amplified, limited in amplitude so as to reduce any noise riding above the sync pulse amplitude and, the phase of the signal inverted so that a positive-going signal can be applied to the second half of the 12SN7GT which functions as a second clipper.

Clipper-Tube Plate Voltage

The clipper tube is operated at a low plate voltage with its bias derived by grid rectification of the positive polarity signal applied to the grid. Thus, conduction occurs only during the sync pulse intervals which are the most positive component of the signal applied, resulting in clipping action. The horizontal and vertical synchronizing pulses are developed across a 6,800-ohm resistor in the cathode of the clipper and are positive-going.

•

DU MONT APPOINTS PICTURE-TUBE DISTRIBUTORS

Twenty-four picture-tube distributors have been named by the cathode-ray tube division of the Allen B. Du Mont Laboratories, Inc.:

Chief Electronics, Inc., Poughkeepsie, N. Y.; Wm. Dandreta & Co., Providence, R. I.; Davis Radio Distributing Co., Mt. Vernon, N. Y.; Edwin E. Taylor Company, Albany, N. Y.; Electronic Supply Corp., Columbus, O.; Louis M. Herman Co., Boston, Mass.; Holub & Hogg, Cincinnati, O.; Hunter Electronics, Rochester, N. Y.; Island Radio Distributors, Hempstead, L. I.; Marsh Radio Supply, Milwaukee, Wis.; Mattson's, Inc., Richmond, Va.; A. W. Mayer Co., Boston, Mass.; Northwest Radio & Electronic Supply, Minneapolis, Minn.; P. A. Burks & Co., Louisville, Ky.; Peerless Electronic Euipment, Louisville, Ky.; Pilgrim Distributing Co., Chicago, Ill.; Pioneer Radio Supply Co., Cleveland, O.; R-K Distributing Co., Louisville 3, Ky.; Radio Distributing Co., South Bend, Ind.; Radio & Electronic Parts Corp., Cleveland, O.; Radio Distributing Co., Indianapolis, Ind.; Radio Electronic Sales, Worchester, Mass.; Radonics (Harry's Radio Parts Corp.), St. Louis, Mo., and Srepco, Inc., Dayton, Ohio.

CHANNEL MASTER EXHIBIT AT AIEE MEETING

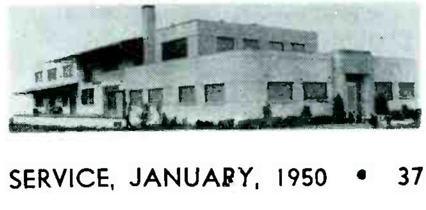
A special exhibit, including an active TV camera chain, *dynamic demonstrator* receiver, transparent plastic model receiver, model transmitter, various types of receiving antennas, typical commercial receivers, a coax and radio relay TV network display, 'scope and tubes used in TV, was displayed by Channel Master Corporation, Ellenville, N. Y., during the recent AIEE-AAAS annual convention at the Hotel McAlpin in New York City.

Joseph Resnick, general manager and Harold Harris, sales manager, were present at the exhibition.

SAMS MOVES TO NEW PLANT

Howard W. Sams & Co., Inc., have moved to a new plant at 2201 East 46th Street, Indianapolis 5, Indiana.

The new building, comprising 30,000 square feet of air-conditioned floor space will house sales and administrative offices, engineering laboratories, photographic and drafting departments, presses and binderies.



RIDER MANUAL TV VOLUME 3 NOW AVAILABLE

TV Manual Volume 3 has been published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N. Y.

Manual includes schematics, chassis views, parts, lists, alignment tables, adjustment of traps, trimmers, transformers, voltages and resistance readings, test patterns, waveforms.

Volume has an enlarged page size, 12"x15". Has a cumulative index for the three TV manuals and a *How It Works* book.

Priced at $21.00.

New TV Parts . . . Accessories

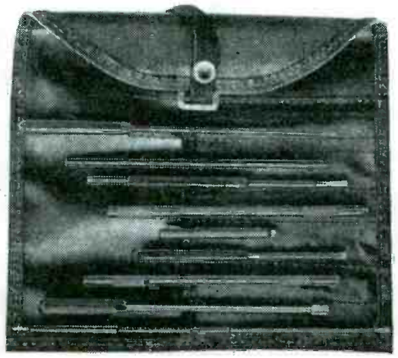
TRICRAFT INDOOR TV ANTENNA

An electrically-tuned indoor TV antenna, the Vidiette model 700 has been announced by Tricraft Products Company, 1535 North Ashland Avenue, Chicago, 22.

* * *

INSULINE TV SERVICING TOOL KIT

A TV *Handi-Kit,* furnished in a pocket-size leatherette carrying case including tools which will fit the adjusting screws of all types of *rf* and *if* transformers, padder and trimmer capacitors, etc., has been announced by the Insuline Corporation of America, 36-02 35th Ave., Long Island City, 1, N. Y.



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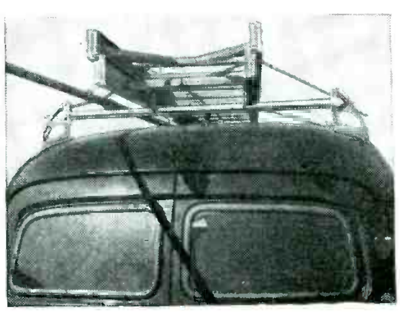
STAMFORD CASTING LADDER RACK FOR PANEL TRUCKS

A rack for carrying ladders and other bulky equipment on panel trucks has been produced by Stamford Casting Company, 820 Atlantic St., Stamford, Conn.

Brackets are polished aluminum castings, and crossbars are heavy wall aluminum tubing. Load carrying capacity is said to be well over 350 pounds. Rack, installed, weighs less than 10 pounds.

In installation, four holes are drilled in the roof, and brackets are fastened with toggle bolts. A felt pad distributes the load over 70 square inches of support area.

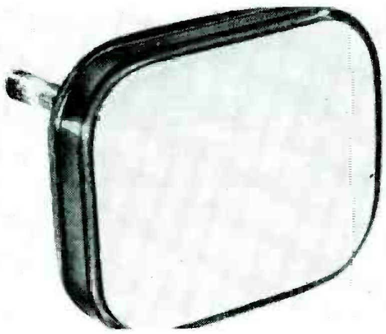


SHELDON RECTANGULAR TUBE

A rectangular screen all-glass gray-black picture tube, type has been announced by Sheldon Electric Division of Allied Electric Products, Inc., Irvington, N. J.

Tube measures 10⅛"x13½"x18¾".

Magnetic focus and deflection are employed in tube.



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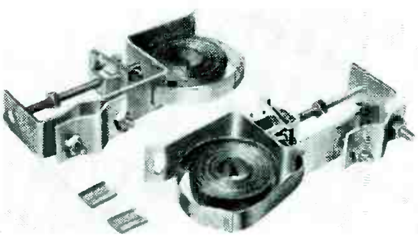
MARVIN CHIMNEY ANTENNA MOUNT

A chimney antenna mount, *Unimac* model UCH-4, with a single bolt which is said not only to lock-clamp a 12' steel strapping in place, but take up the slack in the retaining band at the same time, has been announced by the Unimac Division, Department B, Marvin Radio-Television, Buckeye at 89 St., Cleveland, Ohio.



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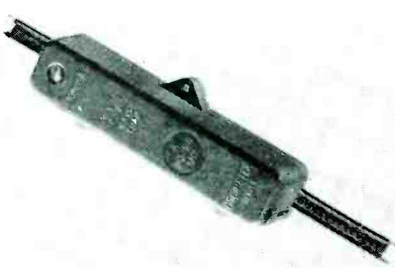
DECIMETER TVI TRAPS

A series of three TVI wave traps has been developed by Decimeter, Inc., Denver, Colorado. Designed to be applied to the 300 ohm leadin to alleviate interference in the three ranges: *A,* 20 to 26 mc; *B,* 25 to 35 mc; and *C,* 88 to 108 mc. Wave trap cases of polystyrene plastic come in three colors; green for the *A* range, red for *B,* and ivory for the *C* range.

Traps operate on induction principle. They slide around the antenna leadin.

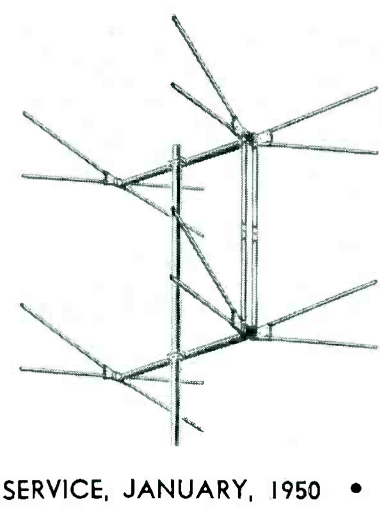


JFD ALUMINUM TV CONICALS

All aluminum conical TV antennas have been announced by the JFD Manufacturing Co., Inc., 6101 Sixteenth Ave., Brooklyn 4, New York.

Conicals, known as the Commandair type, feature elements of heavy-wall aluminum tubing and dipole insulators made of bakelite.

Available in standard conical, conical with high-frequency element and conical with three-element dipole types. Supplied in either single bay or ¼ wavelength stacked arrays.

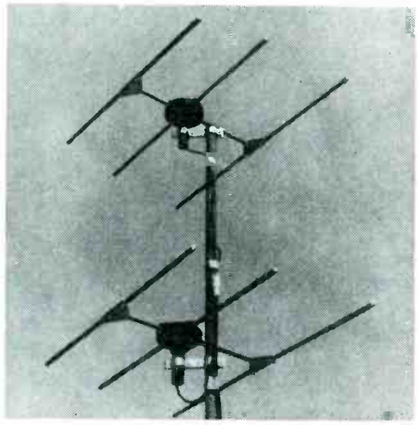


(Right)
JFD aluminum conical.

WORKSHOP ASSOCIATES 6-ELEMENT ARRAY

A 6-element array, consisting of two basic 3-element antennas aligned in the same direction, and spaced ½ wavelength apart, has been announced by The Workshop Associates, Inc., Newton Highlands, Mass.

Array referred to as a version of the *broadside array,* is said to be capable of furnishing high gain (7.8 db) and sharp directional pattern to bring weak TV signals up out of the *snow.* Said to have a front to back ratio of 18 db which can reduce by 98% any interfering signal from the rear.



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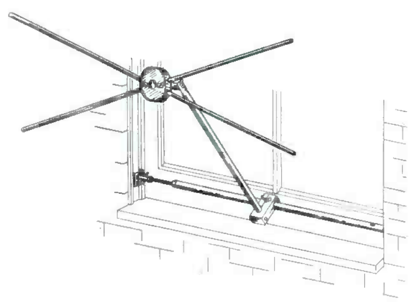
DELSON CONICAL WINDOW-TENNA

A *conical window-tenna,* model B63, has been produced by the Delson Manufacturing Co., 126 Eleventh Avenue, N. Y. 11.

Antenna accomodates windows from 32" to 42". Extension bars available for use on windows from 32" to 54", type X61; X62 for windows from 32" to 66", and X63 for others up to 78".



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SIMPSON TV SIGNAL BOOSTER

A TV booster, model IMB-13, featuring a swivel-based antenna, which can be plugged into the booster, has been announced by Mark Simpson Manufacturing Co., Inc., 32-28 Forty-ninth St., L. I. C. 3, N. Y.

Uses two 6AK5s.

* * *

CLEVELAND AIRCRAFT REMOTE-CONTROL ANTENNA ROTATOR

A remote-control antenna rotator, Tune Vue, has been announced by the Cleveland Aircraft Products Co., 113 St. Clair Ave., N. E., Cleveland, Ohio.

Rotator is powered by an induction-type motor operating off a 110-volt 60-cycle power source.

(See page 42 for additional *New Product* News)

ONTARIO RESEARCH NAMED SOLE AGENT FOR WALKER DUALCOTED STEEL SNYDER TV MASTS

Ontario Research Corp., 2218 W. Ontario Street, Philadelphia, Pa., has been appointed sole selling agent for the Snyder Manufacturing Company's TV masts of Walker dualcoted steel.

Richard Morris has been named sales manager of Ontario.

According to Mr. Morris, the Walker-dualcoting process offers protection against corrosion through a double safety coating on both the inner and outer tube walls. Non-cracking or chipping if bent during installation, the process is said to prevent corrosion from salt, acids and caustics.

Richard Morris

* * *

SUNDBERG NOW OXFORD ELECTRIC V-P

Hugo Sundberg has been named vice president and manager of the Oxford Electric Corp., 3911 South Michigan Ave., Chicago, Ill. Sundberg was formerly with Utah Radio Products.

Hugo Sundberg

* * *

HYTRON TO BUILD PICTURE-TUBE PLANT

The cornerstone of a television picture tube plant at Newburyport, Mass., was laid recently by Bruce A. Coffin, president, and Lloyd H. Coffin, treasurer, of Hytron Radio & Electronics Corp.

The new plant is expected to provide a daily production of 3,000 picture tubes, ranging in size up to 20".

The plant is located next to Hytron's present factory at Newburyport.

* * *

SUN RADIO AUDIO EQUIPMENT HANDBOOK

A pocket manual entitled *1950 Audio Equipment*, has been published by Sun Radio & Electronics Co., Inc., 122-124 Duane St., New York 7, N. Y.

Written by Irving Greene, manager of Sun Radio's audio engineering department, the handbook deals not only with radio AM and FM tuners, phonograph pickups, records, amplifiers and speakers, but also with the installation of such equipment in cabinets and again as built-in home features.

TACO ANTENNA STACKING BULLETIN

Explanation and detailed drawings of the procedure to follow in stacking high-band antennas appear in an engineering bulletin, No. 58, released by Technical Appliance Corporation, Sherburne, N. Y.

Dimensions and proper phasing of antennas are given for both the two-stacked and four-stacked arrays.

* * *

G-C TO MAKE WINDSOR ELECTRONIC MIRROR

General Cement will manufacture the Windsor Electronics, Chicago, *Third Eye Miro-Pix Mirror.*

Miro-Pix is a portable telescoping television service 10" x 12" mirror.

STANCOR TV PARTS GUIDE

A 20-page booklet, No. DD338C, listing replacement transformers for 215 TV receivers and chassis made by forty-three manufacturers has been published by the Standard Transformer Corporation, Elston, Kedzie and Addison Sts., Chicago 18, Illinois. Stancor replacement part numbers are listed together with manufacturers' part numbers for positive identification.

* * *

FEDERATED PURCHASER TO MOVE

Federated Purchaser, Inc., will move to new quarters at 66-68 Dey Street, New York City on or about March 15. Federated's present New York address is at 80 Park Place.

ALLIANCE TENNA-ROTOR WITH DIRECTIONAL INDICATOR

A new model *Tenna-Rotor,* model DIR, which features a directional indicator control case, has been announced by the Alliance Manufacturing Co., Alliance, Ohio. Indicator dial on control case panel enables the viewer to select and know the actual compass direction to which the antenna is pointed.

Model has stainless steel bearing inserts, and is said to be designed to operate in any weather.

Models supplied with special Alliance 4-conductor cables which are said to have a special *zip* feature to facilitate installation.

* * *

G.E. 12-INCH DARK-FACE GLASS PICTURE TUBES

Two 12-inch TV picture tubes, incorporating a *filterglass* face plate, have been announced by G. E.

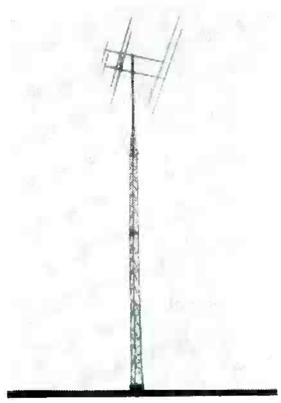
Designated as the 12KP4A (aluminized) and 12LP4A (non-aluminized).

* * *

EASY-UP TV TOWERS

A tower which is said to elevate a TV antenna approximately 30' above roof-top, the 300 *Rota-Tower,* has been introduced by the Easy-Up Tower Co., Racine, Wisc. Incorporated is a rotating feature, permitting the antenna to be oriented after the tower is installed. Horizontal cross-bars form a ladder for climbing. Tower is of electrically-welded steel tube and rod construction, dip-galvanized after fabrication.

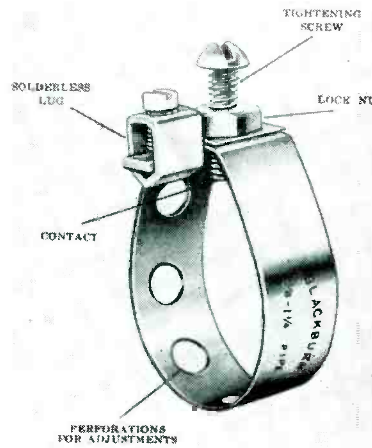
Basic model has two 10-foot pre-assembled tower sections and a 10-foot top pole which mounts the antenna and its pole. Sections are joined together at site of installation by three bolts. A four-way hinged base permits *walking* the tower up along the peak of the roof, or tipping it up from either side.



BLACKBURN ADJUSTABLE GROUND CLAMP

An adjustable ground clamp to fit ⅜" to 1¼" pipe, and ⅜" to 3" pipe, has been announced by Blackburn Specialty Co., 6541 Euclid Ave., Cleveland 3, Ohio. Features a tightening screw which is said to chafe the pipe, draw up slack, cut through rust and dirt and at the same time contract band around the pipe surface.

Clamp consists of a flexible, perforated copper band which encircles the pipe. A boss raised on the flat end of a removable copper alloy terminal lug fits into band holes. Tightening screw with a lock nut is threaded through the boss.



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DU MONT FOUR-SECTION SPIRAL-TYPE INPUTUNER

A four-section imputuner incorporating a spiral-type inductuner has been announced by the Electronic Parts Division of Allen B. Du Mont Laboratories, Inc., 35 Market St., East Paterson, N. J. Tuning range is continuous from 54 to 216 mc. Inputuner requires 5.9 turns of tuning motion as against 10 turns for previous models. Can be used on either 300 or 72 ohm antenna systems, by means of an input transformer.

New Parts, Accessories

MALLORY 6-VOLT BENCH POWER SUPPLY

A 6-volt portable *dc* power supply, type 6RS10, has been announced by P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis 6, Indiana.

Unit has been designed for use in the testing and demonstrating of auto radios and electrical equipment, solenoids, relays, motors, clutches, brakes, chucks, etc.

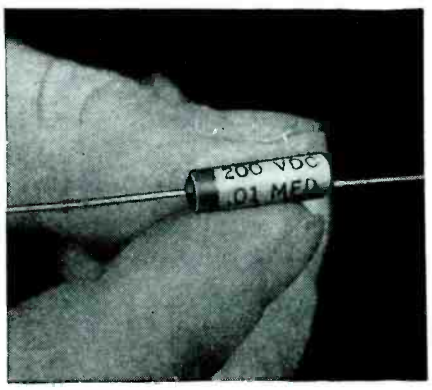
Voltage is continuously variable from 0 to 8. The unit is said to permit continuous operation at 10 amperes and intermittent at 20 amperes. It has a filtered *dc* output with less than 1 volt ripple at 6 volts, 10-ampere output.

Supply is equipped with a 0-20 ampere *dc* ammeter, 0-10 volt *dc* voltmeter, self-resetting circuit breaker in the *dc* line, and a switch and fuse in the *ac* line.

* * *

AEROVOX PLASTIC-SEALED PAPER-CASE TUBULARS

Paper tubulars, type P85, featuring Aerolene-impregnation and a Duranite seal, have been announced by Aerovox Corp., New Bedford, Conn.



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TRIPLETT VOLT-OHM-MIL-AMMETER

A 5½" laboratory-type volt-ohm-milammeter, type 630A, with mirrored, hand-drawn scales has been developed by The Triplett Electrical Instrument Co., Bluffton 2, O.

Six *dc* volt ranges from 0 to 6,000 at 20,000 ohms/volt; six *ac* volt ranges from 0 to 6,000, at 5,000 ohms/volt; and five *dc* current ranges. Resistance ranges from 0 to 100 megohms.

Features a precalibrated rectifier unit.

SYLVANIA SEALED IN GLASS GERMANIUM DIODES

Germanium crystal diodes that are enclosed in hermetically sealed glass cartridges have been announced by the electronics division of Sylvania Electric Products, Inc. Crystals are available in two types; IN34A, a general purpose diode, and IN58A, a 100-volt diode.

Electrical features are said to include small interelectrode capacitance; small shunt capacitance; low forward resistance; high back resistance and ability to work into a low resistive load with good efficiency.

IRC MINIATURE RESISTORS

Two miniature BT type insulated resistors, type BTR and BTB, have been developed by the International Resistance Co., 401 N. Broad St., Philadelphia, Penna.

Type BTR, a ⅓-watt unit, has a body length of 13/32" and a diameter of 3/32", while BTB, a 2-watt unit, has a body length of 1¼" and a diameter of ¼".

Minimum resistance of each is 470 ohms, and maximum resistance 22 megohms. Available in ± 5% and ± 10% tolerances in RMA ranges.

SUPERIOR INSTRUMENT UTILITY TESTER

A pocket size utility tester that is said to be capable of measuring the actual current consumption of any appliance or utility either *ac* or *dc*, while the unit under test is in operation, has been announced by Superior Instruments Co., 227 Fulton St., New York City.

Appliance registers a reading in amperes. A special pair of insulated clip-ends are supplied for motors. Incorporates a direct-reading resistance range for measuring resistances commonly used in electrical appliances, motors, etc.

* * *

UNIVERSITY LOUDSPEAKER CROSSOVER NETWORK

A filter network, model 4410, of the *LC* type for use with coaxial or duplex loudspeaker systems, which is said to provide a proper attenuation rate at a crossover of 600 cycles has been announced by University Loudspeakers, Inc., 80 South Kensico Ave., White Plains, N. Y.

Filter was designed primarily for use with high-frequency tweeters and is particularly efficient when used with University tweeter models 4408 and 4409.

* * *

G.E. SWEEP GENERATOR OUTPUT ADAPTOR

A balanced output adaptor, type ST-8A, for use with the G. E. model ST-4A sweep generator has been announced by General Electric.

The sweep generator presently has a single-ended output and with the addition of this adaptor, balanced output is available.

* * *

INDUSTRIAL DEVICES VOLT-AMP TESTER

A general-purpose volt-ampere checker, type 900, that plugs in between line and connection cord, and is said to provide simultaneous voltage and amperage readings directly off two dials, has been announced by Industrial Devices, Inc., Edgewater, N. J.

Employs two neon indicators which extinguish at the voltage and amperage readings indicated by the adjustable knobs. A multiplying switch provides for the expansion of the range indicated on the ammeter scale. Tester distinguishes between *ac* and *dc*.

* * *

C-D AUTO ANTENNAS

Two models of auto antennas for installation on any contour at any angle have been announced by Cornell-Dubilier Electric Corp., South Plainfield, N. J.

One model, Skyhawk 4-B, is a two-section mast that extends to 43", with a 36" leadin. Another model, Skyhawk 8-B, chrome plated in three sections, extends to 60". Has a 36" polyethlene leadin.

CB AUTOMATIC AUDIO SWEEP GENERATOR

An automatic audio sweep generator which is said to have a frequency of from 25 to 32,000 cycles in one continuous range has been announced by the Clough Brengle Company, 6014 Broadway, Chicago, 40, Ill. Sweep may be adjusted to any spread from 500 to 10,000 cycles, or the instrument may be operated manually.

Wave form distortion is stated to be less than ½ of 1%, and the sweep calibration is linear, sweep frequency being adjustable from 2 to 10 sweeps per second.

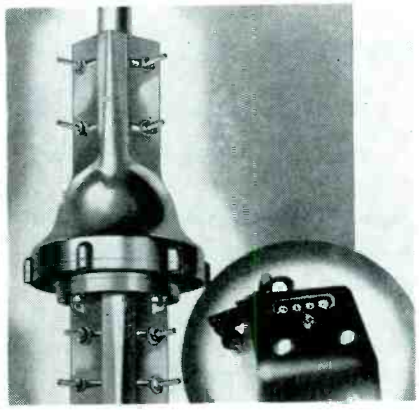
Complete construction and operational data appear in bulletin 18A.

C-D TV ANTENNA ROTATOR

A TV-antenna rotator, the Tele-rotor has been announced by Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Unit is said to take load stress up to 300 pounds. Motor is said to be weather sealed and lubricated for life. It is instantly reversible, and is operated by directional push buttons.

The housing of the rotator is die cast, designed for mast or platform mounting and equipped with three heavy-duty guy-wire lugs. It will accommodate ⅞" to 2" upper and lower masts.



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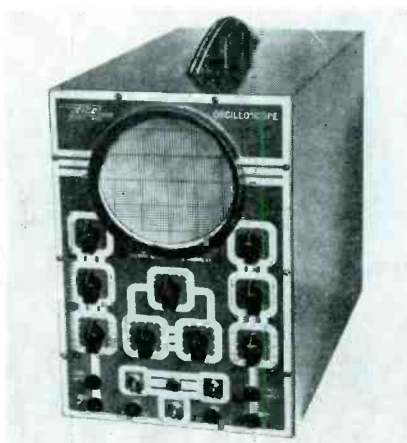
EICO 5" 'SCOPE

A 5" 'scope, model 400, has been announced by Electronic Instrument Co., Inc., 276 Newport St., Brooklyn 12, N. Y. Available both as a kit and a fully wired unit.

The 'scope has a horizontal sweep circuit of 15 to 30,000 cps. Frequency response of horizontal and vertical amplifiers is said to be 50 cps to 50 kc. Input impedance: 1 megohm and 50 mmfd. Tubes: two 6SJ7s, two 5Y3s, and 884, and a 5BP1. Provides for external synchronization, test voltage, and intensity modulation. Deflection sensitivity: .30 volts-per-inch, full gain.



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MARKWELL TV TACKER

A TV tacker (L4) designed for tacking round coaxial cable to wood or plaster using ½" leg staples (LAD), has been announced by Markwell Mfg. Co., Inc., 200 Hudson St., New York 13, N. Y.

Tacker can also be used for tacking twin-lead in using a ⅜" leg staple (L4C) driven parallel and between the two outside wires.

SYLVANIA SUBMINIATURE AMPLIFIER TUBES

Two subminiature tubes, a triode and pentode, designed for use as class *A af* amplifiers or resistance coupled *af* amplifiers have been announced by Sylvania Electric Products, Inc.

The triode, type 6AD4, has a mutual conductance of 2700 micromhos, and the pentode, type 6BA5, a rating of 3300 micromhos.

Both tubes are enclosed in T-3 envelopes and supplied with 6.3 volt, 150 milliampere heaters.

* * *

CALIRI SOLDERING GUN

A soldering gun with a single-pole electrode, the Cal-88, has been produced by the Caliri Manufacturing Co., Inc., 45 Washington St., West Orange, N. J.

Gun is said to have a long duty cycle. Entire gun weighs one and one-half pounds.

Pistol-grip, three-finger trigger controls a dual-heat feature providing 150 and 100 watts heat.

Electrodes are said to be corrosion resistant.

* * *

HICKOK MICROVOLT SIGNAL GENERATOR

A microvolt generator, model 292X, to cover both upper channel TV and mobile band frequencies on fundamentals, has been announced by The Hickok Electrical Instrument Co., 10529 Dupont Avenue, Cleveland 8, Ohio.

Measures both input and output of units under test. Modulated and unmodulated output from 1 to 100,000 microvolts. May be externally modulated from 15 to 10,000 cps. Has a db meter. Self-contained crystal oscillator circuit.

For complete information write to H. D. Johnson.

* * *

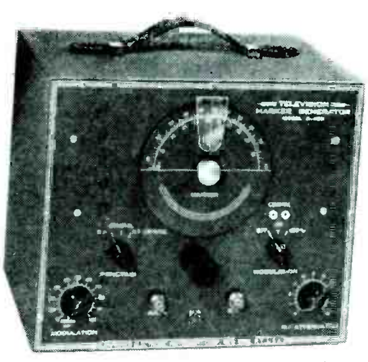
WELLER HEAVY-DUTY SOLDERING GUN

A soldering gun, model WD-250, that is said to be capable of handling 250 watts has been announced by Weller Manufacturing Co., 808 Packer St., Easton, Pa. Features a five-second dual heat, prefocused spotlight and a rigid-tip. Tip design is said to provide more copper in chisel-shaped head.

APPROVED ELECTRONIC MARKER GENERATOR

A marker generator, type A-450, has been announced by Approved Electronic Instrument Corp., 142 Liberty St., N. Y. C.

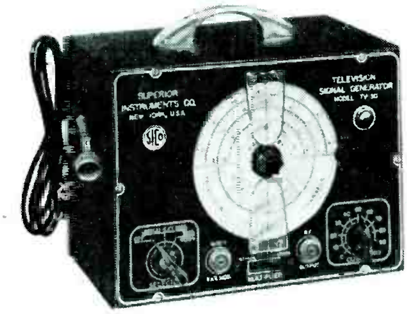
Frequency range is 19.5 to 40 mc, said to be accurate to .5%.



SUPERIOR INSTRUMENTS TV SIGNAL GENERATOR

A TV signal generator, model TV-30, has been produced by the Superior Instruments Co., 227 Fulton St., N. Y. 4.

Frequency ranges are 18-32, 35-65, 54-98 and 150-250 mc, without switching. Audio modulating frequency 400 cycles (sine wave).



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CLAROSTAT VERTICAL POWER RESISTOR

A vertical power resistor, the *Standee*, for above-chassis mounting, has been announced by Clarostat Mfg. Co., Inc., Dover, New Hampshire.

Resistor consists of a wire-winding on fibre-glass core, bent in hairpin form with mica separator between the legs, placed in a ceramic tube filled with cold-setting inorganic cement and provided with bottom terminals and mounting bracket. The lugs are locked into the tube wall in addition to being sealed in cement. Can be mounted above the chassis with a large hole to clear the terminals and a small hole to take a self-tapping screw or rivet for the mounting bracket.

Standees are available in the standard 19/32" diameter, and in heights of 1½", 2", 2½" and 3", with respective power ratings of 10, 15, 20 and 25 watts. Maximum resistance values are 6,000, 9,000, 12,000 and 15,000 ohms, respectively.

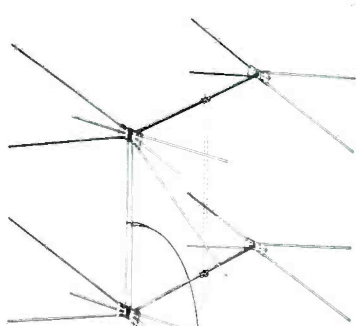
* * *

TRICRAFT CONICAL TV ANTENNA

A hi-lo conical type X antenna series, type 3000, has been announced by the Tricraft Products Co., 1535 W. Ashland Ave., Chicago, Ill.

Constructed of aluminum.

Furnished in single, double or quad element assembly, with or without mast.



JOTS AND FLASHES

THE TV PICTURE TUBE of '50, particularly the 16" type, has begun to display many variables, especially its face radius. To date there are about sixteen types of 16" tubes available with face radius variations from 27" to 60" with the 27" radius the most popular. The situation appears to have confused many Service Men and accordingly it was decided to probe these variables and other features of the larger picture tubes. The results of this study have been compiled into an extremely helpful table, which will be published exclusively in SERVICE in the February issue. . . . Samuel Olchak is now advertising and sales promotion manager of Air King Products Company, Inc. . . . Dr. H. Giuliani has been named chief mechanical and chemical engineer of Telrex, Inc. . . . Irvin Guttman has been appointed chief electronics project engineer and sales engineer of Telrex, and Joseph P. Stephanile has become an associate electronics engineer at Telrex. . . . Alignment and general test techniques will be discussed in a series of twelve lectures programed by G. E. Three basic pieces of equipment will be featured during the lectures; a 5" 'scope, marker generator and sweep generator with a balanced output adaptor. Cities to be visited include Oklahoma City, Tulsa, New Orleans, Houston, San Antonio, Fort Worth, Dallas, Albuquerque, Salt Lake City, Los Angeles, San Francisco and Seattle. . . . The fortieth anniversary of Webster Electric Company, Racine, Wisconsin, was celebrated recently with an open-house party. . . .Sam Stroum, 2229 22 Avenue, North, Seattle, Wash., is now a Clarostat sales rep covering Washington, Oregon, Idaho and Montana. Stroum will also represent Insuline in the same area. . . . Jeff Wilson has been named general sales manager of Columbia Records, Inc. . . . Tydings Company have opened a new store at 5647 Penn Avenue, Pittsburgh, Penn. . . . The Radio Parts and Electronic Equipment Conference and Show scheduled for the Stevens Hotel in Chicago, May 22 to May 25, will be an all-distributor event featuring a series of conferences, clinics and talks covering such problems as turnover, sales promotion, cycle inventory methods of control, etc. . . . H. P. Balderson is now chairman of WCEMA, Los Angeles Council. C. A. Swanson has been named vice chairman and Fred W. Falck, Jr., renamed to his position as secretary-treasurer. . . . Ray T. Schottenberg has become a rep for Vee-D-X covering southern New Jersey, eastern Pennsylvania, Maryland, Delaware and the District of Columbia. . . . Radio Merchandise Sales, Inc., have moved their factory and offices to 1165 Southern Boulevard, New York 59. . . . J. J. Clancy, 3611 Webster Street, Fort Wayne, Indiana, is now representing the sound division of the Webster Electric Company in northeastern Indiana and southern Michigan. . . . The second volume of the RCA TV Pict-O-Guide containing trouble-shooting photographs, has been announced by the RCA tube department. The book, authored by John Meagher, contains eighty-four photos and about 25,000 words of practical trouble shooting data. . . . Larry F. Hardy is now president of sales of the radio and television division of Philco. F. D. Ogilby has been named vice president of the division.

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SERVICE INDEX—JANUARY, 1950

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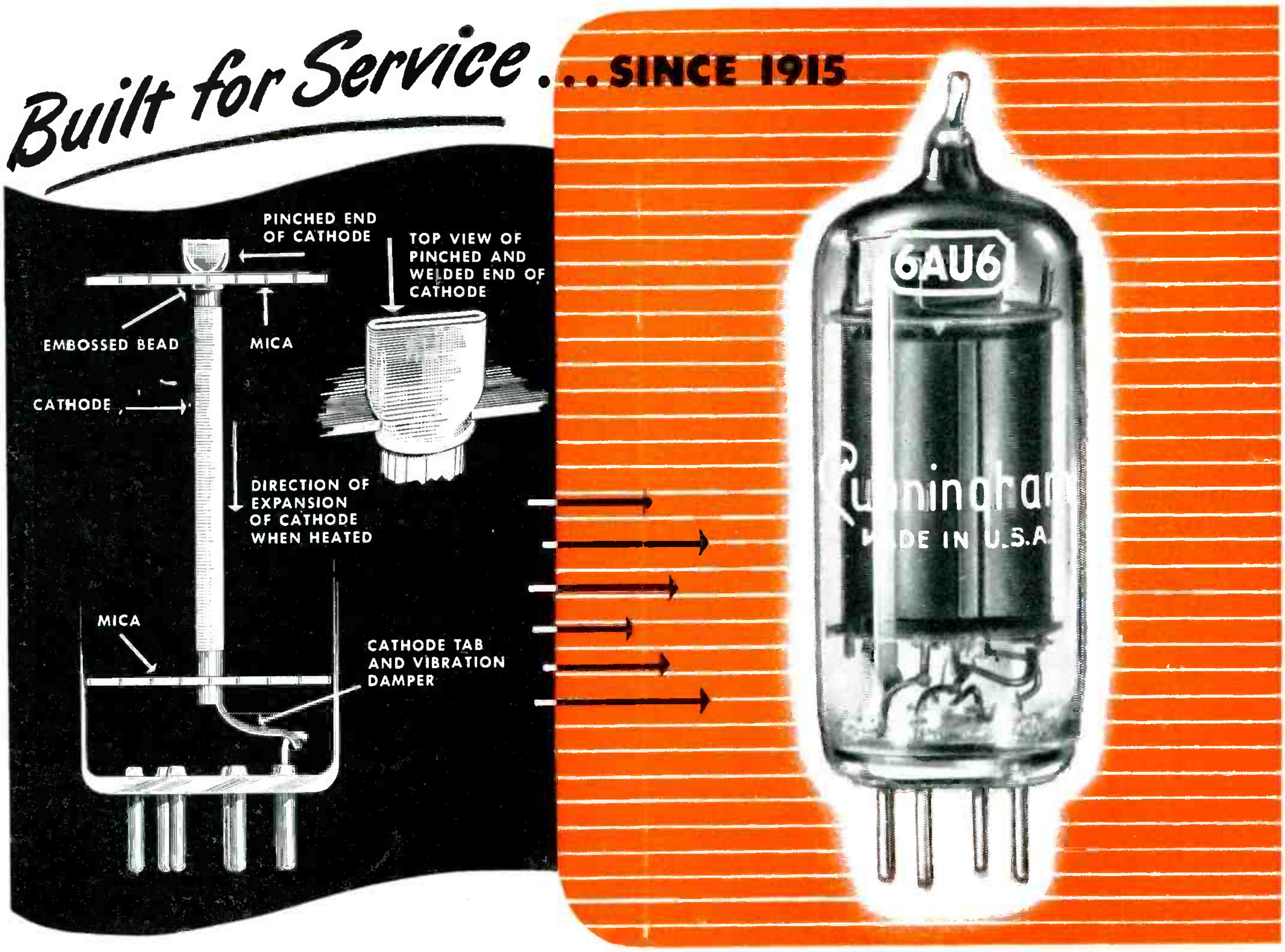

The inside story of Cunningham quality

1. How Cunningham "Inverted" Pinched Cathodes Minimize Microphonics

Engineering progress is part and parcel of Cunningham quality. For instance . . . unlike most tubes Cunninghams use *"inverted" pinched cathodes* to minimize microphonics by preventing cathode vibration or displacement.

These important features are achieved by clamping the mica firmly between the embossed bead and the pinched top end of the cathode. This arrangement holds the upper end of the cathode rigidly, but permits the heated cathode to expand freely downward through the bottom mica without producing cathode strain. The lower end of the cathode is prevented from vibrating by means of the damping tab connected between the cathode and a stem lead.

The "inverted" pinched cathode is only one of the many improvements which account for the *first-line* quality of Cunningham tubes. It serves to explain why experienced servicemen use Cunninghams consistently.

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