Howard W. Sams

PF PHOTOFACT

INDEX

AND TECHNICAL DIGEST

Speaker Enclosures and Frequency Dividing Networks — See pages 11 & 45

MAY · JUNE · 1953 · No. 38

Pick of the Trade

PRESENT INDICATIONS are that Germanium diode use will double again in 1953. 1952 sales totaled 9.5 million, as compared to 4.5 million in 1951. 1953 sales are expected to approach 20 million, and half of this figure being divided between UHF-TV mixers (5 million) and video detectors (5 million) in VHF and VHF-UHF combination sets.

★ ★ ★

UHF GAINS. With 15 stations on the air and a score or more rapidly approaching completion, UHF television has receiver manufacturers watchful. Biggest question mark is front-end design.

Sets available generally feature either of two RF tuning methods: One uses UHF-converter strips with from 13 to 16 positions. (An 82-channel detent-type tuner was recently announced.) The other method requires a separate tuner or converter that tunes continuously through all 70 UHF channels.

★ ★ ★

BIG QUESTION is whether the average consumer will pay extra dollars that all-channel UHF reception might cost.

Manufacturers are divided in their answers. Some have come out for strip tuning. Others offer continuous tuning, while others supply both. A wait-and-see attitude pervades the industry.

★ ★ ★

Of TWENTY-FOUR MANUFACTURERS asked about their plans: 11 said they were making UHF sets, 5 said sets would soon be forthcoming, 6 gave no information and 2 disclaimed interest in UHF.

All 24 had something to say about converting their late-model sets in the field for UHF. Three offered conversion only by adding a continuous tuner, 15 said strips would be available and six offered both.

Of the new sets discussed, six models are continuously tuned, two are strip tuned and three come both ways. Only five set manufacturers responding announced a line of external UHF/VHF converters; two firms said that external converters were under development. — *Electronics*

★ ★ ★

WITH THE SOLE EXCEPTION of the atomic energy program, more money is being spent by the government on electronic research than in any other field. 95% of the major items in current military electronics production are new, designed since the Korean war.

★ ★ ★

BING CROSBY ENTERPRISES, INC., has demonstrated its system for recording TV on tape. The machine is expected to be on the market in 1954. Such an all-electronic device for recording TV shows could have tremendous advantages over present movie techniques in speed, cost and versatility.

★ ★ ★

WATCH THE DEVELOPMENT of a new electronic device still largely hush-hush. All it is is a copper tube but what it does is phenominal. It's a three-way street. Microwaves such as TV's can go through the middle, electrical current for power through the copper, and the outside carries a surface wave. In short, it's an electrical current carrier that is a waveguide on the outside and a coax cable on the inside. —*Electronic Markets*

ABOUT THE COVER: The cover illustration is dedicated to the rapidly growing field of high-fidelity. The reproducer—a Jensen TRi-PLEX, the pre-amplifier—a Brook Model 4B, the amplifier (not shown) a Brook 12A. The attractive model is Jean Cusack, photography by Robert W. Reed.

PF PHOTOFACT INDEX

AND TECHNICAL DIGEST

VOL. 3 · NO. 3 MAY-JUNE, 1953

JAMES R. RONK, *Editor*

Editorial Staff: Merle E. Chaney • Robert B. Dunham
Ann W. Jones • Glenna M. McRoan • Glen E. Slutz
Margaret Neff • L. H. Nelson • C. P. Oliphant

Technical Director: W. William Hensler

Art Directors: Anthony M. Andreone • Pierre L. Crease

Photography: Robert W. Reed

Production: Archie E. Cutshall • Douglas Bolt

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HOWARD W. SAMS, *Publisher*

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SPECK BARKER,
Vice President in Charge of Sales, Magnecord, Inc., says: "Regency proves you can always tell a champion."
Regency · LARGEST SELLING BOOSTER AT ANY PRICE

MILTON S. KIVER

President, Television Communications Institute

Shop Talk

Observation of the picture and listening to the sound is the serviceman's first step toward the repair of a defective television receiver. The next step is to decide, from the symptoms noted, where the trouble is located and then to begin the actual search for the defective component itself.

Of these, the second step is the most important because the decision made there will determine the direction of the serviceman's subsequent probing. And a wrong turn in the road may not be righted for several hours.

Now, the way to avoid falling into a trap, especially in instances when no clear cut decision can be made from screen and sound observation, is to double-check yourself by using one or more of the guideposts which exist in every television receiver. The experienced serviceman is aware of these guideposts and relies on them heavily. The less experienced technician is frequently unaware of their existence or significance and thus loses the benefit of their assistance.

What is a guidepost? A guidepost is an observation point where the serviceman can inspect the signal to determine its condition. If the results are satisfactory, then he knows that a certain section of the set is operating normally. And the trouble must lie beyond this point. But if the signal indications are abnormal (i.e., distorted or missing) then the trouble probably exists at some prior point. So why waste valuable time looking for trouble where it does not exist?

You've encountered the same situation in every day life. If you feel sick between lunch and dinner, you wouldn't blame the dinner, would you? Pretty obvious, you say. But have you ever seen a serviceman check the picture tube because he wasn't getting any high voltage, even with the high-voltage lead disconnected from the picture tube? I have.

There are a number of suitable guideposts in a television receiver and any man may really choose his own. However, the writer has found the following ones to be the most reliable and the easiest to use when the indications obtained are not normal.

1. Sound-Video Separation Point. Probably the most important guidepost in any television receiver is the sound-video separation point. This will tell us first whether the set is of the intercarrier or split-sound (conventional) type, and second, which stages are common to both signals. With this information, the serviceman can then better evaluate the original sound and/or video signal behavior as observed when the set was first brought in. Are both signals affected? If the answer is yes, then the trouble should lie in a stage common to both. This will also include the power supply since it is common to every section of a television receiver. But if only one signal is affected, then, of course, attention would be directed to those stages which deal exclusively with this signal.*

2. Video Detector Output. This observation point is valuable for indicating whether any trouble exists prior to the video second detector. Sync compression, sync clipping, or hum in the video signal are distortions of the video signal which frequently occur in the RF or IF stages. However, they may also arise in any of the stages following the video second detector. As a first step toward their isolation, the video signal is scoped at the output of the video second detector. If it is normal, then the RF and IF stages are freed of suspicion and the technician should direct his attention to the stages which follow the second detector. But if the signal is distorted, then trouble is indicated in the RF and/or IF stages.

Sync clipping or sync compression will show up most markedly as unstable vertical or horizontal lock-in. (The picture will also be darker than normal under the same conditions, but this may not be noticed. Unstable lock-in will be more obvious.) Hum in the video signal will produce such distortions as shown in Figure 1 accompanied by poor vertical lock-in. In either case no clear-cut decision as to defect location can be made simply by observing the picture. Additional information is required and scoping the video signal at the detector is one step in this direction.

3. AGC Voltage. Closely tied in with the appearance of a distorted signal (or no signal at all) at the video second detector is an AGC system that is not operating properly. Too high an AGC voltage will reduce the gain of the controlled RF and IF stages and result in little or no signal reaching the video detector. Too low an AGC voltage can lead to sync clipping or sync compression because of the excessive gain which normal signals would receive.

Hence, checking the AGC voltage can go a long way toward the location of a defect in the IF and RF systems.

There is, however, one problem which the technician may en-

* * Please turn to page 85 * *

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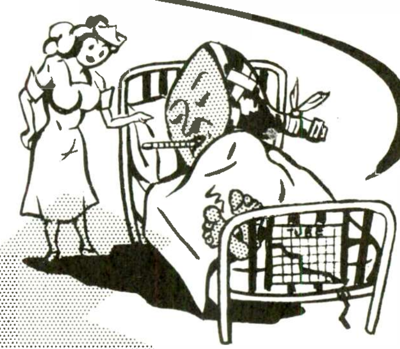
* A more extensive discussion of the sound video separation point and its significance to TV servicing will be found in the author's "Servicing TV In the Customer's Home", published by Howard W. Sams & Company, Inc., Price $1.50.

Figure 1. The Visual Effect Produced When 60-cycle AC (Hum) Enters the Video System.

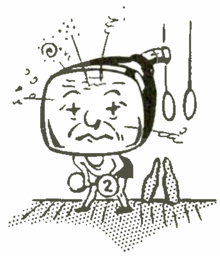
AILING PICTURE TUBE?



by Glen E. Slutz

It is important to you as a service technician and to your customers that your decision to replace a picture tube be well considered and accurate. No one particularly relishes laying out 30 to 60 dollars for a new picture tube, and feelings are apt to become strained if trouble reoccurs shortly after a picture tube replacement has been made. The following information is therefore passed along in the hope that it may help you deal with possible picture tube failures in a manner both time-saving and customer pleasing.

What are some of the ills that befall picture tubes? By far the most common one is insufficient cathode emission. The function of the cathode is to provide the electrons which make up the scanning beam in the tube. If through age, accident, or misuse this electron emitting property deteriorates, the beam current will decrease and certain characteristic changes will occur in the screen image.



One of these changes is illustrated in Figure 1A. At high brightness control settings, a reversal toward the black occurs in the high-lighted portions of the image and produces what we have affectionately named the "Zombie" effect. Faces take on the weird appearance of death masks; the life-like shadings are lost. Very often in a tube with this defect when the brightness control is reduced, the image regains its true shadings as shown in Figure 1B. Sometimes a tube will show very marked evidence of the "Zombie" effect when it is first turned on; then after a half to three-quarters of an hour in operation the cathode emission rate will increase enough to allow a normal picture on the screen. Of course, such a tube is nevertheless defective and should be replaced.

A dim picture, even at maximum brightness setting on the receiver, is another indication of low cathode emission. Certain other defects may also produce a dim picture, but these can be traced down fairly quickly in most cases. For example, a thick coating of dirt and grime on the tube face or safety glass will cut down the amount of usable light from the phosphor. Also a condition of low high voltage may be responsible for lack of brightness in the picture. The latter can be detected through the use of a voltmeter and high voltage probe. Then, too, if the dim picture is caused by insufficient high voltage, a characteristic "blooming" or raster expansion very often accompanies the lack of brightness.

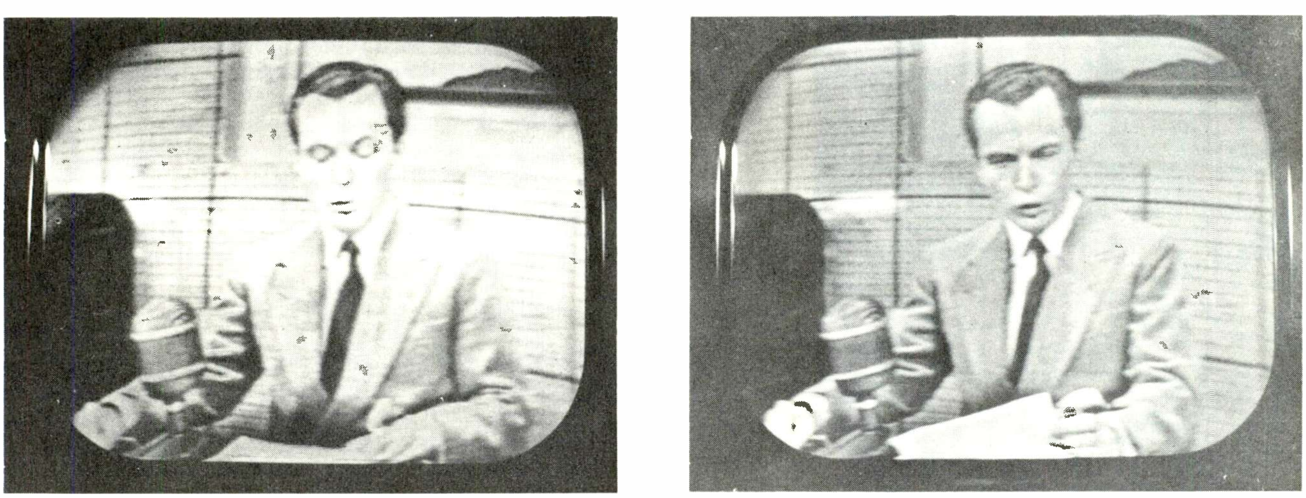
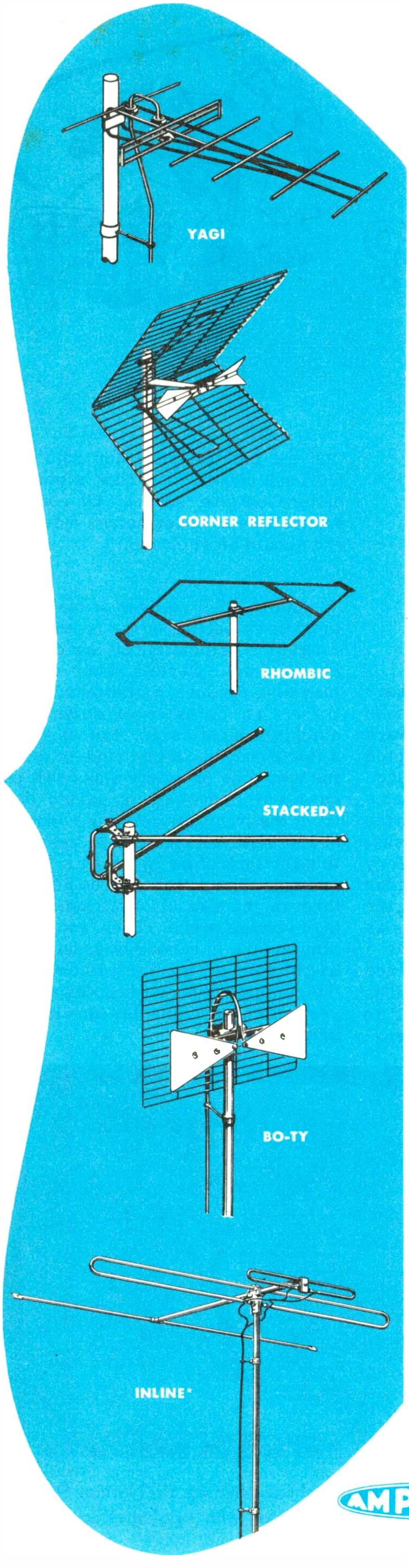


Figure 1. Picture Tube Having Low Cathode Emission. (A) "Zombie" Effect at High Brightness Setting. (B) Normal Shading at Reduced Brightness Setting. (Photographs Reproduced with Permission of CBS Television with Apologies to Winston Burdette.)



PROVEN in field tests—

Amphenol UHF Antennas

The new AMPHENOL UHF antennas, designed by the makers of the fine AMPHENOL VHF INLINE antenna, are the end result of extensive research by television reception experts. In their laboratories many different types of UHF antennas were designed and built, tested, modified and re-built. From these tests certain designs were selected for field testing. And not until they had proved their worth in practical FIELD TESTS were these UHF antennas O.K.'d for production. Servicemen realize that only those testing methods that duplicate as closely as possible actual antenna reception conditions can assure the installer and ultimate user of trouble-free years of antenna use. AMPHENOL'S actual field tests give that assurance.

Amphenol 114-054 UHF Yagi—The single forward radiation pattern and high efficiency of the YAGI makes it ideal for fringe area reception. It is the best antenna for extremely high gain over a specific group of channels. Six elements offer maximum electrical efficiency. The YAGI will give 10 DB gain relative to resonant dipoles.

Amphenol 114-058 UHF Corner Reflector—With good horizontal and vertical directivity characteristics, the CORNER REFLECTOR is excellent for use in areas troubled with "ghosts" and interference. It is designed for high gain over all UHF channels, 14 to 83. Because of ascending signal gain of 7 DB to 12 DB across the UHF channels, the CORNER REFLECTOR is an especially desirable antenna for use in low signal areas.

Amphenol 114-060 UHF Rhombic—The RHOMBIC is particularly recommended for areas troubled with reflections. These are minimized because the antenna provides very narrow horizontal directivity over all UHF channels. The RHOMBIC is excellent for areas of medium signal intensity because of its good signal gain which ranges from 5.5 DB at 470 mc to 10.5 DB at 900 mc.

Amphenol 114-059 Adjustable UHF-VHF Stacked-V—An antenna designed to receive all UHF or VHF channels from 2 to 83. The angle between the seamless aluminum tubing elements can be adjusted to three different angles to permit reception of either UHF or VHF signals or a combination of both. Effects of ground reflections are minimized by good vertical directivity.

Amphenol 114-065 UHF BO-TY with Reflector—This completely pre-assembled uni-directional UHF antenna has already established itself as the most efficient on the market. For all channels, 14 to 83, and with signal gains of 5 DB to 8½ DB, it is an excellent major-area antenna for those locations where reflections are a problem. The AMPHENOL BO-TY reflector eliminates reception off the back, thereby rejecting reflections that cause a "ghost" condition and increasing the received signal strength for better UHF pictures.

— — — and for VHF

Amphenol 114-005 VHF Inline*—Featuring the unique INLINE* design, this antenna has been the leader in a highly competitive field for over four years. It has maximum broadband gain over all channels, excellent impedance match and the single forward lobe radiation pattern experts declare needed in VHF.

*Reissue Pat. No. 23,273

AMPHENOL AMERICAN PHENOLIC CORPORATION
chicago 50, illinois

What may be done to extend the life of a picture tube whose only defect is low cathode emission? This problem has a degree of solution in a brightener attachment of the type shown in Figure 2. Several makes of brighteners are on the market at the present time. They consist essentially of a step-up transformer or similar component which provides a slightly higher than normal filament voltage for the picture tube. In this way the cathode is heated to a higher temperature and consequently gives off more electrons. Some brighteners are equipped with a control which provides a means of adjusting the output voltage between limits. Others have only a fixed output voltage. They all are inserted between the picture tube base and its socket. In the case of electrostatically focused tubes with connections to pin #6, a brightener with pin #6 included in its circuit must be used.

A brightener is not a substitute for a new picture tube. If using one is found to give satisfactory picture improvement, the customer should be fully advised of the limitations of its use. He should be told that a brightener cannot be guaranteed in the same way that a new picture tube would be guaranteed. A brightener may perform properly for only two or three weeks or it may operate over a period of many months, depending upon the condition of the picture tube. If the customer is told these facts when the brightener is installed, call-back misunderstandings will be avoided.

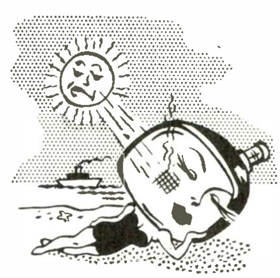
Furthermore, at the time a brightener is contemplated, it is a good policy to give the customer the option either of having the brightener installed with full knowledge of its limitations or of buying a new picture tube outright. If the occasion is a house call, this option can be presented directly to the customer. If the set happens to be on the shop bench, it takes only a phone call to learn the customer's preference.

One further word concerning picture tube brighteners -- many of them have their field of application strictly limited to those receivers employing parallel heater connections. These brighteners are not suitable in series filament sets because a series line cannot supply the increased current demand of a brightener.

Another device for revitalizing tubes with low emission has been on the market for some time. It is known as a reactivator; and, in short, it subjects the picture tube heaters to a high voltage for a short period of time. During this period the cathode coating gets so hot that it literally boils. In this way it decontaminates itself by permitting more of the electron emitting substance to come to the surface.

This device, like that of the brightener, is only a stop-gap measure to extend the useful life of a picture tube for an unknown period, and the customer should be advised of this. Replacement of the picture tube is ordinarily necessary at the end of this period.

The second ill which befalls picture tubes is the ion burn. Figure 3 shows a 16TP4 picture tube with an ion burn visible against the cross hatch image on the screen. (Sometimes a really bad burn can be seen on a screen even when the receiver is off.) The ion burn in Figure 3 is in the shape of an "X". Rectangular picture tubes can develop either these X shaped burns or the round burns depending on the second anode voltage employed with the tube. The X burns are found on rectangular tubes that have been used with rather low second anode voltages. Round picture tubes develop the circular ion burns exclusively.



Ion burns are caused by misadjustment of the ion trap magnet (beam bender). When the ion trap is correctly set for maximum screen brightness, the electron beam threads the aperture in the gun structure cleanly without striking the edges. If the ion trap is not placed properly, on the other hand, the beam nicks the edges of the aperture and the heat generated actually causes the release of very small particles or ions out of the gun material. These are accelerated toward the screen and eventually create the discoloration known as an ion burn.

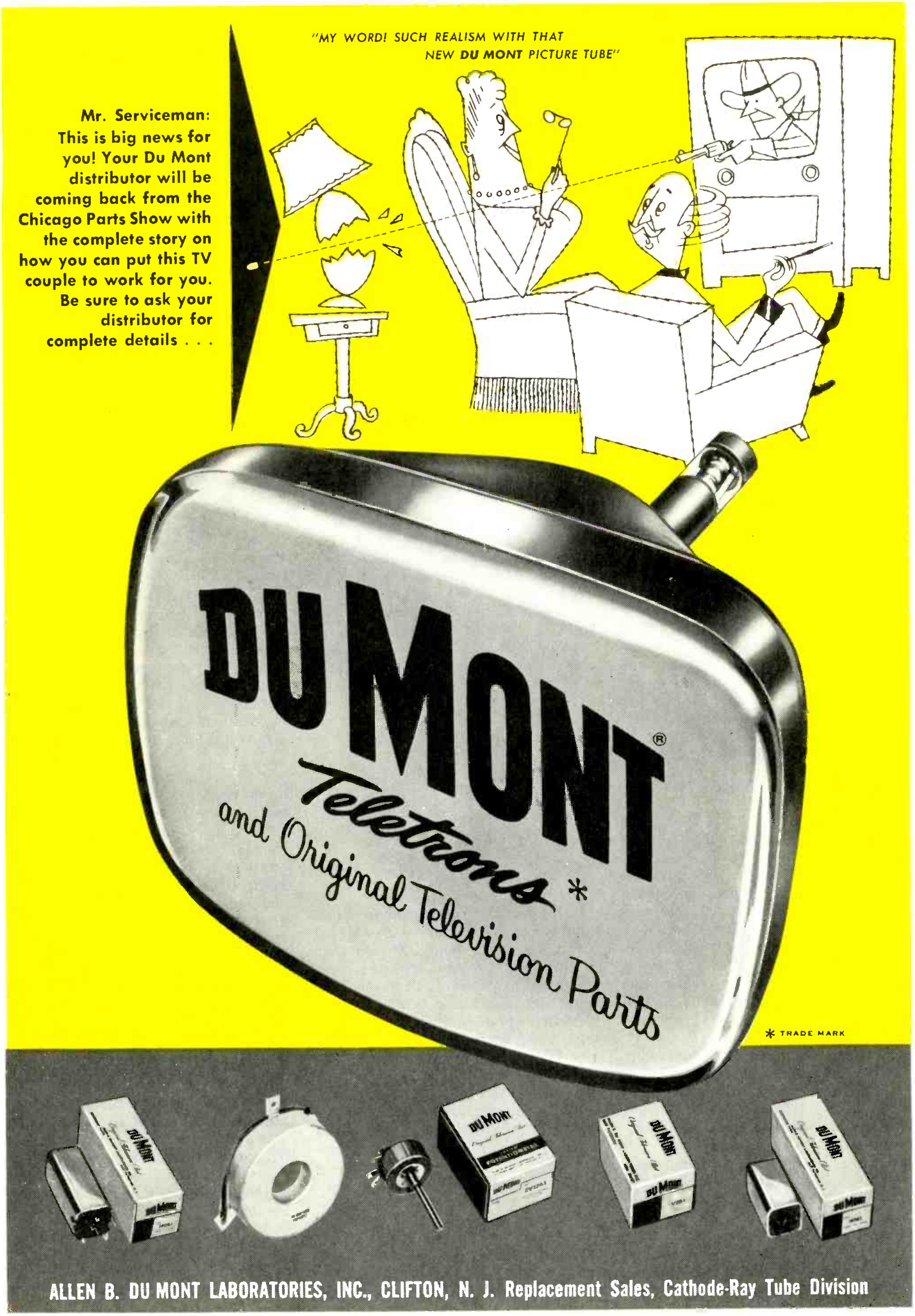
There is no known cure for ion burns within the means of the average service technician. Prevention, therefore, must be the rule. If the brightness control is kept at the lowest convenient level while the ion trap is being adjusted, the beam will have much less energy and so will not work havoc around the gun aperture. On some picture tubes it is actually possible to see the gun material turn fiery red where the beam hits it (the writer witnessed this phenomenon a short time ago in a 17TP4). Picture tubes with aluminized screens are purported to be immune to the damaging effects of ions. The aluminum forms a very thin coating over the inside surface of the phosphor. This coating is such that ions are blocked and kept from striking the phospor while the much smaller electrons penetrate the aluminum and energize the phosphor.

Dirt on the safety glass or picture tube face can sometimes be mistaken for an ion burn. It is surprising how often a supposedly "bad" picture tube can be restored by cleansing. Mild soap and water applied with a soft cloth and a thorough rinse with clear water afterwards perform this job very well.

Sometimes a dark spot appears on the center of picture tube screens because the tube is too close to the safety glass. This dark spot may be mistaken for an ion burn when actually it is produced by an electrostatic discharge between the tube and the glass. Moving the chassis and tube backward a little farther away from the glass will remedy the trouble.

Another defect which develops in picture tubes and which is frequently found in company with ion burns and gassy conditions is a burnt or misshapen aperture in the gun structure. A burnt aperture is caused, in the first place, by misadjustment of the ion trap magnet. The electron beam strikes and eats out holes in the edges of the aperture and so in time a beam is fashioned which is no longer circular in cross-section and which produces a blurred, out-of-focus picture. One instance is known where a tube actually developed a double aperture in this way, and as a result a double

* * Please turn to page 89 * *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A Reflex Enclosure for...

..an 8 in. SPEAKER

by ROBERT B. DUNHAM

Some of the characteristics desired in a high quality loudspeaker system include a smooth frequency response throughout the audible range and a minimum amount of distortion, obtained with adequate efficiency, from an enclosure small enough to be used in the desired location. The one particular qualification difficult to attain, in an enclosure of reasonable dimensions, is adequate reproduction of the low bass tones.

The reflex enclosure (known under such names as bass reflex, vented and phase inverter enclosure) has been popular for some years since it does reinforce the low frequencies with a cabinet of comparatively small dimensions. But to accomplish the desired results certain things must be taken into consideration in its design and construction. A study of the multitude of information concerning reflex enclosures will reveal a great variation in the dimensions and values recommended, which can be puzzling. But the reasons for this situation can be explained.

Cabinet size is dependent upon the speaker; the cubic content of the enclosure increasing with larger speaker (cone) diameter and lower open-air resonant frequency of the speaker. Port size also varies for definite reasons. Some better understanding of this can be had from the following data collected by us when tuning a reflex enclosure to a certain speaker. Figure 1 shows impedance measurements being taken on a speaker enclosure.

In this case an enclosure, which had been designed and constructed for use with one particular 8-inch speaker, was modified for best operation with another 8-inch unit of different manufacture. The inside dimensions of the cabinet and the port had to be changed to tune it to the new speaker, which had a higher resonant frequency than the original one. The following procedure applies whether an existing enclosure is being tuned to accommodate a different type speaker or a new enclosure is being built for a specific speaker.

The term "tuned" is used, as that is exactly what must be done since the reflex cabinet is a resonant enclosure. It has the properties of a parallel resonant circuit while a speaker follows the characteristics of a series resonant circuit. The enclosure should be tuned so its resonant frequency corresponds to that of the speaker.

Since the speaker acts as a series resonant device, its cone movement tends to be excessive when a signal equal to the speaker's resonant frequency is applied to its voice coil. This of course means that any tones at, or very near, this frequency will be reproduced much louder and result in a peak in the response curve at that point. When the parallel resonant enclosure is tuned to the same frequency as that of the speaker, the column of air inside the cabinet offers opposition to the excessive cone travel and does not allow it to "run wild". Therefore a correctly tuned reflex enclosure eliminates the peak caused by speaker resonance. Two peaks, not quite so high

Figure 1. Equipment Used in Determining Resonant Frequency of Speaker and Data for Impedance Curves.

Figure 2. Equipment Used in Making Measurements.

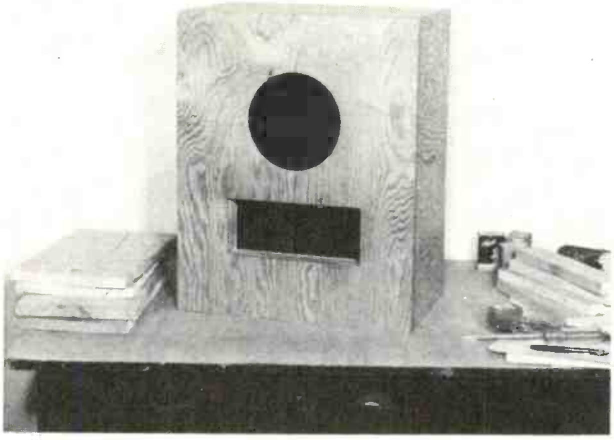

Figure 3. Front View of Reflex Enclosure Discussed in Text. Boards Used to Fill in Cabinet to Reduce Size Are Shown at Left.

Figure 4. Interior View of Enclosure. Ozite Padding, Duct on Port and Boards Installed on Inside of Back to Reduce Cabinet Size Are Shown.

in amplitude, now appear - one above the speaker resonant frequency and one below. These peaks can be reduced by proper damping.

An audio signal generator is required when determining the resonant frequency of the speaker. By connecting a resistor (100 to 200 ohms is satisfactory) in series with the output of the signal generator and the voice coil, the resonant frequency can be found by varying the signal, fed to the speaker, through a range of about 0-200 cps. The speaker must be held in the open air while this check is being made as any surface of appreciable size close to the cone, will load it and change the resonant point. As the generator frequency is varied through this range the resonant frequency will be evident as the frequency at which the cone movement is very pronounced. If an AC voltmeter, or the vertical input of an oscilloscope, is connected across the voice coil, the frequency is very readily indicated by the maximum voltage reading at that point. This is actually an indication of the increased impedance across the voice coil at resonance. The purpose of the series resistor is to isolate the speaker and make the peak reading more evident. The equipment used in making these tests can be seen in Figure 2.

It might be well to mention here that modern high quality audio power amplifiers have a damping action upon the speaker which reduces most of the peaks, in some instances, to such an extent that they are practically eliminated.

The enclosure (Figure 3) used to obtain the following data, was solidly constructed of 1/2-inch plywood with all joints reinforced with 3/4-inch material of sufficient length and secured with screws and glue to insure against air leaks and rattles. All flat inner surfaces were covered with 1/2-inch Ozite (Figure 4) to reduce reflections and absorb the high frequencies inside the cabinet. The back, with crossed braces screwed to its inside surface, was carefully fitted and fastened to the cabinet with wood screws as shown in Figure 5.

The resonant frequency of the new speaker was found to be 94 cps which was, as mentioned before, higher than the original. With this speaker installed in the cabinet, the signal generator was connected to the speaker, following the method previously described, to

* * Please turn to page 108 * *

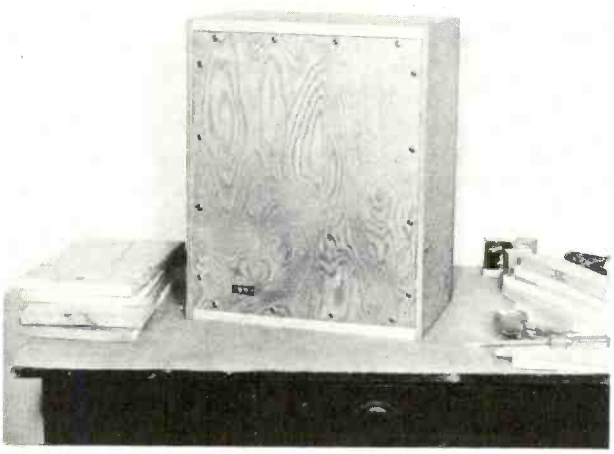

Figure 5. Rear View of Reflex Enclosure.

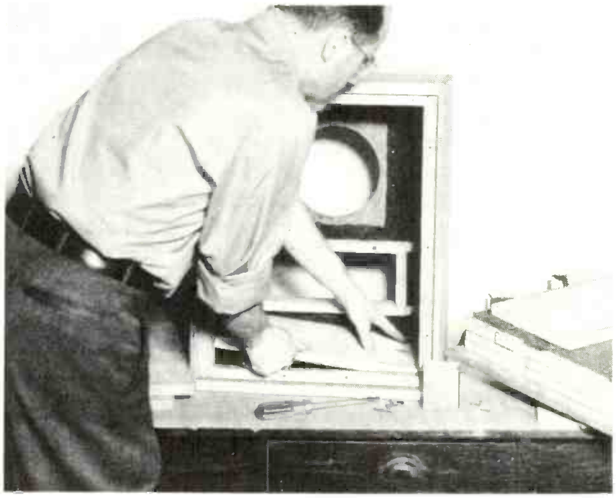

Figure 6. Installing Boards to Reduce Cabinet Size.

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- Attenuation- db/100 ft.

10 mc—	0.50	400 mc—	2.6
50 " —	0.95	500 " —	3.0
100 " —	1.11	1000 " —	4.6
200 " —	1.7		

- SO EASY TO INSTALL:

  Expose required length of wire by stripping off polyethylene. To tight-seal, heat end of tube with match or other flame and crimp together with pliers. Sealing assures quality performance under all atmospheric conditions.

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VERTICAL SWEEP SYSTEMS

BY C. P. OLIPHANT

(Part II)

Multivibrator: Another method of providing vertical sweep is through the use of the multivibrator type of oscillator. The main advantage in using a multivibrator is that it is usually less expensive to manufacture than the blocking oscillator, since it does not require the added expense of a feed-back transformer. However, the reason it is not used as much as the blocking oscillator is that the circuit is more critical to changes of tube characteristics. As the tube ages, any changes in characteristics of the tube affects the operation of the multivibrator circuit. The periods of oscillations of the multivibrator depend critically on the cut-off and conduction characteristics of the tube being used. If these characteristics should change appreciably over a period of time, the cut-off and conduction period of the circuit would be affected.

In Figure 7-14 is shown the basic circuit of a multivibrator. This circuit is known as a plate-coupled multivibrator. Basically the circuit is a two-stage amplifier. In order to sustain oscillations, the output of the second stage (V2) is coupled back to the input of the first (V1). It is possible to obtain oscillations in a circuit of this type because the output voltage appearing at the plate of the second stage is in phase with the voltage appearing at the input of the first stage. This fact is always true in the case of an even number of stages of amplification. In this way, the voltages always aid rather than oppose each other.

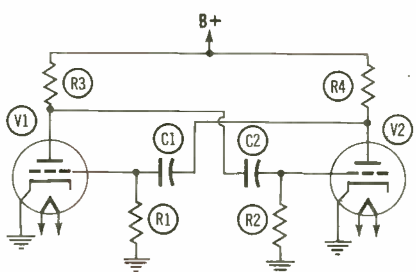

Figure 7-14. A Basic Multivibrator Circuit.

Upon the application of power to the circuit, both sections of the multivibrator tend to conduct. However, due to a slight disturbance in the circuit, one section will start to conduct sooner than the other section. If the characteristics of both tubes were exactly the same and the circuit elements were exactly matched, a state of equilibrium would exist and oscillations would not be produced. Conditions for perfect equilibrium are not obtainable in practice; therefore, oscillations will occur. There are a number of reasons why one plate will start to conduct slightly sooner than the other. It may be due to a lower plate resistance, a hotter cathode, or a slightly lower plate load resistance. Since this is the case, assume that V1 will start to conduct sooner than V2.

The operation of the multivibrator of Figure 7-14 can best be explained by presenting a numerical sequence of the events which occur. With the assumption made in the previous paragraph, the operation of the multivibrator is as follows.

1. With V1 increasing in conduction more rapidly than V2, the voltage drop across R3 increases and the plate voltage of V1 decreases. The rise in plate current of V1 is accompanied by a drop in plate-to-cathode resistance and also a drop in plate-to-cathode voltage.

2. As a result of the lower plate-to-cathode resistance of V1, a low resistive discharge path for C2 is formed. This discharge path, which is shown in Figure 7-15A, is through the grid resistor of V2 and through the low resistive path of V1.

3. Capacitor C1 acquires its charge during the time V1 is conducting. The first instant, the charge path is through R4 to ground and through the grid resistor R1. This charging current instantaneously places a positive charge on the grid of V1 which causes grid current flow from V1. With grid current flowing, the charge path of C1 is as shown in Figure 7-15B. As a result, the plate

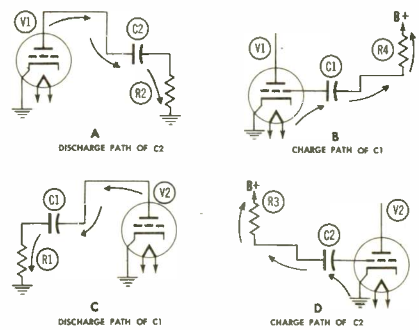

Figure 7-15. Charge and Discharge Paths of the Coupling Capacitors, C1 and C2 of Fig. 7-14.

current flow of V1 is further increased by the slightly positive potential on the grid.

4. The discharging of C2 through R2 applied a negative voltage on the grid of V2. With the voltage at the grid of V2 becoming more negative, the plate current of V2 diminishes. This results in an increase of plate-to-cathode voltage and an increase of plate-to-cathode resistance. The increase in plate voltage of V2 increases the charge on C1.

5. The discharging of C2 through the grid resistor of V2 drives the grid highly negative, driving it beyond plate current cut-off. V2 is held at cut-off until the grid voltage has increased to a value on the exponential discharge-time curve of C2 which will bring the tube out of cut-off. The rate at which capacitor C2 is able to dissipate its charge depends upon the time constant of C2R2.

6. With V2 brought out of cut-off by the discharge of C2, plate current starts to flow in V2. As a result of plate current flow in V2 there is a decrease of plate-to-cathode voltage and a decrease of plate-to-cathode resistance.

7. This lower plate-to-cathode resistance of V2 provides a low resistive path for the discharge of C1. This discharge path, which is shown in Figure 7-15C, is through the grid

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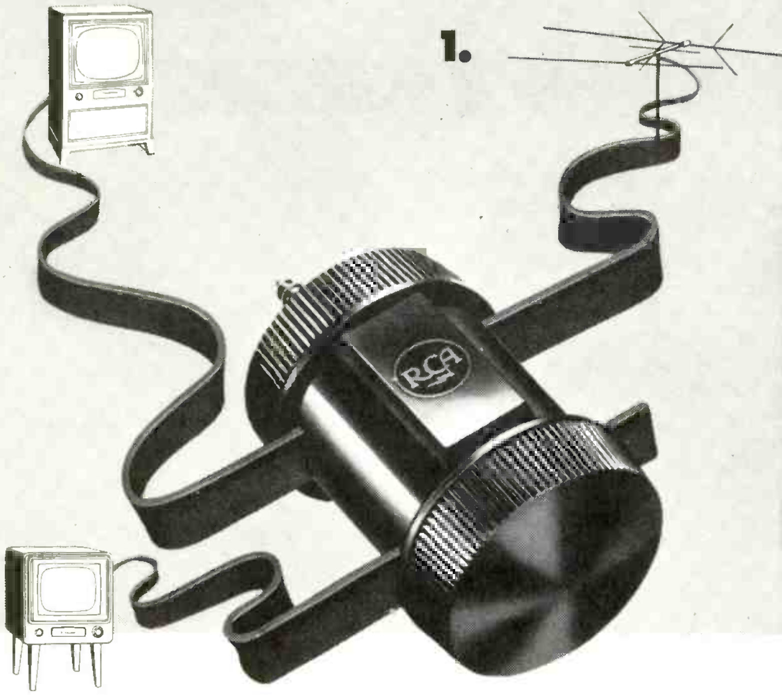

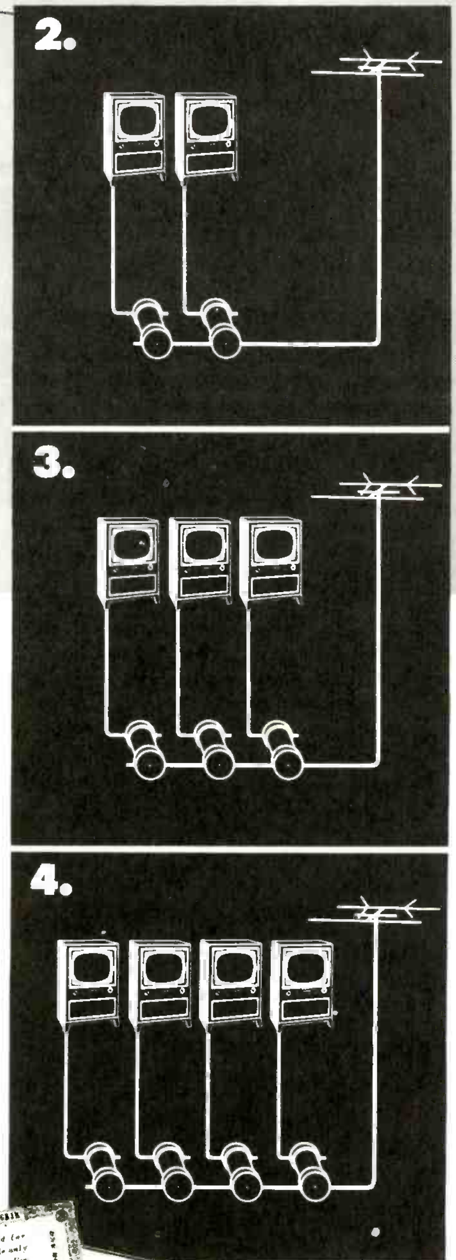

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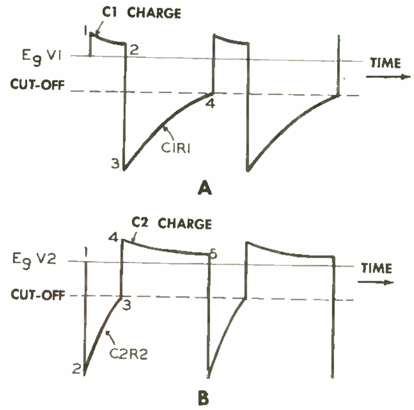

Figure 7-16. Grid Waveform of each Section of the Free-running Multivibrator of Fig. 7-14.
(A) Grid of V1. (B) Grid of V-2.

resistor of V1 and through the low resistive path of V2.

8. Capacitor C 2 acquires its charge during the time V2 is conducting. The first instant, the charge path is through R3 to ground and through the grid resistor R2. This charging current instantaneously places a positive charge on the grid of V2 which causes grid current flow from V2. With grid current flowing the charge path of C2 is as shown in Figure 7-15D. As a result, the plate current flow of V2 is further increased by the slight positive potential on the grid.

9. The discharging of C1 through R1 causes the grid of V1 to become negative. With the grid of V1 becoming negative, the plate current of V1 diminishes. This results in an increase of plate-to-cathode voltage and an increase of plate-to-cathode resistance. The increase in plate voltage of V1 increases the charge on C2.

10. The discharging of C1 through the grid resistor of V1 drives the grid highly negative, driving it beyond plate current cut-off. V1 is held at cut-off until the grid voltage has increased to a value on the exponential discharge-time curve of C1 which will bring the tube out of cut-off. The rate at which capacitor C1 is able to dissipate its charge depends upon the time constant of C1R1.

11. With V1 brought out of cut-off by the discharge of C1, plate current starts to flow in V1. As a result of plate current flow in V1 there is a decrease of plate-to-cathode voltage and a decrease of plate-to-cathode resistance. At this point, the cycle of events of the multivibrator is in the same condition as in step 1. At this time, a new cycle begins which is the same as the one previously described.

Figure 7-16 represents the grid waveform of each section of the free-running multivibrator of Figure 7-14. Waveform (A) is that which is present at the grid of V1. Waveform (B) is that which is present at the grid of V2. The portion of the waveform between points 1 and 2 of curve "A" is formed by the charging of C1. From point 2 to point 3, the voltage at the grid of V1 instantaneously drops far below the cutoff bias of the tube. The portion of the curve between points 3 and 4 of curve "A" is formed by the discharge of capacitor C1. At point 4 the waveform is repeated.

Curve "B" is the opposite curve "A". When curve "A" is going positive, curve "B" is going negative. From point 1 to point 2 of curve "B", the voltage at the grid of V2 drops far below the cutoff bias of the tube. The portion of the waveform between points 2 and 3 is formed by the discharge of C2. The charging of C2 is represented by the portion of the waveform between points 4 and 5. At point 5 the waveform is repeated.

A commercial type multivibrator used for the generation of the vertical sweep voltage is shown in Figure 7-17. This circuit incorporates the use of a plate-coupled multivibrator, which is representative of the type of circuit in Figure 7-14. This circuit follows through the same operation as was discussed in the previous section concerning the basic plate-coupled multivibrator. The only difference between the two circuits being the commercial circuit contains more components than the basic circuit of Figure 7-14. If the components of Figure 7-17 were lumped together the circuit would correspond to that of Figure 7-14.

The free-running frequency of the multivibrator is controlled by changing the discharge time of C80. This adjustment is R3A, which is the vertical hold control. Since this control is located in the grid circuit of V17B the duration of time the tube is cut off is determined by the setting of the hold control. This control is set so that the free-running frequency of the multivibrator is just below that of the incoming synchronizing pulse. The amplitude to which the charge voltage of the saw-tooth forming capacitor is able to reach, is controlled by the height control. This adjustment, R5, is located in the plate circuit of V17B. This control changes the B plus voltage applied to the charging network of V17B; thereby, increasing or lowering the amplitude of the sweep voltage.

The discharge capacitor of the multivibrator of Figure 7-17 is C82. This capacitor acquires its charge from the B plus supply through the plate load resistance of V17B while this section is not conducting. During the time section B is in conduction, the discharge capacitor discharges through the cathode resistance of the output amplifier and the low resistive path of V17B.

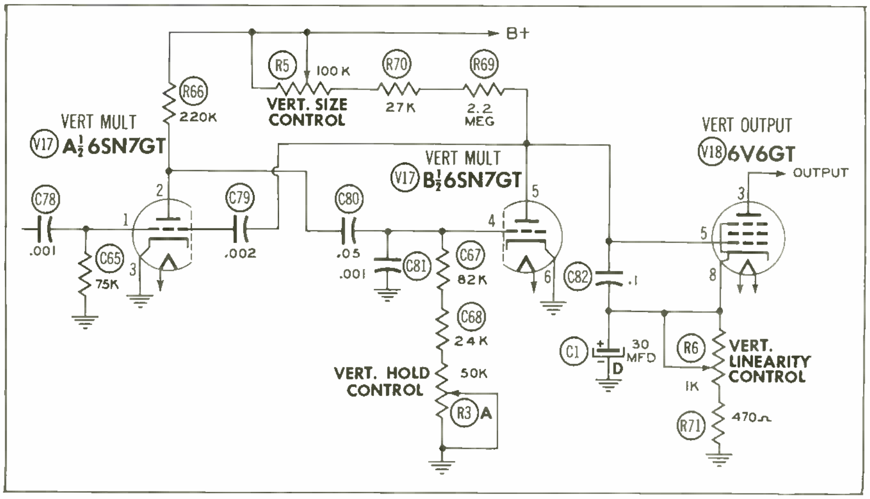

Figure 7-17. A Commercial Type Plate-coupled Multivibrator.

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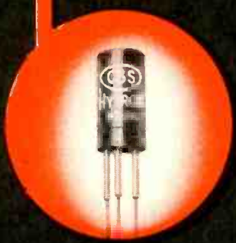
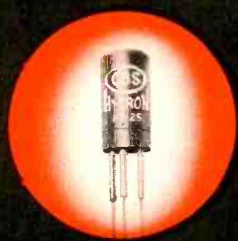


ACTUAL SIZE



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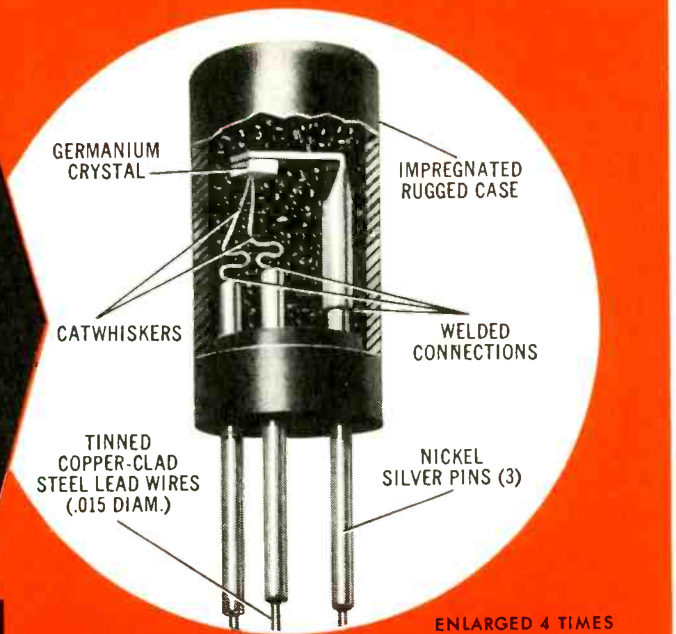

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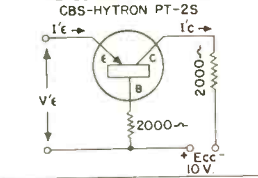
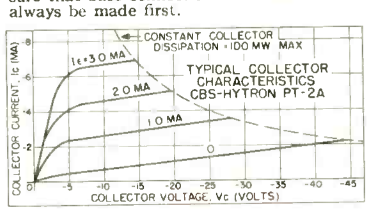
BASING AND SOCKET

Transistor Symbol | Basing Diagram (bottom view) | CBS-Hytron T-2 socket

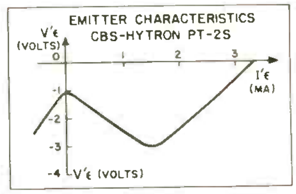
Note similarity of pin layout to that of transistor symbol. CBS-Hytron type T-2 transistor socket features groove to guide pins into socket. Also anti-burn-out design to insure that base connection of transistor will always be made first.

MEASURING CIRCUIT FOR CBS-HYTRON PT-2S





EMITTER CHARACTERISTICS CBS-HYTRON PT-2S



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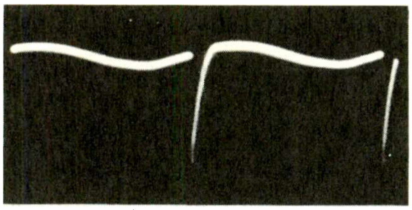
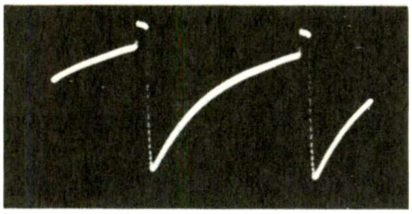
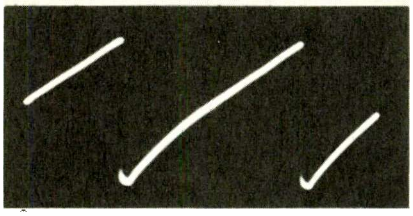


(A) Grid of V17A.



(B) Grid of V17B.



(C) Plate of V17B.

Figure 7-18. Operating Waveforms of the Plate-coupled Multivibrator of Fig. 7-17

The waveforms of Figure 7-18 show the operation of the plate-coupled multivibrator of Figure 7-17. Waveform "A" is the one present on grid number 1, while waveform "B" is the one that is present on grid number 4. Waveform "C" is the output sawtooth of the multivibrator.

A type of multivibrator more commonly used for the generation of the vertical sweep voltage is the cathode-coupled multivibrator. This type of multivibrator enjoys more popularity because of its simplicity of design and the fact that good stability is realized. The circuit of the cathode-coupled multivibrator differs from the plate-coupled multivibrator in two ways. The cathode-coupled circuit does not contain a feed-back capacitor from the output of the second stage to the grid of the first stage as is present in the circuit of the plate-coupled multivibrator. Also, a common cathode resistance is present in the circuit of the cathode-coupled multivibrator.

Figure 7-19 is a typical cathode-coupled multivibrator circuit. The feed-back voltage, necessary for oscillations, is obtained through the common cathode resistor, R84, and the coupling capacitor, C71. V15A drives V15B through the grid coupling circuit C71, R85, and R5. V15B is cut off by the conduction of V15A as C71 discharges through the grid resistance of V15B because of the drop in plate voltage of V15A. The cut-off of V15A is accomplished by the cathode bias produced across the common cathode resistor when V15B is conducting. The hold control, R5, operates the free-running frequency of the multivibrator.

The operation of the cathode-coupled multivibrator of Figure 7-19 is as follows. Upon the application of power to the circuit, both tubes are in the conduction condition because the control grids are substantially at zero potential. Following is a numerical sequence of events through which the circuit passes in order to produce an asymmetrical pulse.

1. Upon the application of power to the plates, capacitor C71 acquires a charge through R86, B plus supply, and from the grid to ground resistance of V15B. This charge is acquired very rapidly because the grid of V15B is initially at zero potential.

2. With plate current starting to flow in both tubes a bias voltage is built up across the common cathode resistor, R84, which will tend to cause the plate current of both tubes to start decreasing.

3. A lower plate to cathode voltage drop across V15A is present due to the decreased flow of plate current. As a result, a lower plate resistance of V15A is present.

4. The discharge of C71 will now be initiated, due to the reduced plate resistance of V15A. The discharge path of C71 is through R85 and R5 in the grid of V15B, through the common cathode resistor, and through the low resistive path of V15A.

5. With the discharge of C71 flowing through the grid resistance of V15B, a negative voltage is applied at the grid of V15B, driving it into cut-off. During the time V15B is cut off, V15A is conducting and biased only by its own plate current flowing through the common cathode resistor.

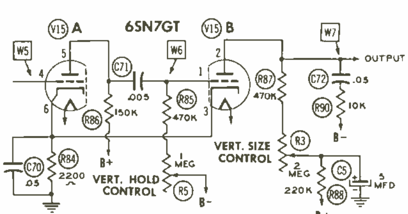


Figure 7-19. A Commercial Type Cathode-coupled Multivibrator.

6. When the bias on V15B decreases, due to the discharge of C71, to the point where it is equal to the cut-off potential, V15B will begin to conduct again.

7. When V15B suddenly conducts it produces a pulse of current through the common cathode resistor. Since this resistor is common to both V15A and V15B, the voltage produced immediately drives the grid of V15A negative with respect to its cathode.

8. With the grid of V15A more negative with respect to its cathode, the tube is driven into cut-off.

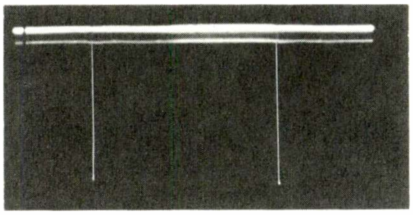
9. With V15A being cut off, there results a sudden increase in plate to cathode resistance and an increase of plate voltage on V15A. This sudden increase of plate voltage on V15A causes C71 to charge, thus instantaneously placing a positive voltage on the grid of V15B. This increase of positive voltage on the grid of V15B further increases the plate current flow.

10. The increase of plate current flow of V15B adds to the voltage across the common cathode resistor, which drives the grid of V15A further into cut-off region.

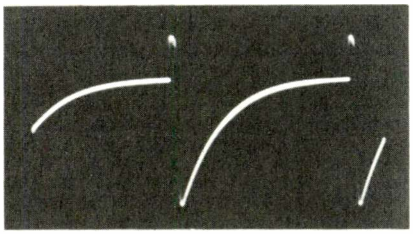
11. When C71 has charged to its full value the plate current of V15B ceases to increase which results in no further increase of the voltage across the common cathode resistor. With a decrease in bias voltage, V15A will begin to conduct.

12. With the start of plate current flow in V15A, C71 will start to discharge through the grid to ground resistance of V15B, the common cathode resistor, and through V15A. The discharge current flowing through the grid resistance of V15B places a negative potential on the grid which drives it into cut-off. At this point the cycle repeats itself.

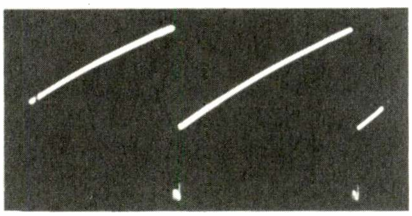
The cut-off time of V15B depends on the discharge time of C71, while the cut-off time of V15A depends on the charge time of C71. The charge time is made very much shorter than the discharge time in



(A) Grid of Tube 1, Point W5.



(B) Grid of Tube 2, Point W6.



(C) Plate of Tube 2, Point W7.

Figure 7-20. Operating Waveform of of the Cathode-coupled Multivibrator of Fig. 7-19.

order that an asymmetrical output can be obtained.

As in the case of the plate-coupled multivibrator, the circuit of Figure 7-19 can be compared with the circuit of a blocking oscillator and discharge tube. V15A corresponds to the blocking oscillator and V15B corresponds to the discharge tube. The discharge capacitor of the circuit of Figure 7-19 is C72. The charge portion of the sawtooth is formed when V15B is cutoff, while the discharge portion is formed when V15B is conducting.

The cathode-coupled multivibrator is controlled by a negative sync pulse that is fed directly from the integrating network. When the sync pulse is applied to the grid of V15A, the tube is cut off and ceases to conduct. At this time V15B begins conducting. With V15B in the conducting state, the sawtooth capacitor C72 starts to discharge through R90 and the low resistive path of V15B. At this time, the rapid flyback portion of the sawtooth waveform is developed in the output. When V15B is cut off by the action of the multivibrator circuit, C72 begins to acquire its charge from the B plus supply through the resistance combination of R88, R3, and R87. During the charge time of C72, the linear rise of the sawtooth is formed.

The variable resistor, R3, is the height control, which varies the amplitude of the sawtooth waveform. The frequency of the multivibrator is adjusted by the variable hold control, R5, located in the grid circuit of V15B. By decreasing the grid resistance of V15B, the frequency of oscillation is increased. On the other hand, by increasing the resistance, the frequency of oscillation is decreased. By proper setting of the vertical hold control the free-running frequency of the multivibrator is set so that it is slightly below the frequency of the controlling vertical sync pulse. The waveforms of Figure 7-20 show the operation of the cathode-coupled multivibrator of Figure 7-19. The waveforms show the operation at the grids of each section and the output of the multivibrator.

Another method employed for the vertical sweep system, which is unique in the fact that only two triode sections are used for the multivibrator and output amplifier, is shown in Figure 7-21. The circuit of Figure 7-21 employs the use of one-half of a 12AT7 for the first half of the multivibrator and uses a type 6S4 for the second half of the multivibrator and also the output amplifier. Other designs of this type of circuit have employed twin triode tubes of the type 6SN7GTA, 12BH7, and 6BL7, with the multivibrator and output amplifier circuits contained in the same envelope. The development of this type of circuit results in simplicity of design and reduced cost of manufacturing.

The circuit of Figure 7-21 is the same as a basic unbalanced multivibrator, with the circuit designed so that V14 will conduct longer than V13. This is accomplished by making the time constant of C57-R88 much longer than the time constant of C60-R80, R4. The desired trapezoidal waveform which is used for the vertical sweep is formed across C56 (sawtooth forming capacitor) and R87 (peaking resistance). This waveform is coupled to V14 through C57. In this stage the waveform is amplified to the desired height before it is fed to the deflection system.

The trace portion of the output waveform of the amplifier increases in a negative direction, which is the desired condition for the vertical sweep. Since the feed-back voltage must be positive in order for the multivibrator to function properly, a wave shaping network is employed in the coupling circuit to obtain the desired pulse. This network is a differentiating type circuit consisting of C58 and R85. The desired pulse is coupled from this network to the input of V13 through capacitor C60. This pulse is used to sustain oscillations in the multivibrator.

Drawings of the pulses present in the wave shaping network are shown in Figure 7-22. "A" is the trapezoidal waveform present at the plate of V14. "B" represents the pulse at point W1 after it has passed through the differentiating network. The pulse then passes through the

* * Please turn to page 110 * *

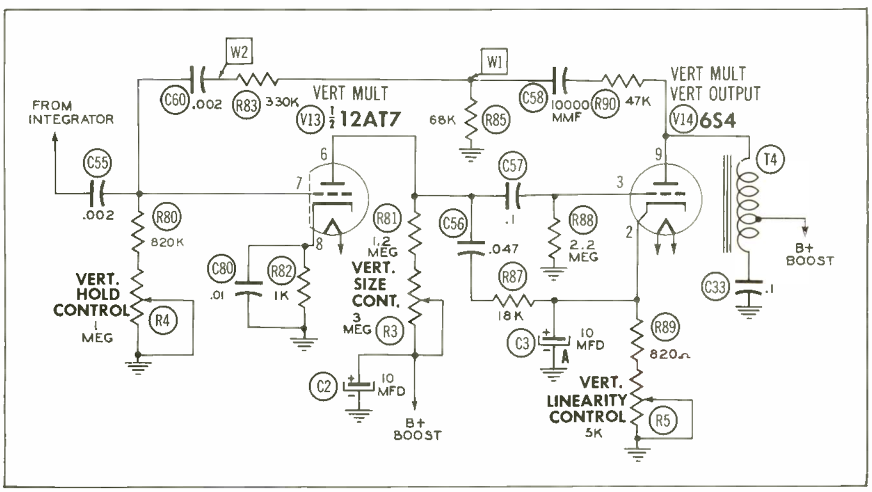


Figure 7-21. A Commercial Vertical Multivibrator Circuit Employing Two Triode Sections for the Multivibrator and Output Amplifier.

A PF INDEX UHF COVERAGE

A description of circuits and equipment for Ultra High Frequency reception.

by MERLE E. CHANEY

GE Model UHF-103 Tuner

The GE tuner Model UHF-103, shown in Figure 1, is a three channel UHF converter designed for installation in existing GE television receivers. It consists of a turret type tuning mechanism contained in a cylindrical shaped can. It employs a VHF-UHF switch, a 6AF4 oscillator tube, 6BK7 IF amplifier tube, a 1N72 crystal mixer, and components associated with these stages. Employing the double conversion system, the UHF tuner output is fed into the antenna input terminals of the VHF tuner which in turn provides the correct frequency for the video IF stages in the receiver.

The UHF-103 is supplied in kit form containing all the parts necessary to complete the installation. Part "A" of the kit consists of the tuner proper, power supply unit, side mounting knob and hardware, and installation instructions. Either bracket kit "C" or kit "D" is used in conjunction with kit "A". The table given below shows the exact model number for which the tuner assembly is designed and the correct bracket kit to obtain for each receiver.

Since the assembly is designed for installation in any one of a number of GE receivers, it may be found that some of the mounting hardware supplied with the kit is not required. In this case, the surplus items may be discarded.

Part "C" Kit for STRATOPOWER ("E" Line) RECEIVERS

17C125	21C206	21C214
20C107	21C208	21T1
21C201	21C208U	21T3
21C202	21C210	21T6
21C204		

Part "D" Kit for STANDARD ("AK" Line) RECEIVERS

17C113	17T10	21T2
17C117	17T11	21T4
17C120	17T12	21T5
17T7	20T2	

The procedure employed in the installation detail is divided into two parts; First, the fastening of the unit to the mounting hardware, and secondly, the physical placement of the assembly into the cabinet and completion of the electrical connections. It is unnecessary to remove the chassis for this installation, thus contributing to a saving of time.

Prior to placing the tuning assembly into the cabinet it should be determined if the UHF tuner output stage is set to the desired channel frequency. Nominally, the output stage is adjusted at the factory at the frequency of channel 5. However, if interference problems arise such as the presence of a strong channel 5 VHF station, the output stage should be adjusted to channel 6. With this adjustment made as required, the assembly can be mounted inside the cabinet.

A feature of the Model UHF-103 is that any combination of three UHF channels may be tuned by the tuning unit, provided of course that the tuned circuits have been pre-adjusted at the time of installation. The switching method employed to activate the UHF positions facilitates the selection of either VHF or UHF reception.

Figure 2 is a view of the tuning unit showing the turret assembly and components contained inside the structure. It is interesting to observe the method utilized in the fabrication and adjustment of the coil-like transmission lines. These lines are employed in the preselector and oscillator circuit and electrically are shorted quarter wave transmission lines. Although exhibiting the physical characteristics of an inductor it is noted that each winding is doubled back on itself. Advantages of the use of transmission lines as tuned circuits is retained while maintaining the small space requirements of conventional wound inductors at the frequencies used. It is further noted in the construction of these lines that the turns

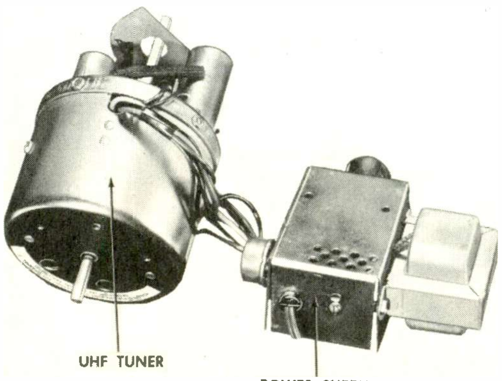


Figure 1. Photo of GE UHF Tuner Model UHF-103 with Included Power Supply.

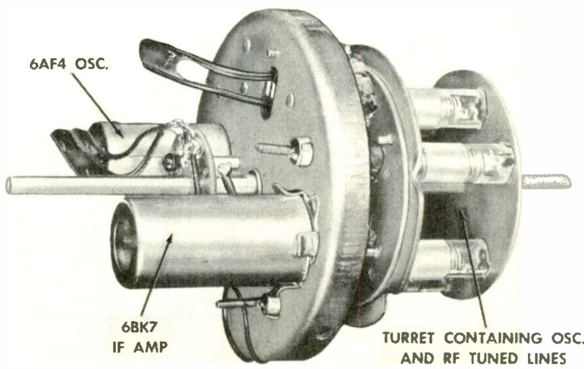


Figure 2. Photo of Tuner Turret with Shield Removed.

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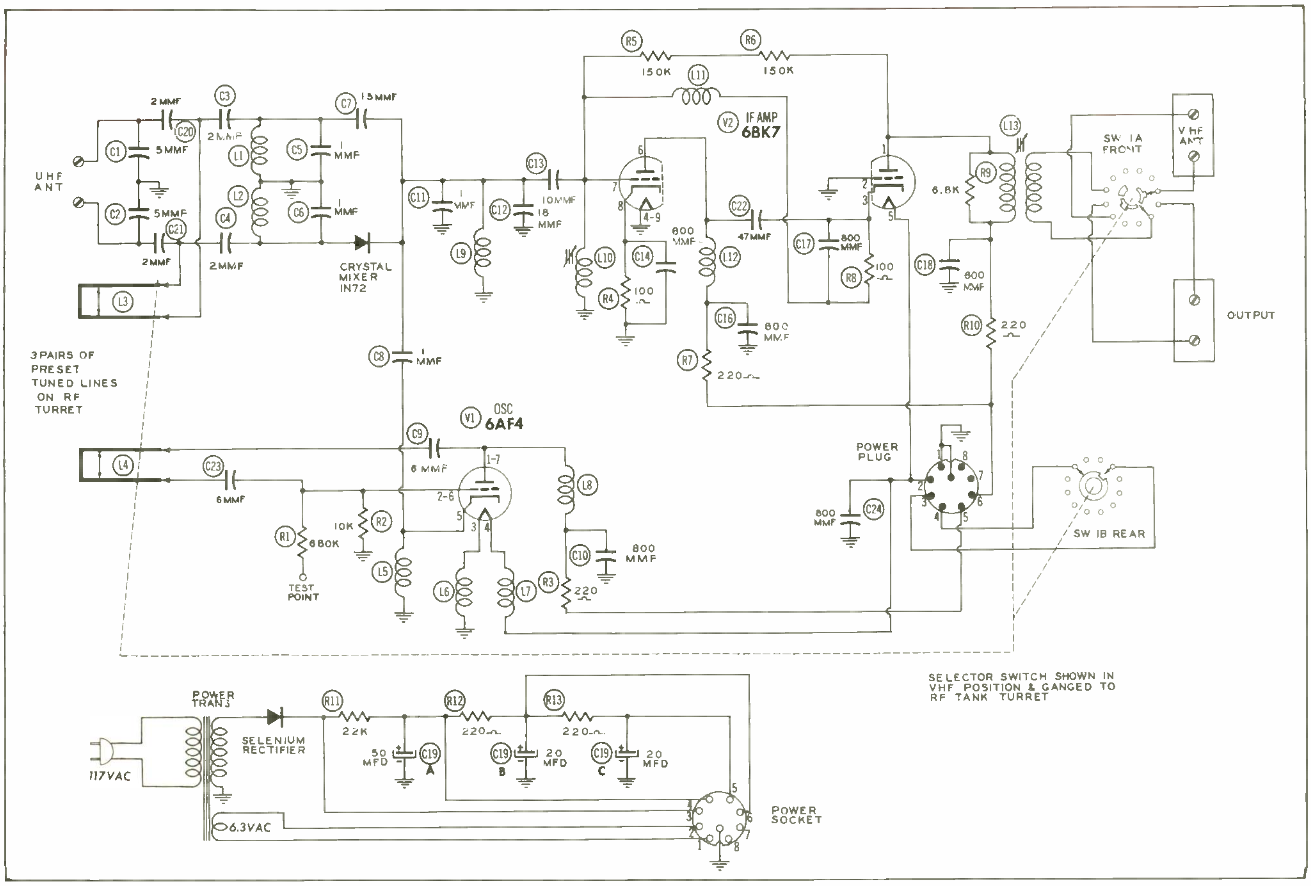

Figure 3. Schematic of GE Model UHF-103.

are formed of bare silver plated wire in such a manner as to accept a threaded silver plated shorting screw. Turning the screw clockwise reduces the length of the transmission line, thus controlling its resonant frequency.

Three pairs of lines are mounted on a detent plate inside the tuner unit. However, there are four detents in the plate. Three positions of the selector knob connect the various lines in the circuit while the fourth or VHF position is located such that the lines are out of the circuit. In this position contacts on a wafer switch connect a 22K resistor in series with the B+ line to the UHF oscillator stage. Additional contacts on the wafer switch disconnect the UHF tuner output and connect the VHF antenna lead to the input of the television receiver.

Operation of the television receiver to accept signals from UHF stations requires that the VHF tuning knob be set at either channel 5 or channel 6 position, determined by the setting of the UHF tuner output established at the time of installation. With the VHF tuning knob set at the desired channel and the UHF tuner switched to the desired UHF position, tuning of the signal proceeds in the accustomed manner as for VHF.

A schematic of the GE tuner Model UHF-103 is shown in Figure 3. An incoming UHF signal and a signal from the oscillator V1 are heterodyned in the mixer stage employing a 1N72 crystal. The resultant intermediate frequency signal is fed to the dual triode amplifier tube (V2) connected cascode and from

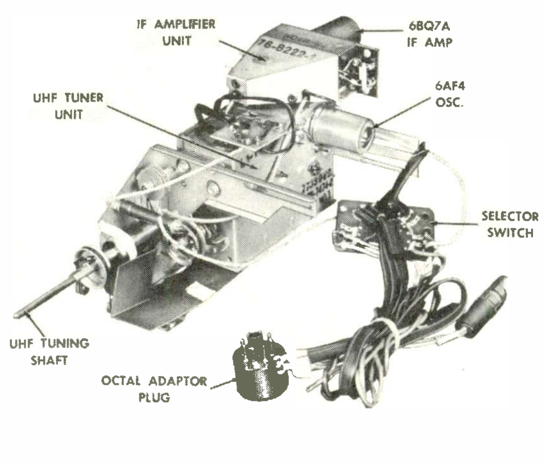

Figure 4. Philco UHF Converter Model UT-21A.

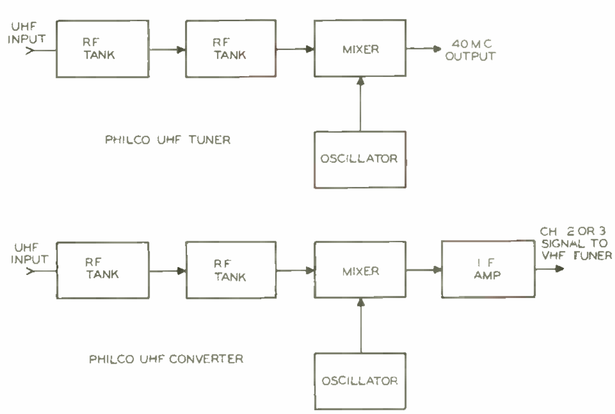

Figure 5. Block Diagram of Philco UHF Tuner and Converter.

INSTALLATION OF UHF TUNER ADAPTOR UT-21 (PUSH-PULL)

The following list of models will accept the adaptor as it is presently being assembled in production.

Model	Code	Model	Code	Model	Code	Model	Code	Model	Code
52-T1802	124	52-T1841	121	52-T2142	121	52-T2252	121	53-T1883	125
52-T1804	124	52-T1842	121	52-T2144	121	52-T2252	124	53-T1884	125
52-T1808	121	52-T1844	121	52-T2145	121	52-T2253	121	53-T1886	125
52-T1810	121	52-T1850	121	52-T2150	121	52-T2254	121	53-T2125	124
52-T1812	121	52-T2106	121	52-T2150	124	52-T2256	121	53-T2126	125
52-T1820	121	52-T2108	121	52-T2151	121	52-T2258	121	53-T2152	124
52-T1820	124	52-T2110	121	52-T2151	124	52-T2259	121	53-T2183	125
52-T1821	124	52-T2120	121	52-T2157	125	52-T1824	124	53-T2260	125
52-T1822	124	52-T2120	124	52-T2224	121	53-T1825	124	53-T2262	125
52-T1839	121	52-T2122	121	52-T2244	121	53-T1826	124	53-T2264	125
52-T1840	121	52-T2140	121	52-T2245	121	53-T1852	124		

The following is a list of models which will accommodate the subject adaptor revised with the cable kit 43-6690m to permit its assemble into receivers using TV-30 (cold) chassis:

Model	Code	Model	Code	Model	Code	Model	Code	Model	Code
51-T1601	121	51-T1836	125	51-T2138	124	52-T1812	123	52-T1844	124
51-T1601	122	51-T1870	121	51-T2170	121	52-T1820	123	52-T2106	122
51-T1602	121	51-T1871	121	51-T2175	124	52-T1827	123	52-T2106	123
51-T1602	122	51-T1871	122	51-T2176	124	52-T1831	122	52-T2108	122
51-T1607	121	51-T1872	121	52-T1610	122	52-T1831	124	52-T2108	123
51-T1607	122	51-T1872	122	52-T1612	122	52-T1839	122	52-T2110	122
51-T1634	123	51-T1874	121	52-T1802	122	52-T1839	123	52-T2110	123
51-T1634	124	51-T1875	121	52-T1802	123	52-T1840	122	52-T2140	122
51-T1800	121	51-T2102	121	52-T1804	122	52-T1840	123	52-T2140	123
51-T1800	122	51-T2102	122	52-T1804	123	52-T1841	123	52-T2142	122
51-T1830	121	51-T2130	121	52-T1808	122	52-T1842	122	52-T2142	123
51-T1832	121	51-T2132	121	52-T1808	123	52-T1842	123	52-T2175	124
51-T1883	121	51-T2133	121	52-T1810	122	52-T1842	124	52-T2176	124
51-T1834	121	51-T2134	124	52-T1810	123	52-T1844	122	52-T2275	123
51-T1836	123	51-T2136	124	52-T1812	122	52-T1844	123		

Model	Code	Ch.	UHF Type Adaptor
53-T1824	123	TV-80	UT-21A
53-T1824	124	TV-70	UT-21
53-T1825	123	TV-80	UT-21A
	124	TV-70	UT-21
53-T1826	124	TV-70	UT-21
53-T1827	126	TV-90	UT-20
	128	TV-90	UT-20
53-T1852	123	TV-80	UT-21A
	124	TV-70	UT-21
53-T1853	126	TV-90	UT-20
	128	TV-90	UT-20
53-T1854	123	TV-80	UT-21A
53-T1883	123	TV-80	UT-21A
	125	TV-45	UT-21
53-T1884	123	TV-80	UT-21A
	125	TV-45	UT-21
53-T1886	123	TV-80	UT-21A
	125	TV-45	UT-21
53-T2124	123	TV-80	UT-21A
53-T2125	123	TV-80	UT-21A
	124	TV-45	UT-21
53-T2126	125	TV-45	UT-21
53-T2127	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2152	123	TV-80	UT-21A
	124	TV-45	UT-21
53-T2183	125	TV-45	UT-21
53-T2226	123	TV-80	UT-21A
53-T2227	123	TV-80	UT-21A
53-T2228	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2228RC	126	TV-90	UT-20*
	128	TV-90	UT-20
53-T2255	123	TV-80	UT-21A

Model	Code	Ch.	UHF Type Adaptor
	133	TV-80	UT-21A
53-T2260	123	TV-80	UT-21A
	125	TV-45	UT-21
53-T2262	125	TV-45	UT-21
53-T2264	123	TV-80	UT-21A
	125	TV-45	UT-21
53-T2266	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2266RC	126	TV-90	UT-20*
	128	TV-90	UT-20
53-T2268	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2269	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2269RC	126	TV-90	UT-20*
	128	TV-90	UT-20
53-T2270	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2270RC	126	TV-90	UT-20*
	128	TV-90	UT-20
53-T2271	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2271RC	126	TV-90	UT-20*
	128	TV-90	UT-20
53-T2272	123	TV-80	UT-21A
53-T2273	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2285	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2285-S	128	TV-90	UT-20A
53-T2286	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2286RC	126	TV-90	UT-20*
	128	TV-90	UT-20

Model	Code	Ch.	UHF Type Adaptor
53-T2287	126	TV-90	UT-20
	128	TV-90	UT-20
53-T2287RC	126	TV-90	UT-20*
	128	TV-90	UT-20
A-T1814	123	TV-80	UT-21A
A-T1816	123	TV-80	UT-21B
A-T1817	123	TV-80	UT-21B
A-T1818	128	TV-90	UT-20A
A-T1856	123	TV-80	UT-21B
A-T1858	128	TV-90	UT-20A
A-T1887	123	TV-80	UT-21B
A-T1888	123	TV-80	UT-21B
A-T2230	123	TV-80	UT-21B
A-T2232	123	TV-80	UT-21B
A-T2233	128	TV-90	UT-20A
A-T2234	128	TV-90	UT-20A
A-T2262	123	TV-80	UT-21B
A-T2266	128	TV-90	UT-20A
A-T2271	128	TV-90	UT-20A
A-T2272	123	TV-80	UT-21B
A-T2274	123	TV-80	UT-21B
A-T2277	123	TV-80	UT-21B
A-T2279	123	TV-80	UT-21B
A-T2280	128	TV-90	UT-20A
A-T2281	128	TV-90	UT-20A
A-T2288	123	TV-80	UT-21B
A-T2289	128	TV-90	UT-20A
A-T2290	123	TV-80	UT-21B
A-T2292	128	TV-90	UT-20A
A-T2750	127	TV-97	UT-20A**

* Shaft extension kit 43-6476 used in conjunction with UT20 on Remote sets.

** Extension cable kit 43-6593 used in conjunction with UT20A for 27" sets.

Figure 6. Table of Philco TV Receivers Showing UHF Tuning Kit to Obtain for Installation.

UHF Adaptor	Designed for Chassis Type	May Be Adapted to Listed Chassis Type
UT-20A	"A" Line TV-90 Series	"A" Line TV-97 (See Note 1.)
UT-20	'53 Line TV-90 Series	"A" Line TV-90 Series (See Note 2.)
UT-21	Universal Adaptor for '52 Line TV-40, TV-45, TV-70 Series	'53 Line TV-80, '53 Line TV-90, "A" Line TV-80, "A" Line TV-90 (See Note 2.)
UT-21A	'53 Line TV-80	'53 Line TV-90, "A" Line TV-90, "A" Line TV-80 (See Note 2.)
UT-21B	"A" Line TV-80	"A" Line TV-90, "A" Line TV-97 (See Notes 1 and 2.)

GENERAL

When using UT-21, 21A, or 21B with TV-90 or TV-97 it is necessary to use Channel 2 or 3 of the TV-90 or TV-97 instead of the UHF position on the VHF tuner.

NOTE 1.

To use UT-20A or UT-21B with TV-97 it is necessary to extend the length of the plug and cable assembly which supplies power to the tuner.

NOTE 2.

The "A" line TV-80 and TV-97 control panel has a cutout (see attached diagram) to accommodate the "A" line Beam of Light Tuner UT-20A or UT-21B. In order to mount UT-20, UT-21, or UT-21A to "A" line receivers it is necessary to change the mounting of the control Bezel (see attached diagram). Brackets for this special mounting may be procured from your Philco distributor.

Figure 6. Table of Philco TV Receivers Showing UHF Tuning Kit to Obtain for Installation.

there to the output transformer L13. This transformer tuned to resonance at either channel 5 or 6 frequency provides an IF signal to the output terminals of the UHF unit which in turn is fed to the input terminals of the VHF tuner unit.

The power supply shown in Figure 3 is used to provide B+ and filament voltage to the UHF oscillator and IF tubes. This is required since the GE receivers for which the UHF-103 is designed employ series filament strings, and have one side of the AC line connected to chassis. It is important, therefore, that the tuner assembly does not make contact with the TV chassis since one side of the AC line would be connected to the control shafts of the television receiver. Also do not permit the transmission lines to contact any portion of the television chassis.

From an operational standpoint it is seen that selection of either VHF or UHF stations by a GE receiver equipped with a Model UHF-103 is a simple procedure. Also availability of reception of all VHF channels has not been impaired while a total of three UHF stations may be selected providing such a number exists within receiving range.

PHILCO - UHF Tuning Devices -

Philco is providing UHF reception through the use of built-in type UHF units continuously tunable over the full UHF TV range. These units are either installed at the factory or maybe obtained for installation in the field. To facilitate the details of installing UHF units in the field, all kits are supplied with adapter sockets, plugs and connectors such that no soldering is required.

The Philco UHF tuning devices are produced in two basic types. The first is strictly a tuner that changes an incoming UHF signal to an IF frequency in the 40 megacycle range in a single conversion process. This type unit is installed in Philco receivers that have a UHF position on the VHF tuner. When the VHF tuner is switched to this UHF position, it becomes a two stage IF amplifier for accepting and amplifying the UHF tuner output prior to application of the signal to the receiver's IF stages.

The second type of UHF unit produced by Philco is a converter type unit. A photo of Philco built-in converter Model UT-21A is shown in Figure 4. In this case the incoming UHF signal is converted to a channel 2 or 3 signal which can be accepted by the VHF tuner in the receiver when switched to channel 2 or 3 position. Figure 5 illustrates in block diagram form the function of the two types of Philco UHF tuning units.

A number of variations are required in the UHF units to provide all the later model Philco receivers with built-in UHF facilities. Circuit-wise all units are similar in design and in many cases the differences are mechanical in nature.

The table given in Figure 6 lists the tuner kits and the Philco TV receivers for which each is designed.

Schematics of the Philco UHF tuner and converter are shown in Figure 7 and 8 respectively. Philco converter unit UT-21 is identical as that shown in Figure 8 except for the switch variation and a different type adapter socket illustrated in Figure 9.

An explanation of the circuitry shown in Figure 8 should serve to illustrate the function of all the Philco UHF tuning units. The antenna RF tank, mixer RF tank and oscillator tank are tuned by a three gang capacitor. An even distribution of channel spacing indications on the UHF dial is accomplished by employing cut-plate construction in the tuning capacitors.

An incoming UHF signal is fed to the antenna tank coil and from there is coupled by mutual coupling

* * Please turn to page 95 * *

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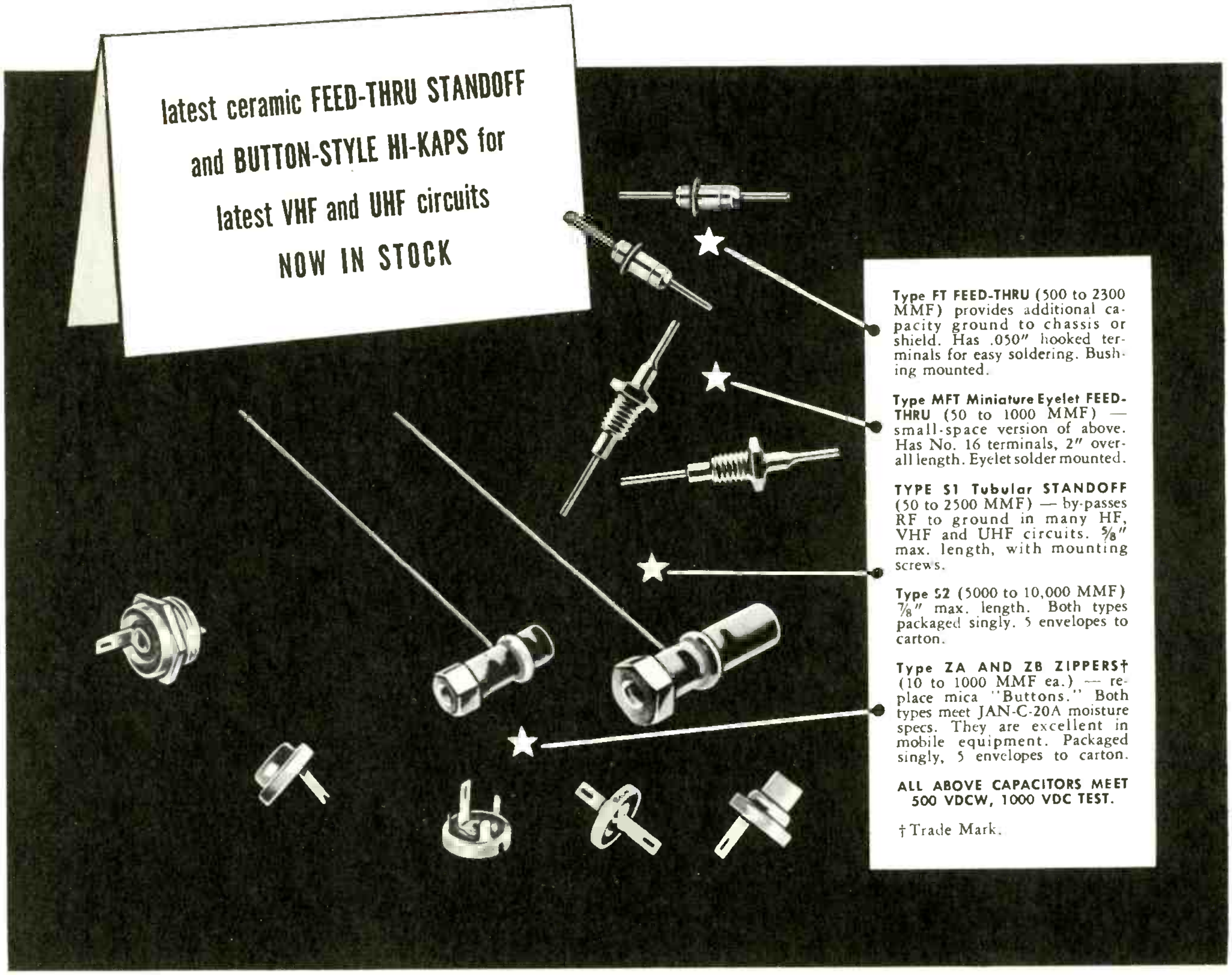

Type FT FEED-THRU (500 to 2300 MMF) provides additional capacity ground to chassis or shield. Has .050″ hooked terminals for easy soldering. Bushing mounted.

Type MFT Miniature Eyelet FEED-THRU (50 to 1000 MMF) — small-space version of above. Has No. 16 terminals, 2″ overall length. Eyelet solder mounted.

TYPE S1 Tubular STANDOFF (50 to 2500 MMF) — by-passes RF to ground in many HF, VHF and UHF circuits. ⅝″ max. length, with mounting screws.

Type S2 (5000 to 10,000 MMF) ⅞″ max. length. Both types packaged singly. 5 envelopes to carton.

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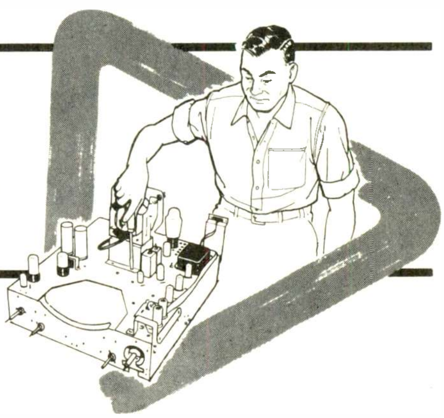

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Rejuvenating Front Panel Knobs

A problem sometimes arises in connection with certain types of front panel knobs used on television receivers. These knobs become worn in such a way that the set owner begins to experience difficulty with slippage between knob and shaft. In order to engage the shaft he is obliged to press the knob tightly against the panel while rotating it. As time goes by this condition becomes worse until finally the knob completely fails to perform its function.

The sketch in Figure 1 shows a style of control knob that has proved to be a frequent offender. There are two opposing keys in the center hole of the knob. These keys fit into keyways cut into the shaft, and normally a firm interlocking of knob and shaft is accomplished. However, the difficulty appears when the keys in the plastic knob start to wear away and fail to mesh securely with the shaft keyways. This wear is most liable to occur in cases where the portion of shaft length extending beyond the front panel of the cabinet is too short; hence the knob engages only the very end of its shaft and the stress on the keys is concentrated.

Such a condition has been known to happen after picture tube replacement. If the new tube is mounted too far forward on the chassis, the control shafts will not extend out their original distance in front of the cabinet. This is something to guard against when making picture tube changes.

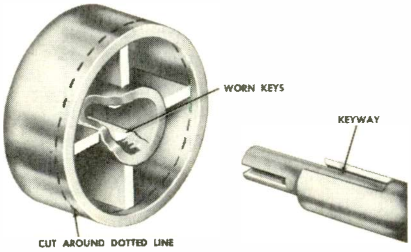

Figure 1. Worn Knob with Dotted Line Marking the Flange Cut.

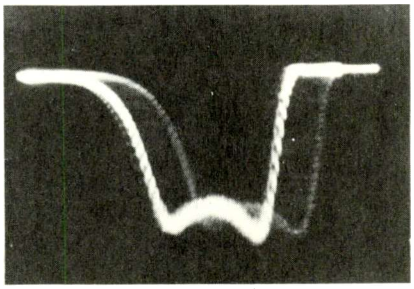

Figure 2. Response Curve with "Ghost" Produced by Horizontal Oscillator Radiation from TV Set.

The wear on the keys is usually confined to their ends on the back side of the knob. The worn portion of one of the keys is visible in the drawing of Figure 1.

Of course, a new knob can be ordered, and in severe cases it should be. However, if a remedy is not found for the inadequate locking between knob and shaft, the new knob may, after short use, follow the way of the old. One sure cure is to move the chassis forward until sufficient shaft length protrudes from the cabinet. But this is not always convenient or possible. In such cases a very practical solution may be had by operating on the knob itself.

Many knobs have flanges on their rims which can be removed by careful use of a sharp knife or coarse sandpaper. For example, a cut along the dotted line in Figure 1 will remove the flange and enable the knob to be moved, sometimes as much as 1/8 inch farther back on its shaft. In this way the keys and their respective keyways will mesh securely and wear will less likely take place during use. Only the flange should be removed in this operation; no cutting should be done around the shaft hole in the knob.

An Alignment Difficulty Caused By Horizontal Oscillator Radiation

During an alignment procedure, the service technician might suddenly find himself faced with an oscilloscope picture like the one in Figure 2. The response curve is present all right, but there seems to be a ghost-like pattern trailing after it. Manipulating the phasing adjustment on the sweep generator fails to improve the picture.

By observing carefully the nature of the undesired image on the scope screen, one may note that in tracing the "ghost" the beam seems to be traveling very rapidly in a horizontal direction; the vertical motion of the beam is apparently as it should be. This clue is enough to indicate the horizontal section of the scope is affected.

Upon further investigation, the connection between the sweep generator and the horizontal input of the scope comes under surveillance. This is the connection which provides the scope with horizontal sweep voltage. When the lead is grasped in the hand, a sharp change is noted in the character of the scope pattern.

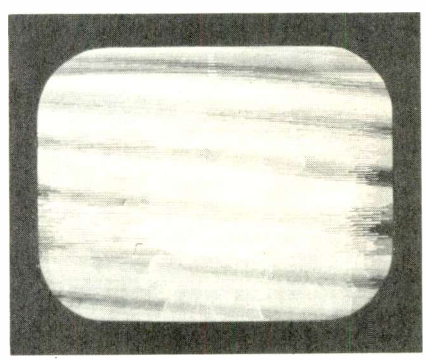

Figure 3. Random Operation of a Horizontal Oscillator Produces Characteristic "Christmas Tree" Effect.

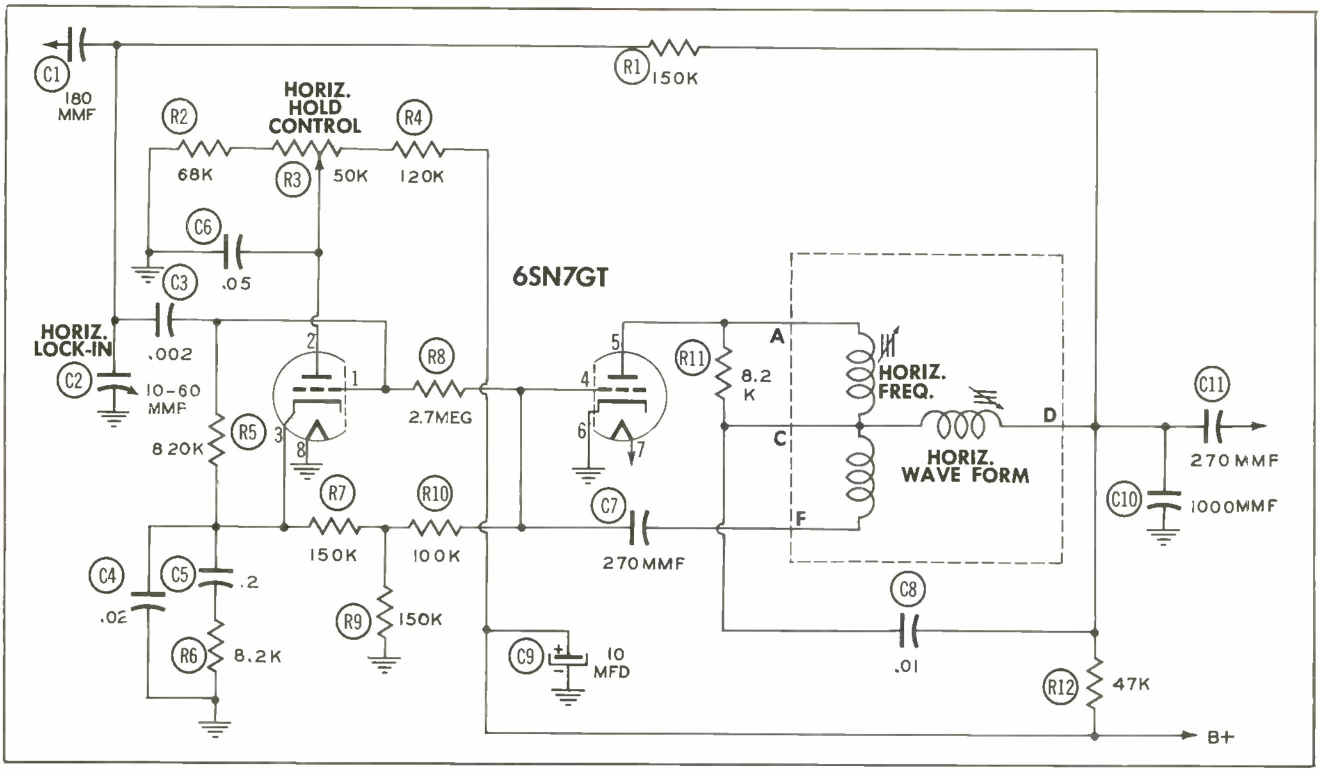

Figure 4. Typical "Synchroguide" Circuit.

It then becomes clear that undesireable interference is being picked up by the lead in question. This interfering signal must be a good deal higher in frequency than 60 cycles because of the rapid horizontal movement of the beam.

What would be a likely source for a signal strong enough to produce this kind of interference? The horizontal output circuit of the television receiver under test is the natural suspect. Its guilt may be substantiated by moving the lead toward or away from the horizontal output circuit of the receiver and noting the pronounced change in the "ghost" pattern. Once the origin of the trouble has been traced in this manner, the remedy is quick to come by.

The unshielded lead connecting the sweep generator with the scope may be replaced by a shielded lead. This will reduce the possibility of interference pick up in this lead to a minimum. Furthermore, in many sets the horizontal oscillator tube may be safely removed when making IF and RF alignments provided there is a current limiting resistor in the cathode circuit of the horizontal output tube.

Remedy For "Christmas Tree" Effect

Multiple triggering of the horizontal oscillator in a television set produces a characteristic pattern on the screen similar to Figure 3. This phenomenon is known as "Christmas Tree" effect because, on occasion, a bright outline of lines in the rough shape of a Christmas tree appears. With some types of receivers the oscillator performs these gyrations for a few moments during warm-up and then snaps into synchronization. Usually if the condition lasts for only a very brief period, there are no customer complaints. However, if the effect begins to persist for a longer time, some remedial measures may be called for.

The circuit of Figure 4 is a type of Synchroguide* circuit, a not

* Registered trademark of Radio Corporation of America.

* * Please turn to page 113 * *

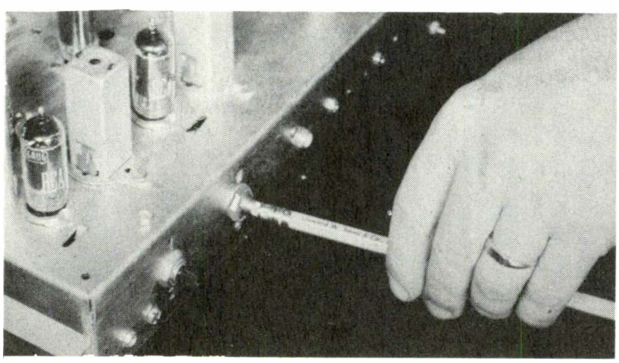

Figure 5. Using a Pencil as a Control Shaft Extension.

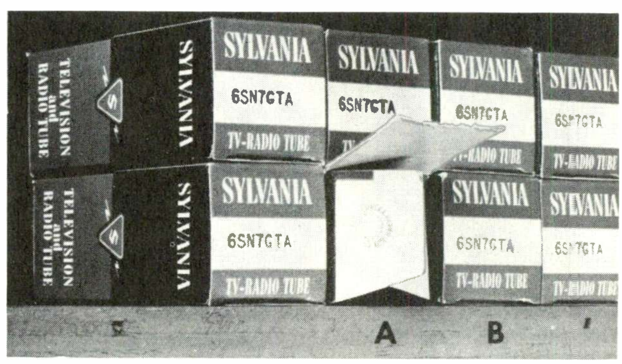

Figure 6. Sylvania Tube Cartons (A) Badly Worn and (B) Neat and New.

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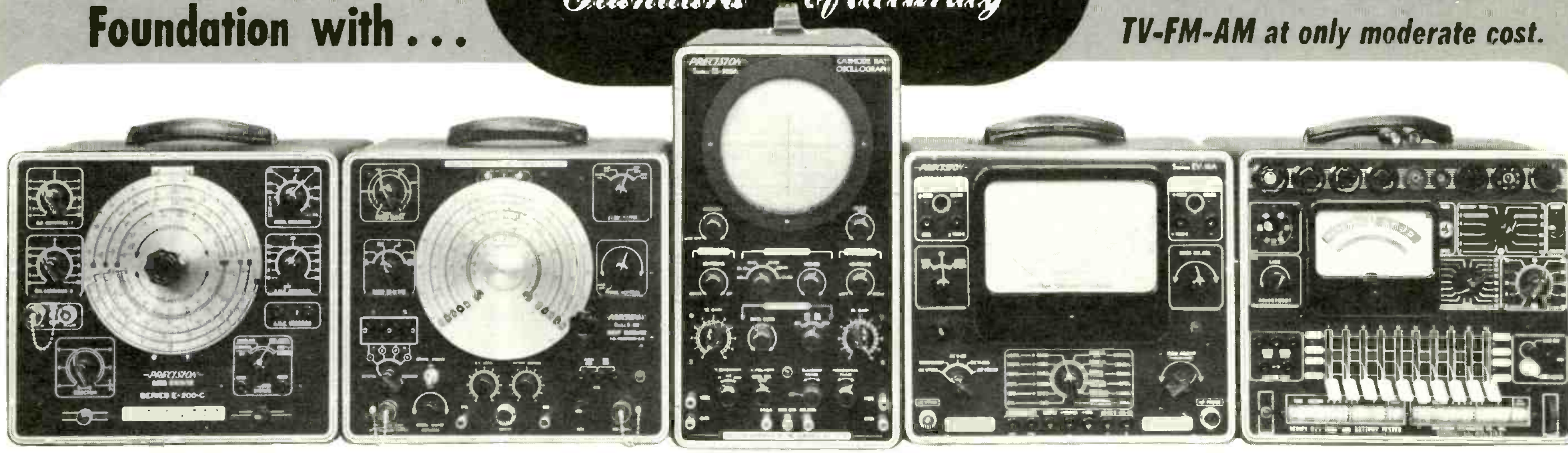

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Examining DESIGN FEATURES

by MERLE E. CHANEY

ADMIRAL PRINTED CIRCUIT CHASSIS

Admiral Models 5S21AN, 5S22AN, 5S23AN, using the 5C3 radio chassis, employ the printed circuit wiring technique in place of hookup wire. The suffix letter "A" in the model number designates the use of printed circuitry. Models without the suffix "A" use the 5S2 chassis.

A photo of an Admiral radio receiver employing the printed circuit chassis is shown in Figure 1. Although early and late production versions of this receiver employ slight variations in the routing of the printed circuit leads, they are electrically the same.

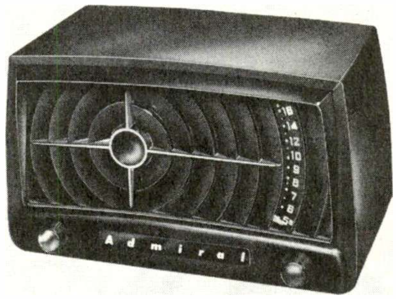

Figure 1. Admiral Radio Receiver Employing Printed Circuit Chassis.

Advantages claimed for the printed circuit wiring technique are: greater uniformity of chassis wiring, fewer wiring troubles, and simplicity of trouble-shooting and circuit-tracing. To aid servicing, all components are mounted above the chassis plate (Figure 2) and are of standard type.

The circuit employed in the 5C3 chassis is the familiar 5-tube AC-DC superheterodyne type. From this fact, standard trouble-shooting procedures may be employed when servicing the unit. There are, however, certain precautions that should be taken because of the unique method of chassis wiring. It is important that the chassis should not be set down on a metallic bench surface since the circuits could easily short out. Also, since one side of the line connects to the B- or chassis ground, the use of an isolating type line transformer is recommended. If it should become necessary to replace a component, use an iron whose wattage is no greater than 60 watts. Heat the connection of the component lug or lead where it connects to the printed circuit and shake off excess solder. In this manner, the component may be easily removed. Another factor influencing quick servicing is that a defective tube socket pin clip may be unsoldered and removed individually without the necessity of replacing the entire tube socket. Socket pin clips are available for replacement purposes and obtained under part number 87A35-2.

Because of the open nature of all lead and component connections, trouble-shooting is facilitated. During voltage or resistance measurements, it is advisable to use needle-point test prods to avoid shorting out sections of the printed circuit.

A damaged section of a printed circuit lead presents no problem since a short length of hookup wire may be readily soldered across the gap.

Additional space saving and simplification of circuitry is maintained by the use of a printed circuit unit in the AF circuit. A total of eight capacitor and resistor components are enclosed in this unit. Should any of these components in this unit become defective, it is recommended that the entire unit be replaced.

The printed circuit wiring leads, shown in Figure 3, are contained on a small plastic base measuring about 1/16-inch thick, 2-1/2-inches wide, and 5-3/4-inches long. The leads are formed on the chassis base by a photo-engraving process. Since the printed circuit is on one side of the base only, all soldering is done from this side. This feature is conducive to a single dip solder process.

After the soldering is completed, the printed circuit chassis base is coated with a quick-drying substance for protection against shorts or leakage due to moisture and the depositing of dust or foreign material.

GENERAL ELECTRIC RECEIVER EMPLOYING DIP SOLDER TECHNIQUE

Features associated with the General Electric Model 542 radio

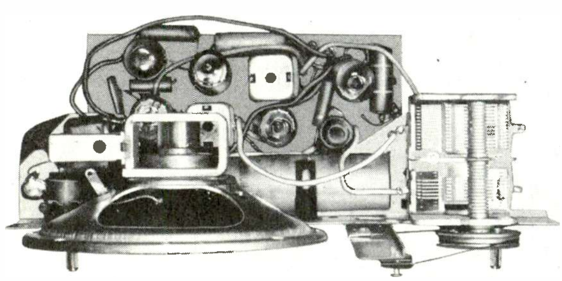

Figure 2. Component Arrangement in Admiral Radio.

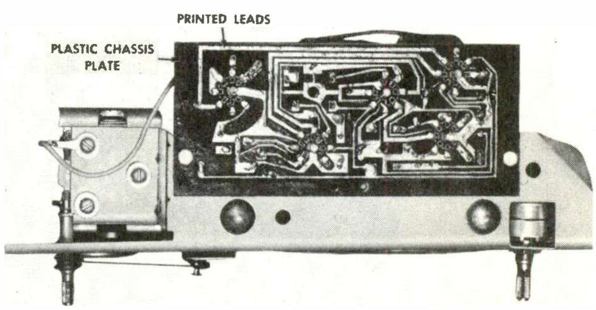

Figure 3. Printed Circuit Leads Formed on Plastic Chassis Plate.

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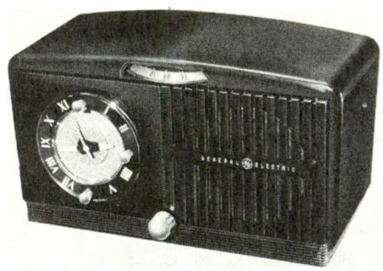

Figure 4. General Electric Radio Receiver Model 542.

receiver are chiefly mechanical in nature. They are of interest primarily because of the particular methods utilized to manufacture the receiver through mass-production techniques.

The Model 542 (Figure 4) is an AC-DC type receiver employing 5 miniature tubes in the familiar superheterodyne circuit. Externally, the appearance of the cabinet is in keeping with current design. However, when the chassis is removed, it is observed that a plastic shield surrounds all the tubes. See Figure 5. The purpose of the shield is to prevent accidental contact with pin-type terminal connections which extend through each tube socket to the top of the chassis. Eight pin-type terminals are on each socket with seven pins connecting to the tube pin clips. The remaining terminal is a spare and utilized as a connector terminal for component leads. Figure 6 shows the construction details of a socket. The side view shows the manner in which the component leads are inserted in the socket.

Each pin terminal on the tube socket is hollow. Thus, during assembly, wire leads and component leads are inserted in the proper terminals. It is unnecessary to bend and crimp each lead as is customary with many assembly procedures. Also, individual soldering of each connection is omitted. At this stage, the IF transformers, variable capacitor, and speaker are temporarily left off the chassis. The chassis is then inverted and dipped in molten solder effecting simultaneous soldering of all pin terminals. The remaining components may then be connected in the circuits by individual soldering. A bottom view of the chassis with the completed wiring is shown in Figure 7.

Servicing the Model 542 receiver may be performed without departing from standard practice. However, it is suggested, when components are replaced, that the plastic shield be left in place in most instances. This eliminates the possibility of causing damage to the tube socket and terminals. Components may be added by first clipping the connecting leads to the pin terminals and forming a small loop at the connecting leads. Crimping and soldering these connections yields a satisfactory repair job with a minimum expenditure of time.

The Model 542 is an AC-DC receiver and one side of the power line is connected to B-. Possible damage to the receiver and test equipment may be avoided through use of an isolating transformer during test procedures.

Although this technique of chassis assembly is not necessarily intended to provide additional performance characteristics, it is evident that production-wise, certain gains have been sought to achieve accelerated assembly processes and greater uniformity of the finished product.

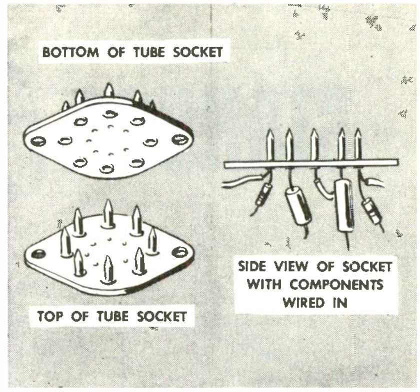

Figure 6. Construction Details of Socket Employing Hollow Tubular Terminals.

GENERAL ELECTRIC
MODEL 21T1

A new technique employed in the fabrication and assembly of General Electric receivers is illustrated in the G. E. Model 21T1 television receiver.

This technique, particularly associated with this receiver, has to do with wiring and component placement procedures and methods. Standard techniques require that the component leads and wires be individually placed in each lug or terminal opening, manually bent and crimped to insure mechanical connection, and then individually soldered. A process utilized by G. E. greatly minimizes the time required to complete each individual connection. Through the use of special types of hollow terminal lugs, which are designed to extend through to the top of the chassis, wires and leads from components are inserted in the respective terminal lugs. Figure 8 illustrates the placement of the terminal strips and components. After this process is completed, the chassis is inverted and dipped into molten solder which

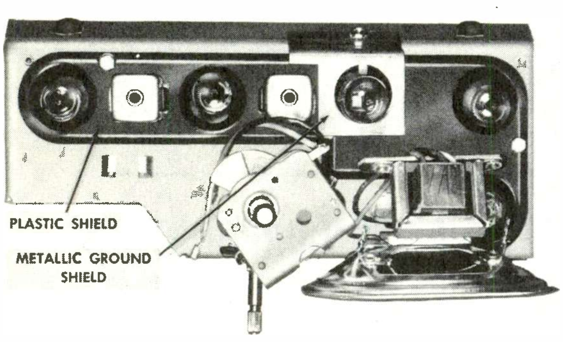

Figure 5. GE Chassis with Plastic Shield Surrounding Socket Terminals.

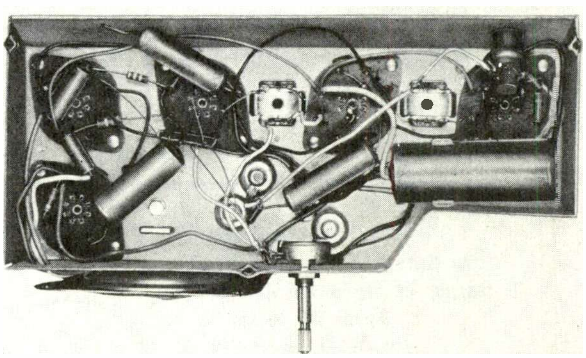

Figure 7. Bottom View of Model 542 Showing Completed Wiring.

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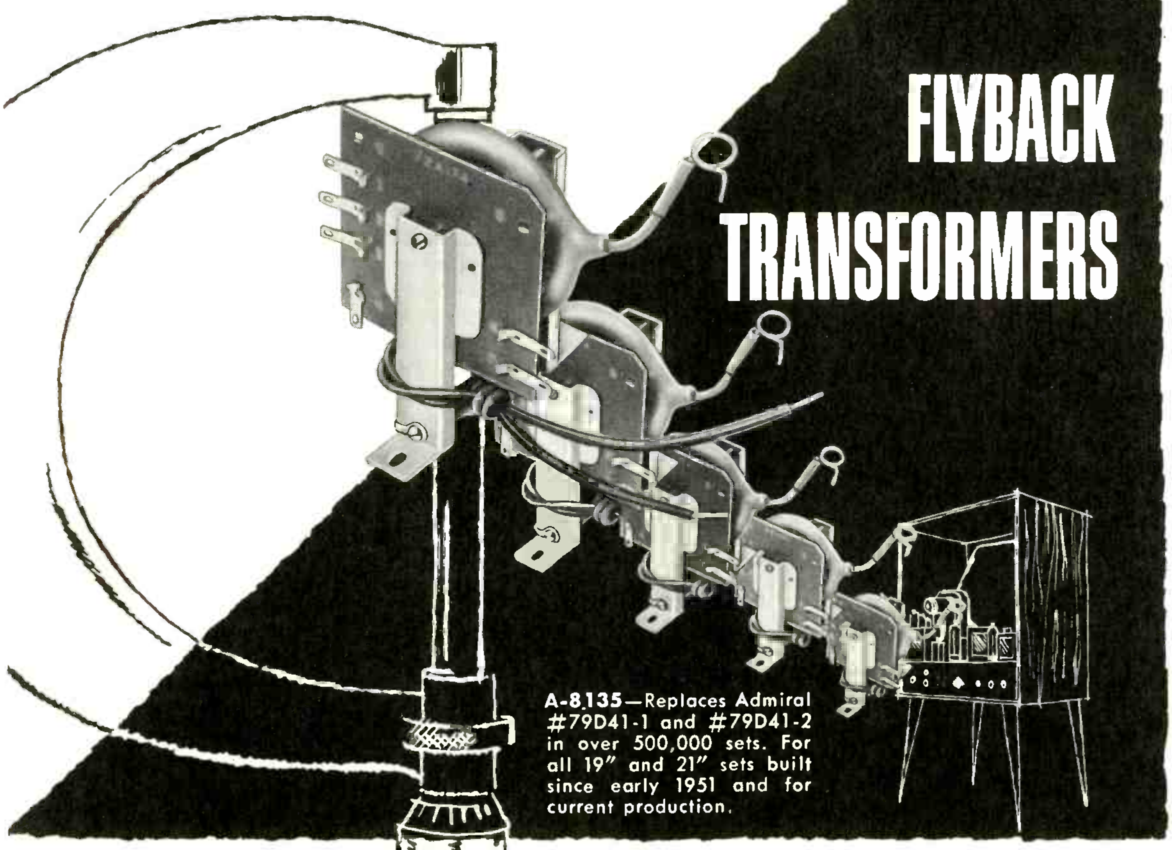

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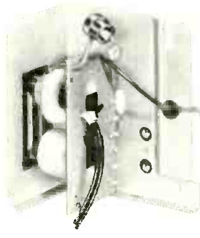
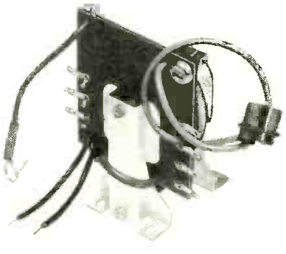


A-8132—Replaces Muntz #TO-0031; used in 1951 and 1952 production. Covers approximately 300,000 Muntz sets.



A-8136—Replaces Philharmonic #80-263, #80-265-2 and #80-265. Used in all sets built since early 1951 including AMC, Pathe, Silvertone, and other "private label" sets.

Stancor Transformers are listed in Howard W. Sams' Photofact Folders, John W. Rider's Tek-Files, and the Howard Company's Counterfacts.

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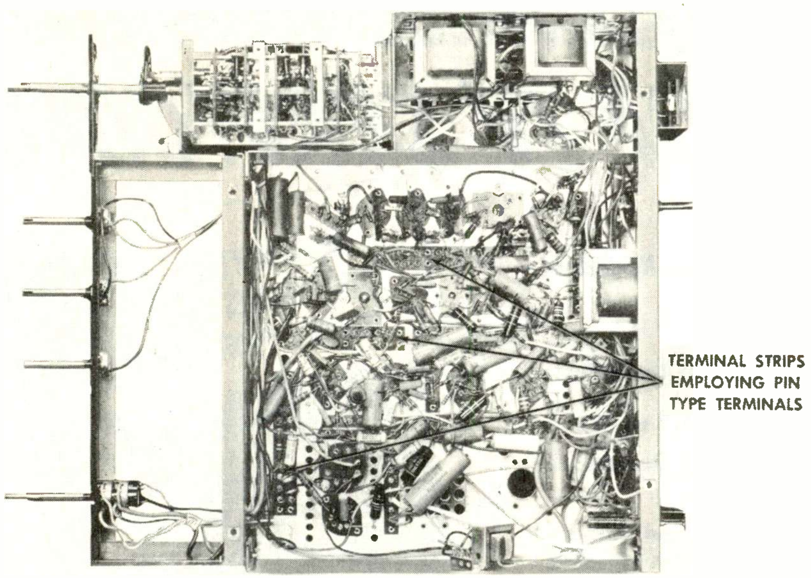

Figure 8. General Electric Receiver Model 21T1 Using Tubular Terminal Strips.

makes the required soldering connections at all terminal points simultaneously. These terminal lugs can be seen extending above the chassis in Figure 9.

A feature of this method of chassis fabrication is that a number of test measurements may be performed from the top of the chassis at the various terminal lugs. In Photofact Folder 2 of Set 194, covering the G. E. Model 21T1, the terminal lugs at the top of the chassis are keyed to similarly indicated points on the schematic. Although not primarily designed to effect this method of chassis testing, measurements from the top of the chassis may prove advantageous in many instances.

The previously listed features are essentially mechanical in nature. However, a number of other features are observed in the electrical circuitry of the unit. Among these are: two stages of amplification in the RF tuner, noise cancellation, AGC level control (Picture Stabilizer) with an attached "Local-Distance" switch, horizontal and vertical retrace blanking circuits, and intercarrier sound.

RF TUNER

The RF tuner is a switch type, employing three tubes. A 6AB4 is used as a grounded grid 1st RF amplifier, the 6AK5 is a grid driven 2nd RF amplifier, and a dual-triode 12AT7 is used as an oscillator and mixer. An adjustable IF trap is built into the tuner for reduction or elimination of interference. The tuner is designed to provide an IF signal in the 40 mc range.

NOISE CANCELLATION CIRCUIT

A noise cancellation circuit, shown in Figure 10, is employed to prevent premature triggering of the sweep circuit by high level noise pulses. The purpose of the inverter stage is to apply a pulse of opposite polarity to that of the sync pulses at the input of the sync clipper tube. By correct arrangement of biasing, this process occurs only when pulses are received whose amplitude exceeds that of the sync pulses.

From examining the schematic in Figure 10, it can be seen that the video detector is connected to provide negative-going sync pulses in the detector output. It is further noted that negative-going pulses are applied to the grid of the sync amplifier tube and the cathode of the noise inverter tube. Normally the sync pulses are amplified by V3A and, due to signal inversion, positive-going signals are present in the plate circuits. From here the signal is fed to the clipper stage. Clean sync pulses are obtained in the output and applied to the vertical and horizontal sweep oscillator sections.

During the reception of a noise free signal, the noise inverter tube is inoperative. This is achieved by applying a bias to the cathode of V3B by means of the voltage divider R8 and R7. Additional bias, obtained from the output of the video detector is applied to the grid of the stage. When a noise pulse occurs, the noise inverter tube is driven into a conductive state, negative-going pulses are produced in the plate circuit and coupled to the grid of the clipper tube. Simultaneously, positive-going pulses are fed from the sync amplifier plate circuit to the grid of the clipper tube. Thus, the two opposite polarity signals cancel each other

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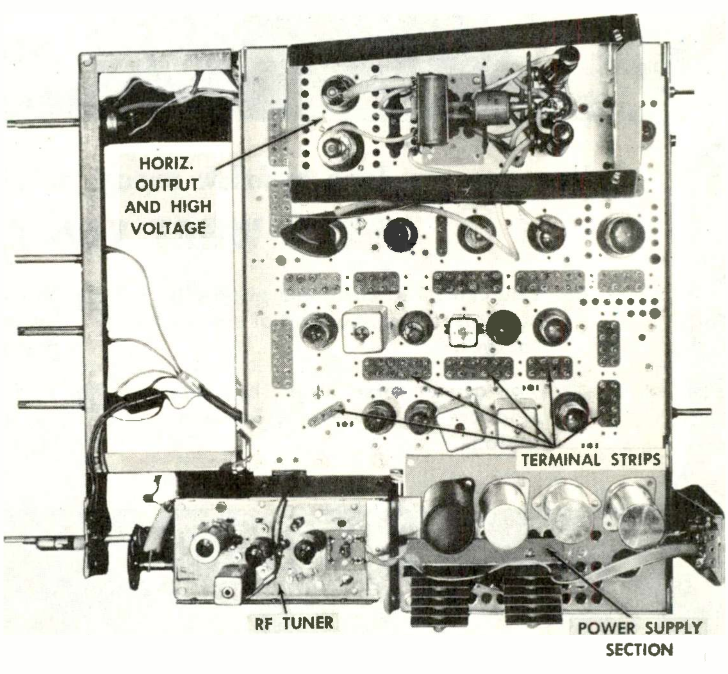

Figure 9. Terminal Strip Pin Extending Through Top of Chassis.

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TUBE DEPARTMENT, SCHENECTADY, N. Y.

GENERAL ELECTRIC

A STOCK GUIDE FOR TV TUBES

One of the most difficult merchandising problems that confronts the service technician is that of maintaining an adequate stock of tubes. This is brought about by several things. With the introduction of the television medium, a great number of tubes are required to operate this type of instrument. Since the various manufacturers employ different type tubes to perform a given function, an even greater number of tube types must be stocked in order to properly service several brands of receivers. Certain tubes have a shorter life due to the amount of work that they must do in any given circuit. This fact places an even greater demand upon the number of tubes which must be stocked in any given type.

Tubes are the most frequently replaced component in a television receiver. Thus, adequate tube stocks provide the service technician with a very valuable tool to perform fast, efficient, and profitable service work. With this thought in mind, we have made a survey of all television receivers produced since World War II. The data obtained from this survey is contained in the accompanying chart.

This chart takes into account the total number of receivers produced rather than classification by models only. For example, a manufacturer who produces 50,000 units of a given model will obviously use more tubes than a manufacturer who only produces 5,000 units of a given model. Thus, a "production factor" has been projected into the final tabulation so that a more truer representation of the number of any given tube type in service is provided in the chart.

Another factor which is included is that of a "depreciation factor." The complete retirement of a set has been estimated, for the purpose of this chart, at slightly over six years. This means that a tube type that might have been used in a receiver built in 1946 would not appear in this chart since most of these receivers are now completely out of service, making it unnecessary to continue stocking of tubes for servicing that particular receiver.

The quantities shown in this chart are arrived at on a percentage basis and the figure shown is based on 1,000 units. For example, the 6AL5 is shown with a rating of 80, which means that 8% of all tubes in service in television receivers are the 6AL5 type. Likewise, 15% of all tubes in television receivers are the 6AU6 type. By presenting these figures it is hoped that they will be helpful in determining not only the tubes which should be stocked but also the quantity of each type that need be stocked.

As a word of explanation, the figure 140 for the type 6AU6 does not mean that we are recommending that a shop stock 140 6AU6 tubes. This high figure, however, can be used as a guide to point out that a sufficient quantity of these tubes should be stocked to take care of replacement needs between the regular ordering periods.

As we know, the life of some types of tubes is much longer than other types. For instance, the replacement requirements of a type 6AL5 tube is much lower than a 6SN7GT or a 6BG6G. Referring to the chart, it can be seen that the frequency of use of the 6AL5 tube gives it a rating of 80 while the 6BG6G has a rating of only 15. In actual practice it would be advisable to stock no more 6AL5 tubes than the type 6BG6G, since the replacement rate of the 6AL5 is so low. The important thing to remember in the use of this chart is that it only represents the number of tubes of any given types that are now in service as compared to the total number of tubes in service. Also keep in mind that the units shown in the chart are based on a total of 1,000 units.

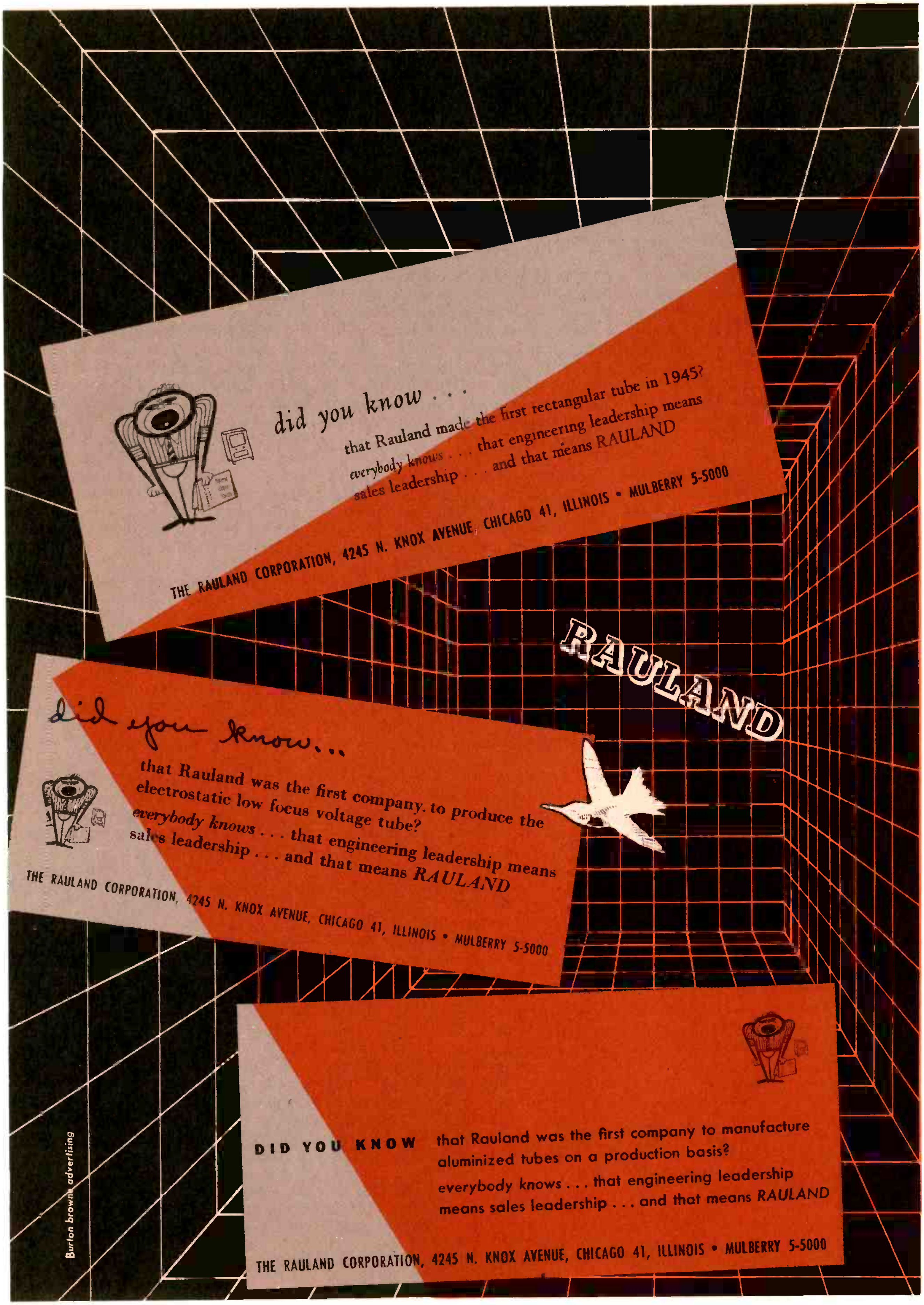
There are some tubes that have been employed in television receivers which do not appear on this chart. In compiling the data, any tube having a rating of less than one-tenth of one percent was dropped from the chart. Most of these tubes were used several years ago and, due to the retirement of these sets, the rating has fallen to a very low value. There are a few tube types, however, which have been incorporated very recently but because of their newness, they still do not have sufficient rating to be included in the chart. In order that you can be advised of these new types, they will be included in subsequent charts with an indication as to what type receiver started using that particular tube. For example, the 6CL6 tube appears in the chart without a rating. The reason being that on a percentage basis this tube is far below the one-tenth of one percent minimum rating. Perhaps in the next chart there may be a sufficient number of these tubes employed that a rating figure will appear. You will note, however, that the notation following the 6CL6 listing indicates that this tube is employed in a recent RCA chassis. Any service shop or distributor specializing in this brand of receiver should stock a minimum number of these tubes so that they will be available in case of tube failure.

The type 6AF4 presents a similar situation. This tube is being employed in a great many UHF tuners and converters. On a percentage basis, however, it has not been used sufficiently to warrant a rating figure. It is recommended, however, that service shops or distributors who are called upon to handle UHF equipment should stock a few of this type tube. It is very probable that the next chart will provide a rating figure for this tube type.

You will note that there are two columns included in the chart. The left column headed "46-53 Models" is based on all post war receivers. The right hand column headed "52-53 Models" is based on these model receivers only. The double rating is intended to serve two purposes. One, a service shop located in an area where television transmission has been carried on before the freeze, will be called upon to service the older models as well as the new models. The left column is helpful in determining what type tubes must be stocked to service all of these receivers. The right hand column can be used by service shops in those areas which have had television service inaugurated after the freeze. These areas, for the most part, will have the greatest percentage of the later 52-53 models. Thus, the right hand column should be helpful in serving as a guide for tube stocking purposes.

The second advantage of the double rating lies in the fact that a trend in tube usage can be readily noted. To cite an example; the most popular tube, as indicated by a rating of 140 in the left column, is the 6AU6. In the right hand column, however, the most popular tube type is the 6CB6 which has a rating of 137. The rating on the 6AU6 has fallen to 128. This indicates that there is a trend for less use of the 6AU6 while the

* * Please turn to page 120 * *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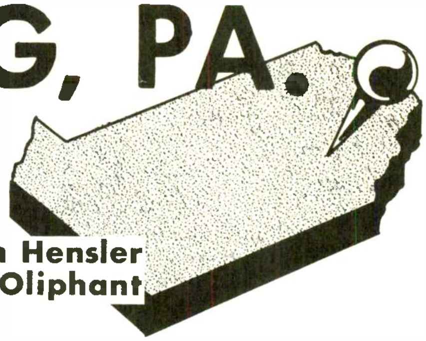
A PF INDEX UHF REPORT

READING, PA.



by W. William Hensler and C. P. Oliphant

As was reported in PF Index and Technical Digest #37 for March-April, 1953 satisfactory UHF reception in the South Bend, Indiana area can be obtained with very little difficulty. This is due to the comparatively level terrain that surrounds South Bend. But, what happens to the UHF signal when it must pass over hilly or mountainous terrain? How great are the installation problems then?

In order to obtain answers to the above queries, we ventured to Reading, Pa. for the purpose of conducting personal interviews with the installers and dealers of that area. By conducting these interviews it was hoped that an idea of problems common to the area could be obtained.

It was substantiated from our interviews that the installers are frequently having a difficult time obtaining desirable reception for their customers. According to most of the installers, the UHF reception in Reading is very spotty. Good reception may be obtained at one location while only a block away the signal may be so weak that nothing at all can be received. Furthermore, the final positioning of the antenna is very critical, which results in considerable probing for the best signal. Depending on the condition of the signal, the final placement of the antenna may be as low as five feet off the ground. Because of this necessity of probing in areas of rough terrain, installations should not be made prior to the time that the UHF station goes on the air.

In presenting the results of our interviews, it must be kept in mind that solutions to the problems of the installers in Reading are not attempted in this writing for the simple reason that we have made no field tests in the area to date.

Station WHUM-TV of Reading operates on Channel 61 with a frequency of 752-758 megacycles. The ERP (Effective Radiated Power) of the transmitter is listed as 260 kilowatts. The antenna, which is mounted on a 1000 foot tower, is located approximately 28 airline miles northwest of the city of Reading. It was placed at this location so that the surrounding towns and cities, such as Harrisburg, Wilkes-Barre, Allentown, and Lancaster would be included in the service area.

The terrain of Reading is very hilly, the highest elevation being Mount Penn which is approximately 1100 feet. Mount Penn is located along the eastern boundary of Reading. Hills of smaller elevations surround the other sides of the city. The city itself, especially the downtown area, lies in a valley which extends out toward the direction of the transmitter.

Upon our arrival in Reading, we contacted Mr. Carl Barbey of the George Barbey Company. He was very helpful in supplying us with a list of dealers and installers in the Reading area and the surrounding towns. After a short discussion with Mr. Barbey we began making contacts with the installers.

Below is a list of questions that were asked during the course of our interview with the installers.

Are you having any trouble receiving UHF?

How many UHF installations have you made?

Are you having any ghost elimination problems?

Do you probe for the best signal? If so, how long? How high?

What type or types of antennas do you use?

What type of lead-in do you use?

Any difficulties with lead-in?

Have you used lightning arrestors in UHF installations? If so, with what results?

Have you installed matching units? If so, with what success?

Which are you selling the more of, external converters or conversion kits?

Have you installed strips? If so, how does the operation of the strips compare with the operation of converter units?

Have you made any service repairs on converters?

Answers to the above inquiries were always nearly the same in the Reading or nearby Reading area. When asked, "Are you having any trouble in receiving UHF?", the answer in almost every case was, "very much so". The installers seemed to be very disheartened with the difficulty they were experiencing in making UHF installations for Channel 61. They never know whether desirable reception will be received or how many hours they will have to spend in locating the best signal. One of the installers that we interviewed said that his crew usually spends an entire day in making an installation. Sometimes after spending that much time, the reception isn't acceptable at all. It can be seen that if this much time is spent, an installation job would not be profitable. This particular installer has approximately 20 UHF installations in operation.

Another installer reported that he sells a survey first for a certain charge and spends from two to three hours in locating the best possible signal. If an acceptable signal can not be found within three hours, the installation is disregarded. The maximum height which is probed is 20 feet above the roof top. The only thing that the customer pays for in this instance is the survey charges that are agreed upon before the installation is attempted. This particular installer reported that he has approximately 30 UHF installations for Channel 61 in use.

In answer to the question "Are you having any ghost elimination problems?", it can be said that surprisingly little trouble is being experienced in the elimination of reflected signals. Some of the install-

* * Please turn to page 123 * *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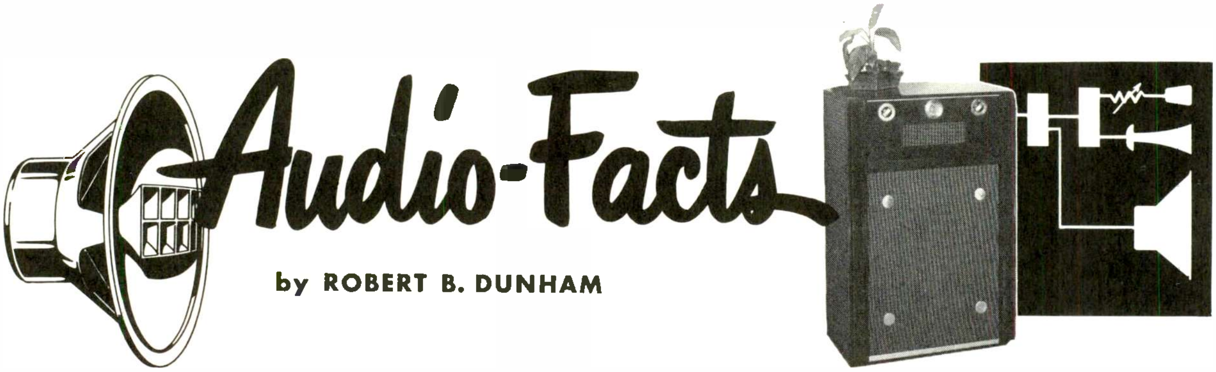

Audio-Facts

by ROBERT B. DUNHAM

Most high quality sound systems now employ more than one speaker to reproduce the excellent present day recordings and program material. Some of these are coaxial (or even triaxial) and may appear to be single speakers, but are actually dual (or triple) systems, composed of two (or three) separate units within the large unit. Of course special extended range single cone speakers are available and are a definite improvement, but their performance cannot be expected to equal that possible with a good multiple system.

When a system of two or more speakers is used, some form of divider network must be included, if correct tonal balance with low distortion is to be attained. An understanding of why this is true is valuable when designing or assembling a speaker system.

The range of frequencies in the audio spectrum is actually quite wide, which poses problems in all phases of audio work, especially when handling the extreme high and low frequencies. This can be realized when the wavelengths are considered. At 40 cps, the wavelength is approximately 28 feet; at 500 cps, 2.2 feet; at 10,000 cps, 1.1 inches; and at 20,000 cps, 0.56 inches.

Since most high fidelity systems are used for the reproduction of music, which covers the full frequency range, these problems must be solved, if realism is to be had from the speaker. The speaker is one part of the audio system which encounters difficulties in reproducing this wide range. One definite reason for this is that a speaker is a mechanical device.

Low frequencies can be best reproduced by powerful, large speakers, with compliant cone suspensions and low resonant frequencies, because of the amount of air to be moved at these long wavelengths. Also, large enclosures are needed for producing low bass tones.

A small speaker can reproduce the high frequencies very efficiently since comparatively low power is handled and a fast, short movement is required at the short wavelengths.

The large speaker cannot reproduce the higher frequencies satisfactorily with its large cone designed for low frequencies. Neither can the high frequency speaker, or tweeter, handle the low frequencies. So compromises have to be made in the design and construction of a single cone speaker to approach a wide range response. This usually results in uneven output over a still limited range and tendencies toward something not wanted, intermodulation distortion.

Intermodulation, the generation of unwanted beats and sounds, due to the modulation of the high frequencies by the low frequencies, is a product of the non-linear action of the large cone of a single cone speaker vibrating at both high and low frequencies.

All of the above touches just lightly upon some of the difficulties encountered when trying to obtain high quality wide range response from a single cone speaker. But it does give some idea of why we have coaxial speakers, woofers, tweeters, dual systems, three-way systems and other speaker arrangements

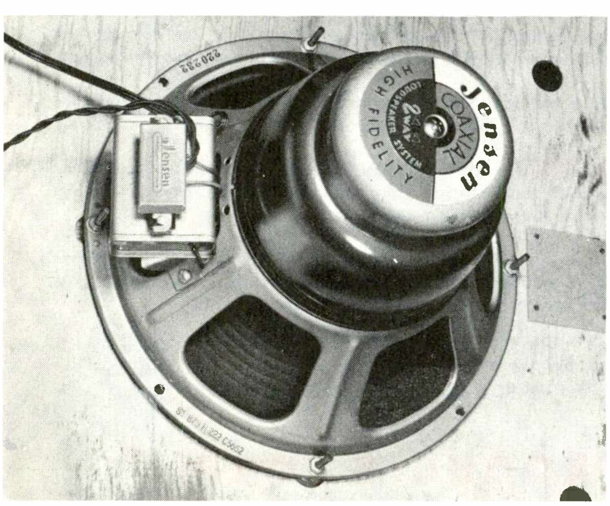

Figure 1. Jensen H-222 Coaxial Speaker with Capacitor Attached to Frame.

Figure 2. Stromberg-Carlson RF-71, Coaxial Speaker Showing Capacitor in Series with Tweeter.

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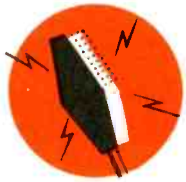

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that make divider networks necessary.

Many speaker systems use one or more woofers for the low tones and one or more tweeters for the highs. Three-way systems have a third speaker (or speakers) for the middle range of frequencies. Each unit does the work which it can do best, provided the correct range of frequencies is fed to it. That is where the divider network fits into the picture.

In a two-way system, the network directs the low frequencies to the woofer and the highs to the tweeter, while also performing the important function of keeping the high frequencies out of the woofer and the lows out of the tweeter. Otherwise the tweeter could be easily overloaded by the lows, creating distortion, which would also occur if the highs were fed to the woofer. The frequency at which this division is made is known as the crossover frequency. Two crossover frequencies are used in a three-way system.

Divider networks can be elaborate or simple. Many of the complex types are very satisfactory; others of the simpler variety, while not ideal, do serve the purpose.

Many woofers are so designed that they respond only to the low frequencies. Advantage is taken of this by inserting a capacitor, of correct value, in series with the tweeter, blocking the low frequencies to it, thereby achieving frequency division by a combination of electrical and mechanical means. The Jensen H-222 in Figure 1, and the Stromberg-Carlson RF-71, in Figure 2, are two high-quality 12-inch coaxial speakers using this method. The schematic in Figure 3 illustrates the simple circuit of the RF-71.

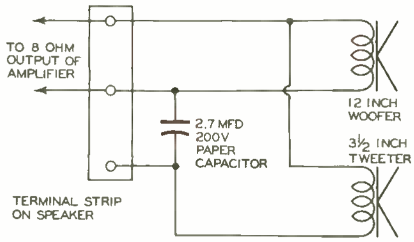

Figure 3. Schematic of Stromberg-Carlson RF-71 Speaker.

Several speakers accomplish strictly mechanical division with specially designed cones and voice coils.

Characteristics of the speakers and enclosures involved must be considered when selecting the crossover frequency of a divider network to be used with a speaker system. The usual coaxial speaker has a crossover of somewhere around 2000 cps, while a large elaborate system may have its lowest crossover as low as 45 cps.

The usual large enclosure, necessary for the reproduction of the low bass tones, cannot handle the high frequencies satisfactorily for several reasons. In most types, the treble tones can become lost and absorbed in the long, sometimes folded, signal path. Also standing waves can be created inside the enclosure by the short wavelength tones, causing very uneven, muddy response. Some enclosures, designed for the extreme low tones, will resonate at frequencies above 45 cps, resulting in "booming" at these frequencies. The above effects can be eliminated by a crossover frequency low enough to keep the unwanted frequencies out of the woofer. This may even call for a third divider network, with a crossover as low as 45 cps, for the operation of a fourth speaker to reproduce the lowest bass tones.

If the crossover frequency is kept low (around 45 to 800 cps in many three-way systems) the tweeter has to operate nearly out of its lower range. This is particularly true with the tweeters designed to reproduce up into the 15000 cps region. To overcome this a mid-range speaker is included in the system to handle the frequencies from the low crossover (600 to 800 cps) to another at possibly 4000 cps. Above the crossover at 4000 cps, the high frequencies are fed to the high-frequency tweeter.

Most manufacturers furnish divider networks designed for use with individual speakers and complete systems. The Jensen A-402 Crossover Network, shown in Figure 4 with the Jensen RP-302 High Frequency Unit (Supertweeter) is a 4000 cps divider network designed and supplied by Jensen for use with this tweeter in their complete speaker systems or in any application of this unit. The selection of such matched components is certainly to be recommended when assembling a custom installation.

Divider networks can be constructed if certain precautions are taken. The coils, with inductance kept within reasonable tolerances, should be wound with large gauge wire to keep resistance low, since networks are connected into the circuit between the output transformer and the speakers.

Paper and oil capacitors are recommended although electrolytics have been reported as giving satisfactory service. The signal in the network is AC, so if electrolytic capacitors are used, they should be the AC type or connected back-to-back for nonpolarization. Electrolytic capacitors are susceptible to heat so this should be taken into consideration when installing the

* * Please turn to page 112 * *

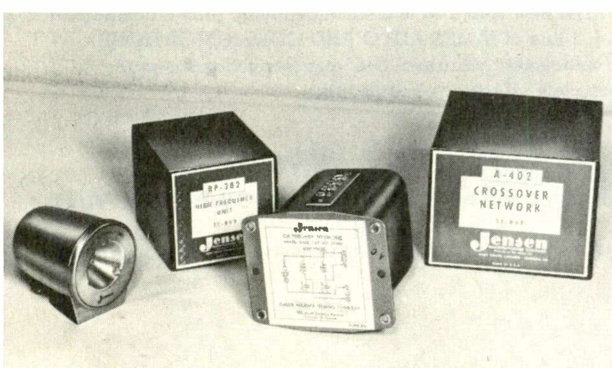

Figure 4. Jensen RP-302 High Frequency Unit and A-402 Network.

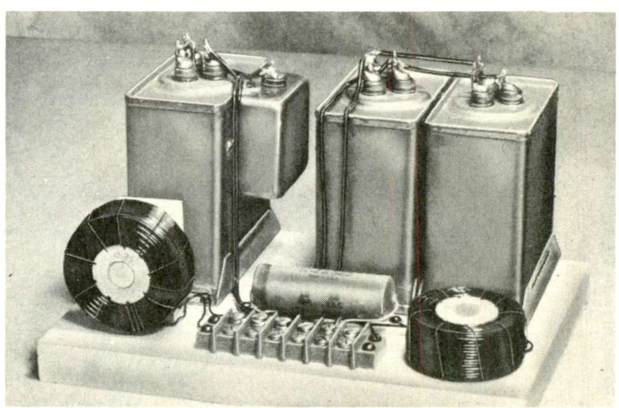

Figure 5. Home-Constructed Divider Network.

John Markus

Editor-in-Chief, McGraw-Hill Radio Servicing Library

Dollar and Sense Servicing

BATHTUB. In Chicago, there are now more television receivers in homes than bathtubs or telephones, according to Admiral's sales vice-president, Wallace Johnson. The figures he offers are 1,350,000 TV sets, 1,320,000 phones and only 1,260,000 bathtubs. Other cities having more TV sets than telephones are Baltimore, Boston, Cleveland, Los Angeles, and Philadelphia. Indications are that people will drop the telephone before the TV set in a depression, which is good for servicing's future.

KISS AND PUNCH. Over in Leicester, England, Harold Cross left the engine of his truck running while giving his girl friend a long goodnight kiss. Ignition interference from the idling engine ruined a neighbor's television picture, causing him to go out to the truck to protest. Mistaking the neighbor for a peeping Tom, Cross dashed out to the truck and broke his jaw. For this, a Leicester court awarded the neighbor exactly $204 damage, two weeks after Cross had married the girl.

ELECTRONIC SERVICE RATES. Servicing of all-electronic mimeograph stencil cutters is billed at $4 per hour per man for local calls and $7 per man hour for provincial calls. Provincial is defined as outside the corporate limits of cities where service representatives are maintained by Times Facsimile Corp., the manufacturer.

Many well-known television and electronic service organizations throughout the country are listed as service representatives in the company's booklet. With electronic stencil-cutting just beginning to take hold in business offices, there are undoubtedly opportunities for other organizations to get in on the ground floor in this potentially attractive new branch of servicing. If interested, the firm's address is 540 W. 58th St., New York, 19, N. Y.

The machine itself is simpler than a television set. Copy is placed on a cylinder under a photo tube at one end of a lathe-type carriage. The stencil to be cut is placed on another cylinder under a high-voltage cutting electrode at the other end of the moving carriage. As the lathe rotates, photo tube and sparking electrode move in unison to scan copy and stencil spirally. In response to amplified photo tube output, the sparks burn holes far apart for black regions and close together for lighter-colored regions of the copy.

An important advantage of electronically cut stencils is that they have no mistakes and hence require no proof reading. Even photographs can be transferred to stencils. With a similar but more complex British-made Roneo machine having 500 line resolution, the mimeographed reproduction of a photo can scarcely be told from the original copy at a distance of a few feet.

FLASHBULBS. When a Los Angeles photographer ran out of flashbulbs while covering a televised hearing, he simply penciled a note "I NEED NO. 5 BULBS" and held it up to the TV camera. The bulbs were sent over immediately by his newspaper, which had a TV set right in the city room for watching the hearings.

OVERSHOOT. Among the technical growing pains of high-powered UHF station WHUM-TV, on channel 61 in Reading, Pa., was the discovery after many weeks on the air that the antenna on their 1,000 foot tower was overshooting the entire service area. This left tremendous dead spots within its announced coverage area and gave erratic but phenomenal long-distance reception. After diagnosing the cause of the trouble, engineers still had the terrifically complicated job of electrically tilting the entire transmitting antenna array 0.8 degree downward in all directions.

AUSTERITY. Despite a head start of many years, British TV is now way behind ours in at least one category - picture size. Over there, 63% of all post-war set sales were for the 12-inch size, 20% were 14-inch and 12% were 15-inch, according to Television Digest. This left 5% for smaller tubes and possibly a few larger tubes.

BRAIN MACHINES. Can a machine have more intelligence than man puts into it? Putting the question another way, can a robot ever be smarter than the men who made him? Two brain-machine experts, Ashby and Wiener, agree that the answer is yes under certain conditions.

Once a machine is made sufficently large and complex to absorb a sufficient quantity of man's knowledge, they say, it can conceivably do things far beyond the scope of the instructions built into it, and possibly even go in for reproduction. One analogy is the atom bomb, which does nothing until it exceeds a certain size.

Getting back to earth, it's reassuring to know that when a tube burns out or a condenser blows in a machine that's smarter than man, they'll still call a human serviceman to fix it.

PAINT-ON SOLDER. Newest in soldering is Eutec-TinWeld, a solder-paste-flux combination that's applied with a brush, then heated conventionally. The need for a third hand in soldering is thus eliminated. Where necessary, the excess flux can be wiped off with a damp cloth. Tinning and soldering are combined in one operation. By leaving the soldering iron in its holder, both hands can be free to hold the parts being joined by soldering.

In one test for production soldering of small radio sets, output was more than doubled. Other equally attractive applications are for joining sheet metal, copper tubing, and any other parts that can be soldered conventionally with 50/50 or 60/40 lead-tin solder. It's not for aluminum. At $5.60 postpaid for a 2 lb can, the cost seems high, but it is claimed that the material goes much farther because there is no waste. Source is Eutectic Welding Alloys Corp., 172nd St. & Northern Blvd., Flushing 58, N. Y., for those who like to be the first to try something new.

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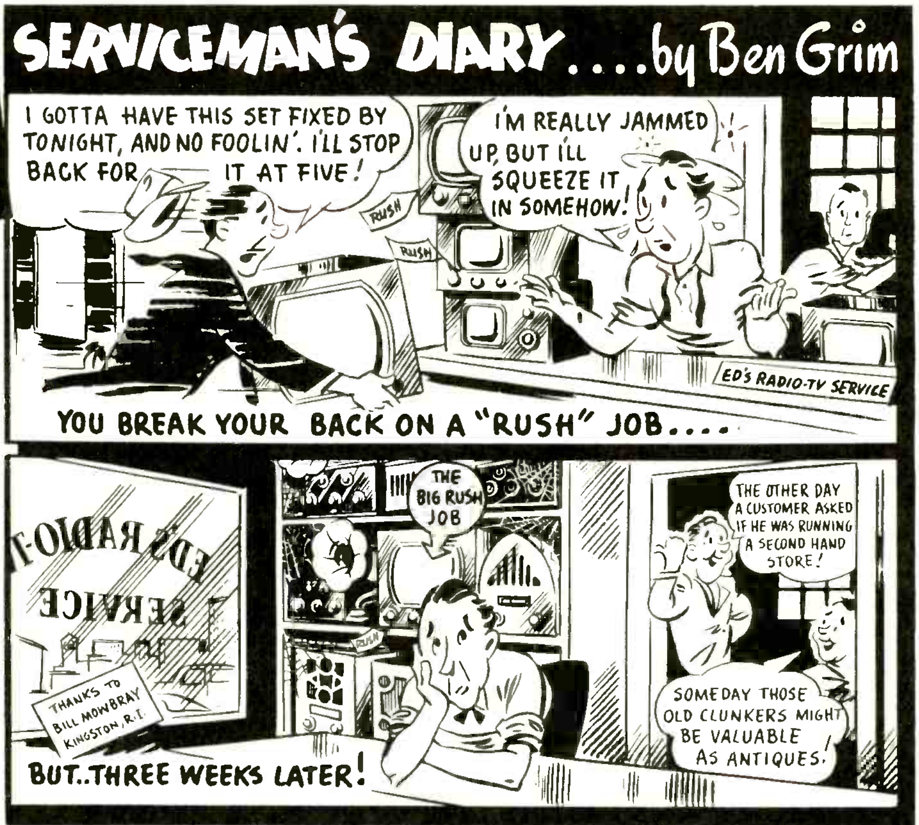
SPRAGUE



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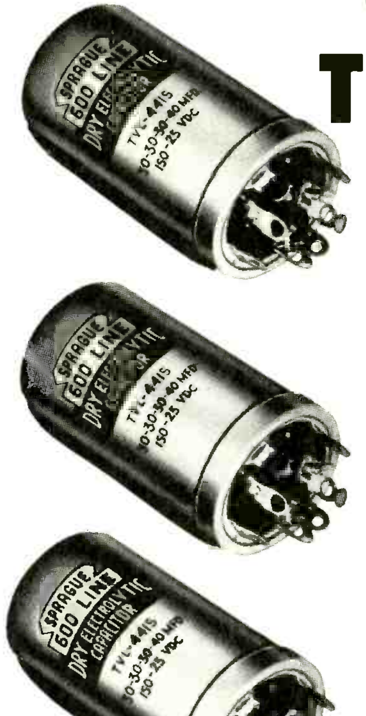

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RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 38

Covering Folder Sets Nos. 1 thru 206

HOW TO USE THIS INDEX

To find the PHOTOFACT Folder you need, first look for the name of the receiver (listed alphabetically below), and then find the required model number. Opposite the model, you will find the number of the PHOTOFACT Set in which the required Folder appears, and the number of that Folder. The PHOTOFACT Set number is shown in bold-face type; the Folder number is in the regular light-face type.

IMPORTANT—1. The letter "A" following a Set number in the Index listing, indicates a "Preliminary Data Folder." These Folders are designed to provide you *immediately* with preliminary basic data on TV receivers pending their complete coverage in the standard, uniform PHOTOFACT Folder Set presentation.

2. Models marked by an asterisk (*) have not yet been covered in a standard Folder. However, regular PHOTOFACT Subscribers may obtain Schematic, Alignment Data or other required information on these models without charge by supplying make, model or chassis number and serial number. (When requesting such data, mention the name of the Parts Distributor who supplies you with your PHOTOFACT Folder Sets.)

3. Production Change Bulletins contain data supplementary to certain models covered in previously issued PHOTOFACT Folders, and are listed in this Index immediately following the listing of the original coverage of the model or chassis. These Bulletins should be filed with the Folders covering the models to which the changes apply.

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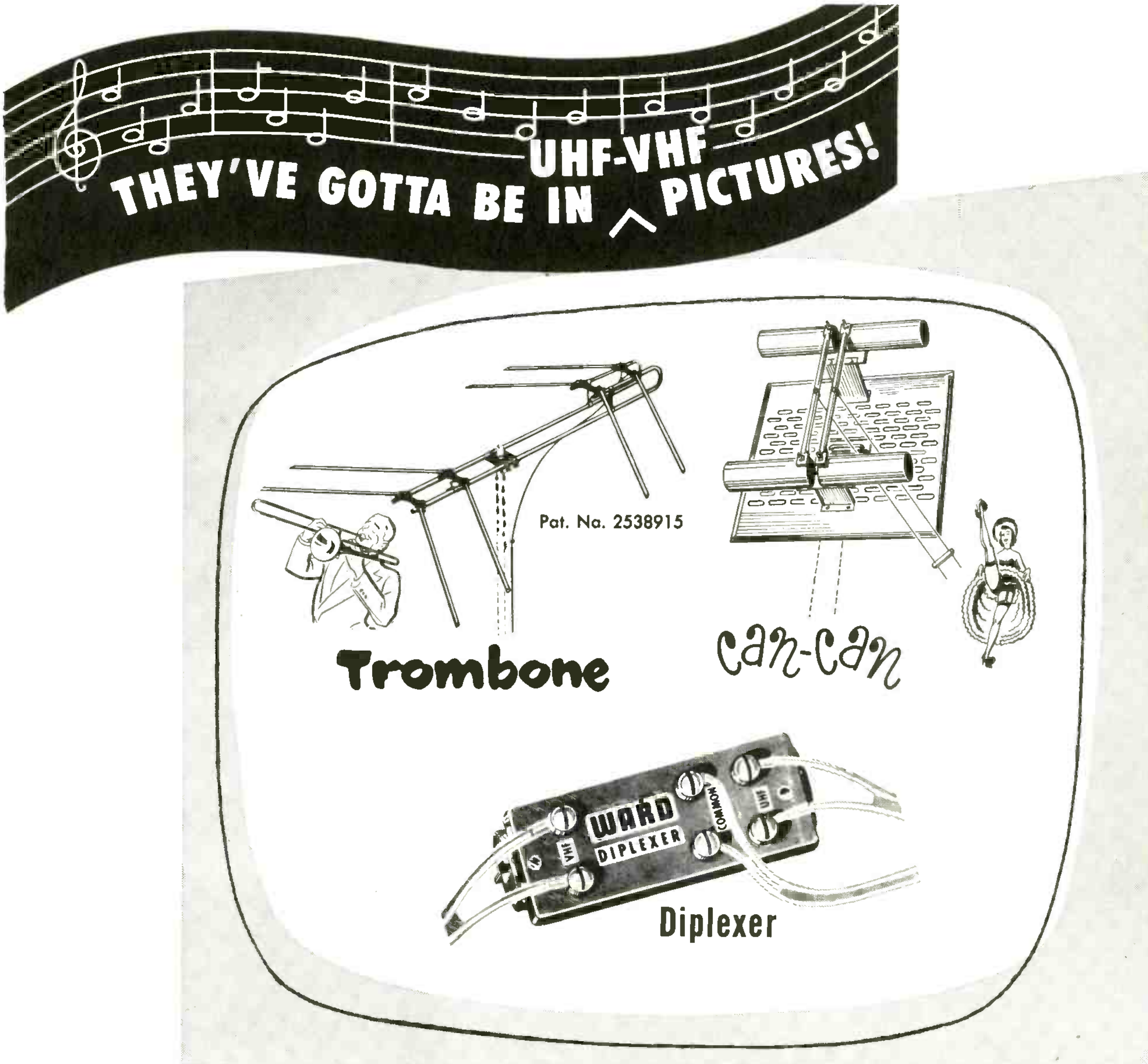

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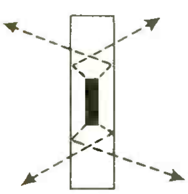

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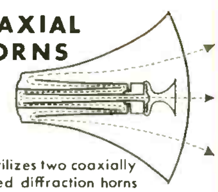

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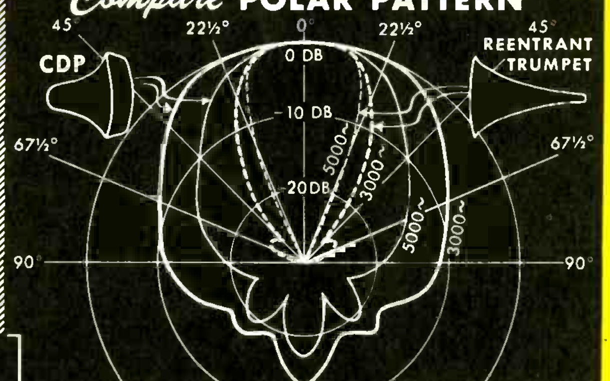

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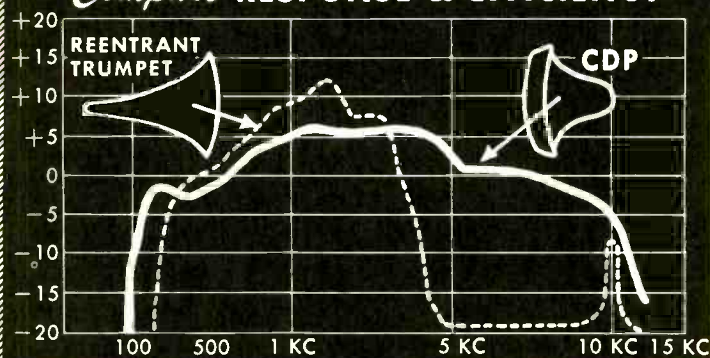

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IMPORTANT

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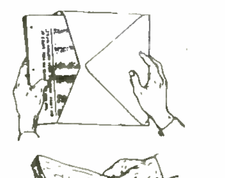
The preferred 30-Second method for filing PHOTOFACT Folders

Your PHOTOFACT Folder Sets come to you in convenient envelopes. When you remove a Set from its envelope, you will find the Folders already arranged in proper filing order, and preceded by an Index Separator. This Separator lists each receiver covered in the Set, and has an index tab showing the Set number. To file, here's all you do:



1. Remove the Index Separator and the Folders from the envelope. The Folders and manila TV Jackets are already arranged in proper numerical filing order except the TV folders, which are placed last in the Set.

2. Open your binder and place the entire contents, taken from the envelope, behind the preceding Set of folders, laying aside the TV folders.

3. Now, insert the TV folders in their respective manila jackets and your filing is complete.

To locate the folder you want, refer to instructions on the first page of this index listing.

ALWAYS REFER TO THE PHOTOFACT INDEX

IMPORTANT

How to obtain Service Data on Pre-War Models

Photo copies of schematics covering pre-war (prior to 1946) receivers can be obtained by regular PHOTOFACT subscribers at 50¢ each (our cost). Additional data can be supplied at a nominal cost per page. When requesting pre-war data, please mention the name of the Parts Distributor who supplies you with your PHOTOFACT Folder Sets.

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(See Policalarm & Monitoradio)

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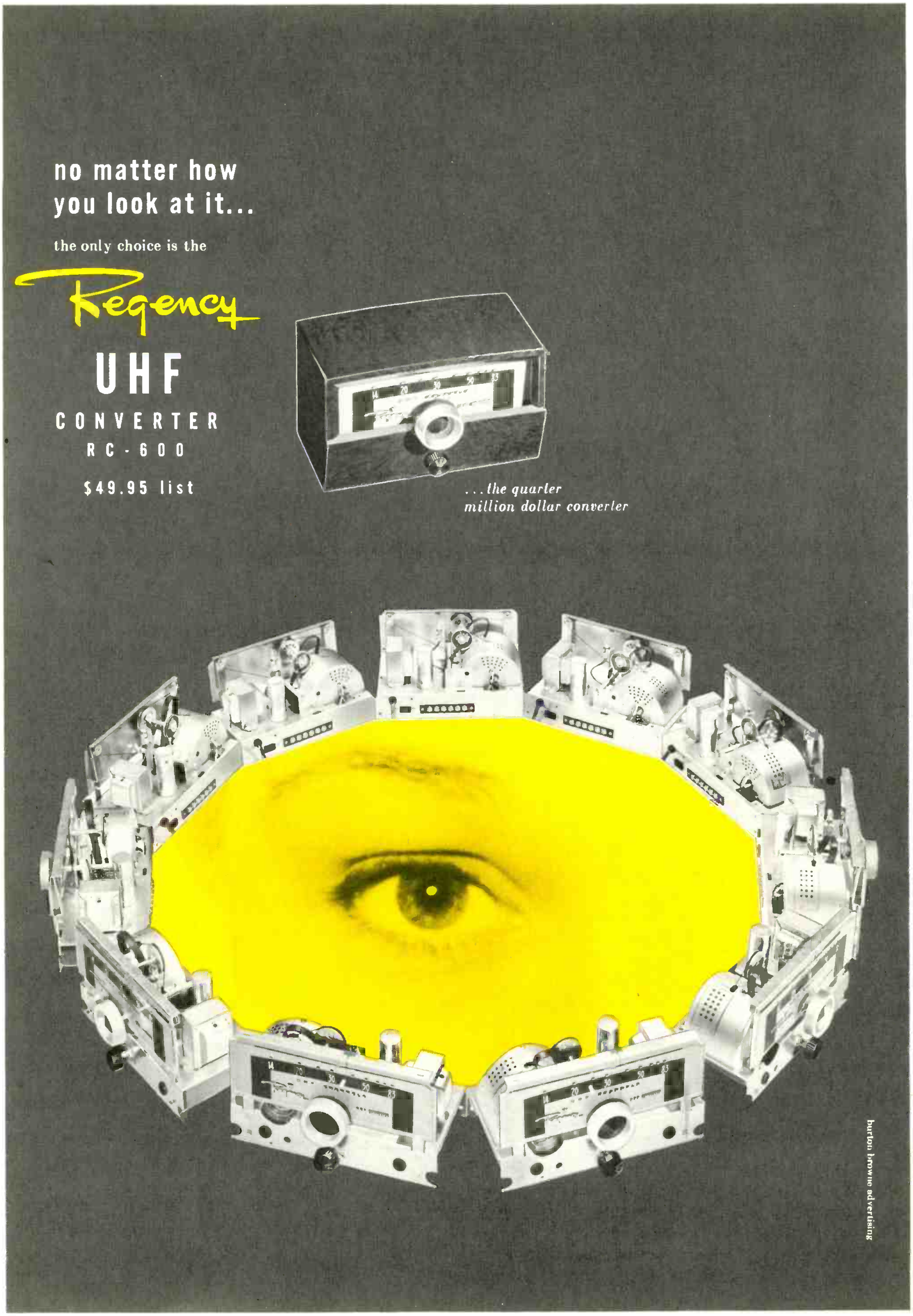
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(CM-1) indicates service data *also* available in Howard W. Sams 1947 Record Changer Manual. (CM-2) indicates service data available in Howard W. Sams 1948 Record Changer Manual. (CM-3) indicates service data available in Howard W. Sams 1949, 1950 Record Changer Manual. (CM-4) indicates service data available in Howard W. Sams 1951, 1952 Record Changer Manual.

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T-70153, T-70157, T-70163, T-70167, T-70235, T-70257, T-70263, T-70267, T-77153, T-77157, T-77163, T-77167, T-77253, T-77257, T-77263, T-77267.....**193—9**

SILVERTONE

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WILCOX GAY

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WIRE RECORDING CORP.

WP ....(CM-2) **76—19**

DOLLARS AND SENSE
(Cont'd. from page 49)

GOPHERS. Don't rely on lead-covered cable for underground use out on the Western plains. Bell Labs scientists haven't yet found out why gophers and muskrats take delight in chewing up buried Long Lines transcontinental toll cable, but they did discover that a thin steel tape wrapped around the cable sheath is more than a gopher can swallow.

FIREMEN. According to St. Paul, Minn. fire department officials TV is the greatest boon to department morale since the retirement of fire horses. Sets are installed in all 20 engine houses, and are making science, cooking and political experts out of erstwhile pinochle and cribbage players.

NOTES. Left on back door for telephone installer: "Key inside small tub under wash tub. Don't let little dog out or big cat in". In the big city such a note would be a museum-piece, but in small towns or out in the country where people trust each other it's quite customary to leave notes. Books and pamphlets on good business practices for servicemen warn against going in when no one is home, but local practices should govern. Many a good small town customer would be highly insulted if you refused to go into his empty house to fix a set.

GROUNDS. An old ten-inch TV set in a poorly wired home provided an interesting case history of the importance of a good electrical ground for house wiring. Each time the oil burner came on, the picture was wiped out horizontally and took up to 20 seconds to return. As part of the wiring overhaul job on this house, an electrician routinely connected a new ground lead to the fuse-meter box. Now there is only a slight twitch on the top line or two of the picture when the oil burner comes on. A possible explanation offered by Electronics' managing editor Vin Zeluff, who encountered this trouble, is that the high resistance of the old ground lead and the capacitance of some 1,400 feet of BX cable were involved. What a tough one this would be to ferret out on a service call!

BALANCING. To check for balance in a push-pull audio amplifier without using meters or test equipment, short the plates together with a wire jumper and feed a signal of any kind (such as from a phonograph) to the amplifier input. If the output stage is unbalanced, the output signal will be heard. This technique permits accurate balancing by adjusting for zero sound output.

CARUSO RECORDS. Values of Caruso records for collectors range from $2.00 for Victor No. 87321 to $25.00 for Victor No. 5014, with the average price running somewhere around $7.00, according to a recent publication, "Price Guide to Collector's Records." Values are listed for over 7,000 historical recordings by the greatest names in recorded music, and are average prices for original copies in good condition. Increasing interest in old records as a hobby is boosting their value rapidly.

Servicemen are in a particularly good situation for acquiring attic hoards of such records for their personal enjoyment or for resale. A casual inquiry will often reveal almost forgotten collections that can be bought for a few dollars. There is, of course, a gamble in this as many old records have been so abused as to be worthless, but the true collector willingly takes this gamble. The 32-page booklet of record prices is available at $2.50 from American Record Collectors' Exchange, 825 Seventh Avenue, New York 19, New York.

Another book published by the same firm, "Collectors' Guide to American Recordings 1895 - 1925" supplements the above by giving titles and dates for each important record, along with other interesting data.

HORSEBACK RADIO. Out in Arizona, posse men on horseback use the Motorola "Handie-Talkie" as an aid to law enforcement. In one instance, Jim Van Winkel, captain of the hounds for Arizona State Prison, used the radio to call for additional men when his dawgs picked up the trail of an escaped prisoner. As another instance, Ernie Chilson of the Bar-T-Bar Ranch uses the Motorola set for contacting the ranch house while riding the range, for effective supervision of operations on this mammoth northern Arizona cattle spread.

WATER-TV RATIO. Watching the city water pressure is one way of telling which television programs are the most popular, according to Toledo's water commissioner. During a popular program the water pressure is a bit higher than normal and drops sharply during station breaks. The explanation, he says, is that so many people get up to go to the bathroom all at once right after a popular program.

* * Please turn to page 105 * *

This might help sometime

An interesting story comes to us from Los Angeles, California. A customer came into the shop one morning with two radios to be repaired. One set was a GE, AM-FM radio; the other was an old Lyric of pre-octal vintage. The GE needed only a new 12AT7 to return it to normal working order; the Lyric, however, had been tampered with and considerable work was necessary in its repair. The owner, when he called for the sets, questioned the charges.

Knowing that the man operated a gasoline filling station, the service shop manager asked him this question by way of reply: "If a brand new Cadillac and an old jallopy each got five gallons of the same grade of gasoline at one of your pumps, would you charge each a different price?"

The man immediately answered, "Of course not. Our charge is based on grade and amount of gas, not on the value of the cars."

To this the service manager returned, "An hour is an hour, regardless of the value of the radio. Material and labor determine our prices."

In this way, the technician and his customer arrived at mutual understanding through the medium of common business practice.

SHOP TALK (Cont'd. from page 5)

counter. Since the AGC voltage is dependent upon the strength of the video signal which the AGC stage receives, how can you tell whether a defect in the RF or IF systems is causing the abnormal AGC voltage or whether the AGC network itself is defective.

The answer to this problem can be obtained by the following procedure. Disable the AGC system, either by removing the AGC tube (if this is feasible) or by breaking the connection coming from the AGC stage; then apply a negative DC bias to the AGC line. A pair of flashlight batteries with a control connected across them or a small bias supply can be used for this purpose. Now observe the picture. If it is normal, the AGC network is defective; if the picture is still distorted, the AGC system is probably OK.

4. Input and Output of Sync Separator Stages. The sync separator stages are at the threshold of the horizontal and vertical sweep systems and, as such, figure prominently in the operational stability of these systems. Any change in the sync separator stages which overly reduce the amplitude of the sync pulses or prevent the clean separation of the pulses from the video signal, will affect horizontal and vertical lock-in. (Visual consequences include picture curvature, critical hold-in, and a tendency for the picture to roll or break-up into a series of diagonal slices with the slightest distrubances.) It is desirable, therefore, for the technician to inspect the input and output signal waveforms of the sync separator stages whenever these difficulties are encountered.

When checking the horizontal and vertical pulses in the sync separator system, use an oscilloscope sweep frequency of 30 cycles for the vertical pulses and a sweep frequency of 7875 cycles for the horizontal waveform. These are half the normal frequencies for these pulses and enable you to observe two cycles of each.

5. Sweep System. The remaining guideposts exist within the sweep systems themselves. In the vertical system there are two items that have found to be important to check. One is the ability of the vertical sync pulse to lock in the oscillator, and the other is the shape and peak-to-peak amplitude of the deflection wave at the grid of the output tube.

The vertical sync pulse, after it leaves the sync separator section, must travel through an integrating network to reach the vertical oscillator. An open resistor or a shorted by-lass capacitor in the integrator can prevent the sync pulse from reaching the oscillator. By the same token, a change in resistor values or an open capacitor can cause a reduction in the sync pulse amplitude.

To determine whether the sync pulses are reaching the vertical oscillator, place the vertical input lead of the oscilloscope at point B, Figure 2. The ground lead of the scope attaches to the receiver chassis. On the screen you should now see the waveform shown in Figure 3. The large negative pulse is that which the blocking oscillator develops in its grid circuit due to its oscillations. It appears at point B because of the coupling between this point and the oscillator grid.

The incoming sync pulse, if it is present, will show up as a small pip riding along the top of the grid wave. When it reaches the point indicated in Figure 3 the oscillator is locked in. This can be checked by rotating the vertical hold control. During a portion of the rotation, the wave will remain stationary on the screen. Then, when the control is advanced too far, the small sync will again be seen riding along the top of the wave indicating that the vertical oscillator has again slipped out of control.

The amplitude of the sync pulse can be measured, if desired, by removing the vertical oscillator tube from its socket. This kills its oscillations and permits the sync pulses to be observed alone on the scope screen.

In the horizontal sweep system, one reliable guidepost exists at the output of the AFC control tube and one at the grid of the horizontal output amplifier. The significance (and importance) of the DC output voltage of the AFC control tube was discussed at length in this column in PF INDEX and Technical Digest, No. 37. It was shown how this voltage could be measured and what it would mean if the voltage was absent.

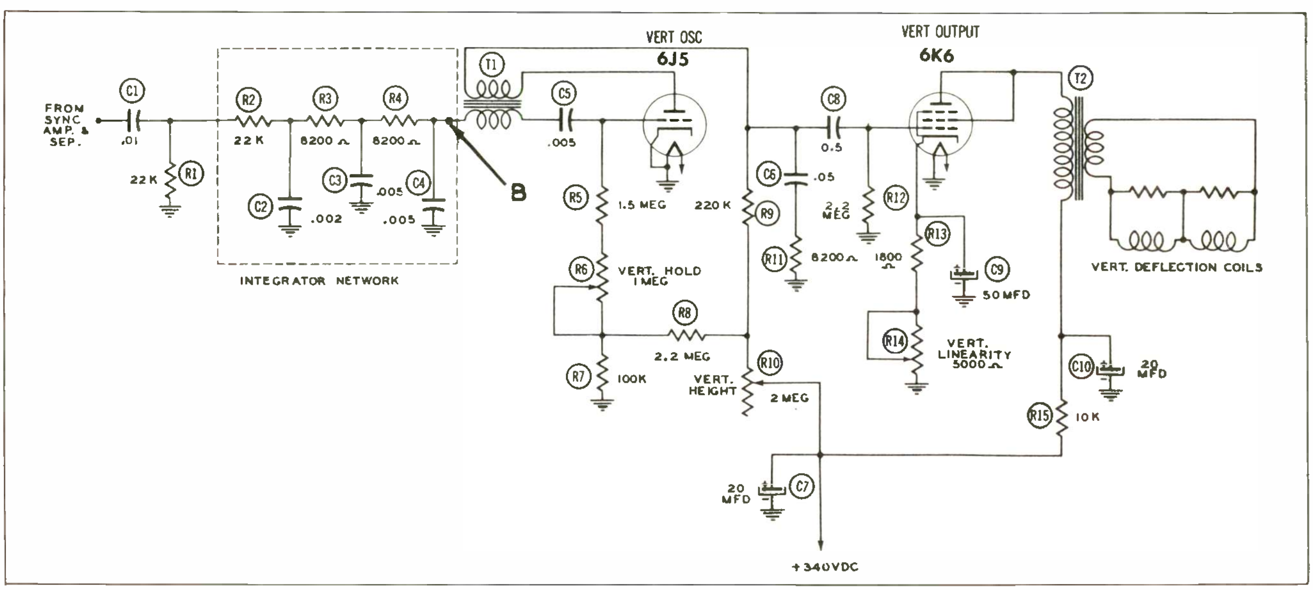

Figure 2. A Typical Vertical Deflection System

At the second point, i.e., the grid of the output amplifier, both form and amplitude are important. Check both carefully to make certain they meet specifications.

Here, then, are the major check points in a television receiver and the technician should consult one or more of them whenever he is unable to make a definite decision as to the cause or location of a defect. The rewards, in terms of time saved, will astound you.

REVIEW. The review this month concerns a quantity which is widely employed in everyday radio and television but which, strangely enough, is only vaguely understood by a good many technicians. The quantity is decibels and before you scoff at the idea that YOU are not familiar with decibels and how they are computed, see how fast you can work the following problem.

If you double the power output of an amplifier, how great is the db increase? (This is about the simplest problem you could have been given. If you cannot snap an answer back, you had better read further. And even if you know the answer right off, further reading is advisable for more complicated problems.)

DECIBELS PROBLEMS
by John B. Ledbetter
Radio-Electronics
(Formerly Radio-Craft)
February and March 1946

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* * *

The adoption of a special notation for indicating sound increases and decreases is based primarily on the fact that the human ear is not equally sensitive to all sound intensities. It is, for example, much more sensitive to changes in volume at low sound levels than it is at high sound levels. Therefore, since our ears are not linear detectors, so to speak, any system we establish for expressing changes in sound intensities must be similarly non-linear. This is where the bel and its more practical successor, the decibel, come in.

As originally established, the standard unit chosen for indicating power gains or losses was the bel. This, however, proved to be unwieldy for small ratios of sound and so a quantity only one-tenth as large as the bel, the decibel, was introduced. In all other respects, however, both quantities operate in the same manner.

A good insight into the bel and the manner of using it can be obtained from the following definition: The bel is equal to a power amplification of 10. One db, then, is a step which, when taken 10 times, will multiply the original power by 10. From this we can arrive at the fact (to be shown in a moment) that 1 db is equivalent to a power ratio of approximately 1.26. In other words, if you take the power output of some device and multiply it by 1.26, you are raising its level by 1 db.

Now let us prove some of these statements, principally the fact that 1 db is equivalent to a power ratio of 1.26. Start with 1 watt and increase this power by 1 db or 1 x 1.26 = 1.26 watts. Increasing again by 1 db, 1.26 x 1.26 = 1.588 watts. Increasing the third time by 1 db gives us 1.588 x 1.26 or 2.0 watts.

Let us pause for a second here and note that in going from 1 watt to 2 watts, we went up 3 db. In other words, an increase of 3 db doubles the original power. (Here then is the answer to the introductory question. But let us continue.)

Increasing 2 watts to 4 watts (another doubling of power) requires 3 more 1 db steps. 4 watts, then, represents here a 6 db rise from 1 watt. Again increase by 3 db, for a total of 9 db, and we have 2 x 4 = 8 watts. Now increase by 1 db to make the total increase 10 db and we have 8 x 1.26 = 10 watts approximately, or 10 times the original power.

From the foregoing we learn two important facts.

1. 1 db is equivalent to a power ratio of 1.26. Thus, a 1 db change is always a change of approximately 26% regardless of the power we start with. The decibel, remember, is a unit for expressing a change in power and it does this on a relative basis. Thus, a change from 1 watt to 1.26 watts represents the same 1 db increase as a change from 20 watts to 25.2 watts (20 x 1.26).

2. The second important fact is that a 3 db change means an increase in power by a factor of 2. By the same token, a 3 db decrease means cutting the power in half.

It is interesting to note that a difference of 1 db is the smallest change in sound intensity that the ear can discern. Thus, if you are listening to a sound possessing a power of 1 watt, an increase to 1.26 watts would be necessary for you to tell the difference. But were you listening to a sound level of 20 watts, it would require a change to 25.2 watts before you could tell the difference. This illustrates forceably how non-linear a device the ear is.

The discussion, thus far, has concerned itself chiefly with power and that is as it should be since the decibel unit was originally concerned with power levels. However, power is given in terms of current or voltage by: $W = I^2R$ or $W = E^2/R$. Hence, power may be calculated from the current or voltage, if the resistance is known. However, for a change in voltage across a given resistance, the corresponding power changes may be determined without regard to the value of the resistance. Following through with this in the above formulas, we arrive at the result that:

$$\frac{\text{Final Power}}{\text{Initial Power}} = \frac{\text{Square of the Final Voltage}}{\text{Square of the Initial Voltage}}$$

This tells us that if we double the power, the corresponding voltage is raised four times. But, we have previously seen that doubling the power resulted in a 3 db rise and an increase of 4 times meant a 6 db rise. Thus, a 3 db power rise is equivalent to a 6 db voltage increase.

Which leads us to the next important rule: To obtain the db value corresponding to a certain voltage ratio, proceed the same as for a power ratio and then multiply the result by 2. (Conversely, if the db value is given and the corresponding voltage ratio is desired, divide the db values by 2 and then proceed to work the problem).

Now that we have established the fundamental rules for obtaining db values corresponding to various

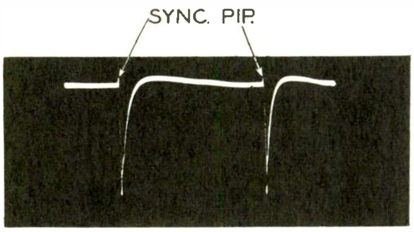


Figure 3. The Incoming Sync Pip as Seen on the Grid Waveform of the Blocking Oscillator.

power, voltage, or current ratios, let us work a number of problems to see how the rules are applied. To help us, the following figures should be memorized.

DB	Power Ratio
.5	1.12
1	1.26
2	1.5 (approx.)
3	2.0
7	5.0
10	10.0

Also keep in mind that adding 3 db causes the power ratio to be multiplied by 2.

Example 1. 4 db corresponds to what power ratio?

Answer. 4 db = 3 db + 1 db. 3 db equals a power ratio of 2 and 1 db represents a power ratio of 1.26. Hence, the answer is 2 x 1.26 or a power ratio of 2.52.

Remember that power ratios (and voltage and current ratios, as well) are multiplied while db figures are added. We demonstrated this in our initial explanation.

Example 2. 15 db corresponds to what power ratio?

Answer. 15 db = 10 db + 3 db + 2 db. 10 db is a power ratio of 10; 3 db represents a power ratio of 2; and 2 db stands for a power ratio of 1.5. Hence, 10 x 2 x 1.5 = 30.

What is perhaps somewhat more difficult is to work from a given voltage or power ratio to the corresponding db figure. The difficulty arises in finding simple factors into which the ratio figure can be sub-divided. As an example, what is the db value for a power ratio of 60? Looking at the key figures in our little table, we see that 5 x 4 x 2 x 1.5 equals 60. Thus, corresponding to a power ratio of 5, we get 7 db; for the power ratio figure of 4 we get 6 db; for the number 2, there is 3 db, and for 1.5, there is 2 db. Adding these four db figures together gives us; 7 + 6 +3 +2 = 18 db.

A voltage ratio of 60 is, according to a previous rule, the db value for the power ratio multiplied by 2. In this case it is 36 db.

In working problems of this latter type, it may be impossible to obtain the exact db value working with the simple table given above. In that case, an estimate of what this value should be can usually be arrived at by considering a slightly higher or a slightly lower value. Thus, suppose you wish to determine what the db equivalent of a power ratio of 57 is. Now, this number is not readily broken down into simple factors. However, we can readily obtain the db value of a power ratio of 60; this was 18 db, as we just saw. Also, a power ratio of 50 is, from the table, 17 db. So we know that 57 stands between 17 and 18 db and for most practical purposes, this is close enough.

Just a few more examples to help cover the most important aspects of our simple table. Suppose we are told that a certain amplifier has a voltage gain of 50 db. What voltage ratio does this correspond to?

Well, now, before we start the problem let us consider the rule that states; To obtain the db value corresponding to a certain voltage ratio, proceed the same as for a power ratio and then multiply the result by 2. In our present example, we are going in the opposite direction, that is, from db to the voltage ratio. Thus, as a start, we divide the db figure by 2. Doing this gives us 50/2 or 25 db. Now from our table we see that 25 db is equal to 10 db + 10 db + 3 db + 2 db corresponding to ratios of 10 x 10 x 2 x 1.5 or 300. Hence the voltage ratio is approximately 300 (actually 316 when worked more accurately).

Positive db values represent voltage and power gains whereas negative db values stand for voltage and power losses. + 3 db is a power increase by a factor of 2; - 3 db means that the power is cut in half. By the same token, - 6 db represents a power ratio of 1/4 and - 10 db indicates a power ratio of 1/10. If you are told that a certain system has a db loss, convert this db value to the corresponding voltage or power ratio using the table and then take the reciprocal of it. Thus, a 1 db loss represents a power drop of 1/1.26 or approximately .8.

As a quick and ready method for understanding the significance of db figures, the reader will find the foregoing extremely helpful. Naturally, for more precise computations, recourse to the logarithmic formulas for db would be necessary. But there is no need to become that involved for everyday applications and that is all that was considered here.

MILTON S. KIVER

"AILING PICTURE TUBE?"

(Continued from page 9)

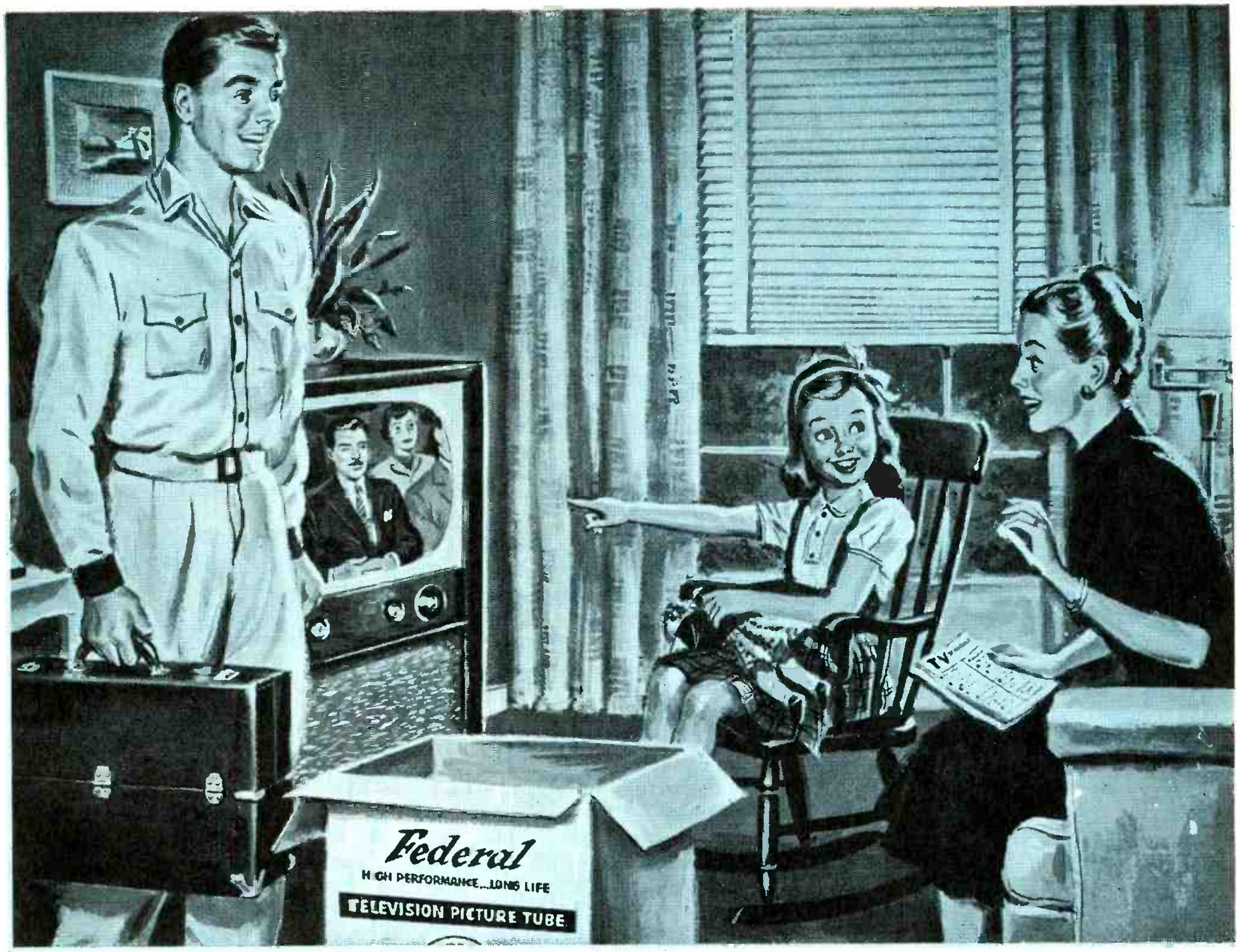
image was visible on the screen. The double image resembled a "ghost" but differed in that it was displaced vertically as well as horizontally. In most cases, however, the principal symptom of a burnt aperture is the lack of sharp focus as a result of the deformed spot.

Loss of vacuum or gassiness is another affliction which sometimes strikes down picture tubes. The serious cases very often show no visible picture at all, but instead a brilliant blue-tinted glow illuminates the necks of these tubes. The glow is a corona discharge through the gas which has either leaked into the tube or accumulated within the tube from vaporization of internal parts.

In less advanced cases of gassiness, the corona may not be so apparent. However, the scanning beam is very often affected as though the tube suffered from low cathode emission. Sometimes the "Zombie" effect, which was described in connection with low emission troubles, makes its appearance. Also a general loss of picture brightness accompanies the trouble. Substitution of a good tube is the only solution for a gassy picture tube.

Occasionally leakage or shorted conditions develop between elements within a picture tube. Frequent offenders in this regard are the heater and cathode. The symptoms of this trouble vary considerably due to the differences in the circuits involved. Very often a heater-to-cathode short results in no picture at all because the poor regulation of the high voltage supply will not permit excessive beam current flow. If the brightness control is in the cathode circuit of the picture tube,

Figure 2. A Picture Tube Brightener. (Sample—Courtesy of Workman TV, Inc.)



The man who brought back a smile

EXCITED? Cynthia was practically bursting! Last thing Dad said was "Now you look close, Cindy. You'll see me right there in the audience tonight, and I'll wave to you." (They always do!)

Long about three o'clock Cynthia's mother turned on the set . . . "just to make sure." Well, there was a picture, if you could call it that . . . but so dim and fuzzy they'd never even recognize Dad that evening. And Cindy . . . disappointed? She was brokenhearted!

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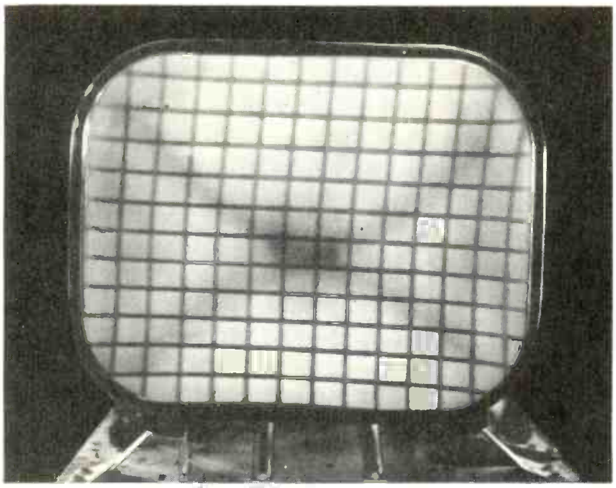

Figure 3. Severe X-shaped Ion Burn on a Rectangular 16TP4.

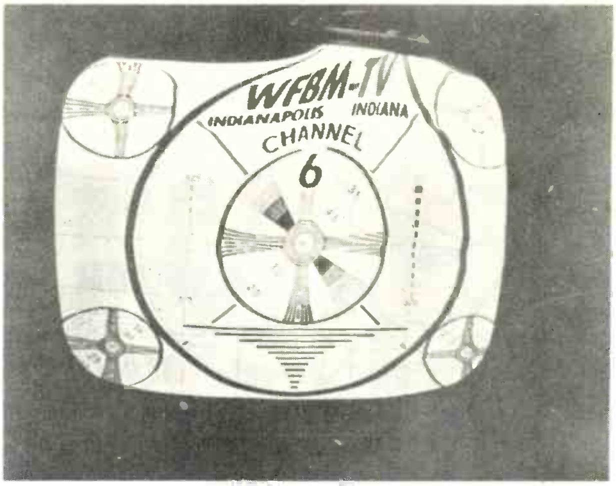

Figure 4. The Effect of a Strong Magnetic Field on a Picture Tube.

the control will very likely fail to function properly in the presence of a heater-to-cathode leakage or short. Sometimes, also, a negative picture occurs with this condition.

There is a remedial measure which may serve in some cases of heater-to-cathode shorts. A 6.3 volt, 0.6 amp. transformer may be used as a separate filament transformer to supply the cathode ray tube heater. The secondary of this transformer is left ungrounded; in this way the filament is isolated from ground and the cathode is left undisturbed by the heater-to-cathode short. When this method is employed in receivers using series connected filaments, an appropriate resistor must be substituted in the filament string to take the place of the picture tube heater. In such cases a transformer having a 117 volt primary must be used.

Other electrodes in the gun structure of picture tubes develop electrical leakage or shorts. The second anode is quite often involved because of the high voltage it handles. One such case came to the writer's attention not long ago. The complaint was a dim picture; and when a check was made with a voltmeter and high voltage probe attachment, it was found that the second anode voltage on the picture tube was two or three thousand volts lower than it should have been. Moreover, it was found that the voltage out of the high voltage supply rose to its correct value as soon as the anode lead was removed from the picture tube. With the brightness control kept at minimum setting, the anode lead was connected again to the picture tube and the high voltage was seen to drop once more to its former value. This indicated that leakage was occurring within the tube and consequently causing the low high voltage. A new picture tube was the only solution.

We have received reports that a method of "sparking" has been used to try and remove shorts caused by particles of material which becomes wedged between close-spaced electrodes. This "sparking" procedure is done with a source of high voltage, low current AC or DC such as that developed in the average TV receiver. The high voltage, when placed across the shorted elements, produces a spark through the foreign particle causing the trouble. The energy heats up the particle and vaporizes it. This method of curing a short has been reported to work in a percentage of cases, but it cannot be relied on for all. Care should be exercised in this procedure since dangerously high voltages are involved.

Figure 5. Cathode Ray Tube Analyzer Model 707 Produced by Jackson Electrical Instrument Co.

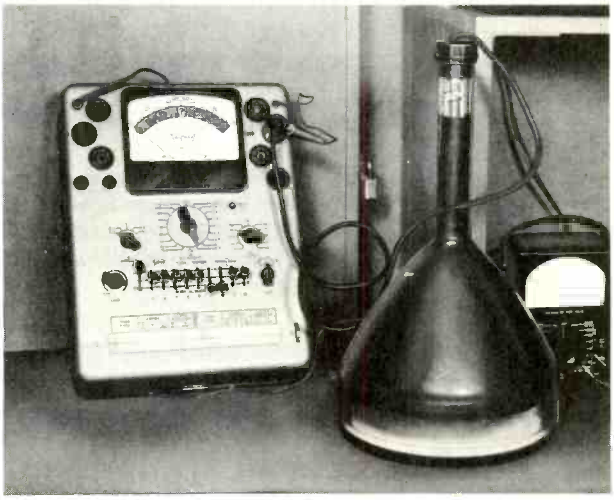

Figure 6. BV Adaptor Made by Triplet Electrical Instrument Co.

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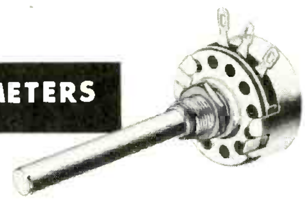

Because the resistance material in these units is solid-molded—not sprayed or painted on—continued use has practically no effect on the resistance. Often, the noise-level *decreases* with use . . . and they provide exceptionally long, trouble-free service. Rated at 2 watts, with a good safety factor.

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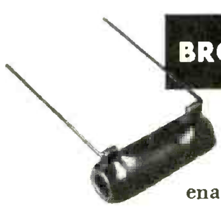

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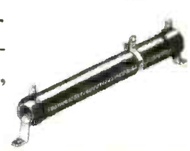

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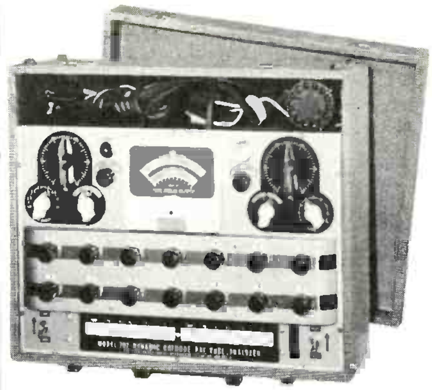

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In Canada: The Canadian Marconi Co.

Here again, there can be no guarantee given the customer as to how long a tube treated with this sparking procedure will perform. By making it clear to him that the sparking may only effect a temporary cure, future misunderstandings can be avoided.

One very obvious ill which might afflict a picture tube is an open heater. Visual inspection of the neck of the tube will usually reveal this trouble. Sometimes the heater will open after a brief warm-up and make contact again when cool; it may undergo on and off cycles of operation, in this way producing a rather weird effect.

In cases of flickering in the picture or unaccountable changes in brightness level, the picture tube's base and socket and the socket cable should be checked for intermittent open connections before condemning the picture tube itself. In any case, where a picture tube is suspected of being defective, a test of the voltages at the socket contacts should be standard procedure to eliminate any possibility of the cause being there rather than within the tube.

Finally, in discussing picture tube ills some mention should be made of the effect of cone magnetization on a metal picture tube. Figure 4 shows what happens to a picture when subjected to a strong external magnetic field such as might be produced by the field magnet of a PM speaker. If a metal picture tube cone acquires a magnetized area either through proximity to, or contact with a magnet, the effect is similar to that shown in Figure 4. The prescribed remedy calls for a focus coil connected to a variable source of AC power such as a variac. The application of this focus coil, energized with low voltage AC, to the affected cone area is the recommended treatment. However, from experience with this method, we cannot vouch for its reliability. Replacement of the picture tube is advisable.

Cathode Ray Tube Testers -

In the matter of picture tubes, several manufacturers of test instruments have presented the service industry with some assistance. They have produced cathode ray tube testers and special adapters which extend the utility of their regular tube testers to include picture tube checking.

Figure 5 shows the Cathode Ray Tube Analyzer, Model 707, manufactured by the Jackson Electrical Instrument Co., of Dayton, Ohio. This instrument is laid out similar to a conventional tube tester, it has a roller chart which gives all control settings for the various types of picture tubes, and it features a meter with a "bad-good" calibration for the beam test and a "normal-gassy" calibration for the gas test. There are also a "shorts" test and a "grid control" test incorporated in the instrument. The socket is made so that it fits either the diheptal or the popular duodecal tube base. For other bases a universal adapter is provided with the instrument. The Jackson 707 will test for shorted elements, low cathode emission, poor grid control, and gassiness; moreover, the tests may be performed on a picture tube without removing it from chassis, cabinet, or packing box. This instrument has indeed proven its worth in verifying the condition of picture tubes in the field.

Triplett Electrical Instrument Co., of Bluffton, Ohio, has a BV Adapter which is pictured in Figure 6. This unit consists of an 8 pin octal base, a cable, and a duodecal socket. It may be used with any of the Triplett Models 2413, 3312, 3413, and 3413-A Tube Testers. Tests for shorted elements and for cathode emission rate are the principal checks which may be performed.

Sylvania Electric Products Inc. of Emporium, Pa., also has an adapter for use with Sylvania Models 139, 140, 219, and 220 Tube Testers. It goes under the designation of Sylvania Cathode Ray Tube Testing Adapter Type 228 and is pictured in Figure 7. Both it and the similar Triplett adapter are for use only with electromagnetically deflected picture tubes having duodecal bases. Since this classification includes most modern picture tubes, the limitation is not a particularly serious one. When used with a Sylvania tube tester, the Type 228 adapter enables the technician to check the emission of a picture tube and detect the presence of shorted elements.

The adapter unit in Figure 8 is produced by the Hickok Electrical Instrument Co., of Cleveland, Ohio. The CRT-1 adapter is made for use with any Hickok tube tester and enables checks to be made on all picture tubes using the standard small duodecal base or the noval base such as employed by the 12WP4. The emission of the cathode, the grid control, and the presence of gas in the picture tube can be checked with the Hickok adapter and tube tester.

While this discussion has by no means exhausted the subject of picture tubes and their ills, we hope that it has contributed to the information on the subject. A picture tube cannot be substituted as easily and quickly as other tubes. Therefore, the more accurate the service technician's diagnosis with regard to a picture tube, the better and more profitable his work becomes.

GLEN E. SLUTZ

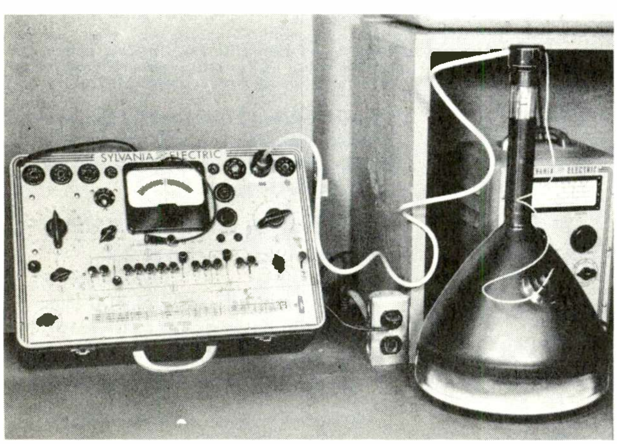

Figure 7. Sylvania Cathode Ray Tube Testing Adaptor Type 228.

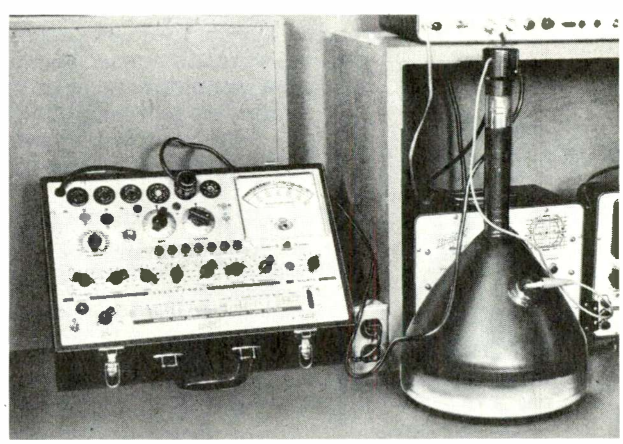

Figure 8. CRT-1 Adaptor Made by Hickok Electrical Instrument Co.

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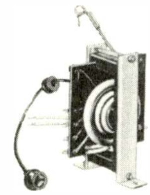

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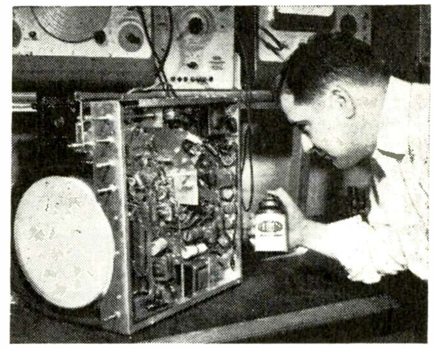

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"UHF" (Continued from page 27)

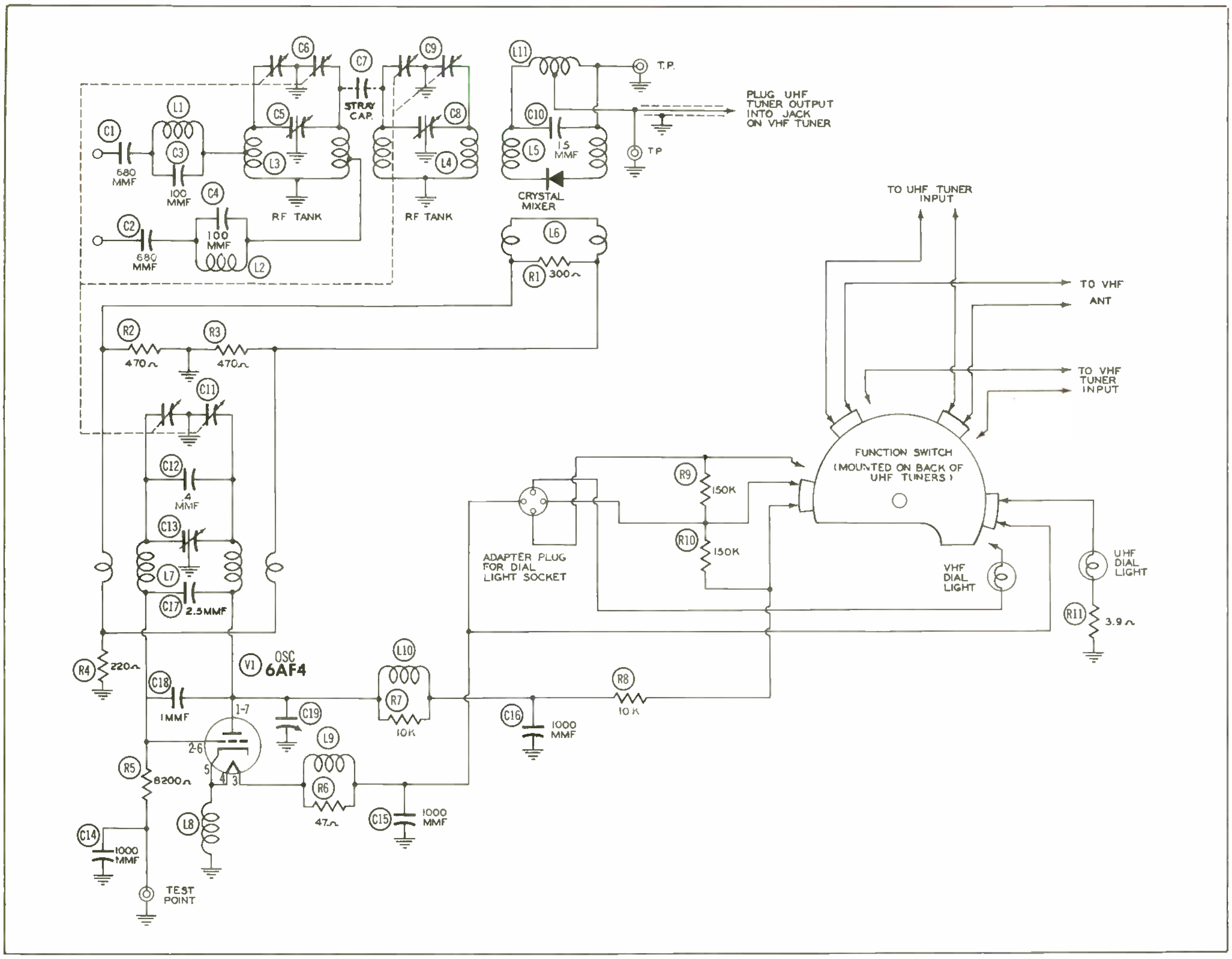

Figure 7. Schematic of Philco UHF Tuner Model UT-20A.

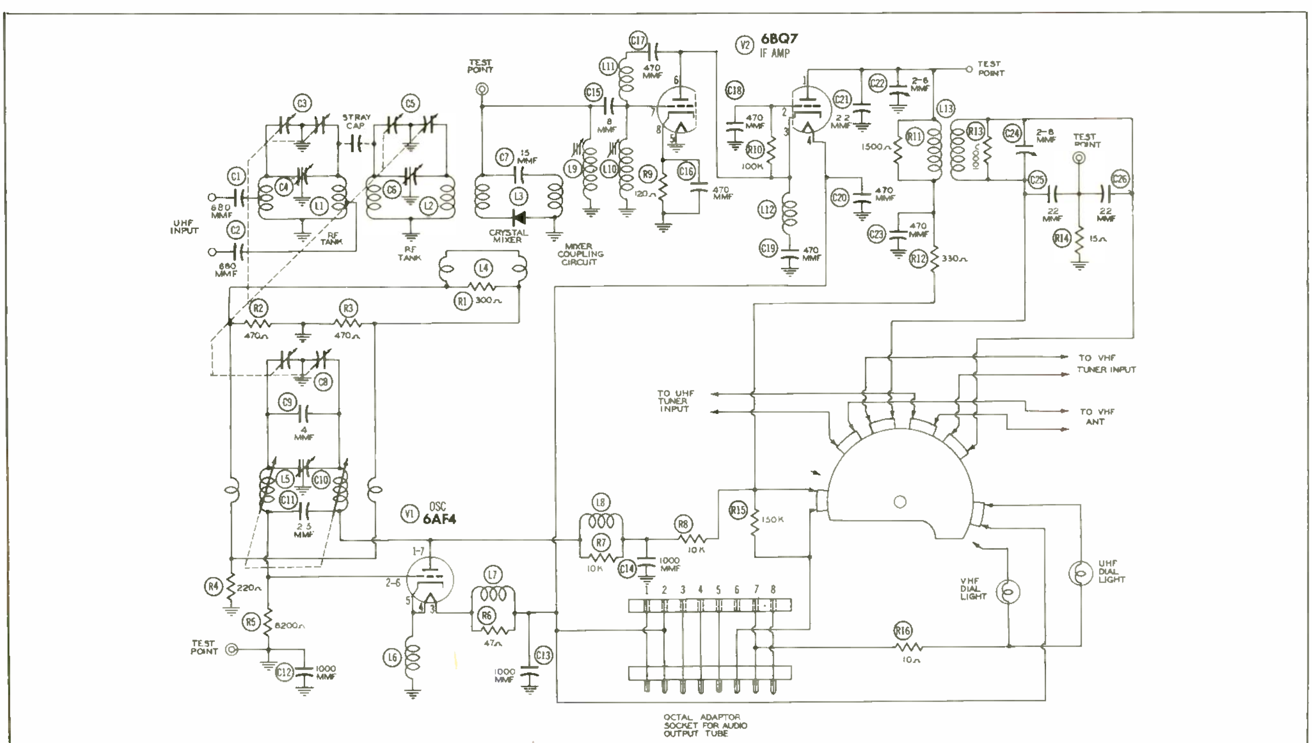

Figure 8. Schematic of Philco UHF Converter Model UT-21B.

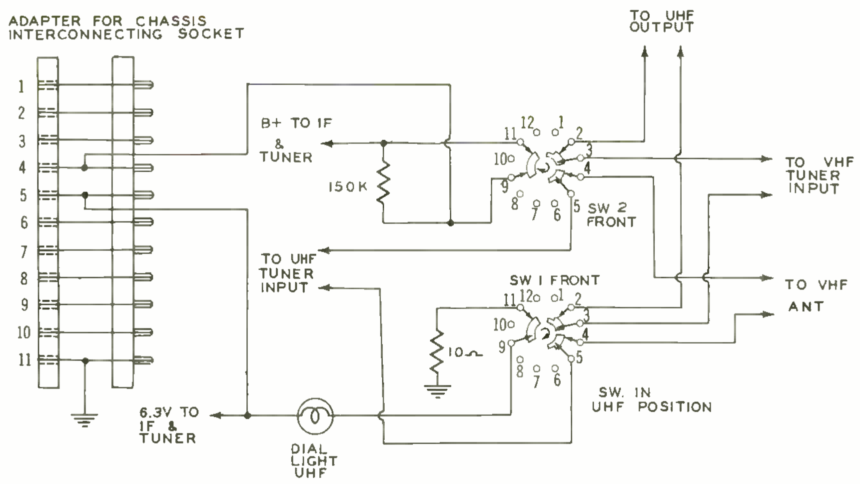

Figure 9. Function Switch and Adaptor for UHF Tuner UT-21.

and stray capacitance to another tank coil. Adequate selectivity is thus achieved in these tuned circuits while simultaneously maintaining the required bandwidth. From the tank circuits the signal is coupled to the mixer circuit. Signal conversion is achieved at this point by feeding a signal from the oscillator to the mixer. The oscillator tuned circuit also employs a semi-butterfly arrangement in a modified Colpitts oscillator circuit. The crystal mixer employed in the Philco UHF tuner units is specially designed for this application and yields the desired signal at the frequency of channel 2 or 3. Signal gain is provided by a cascode coupled twin triode tube type 6BQ7. The output of the IF amplifier is transformer coupled to the function switch and from there to the input of the VHF tuner in the receiver.

Observe on the schematic in Figure 8 the use of an octal adapter socket. When plugged into the audio output tube socket, the required operating voltages are supplied to the UHF unit. In the case of the factory installed unit, adaptor sockets are not employed since the leads are wired directly to the receiver.

To simplify control of the UHF tuning unit when installed in a television receiver, the function switch is attached at the back of the VHF tuner except for the Model UT-21. Thus, the switch can be made to actuate at the position of the VHF tuner previously established to provide UHF reception.

The function switch is actuated in a different fashion in the Model UT-21 tuning unit. This tuner is designed for some of the earlier production receivers. In this Model unit, the function switch operation is controlled by pulling out or pushing in the UHF tuning knob.

The schematics of the UHF tuning devices are drawn showing a common antenna connected. It may be found after the completion of the installation that the existing VHF antenna provides adequate reception of both VHF and UHF signals. Thus the antenna problem will not exist. It may be necessary to install either a common VHF-UHF antenna or install a separate UHF antenna whichever fits the particular situation.

Supplied with the tuner kits are the instructions for making a satisfactory installation. It is important that the included instructions be followed closely to obtain efficient performance. Another item of importance, is to obtain the correct tuner kit for a specific receiver and to make sure, particularly with older receivers, that built-in kits are designed for that particular receiver.

RCA KRK-25 VHF-UHF TUNER KIT

The KRK-25 kit is designed for installation in certain existing RCA television receivers not previously supplied with UHF tuning provisions. RCA chassis for which this kit was designed are as follows: KCS66, KCS66A, KCS66C, KCS66D, KCS68C, KCS68E, KCS68F, KCS68H, and KCS74.

The tuner unit is identified as a KRK-12 and is designated as such when factory installed in a receiver chassis. This tuner is shown in Figure 10.

Included in the KRK-25 kit is VHF-UHF tuner unit KRK-12 and the necessary mounting hardware to complete the installation. To install this tuner in the previously listed chassis, the original tuner is replaced with the KRK-12. Supplied with the tuner kit are 12 VHF channel inserts to provide reception of any VHF station within the receiving area. As UHF stations go on the air, UHF inserts may be obtained from local RCA distributors. Figures 11 and 12 show the VHF and UHF inserts used with the tuner.

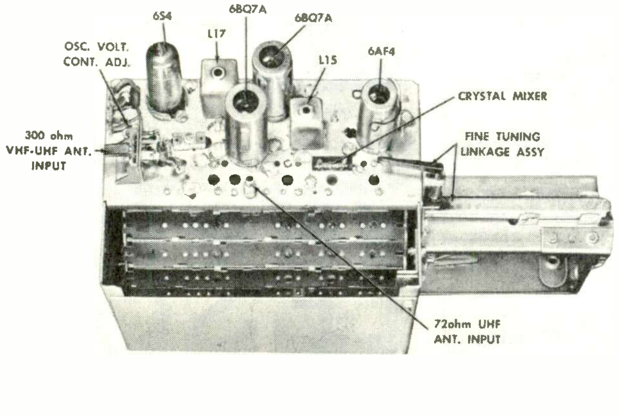

Figure 10. The RCA KRK-12 Tuner.

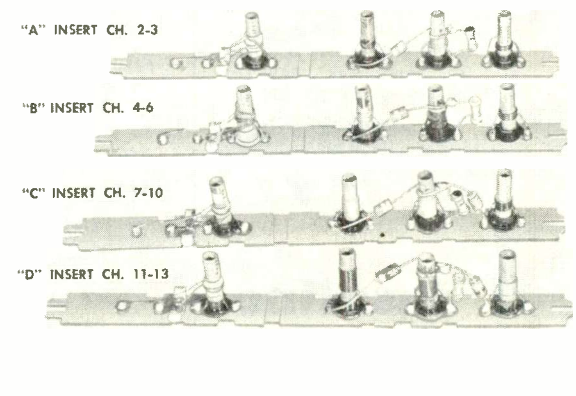

Figure 11. VHF Channel Strips for KRK-12 Tuner.

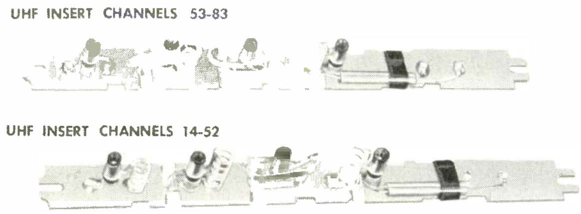

Figure 12. UHF Channel Strips for KRK-12 Tuner.

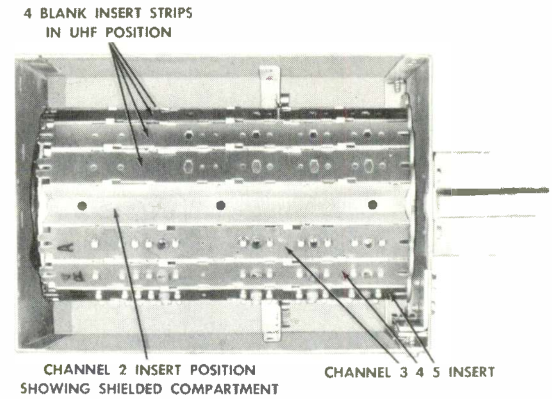

Figure 13. Turret of KRK-12 Tuner.

To install this tuner in any of the above listed chassis, the original tuner is removed and the new tuner substituted in its place. Included in the KRK-25 kit are the VHF-UHF tuner unit shown in Figure 10, and accessories necessary to complete the installation. In addition, the rotor is equipped with twelve VHF channel inserts to provide reception of any VHF station within the receiving area. As UHF stations go on the air, UHF inserts may be obtained from local RCA distributors.

The design of the RF tuning unit in the KRK-25 departs considerably from that of the original tuners in the previously listed chassis. The new tuner is a rotary turret type employing sixteen channel positions, four tubes, and a crystal mixer. (This rotor is shown in Figure 13.)

All tuner electrical components, with the exception of those on the insert strips, are mounted on the top cover plate. Components mounted below this cover are shown in Figure 14.

A cascode-connected 6BQ7A functions as an RF amplifier stage for VHF reception. Common to both VHF and UHF operation is a type 1N82 crystal mixer and a cascode-connected 6BQ7A IF amplifier. Thus, it is noted that the tuner operation remains essentially identical for both types of reception, with the exception of the RF amplification provided in VHF positions only. This is illustrated in the block diagrams in Figure 15.

One feature of the tuner unit in the KRK-25 kit is the use of a 6S4 tube as a voltage control. Incorporation of the control circuit tends to provide greater stability characteristics of the oscillator circuits in UHF position. Although the control tube functions during both VHF and UHF reception, its primary function is to assure stable oscillator performance when receiving UHF signals.

Oscillator plate voltage should be established at the desired figure by measuring the oscillator tube plate current with the circuit in a non-oscillatory state. The desired current to be read on the meter is 28 milliamperes and it is obtained by adjusting the oscillator voltage control. This procedure is facilitated by switching the tuner rotor to a point midway between channel positions. Even though the tuned circuits are not connected, the tube may still continue to oscillate. If this occurs, touch the tuner spring contacts 12 and 13 (located near the front of the tuner) with a finger while making the necessary adjustments.

Note in the schematic for the tuner unit (Figure 16) only one oscillator tube (6AF4) is employed. Thus, a single conversion process provides the desired IF frequency of 40 megacycles in both the VHF and UHF channel positions.

After the tuner installation is completed, and all the necessary tuner inserts are installed and correctly adjusted, channel selection is automatic, governed only by the setting of the channel selector knob.

The circuitry for the tuner in the KRK-25 is shown in the schematic Figure 16. The schematic is drawn showing the channel 2-4 insert in position. In tracing a VHF signal through the unit, assume a VHF antenna is connected to the input terminals with a low channel VHF insert in place. The combination L1, C1 and L2, C2 forms

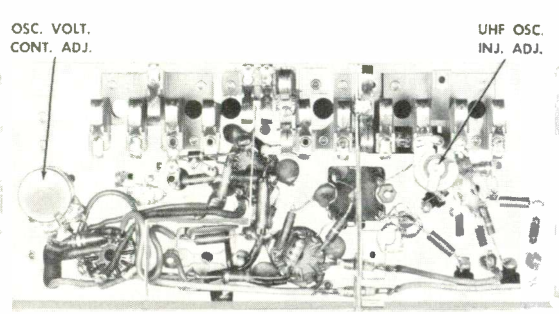

Figure 14. Under Chassis View of KRK-12 Tuner.

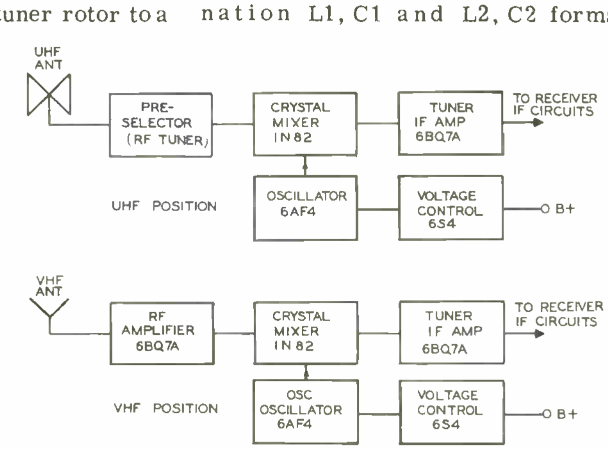

Figure 15. Block Diagram Showing Operation of KRK-12 Tuner.

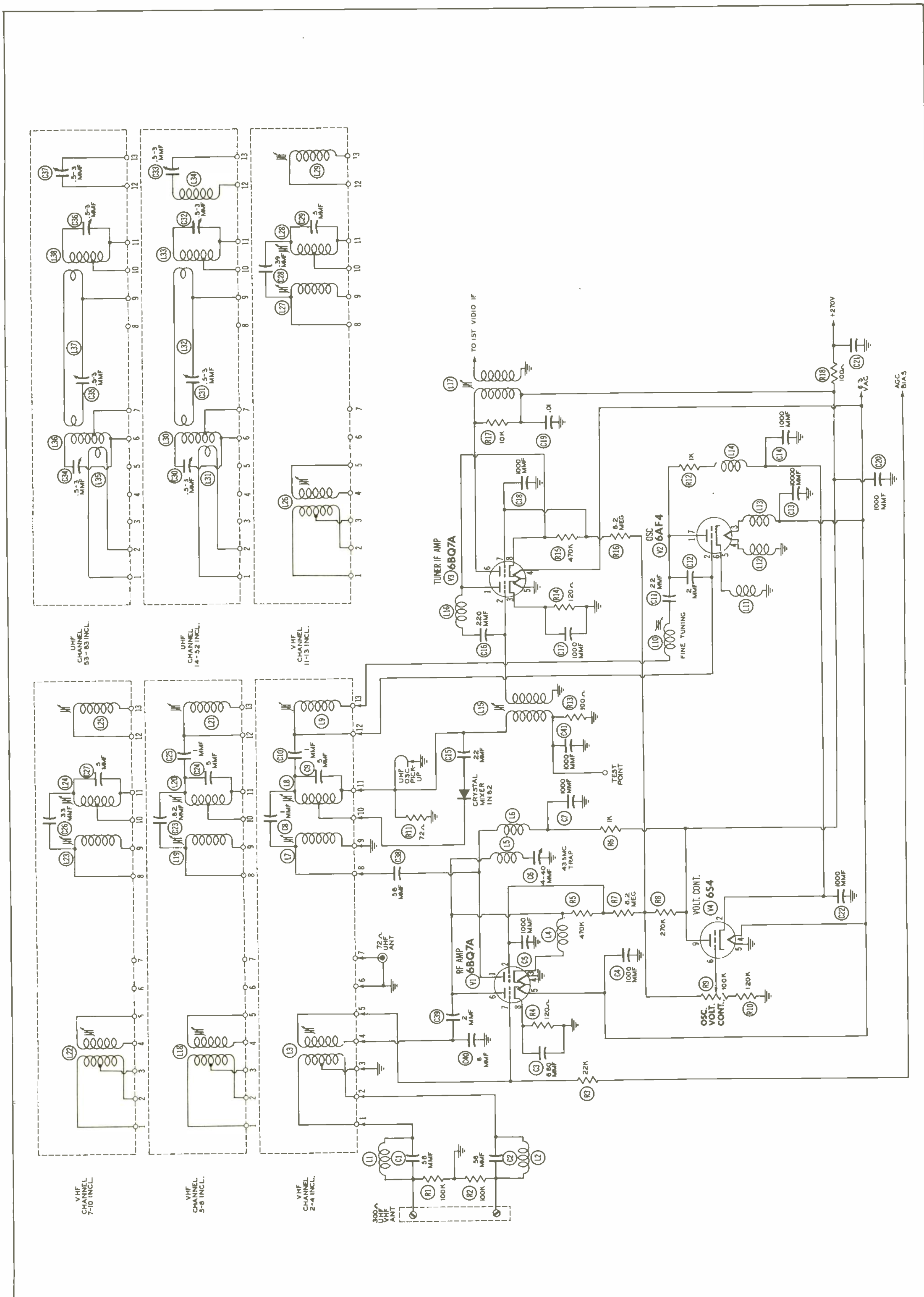

Figure 16. Schematic of RCA KRK-12 Tuner.

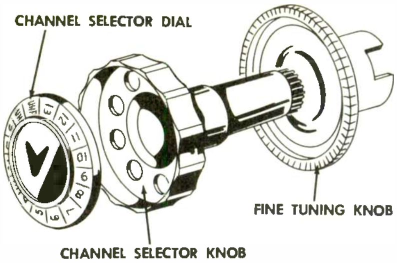

Figure 17. Details of Selector Knob.

bandpass filters for attenuating undesired signals in the input. L3 is the antenna matching transformer that provides the proper impedance match for a 300 ohm line. The secondary of L3 applies the incoming signal to the RF amplifier tube V1. Connected cascode, this tube provides the desired amplification with low noise as a result of its inherent low noise characteristics. L5 and C6 are a series resonant 43.5 mc IF trap. The signal in the output of V1 is developed across the plate load inductor, L6. The combined effects of L7, C8, L8 and C9 control the frequency response characteristics in the output circuitry of V1 and the input to the crystal mixer.

A 6AF4 oscillator tube is employed in the tuner for both VHF and UHF applications. Oscillator frequency is controlled primarily by the variable inductor, L9, in this instance, preset to obtain the desired frequency. L10, consisting of a small amount of inductance, may be varied by the fine tuning control knob to touch up tuning as required. C10, a 1 mmf capacitor on the insert strip provides the correct coupling of the oscillator to the mixer circuit. Note, that a coupling capacitor is not employed in this application on the high VHF channel inserts since adequate coupling at the frequencies of these channels exists due to the proximity of the components.

From the mixer the resultant intermediate frequency is applied to the IF input transformer, L15. The primary is connected to ground through a 100 ohm resistor, R13, shunted by a 1000 mmf. capacitor, C39. At the junction of these connections is a test point location employed during alignment procedures.

The tuner IF amplifier tube, type 6BQ7A, is cascode-connected and is employed to counteract for the losses in the crystal mixer, and provide a signal to the receiver IF stages of a level necessary to effect efficient receiver performance. Tuned elements associated with this stage operate at a fixed frequency which is the frequency of the receiver IF stages.

When the turret rotor is switched to a UHF position, tuner operation remains essentially the same, with the exception that RF amplification is not employed. In this instance, double tuned tank circuits (link coupled) are employed as preselectors prior to application of the signal to the mixer stage.

The tuning knobs and dial indicator are shown in Figure 17. As UHF inserts are incorporated in the unit, index tabs are placed in the indicator dial at positions corresponding to the location of the UHF inserts.

Since this tuner has provisions for utilizing various types of antenna systems, certain minor tuner input modifications are essential to achieve efficient performance. If a combination 300 ohm UHF-VHF antenna system is employed and connected to the input of the tuner, it is necessary to break connection between the contact springs connected to the 72 ohm coaxial input and the buttons on the UHF inserts. This procedure is performed by removing the tuner cover and turning the selector knob until an empty drum compartment lies under the 72 ohm input jack. The contact springs are then accessible and may be bent away from the insert buttons.

Should separate VHF and UHF antennas be employed, it is necessary to remove the coupling link on each of the UHF inserts. The link is cut free from the contact buttons to which they are soldered. The tape securing the loop to the insert, is then removed. The loop is then removed by carefully rotating until it slips out easily.

Features associated with the tuner in the KRK-25 kit are as follows:

1. All channel inserts are preset at time of installation.

2. The same tuning knobs are employed for both VHF and UHF.

3. The tuner is built-in, forming an integral part of the television receiver chassis.

4. Oscillator drift is minimized through the use of an oscillator-voltage control tube.

5. A crystal diode forms the mixer for reception of both VHF and UHF signals.

6. The design of the tuner permits reception of any combination of sixteen VHF and/or UHF television signals.

MERLE E. CHANEY

"DESIGN FEATURES"
(Continued from page 39)

and noise pulses are blocked from the sweep oscillator sections. Another way of looking at the operation of the noise canceller tube, is to view it as a shorting switch or variable shunt. When the noise level of the received signal is below that of the sync pulse amplitude, the noise canceller tube is non-conductive or the switch is open. However, a high amplitude noise pulse causes the tube to conduct, immediately shorting the output of the sync amplifier, thus providing a low resistance path to ground for the signal.

Although, sync pulses may be eliminated simultaneously with the high amplitude noise signal, for short intervals of time, the sweep oscillator circuits in the receiver continue to function synchronously with the signal due to their inherent inertia or flywheel action.

PICTURE STABLIZER CONTROL

The picture stablizer control located on the rear apron of the chassis should be adjusted at the time of installation. It establishes the range of AGC bias developed. The correct setting for this control is at a position whereby the strongest received signal does not cause overloading.

LOCAL-DISTANCE SWITCH

A "local-distance" switch is incorporated in conjunction with the picture stablizer control. The switch is actuated by the stablizer control at the full clockwise (distance) position. In this position, R9, a 22K ohm resistor is switched out of the circuit, thus enabling a larger swing of plate voltage to effect triggering of the sweep oscillator circuits.

HORIZONTAL AND VERTICAL RETRACE BLANKING

An additional feature of the G. E. Model 21T1 receiver is the use of circuitry to eliminate visible retrace lines from the screen of the picture tube. Provisions are employed to eliminate both vertical and horizontal retrace lines. In both instances, positive-going retrace pulse voltages are fed to the cathode of the picture tube, driving the tube into non-conduction, or to sufficiently low beam, that fluorescence of the tube is not achieved. Vertical blanking is achieved by coupling a signal from the vertical amplifier stage through a differentiating network to the picture tube cathode. To achieve effective horizontal blanking, an additional triode is employed, connected as a cathode follower. This method provides adequate decoupling between the horizontal output stage and the picture tube cathode circuitry.

INTERCARRIER SOUND

Adaptability of this receiver to UHF service is assured through the use of the 40 megacycle IF system and intercarrier sound. The sound stages are fed by a 4.5 megacycle signal taken off from the video detector output stage. The sound IF circuits consist of an IF amplifier, limiter, and ratio detector.

STEWART-WARNER 9300 SERIES

The Stewart Warner 9300 Series television receiver incorporates several features of interest to the servicing technician. Physically a difference noted over the previous 9200 Series is the use of sectionalized chassis assembly. This permits the wiring in the form of a sub-assembly of many of the receiver circuits which in turn effects a grouping of components associated with each circuit. A comparison between the 9200 and 9300 Series chassis is shown in Figure 11.

One sub-assembly contains the entire video IF, video detector, sound IF and output stages. The next assembly consists of the gated sync separator stage, sync amplifier, vertical blocking oscillator circuit, and keyed AGC. The remainder of the chassis holds the deflection circuits.

Another mechanical feature is the use of a bridge bracket at the rear of the chassis to support the deflection yoke. This bracket is useful when servicing the receiver since the chassis may be tilted on its side without danger of damaging tubes or components.

Other features of interest are the use of plug-in leads for the yoke. These leads are plugged into a terminal strip mounted on top of the vertical output transformer. (See Figure 12.) Thus the yoke leads may be readily disconnected for testing or removal without any soldering operations. In the same manner, the horizontal output transformer is designed with plug-in jack connections (Figure 12)

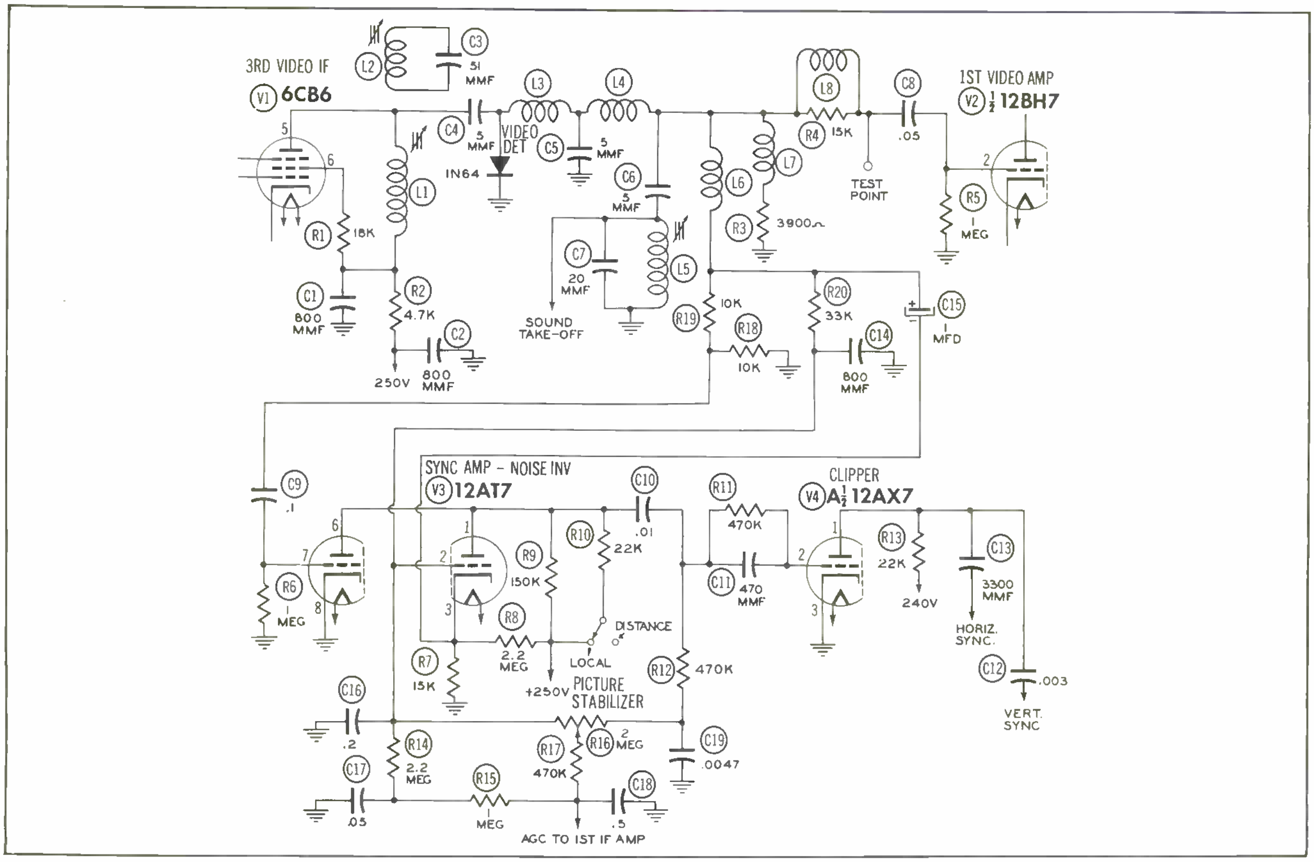

Figure 10. Partial Schematic of GE Model 21T1 Receiver.

which can be readily removed without unsoldering. Since horizontal output transformers are frequently tested when diagnosing receiver troubles, the plug-in connections contribute to a saving of time during this procedure.

In addition to the mechanical details described, there are several interesting electrical features. Among these are keyed AGC, gated sync separator, width control, and electrostatic self-focus picture tube.

The purpose of the keyed AGC tube is to permit a fast action AGC system that is relatively immune to noise bursts and rapidly varying signal strength such as encountered when TV signals reflect from aircraft. Thus, the AGC bias developed is more nearly indicative of the signal level at a given instant than with slower acting systems. Figure 13 is partial schematic showing the keyed AGC circuit.

The keyed AGC tube employs a gate-like action for its operation. In order for the keyed AGC tube to conduct and develop bias, a pulse is fed to the plate of the tube from the horizontal output transformer. At the same time a sync pulse is fed to the grid from the video amplifier. Thus, if the horizontal sweep is not in synchronization with the sync pulses no AGC is developed. This allows the RF tuner and IF stages to provide increased amplification for pulling the sweep circuits into a synchronous condition with the incoming signal.

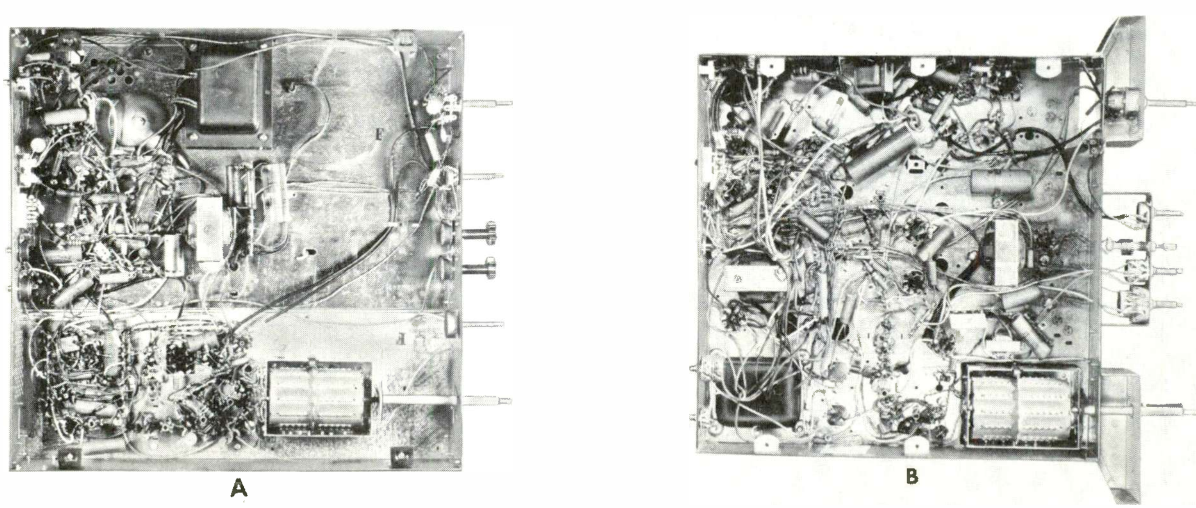

Figure 11. Stewart Warner Chassis Showing Component Grouping in 9300 Series (A) as Compared to 9200 Series (B).

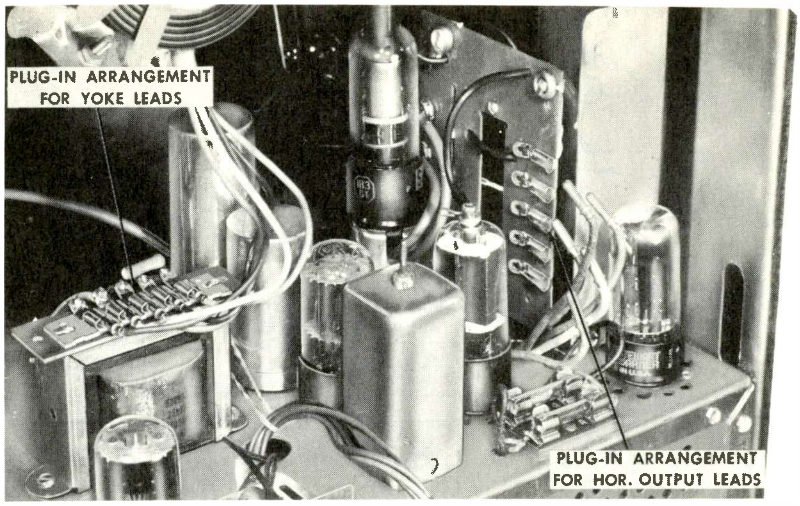

Figure 12. Plug-in Connections Employed on Horizontal Output Transformer and Deflection Yoke.

The sync separator circuit in the Stewart Warner 9300 Series employs gating action for its operation. In this instance, a 6BF6 is employed as the sync separator. Frequently used as a converter in radio receivers, certain characteristics of this tube also make it readily adaptable for service as a sync separator. When employed in the circuit shown in Figure 13, it not only functions as the sync separator but also acts to prevent noise pulses from prematurely triggering the sweep oscillator circuits.

The components and voltages applied to the sync separator are selected to insure that the normal video signal from the detector will cut off tube current. The signal from the detector is fed to pin 1 of the 6BE6 separator which is grid No. 1. Also observe that an opposite polarity signal from the video output stage is fed to grid No. 3 (pin 7) of the separator. Therefore, the action of this stage is as follows. The normal sync pulse signal is fed to grid No. 1 and, although of negative polarity, it is low in amplitude and will not cut off plate current in the tube. The large amplitude signal fed to grid No. 3 is passed by the tube. The low screen and plate voltages permit ready saturation in the tube which

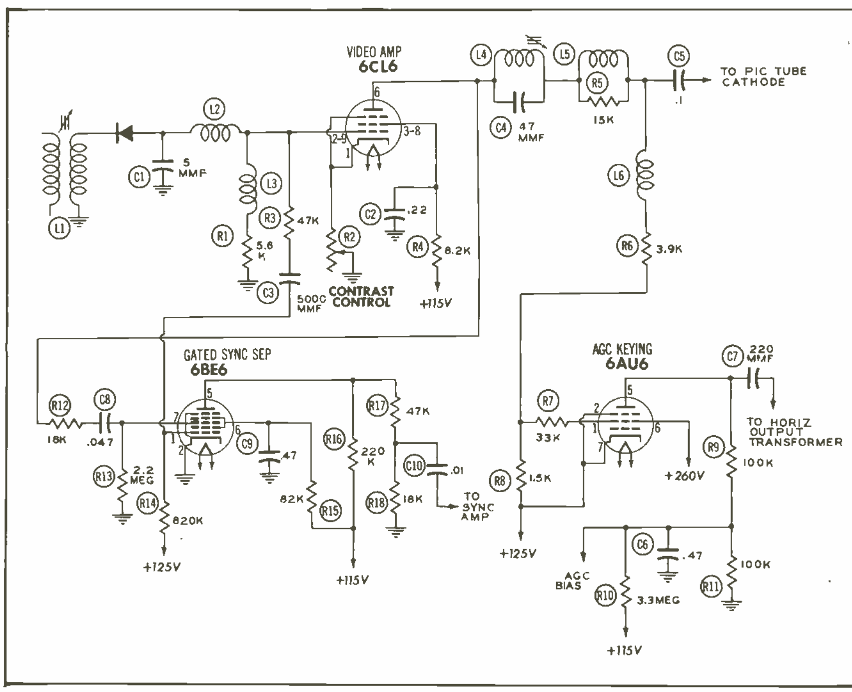

Figure 13. Partial Schematic of Video, Keyed AGC, and Gated Sync Separator Circuits.

tends to provide uniform amplitude sync pulses.

When a noise pulse occurs and is fed to grid No. 1, tube current is cut off providing the noise pulse is of greater amplitude than the sync pulse. Although a positive-going amplified version of the noise is fed simultaneously to grid No. 3, there is no action upon the plate current since the electron stream is blocked from reaching the plate by the gate action at grid No. 1.

It is noted, therefore, that noise occurring simultaneously with a sync pulse can prevent sync pulse triggering of the horizontal oscillator. This, however, should not affect synchronization since the flywheel action in the horizontal system will maintain a synchronous condition.

The width in the Stewart Warner 9300 Series is adjusted with the damper tube. All B+ voltage supplied to the output transformer and output plate flows through the damper tube. Thus, the width control varies the B+ voltage to this stage which in turn varies the amplitude of the sweep pulses.

An electrostatically focused picture tube 21MP4 is employed in this receiver. This tube is the self-focusing type and external adjustments are not required. The focusing anode is connected directly to ground for this tube. Centering of the raster is achieved through the use of centering magnets on the neck of the picture tube.

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"DOLLAR AND SENSE"
(Continued from page 83)

TELEPHONESE. Hot stick--a soldering iron. Punk fat--solder. Digs--diagonal pliers used to cut and skin wire. Bliffy sniffer--an amplifier used to detect breaks in a cable without picking through the insulation; linemen claimed it could smell the tone signal. Buttinski--hand telephone used for test purposes. Relay buster--an installer who specializes in adjusting relays. Shiner--the bare wire between the end of the insulation and the terminal. From a Western Electric collection of colloquialisms used by telephone people.

KAMERAPHONE. A phonograph no bigger than a box camera got added to our collection this spring. It was made in Germany around 1900 and could well be the forerunner of portable phonographs. Spotted it at a moving-to-California auction in Mahway, N. J. and bid it in at $3.50 for a real bargain.

The turntable is a cute three-spoke folding arrangement that holds a 10-inch record yet folds into three parallel bars for which there is a recessed storage slot in the wood motor-board. The horn is a celluloid half-sphere about 3 inches in diameter; it plugs onto the sound outlet of an almost-standard-size orthophonic reproducer, and even has a shutter-type volume control that controls the aperture sizes through which sound waves emerge from the half-sphere. This contraption violates all textbook rules we've seen on horn design, yet it sounds quite loud and clear.

The spring motor, wound by inserting the crank in a hole where you'd expect the camera lens to be, lasts for about half of a 10-inch record, but may do better after an overhaul and cleaning. Something


Ultra-Hi and VHF "Conical-V-Beams" by
telrex
OUTSTANDING BROADBAND LOW ANGLE, constant impedance array.
A stacked "Conical-V-Beam" array offers the perfect pattern with constant center impedance, one major in-line lobe with compacted, low angle vertical lobe and elimination of all spurious lobes, for outstanding long distance or local reception without snow, ghosts or reflections, with full video and audio fidelity on any UHF channel.
Designed with spline reflector (no chicken coop wire) for complete freedom from flutter, flicker and reflections.
Factory assembled for "ease of mind" installation. All aluminum construction—Nothing to rust!
BETTER BY DESIGN...
RAIN OR SHINE!
NEW TELREX UHF "BOW-TIE"
• All Aluminum Hurricane Design—with spline reflector—No "Chicken Wire" Reflector
• 66% Less Wind and Ice Loading for Longevity and "Ease of Mind" Installations
• Nothing to Rust!
MODEL 750 UHF "BOW-TIE"
• Peak Efficiency—No Dead Spots
• Gain Over 13 db (stacked)
• Front-to-Back Ratio Over 25 db.
• Simplicity of Installation
• Sectionalized Design—Basic Units Interchangeable for Single Bay, Stacked or Parabolic Assembly
Call or write for catalogs today on the complete TELREX line—there is no obligation, of course.
TELREX MODEL 800-2X
Other models available for every price range.
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The ultimate in long distance arrays. Guaranteed to out-perform any antenna or combination of cut-to-frequency antennas. When used with Duo Band splines it comprises the ultimate from Channel 2 to 83. Unequalled for reception up to 200 miles.
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"CONICAL-V-BEAMS" ARE PRODUCED UNDER RE-ISSUE PATENT NUMBER 23,346 and SOLD ONLY THRU AUTHORIZED DISTRIBUTORS
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seems to slip and groan inside after it's partially wound. Reminds us of an old Electrical Merchandising carton showing a slide-'em-in portable phonograph being brought into a service shop with the complaint, "Every time I put in a record, it goes crunch, crunch, and then burps."

RARE NEEDLES. Getting spare parts or a new needle for a customer's favorite old cylinder or disk phonograph is by no means hopeless even now. The company to which Edison, Victor, and Columbia often refer requests for spare parts and repairs is Facorite Manufacturing Co., 105 E. 12th St., New York 3, N. Y. It is run by Charles Kronenberger, Jr. as a wholesale distributor and manufacturers of practically everything in the phonograph line. Here are a few examples of prices: Replacement needle for cylinder phonograph-- \$2.50 up for sapphire and \$12.50 up for diamond. Replacement diaphragm for reproducer is \$2 up for aluminum, mica, or glass. New motor main springs run \$6.75 up. The broken part, worn needle, or motor spring barrel should be submitted for duplication. When the correct needle is not on hand, it can be made to order in diamond for \$50 up. Over 80% of this type of business is with collectors and antique dealers, according to the owner, so these people may be a source of extra income for mechanically-inclined servicemen.

CD. Government assigned frequencies of 640 kc and 1240 kc, the only ones that will broadcast in a national emergency, are marked CD on the tuning dial of Admiral's newest personal portable radio. Production of small, low-cost AM battery sets is being urged by the Federal Civil Defense Administration for use if power fails.

ITV. A three-tube television camera attachment that can be hooked up to a home television receiver was announced by RCA engineers at the recent IRE annual convention. The Vidicon camera tube is the same as that used in the larger RCA industrial television (ITV) system. This ultimate in simple picture pickups gets its power and scanning signals from the receiver through a connecting cable. The design is ready for mass production, at a cost comparable to that of a receiver, when demand warrants.

Suggested uses are closed-circuit TV for small business, for conventions, halls, and schools to handle overflow audiences in adjacent rooms, and possibly even in homes to let upstairs invalids see what's going on in the living room.

Newest industrial use for ITV is for cutting down delays while customers' records are being checked at the New York Savings Bank. With the aid of television, signatures can be identified and other savings account information conveyed from the master file room to the tellers' cages at the speed of electricity. Telescreen Corp. installed the system, using Remington Rand camera tubes. Branch banks can be tied into the system with rooftop microwave links.

At this year's International Beauty Show in New York, RCA's closed-circuit TV brought close-range pictures of the creation of each new hair style to beauty-shop operators and owners gathered around 19 TV receivers in the demonstration room and in nearby lounges. Curls and other coiffure details were often larger than life-size.

LIVING. The United States is the only country in the world where the workers who make and fix automobiles and television sets can afford to buy them.

JOHN MARKUS

"REFLEX ENCLOSURE"

(Continued from page 13)

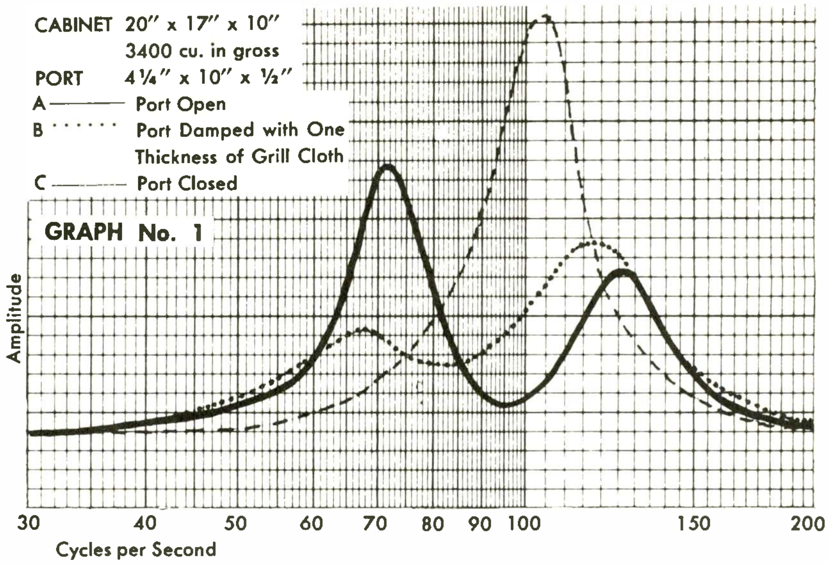
obtain the data found in Graph 1, which shows the characteristics of the enclosure when using this speaker.

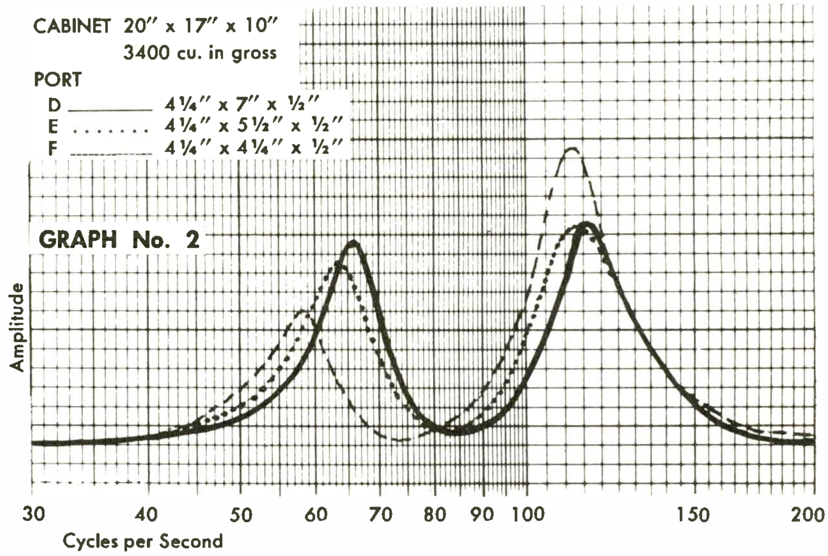
Curve A (Graph 1) illustrates the peaks found at 72 cps and 125 cps, with the low frequency peak having the greater amplitude. With a single thickness of grille cloth stretched over the port for damping (Curve B, Graph 1), the low frequency peak was reduced both in frequency and amplitude, while the higher peak was lowered in frequency but increased in amplitude. This was the effect of adding resistance to the tuned circuit of the enclosure and the reason for the damping action. If the port were to be covered with heavier and thicker material the effect would be increased to where eventually the cabinet would operate as a total enclosure and Curve C (Graph 1) would be obtained.

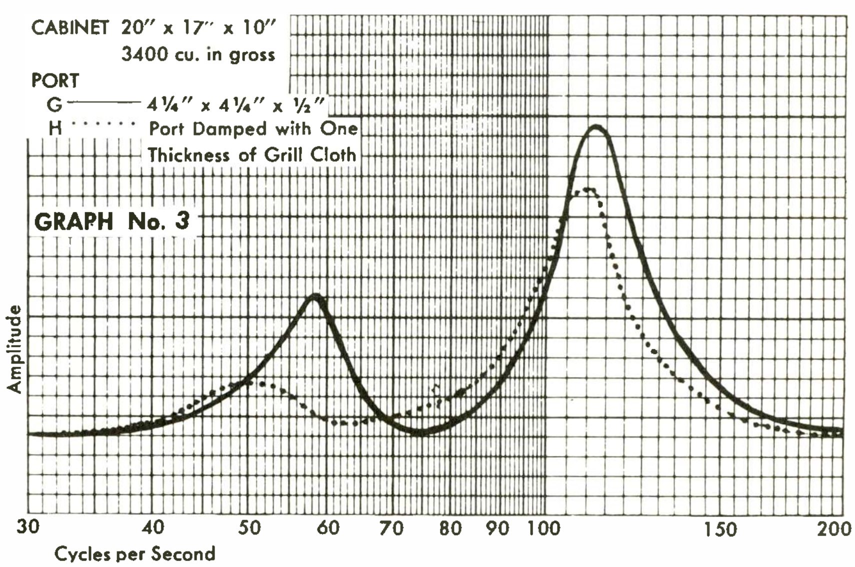
Actually, any of the three conditions in Graph 1 would give fairly satisfactory reproduction with a good amplifier, but from the difference in level of the peaks shown in Curve A, and the uneven peaks with the port damped, it is apparent that some change in dimension of either the cabinet or port, or both, might be needed.

Graph 2 illustrates the curves obtained when the port was partially covered with pieces of plywood to reduce it to the dimensions listed. Curves D and E are good but Curve F, with a port size of 4-1/4 x 4-1/4 x 1/2 inches is the opposite of Curve A (Graph 1) although the peaks are lower in frequency. Damping of the smallest port is not satisfactory as can be seen in Graph 3, since the low frequencies are down to a very low level.

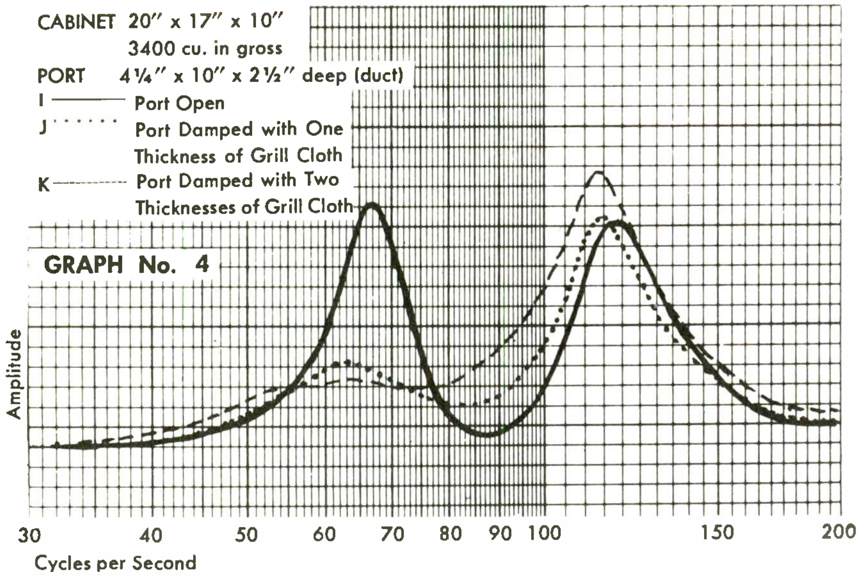
Next, still keeping the original dimensions of 20" high x 17" wide x 10" deep (inside) and a port of 4-1/4" high x 10" wide x 1/2" deep, a 2-inch extension or duct was attached to the port inside the cabinet (See Figure 4). This had the effect of lowering the resonant frequency of the enclosure similar to that of reducing the size of the port. The resulting curve (Curve I, Graph 4) is nearly the same as Curve D in Graph 2. With damping of one or two layers of grille cloth (Curves J & K, Graph 4) the curves are still not very satisfactory.

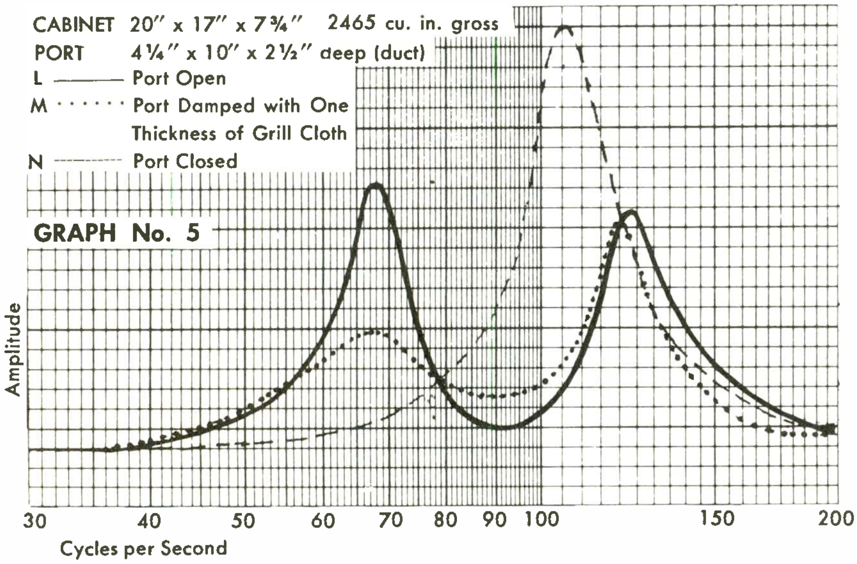


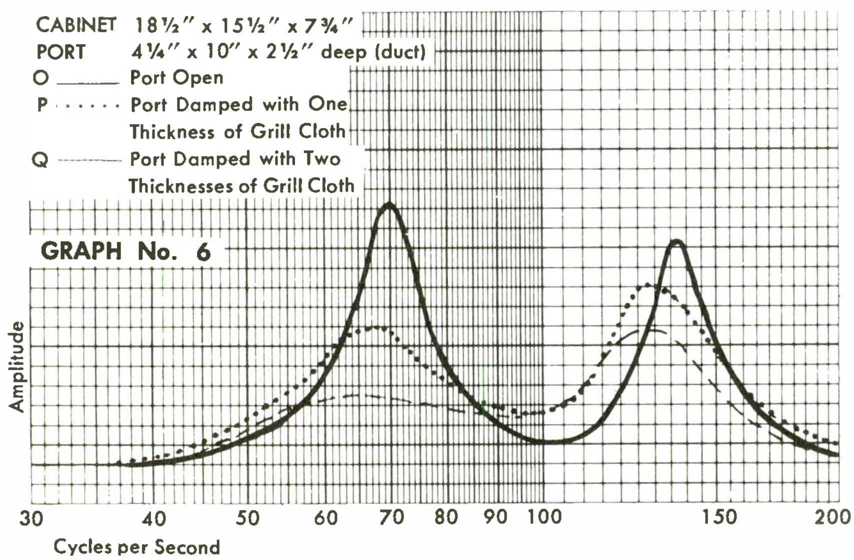




To reduce the size of the enclosure, from its original cubic content of 3400 cubic inches, the







braces were removed from the inside surface of the back and the pieces of board were securely mounted with screws to the back. This can be seen in Figure 4. This reduced the cabinet to 2465 cubic inches gross content. The 2-inch duct was permanently installed and figures in all of the following readings. The curves in Graph 5 obtained with these dimensions show more stability with a more satisfactory low frequency peak. This low peak, due to the action of the port, is the one least affected by the damping action of the amplifier. Curve N is included to give a comparison of the reflex action with that of a totally enclosed cabinet of the same dimensions.

To further reduce the size of the enclosure, the Ozite padding was removed from the top, bottom and sides and the boards, shown beside the cabinet, were attached solidly with screws to the sides, top and bottom as shown in Figure 6. The Ozite was then reinstalled. This reduced the size to 2222 cubic inches which resulted in the curves in Graph 6. The cabinet was now very close to the correct size to tune to the speaker used and damping of the port produced a more uniform curve. Any of the three conditions in Graph 6 would give very satisfactory listening, depending upon the amplifier used. Although there was no great change, the effect of one or two layers of grille cloth for damping did progressively reduce the peaks to arrive at the most uniform curve.

The low frequency response has been extended without excessive peaks and with a fairly small cabinet of 18-1/2 x 15-1/2 x 7-3/4 inches inside dimensions. Reproduction of music is very satisfactory, being smooth and clean, lacking only the extreme lows.

With larger speakers, with their lower resonant frequencies, the response can be extended well down into the very low frequencies very smoothly and with substantial output, by the methods described here. The smaller speaker with its resonance at 94 cps was selected since it was reaching the critical upper limits for this application and consequently emphasized the results of the changes made.

The curves are typical and illustrate what can be done to check and improve the response when installing a speaker in reflex enclosure. "Boom," which is sometimes so objectionable, can be avoided by tuning and/or damping the port or even, in some cases, changing the cubic content of the enclosure with a sufficient number of wooden blocks or bricks.

ROBERT B. DUNHAM

"VERTICAL SWEEP SYSTEMS"
(Continued from page 21)

limiting resistor R83 and is coupled to the grid of V13 through capacitor C60. "C" represents the waveform that is present at the grid of V13. The time constant C60, R80, and R4 is of such a value that the voltage developed across R80 and R4 will hold V13 at cutoff long enough to provide the correct free-running frequency of operation. In actual practice, the vertical hold control is set to provide a free-running frequency slightly slower than the vertical scan frequency. The positive-going sync pulse, which is coupled to the grid by C55, can then trigger the multivibrator at the proper instant to provide synchronization.

VERTICAL AFC SYSTEM

A very elaborate system of keeping the frequency of the vertical oscillator from being changed from one field to the next, by interference from horizontal sync or deflection signals, is shown in Figure 7-23. This circuit uses the same principle as is employed in the design of most current horizontal systems; whereby, flywheel synchronization is used to keep the frequency of the horizontal oscillator from being changed from one line to the next by noise. This type of circuit is known as an

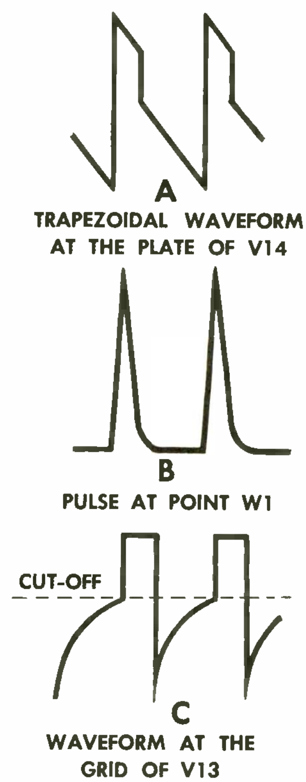


Figure 7-22. Pulses Present in the Wave Shaping Network of Fig. 7-21.

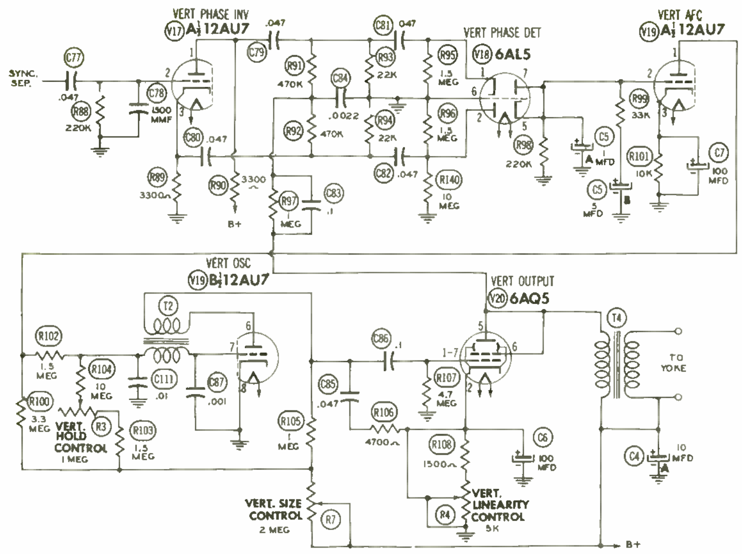


Figure 7-23. Vertical Sweep System Controlled by an AFC Circuit.

AFC (automatic frequency control) circuit.

The operation of the circuit uses the principal of picking a pulse off the plate of the output amplifier and feeding it back to the input of the phase detector. At the input of the phase detector, positive and negative sync pulses are obtained from the phase inverter and are combined with the deflection pulse obtained from the plate of the output amplifier. The output voltage of the phase detector depends upon the phase relation between the sync pulse and the receiver deflection signal (pulse from plate of output amplifier). This output voltage from the phase detector is amplified by V19A, vertical AFC, and is applied to the blocking oscillator, for bias, to control its frequency. The synchronizing pulses are not applied directly to the oscillator and the control voltage is prevented from changing rapidly by C111. The blocking oscillator performs in the same manner as was presented in the previous discussion of the blocking oscillator. C85 is the sawtooth forming capacitor with the peaking resistor being R106. Note that the vertical oscillator plate voltage is not obtained from the damper tube in this design, which removes that possible source of horizontal interference.

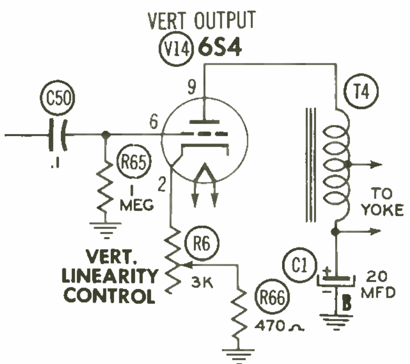


Figure 7-24. Vertical Output Circuit Employing a 6S4.

There are a number of reasons why this circuit doesn't realize a greater popularity. Obviously, a prime reason is that the circuit is too expensive to manufacture. A theoretical disadvantage is that the circuit is too stable. Whenever a change occurs in the video signal source at the time of a station break or when the receiver is switched from one channel to another channel, the picture usually rolls through part of a frame before becoming stationary again. This stems from the fact that the new vertical signals are not in phase with the previous ones and the receiver phase must be changed to correspond with the incoming vertical signals. If the time constant of this type of circuit is made short, so that the speed of the receiver's phase change can be very rapid, its ability to reject interference will be reduced.

VERTICAL AMPLIFIER

Most vertical circuit designs include an output amplifier stage in order to amplify the sawtooth voltage generated by the oscillator stage. This stage is necessary because the charging capacitor, across which the sawtooth sweep voltage is formed, is not allowed to charge to the full amount of the applied voltage. This is done, as was explained before, so that the most linear portion of the sawtooth may be used. As a result, the output voltage of the sawtooth generator is not of sufficient amplitude to deflect the beam of the picture tube to the proper height. For this reason, the signal is fed to an output amplifier before it is fed to the deflection coils.

Figure 7-24 shows a vertical output amplifier. In this stage, the sweep voltage is amplified and the linearity of the waveform improved. The circuit incorporates the use of a high perveance triode (6S4), with the output being matched to the vertical sweep coils by transformer T4. The linearity control, R6, located in the cathode circuit controls the operating bias of the tube.

The use of a linearity adjustment is necessary because the voltage produced across the sawtooth forming capacitor is not linear enough to produce a smooth sweep of the beam in the picture tube. The DC voltage present on the cathode of the amplifier is changed by the linearity control which in turn changes the bias on the grid. Due to the fact that the characteristic curve of the amplifier is not linear over the entire portion, the tube may be operated on the portion of the curve that is non-linear. When the amplifier is operated on the non-linear portion of the characteristic curve the distortion present in the input voltage is cancelled out, which provides a more linear sweep voltage. Without the variable resistance in the cathode

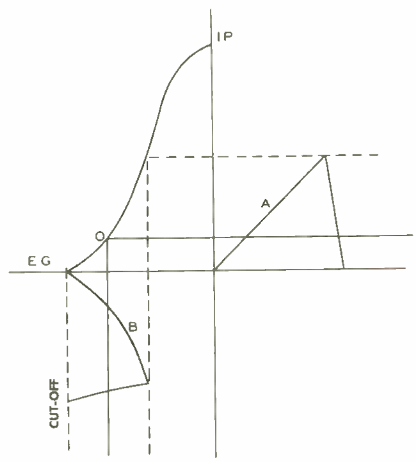


Figure 7-25. Removal of the Non-linearity from the Sawtooth by Operating the Amplifier on the Curved Portion of the Characteristic Curve.

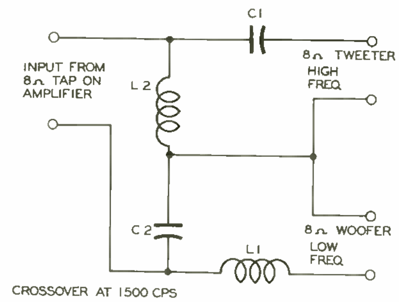
circuit the amplifier would operate as any class "A" amplifier. Figure 7-25 shows the removal of the non-linearity from the sawtooth by operating the amplifier on the curved portion of the characteristic curve. By operating the amplifier at point "O" the amplifier produces a sawtooth output that is linear as is seen from curve "A". By changing the value of the cathode resistance, point "O" can be changed from a linear to a non-linear portion of the curve; thus achieving different degrees of linearity.

The output of the vertical sweep amplifier is fed to the deflection coil circuit through transformer T4. This transformer matches the plate impedance of the amplifier tube to the resistance of the deflection coil circuit. It is a step-down auto transformer, having a turns ratio of 11.4 to 1. Transformers having a turns ratio of 10 to 1 are most commonly used for the vertical output. However, some circuits are designed to employ transformers with the turns ratio as high as 20 to 1.

C. P. OLIPHANT

"That reminds me . . .
Order a new JENSEN NEEDLE
for my record player."

AUDIO FACTS (Cont'd. from page 47)



C1	13.25 MFD	(1- 5/5 MFD 400V AND 1-4 MFD 50V)	
C2	21.2 MFD	(2- 5/5 MFD 400V AND 1-1 MFD 200V)	
L1	0.85 MH	160 TURNS	#16 ENAMELED WIRE
L2	0.53 MH	100 TURNS	#16 ENAMELED WIRE

Figure 6. Schematic of Home-Constructed Network with Data. Single L-Section Filter Type, Series Connected.

network. High values of capacity are required, notably at low crossover frequencies, but at the usual voice coil impedances no high voltages are involved, so 25 working voltage capacitors are satisfactory. Figure 5 is an example of a network constructed with surplus capacitors and handwound coils of No. 16 enameled wire. It was designed for a woofer and tweeter with 8 ohm voice coils and to have a crossover at 1500 cps. This is a single L-section type filter, series-connected. It has an attenuation of 12 db of the high-frequency signal below, and the low-frequency signal above, the crossover frequency. Data and the schematic are given in Figure 6.

Two of the many circuits possible are shown in Figure 7.

The number of possible circuit component value combinations is tremendous and will not be detailed in this general discussion. Data on the design and construction of divider networks has been published in many books and journals. Very complete information can be found in the following:

"The Recording and Reproduction of Sound," by Oliver Read. (Chapter 16.)

* * * *

"Design and Construction of Practical Dividing Networks," by C. G. McProud, appearing in Audio Engineering, June, 1947. (Also in Audio Anthology.)

* * * *

"Design of Crossover Networks," Parts 1 and 2, by Saul J. White, appearing in FM-TV Radio Communication, January-February, 1952.

* * * *

"How to Design Dividing Networks," by Roy F. Allison, appearing in High Fidelity, September-October, 1952, Volume 2, No. 2.

* * * *

ROBERT B. DUNHAM

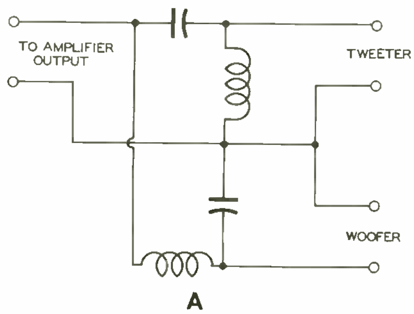


Figure 7. (A) Half Section Network for Two Way System, Parallel Connected.

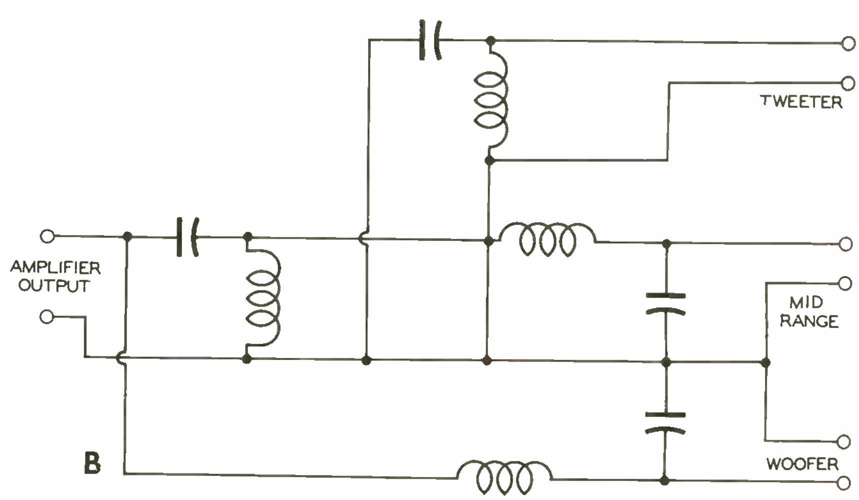


Figure 7. (B) Half Section Network for Three Way System, Parallel Connected.

"QUICKER SERVICING"

(Continued from page 31)

uncommon offender in this respect. After the circuit has been checked for component failures and none are uncovered, certain modifications may be tried to reduce the multiple triggering tendency. First of all, a reduction in the size of capacitor C7 from 270 mmf. to about 220 or 180 mmf. may help the situation by increasing the adjustment tolerances in the oscillator transformer. Another feasible move would be to increase slightly the size of resistor R9 from 150K ohms to 220K ohms or thereabouts.

It is recommended that the circuit alterations be kept to the very minimum needed to cure the "Christmas Tree" effect. A horizontal oscillator alignment should be performed on the receiver after every modification is made so that true tests for improvement in operation are ensured.

Knack for Knurled Knobs -

Here's a very handy way of manipulating those rear and recessed panel controls which are a part of many modern TV sets. These controls often have short shafts terminated with a 1/8 to 1/4 inch length of knurled surface. Sometimes they are not so easily managed with a thumb and forefinger, particularly where other chassis or cabinet parts are in the way.

The trick is to take an ordinary, full length lead pencil and remove the rubber eraser from its end. Then the metal band, which formerly held the eraser, will be found to slip snugly over the end of the control shaft so that the pencil in effect becomes a temporary shaft extension (See Figure 5). Turning the pencil will rotate the control.

So if you have been vexed with hard-to-manage controls, maybe this simply-made gadget will help you in the future.

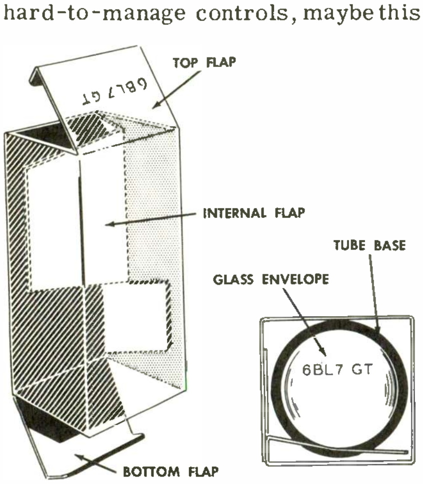


Figure 7. Diagram Showing Tube in Sylvania Tube Carton.

Sylvania Tube Cartons -

Maintaining a neat, orderly tube shelf is a never-ending problem in a busy service shop. Its frequent use is the chief reason for this. Replacing tubes in their correct positions and keeping the tube cartons in good condition are two of the factors in this problem. The first of these is purely a matter of conscientiousness on the part of the individual. The second, however, may be helped along by the acquisition of a simple work habit.

Figure 6 shows a picture of two Sylvania tube cartons. The one on the left (A) has been opened and closed several times for the purpose of making tube substitutions in receivers and the top flap has torn so that it presents a decidedly shop worn appearance. Moreover, the identity of the tube in the carton goes unknown unless one reaches up and pulls down the open flap on which the tube number is stamped. Contrast this with the tube carton on the right (Figure 6B); this carton has also been opened and closed many times but it looks new. That is because the top flap, which is the one bearing the tube type number and in full view, is never opened. Instead, the flap on the bottom is the one that is opened and the tube is removed by grasping the base pins and pulling it out through the bottom of the carton. This procedure applies to all GT and metal type tubes which will not come out through the top of their cartons because their bases are blocked by the diagonal internal flap visible in Figure 7. Opening the top flap of these cartons, therefore, is totally unnecessary.

The miniature 7-pin tubes will usually drop out of the open bottoms of their cartons with very little coaxing. In the case of the larger 9-pin miniatures such as the 12AT7 and 6T8, a little more difficulty may be experienced. It may be necessary, with one of these tubes, to open the flap top also and push the tube through the carton and out the opposite end.

In order to keep your Sylvania tube cartons like new, even while conducting numerous tube substitution tests, develop the habit of opening the bottom flap of a carton first. Such a habit will result in fewer torn flaps detracting from shelf neatness, tube type numbers being visible at a glance, and tubes coming out of their cartons quickly and without fumbling.

GLEN E. SLUTZ

TACO ANTENNAS ARE SOLD BY LEADING DISTRIBUTORS FROM COAST TO COAST

NON-INTERCARRIER RECEIVERS

The arrival of UHF television to the commercial broadcasting field has placed an additional requirement upon the design of television receivers. To fulfill this requirement, currently produced receivers are designed with an intercarrier sound system. Although advantages are attributed to both intercarrier and non-intercarrier receivers, it is found that drift problems are minimized in the intercarrier type.

It should not be construed that UHF reception is not feasible using non-intercarrier receivers. As a matter of fact, large numbers of such receivers will be used in conjunction with UHF tuning devices. It is important, however, to point out prior to a UHF installation, that if a non-intercarrier receiver is used, it may be necessary to retune more frequently. In this way, the customer is aware of the possibilities of such an eventuality and will be less prone to condemn either the receiving equipment or the serviceman.

There are definite reasons why a non-intercarrier receiver may be subject to the effects of oscillator frequency drift which would show up either as weak or distorted sound. In the first place, UHF tuning units are designed with a maximum of stability consistent with all the factors involved. This degree of stability is satisfactory for use with most of the existing receivers and all the receivers in current production. The principle of intercarrier sound provides a sound carrier IF signal that is obtained by heterodyning the video carrier and sound carrier at the video detector. The bandpass of tuning systems are designed quite broad such that both sound and video carriers can be properly tuned. Slight oscillator drift does not impair intercarrier sound performance since both carriers remain in the passband of the receiver circuits.

Non-intercarrier receivers employ quite a different system. In most instances, the sound IF signal is taken off from the output of the tuner mixer stage. In effect the non-intercarrier sound take-off is a bandpass filter arrangement accepting only a narrow range of frequencies. Thus, if the local oscillator frequency shifts, the resultant sound carrier will be displaced from the center frequency setting of the sound IF tuned circuits. The resultant therefore will either be distorted, weak, or no sound.

Although not presenting a problem in many cases, it should, however, be pointed out to the customer possessing a non-intercarrier receiver, that some tuning touch up may be required at various intervals.

To aid in identifying non-intercarrier receivers produced to date, the following table is given containing the Model or Chassis designation of the non-intercarrier receivers. The table is as complete as it is possible for us to make it with the information available to us. A quick look at this chart should aid in pointing out the particular Model numbers for which UHF units may not function with as high a degree of tuning ease as may be expected from intercarrier receivers.

ADMIRAL

Chassis 20A1, 20B1
Chassis 21A1
Chassis 24D1, 24E1, 24F1, 24G1, 24H1
Chassis 30A1, 30B1, 30C1
Models 4H15, 4H16, 4H17, 4H18, 4H19
Models 4H115, 4H116, 4H117
Model 4H126
Model 4H137
Models 4H145, 4H146, 4H147
Models 4H155, 4H156, 4H157
Models 4H165, 4H166, 4H167
Models 24A11, 24A12
Models 24A125, 24A126, 24A127
Models 24C15, 24C16, 24C17
Models 25A15, 25A16, 25A17
Models 26R35, 26R36, 26R37
Models 26X35, 26X36, 26X37
Models 26X45, 26X46
Models 26X55, 26X56, 26X57
Models 26X65, 26X66, 26X67
Models 26X75, 26X76
Models 29X15, 29X16, 29X17
Models 29X25, 29X26, 29X27
Models 30A12, 30A13, 30A14, 30A15, 30A16
Models 30B15, 30B16, 30B17
Models 30C15, 30C16, 30C17
Models 30F15, 30F16, 30F17
Models 36X35, 36X36, 36X37
Models 39X16, 39X17
Models 39X25, 39X26

AIR KING

A-1000, A-1001
A1016

AIRLINE

05WG-3016A, B
05WG-3030A
05WG-3030C
05WG-3031A
05WG-3031B
05WG-3032B
05WG-3036A
05WG-3036C
05WG-3038A
05WG-3039A, B
05WG-3039C, D
05WG-3045A
94WG-3006A
94WG-3006B
94WG-3008A, 94WG-3009A
94WG-3009B

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94WG-3016A, B, C
94WG-3022A
94WG-3026A
94WG-3028A
94WG-3029A

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C2050
C2150
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BC-VL17
BT-VL17
CO-VK15, COVK16
COVK-125
COVL-16
CO-VL19
C-VK19
CVK-126
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C-VL17
T-VK12
TVK-127B
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Ch. VL16
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Ch. VL19
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17CRR
17ROG
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18-M-39, 18-W-39
20-M-39, 20-W-39
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29-P-40
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31-P-40
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33-B-44
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05TV2-43-9010A
05TV2-43-9010B
15TV2-43-9012A, 15TV2-43-9013A
94TV2-43-8970A, 71A, 72A, 73A, 85A, 86A, 87A, 93A, 94A, 95A

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9-403M, 9-403M-2
9-404M
9-407, 9-407M-1, 9-407M-2
9-409M3
9-413B, 9-413B-2, 9-414B
9-419M1, 9-419M1-LD, 9-419M2, M3, M3-LD
9-420M
9-422M, 9-422MA
9-423M
9-424B

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CT-101
CT-102, CT-103, CT-104
DT-160

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RA-102B1, B2, B3
RA-103
RA-103D
RA-104A
RA-105
RA-105B
RA-106
RA-108A
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RA-109-A1, A2, A3, A5, A6, A7
RA-110A
RA-111-A1, A2, A4, A5
RA-112-A1, A2, A3, A4, A5, A6
RA-113-B1, B2, B3, B4, B5, B6, B7, B8
RA-116A
RA-117-A1, A3, A5, A6, A7
RA-119A
RA-120
RA-130A
RA-147A
Andover Model RA-117-A6
Ardmore Model RA-112-A1, A4
Bradford

DUMONT—Cont.

Brookville Model RA-113-B1, B2
Burlingame Model RA-113-B5, B6
Carlton Model RA-117-A3
Chatham
Chester
Club 20
Colony
Devonshire
Fairfield
Guilford Model RA-111-A2, A5
Hampshire
Hanover Model RA-109-A2, A6, FAS
Hastings
Manchu
Mansfield
Meadowbrook II
Mt. Vernon Model RA-112-A3, A6
Park Lane Model RA-117-A7
Parklane
Plymouth
Putman Model RA-111-A1, A4
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Revere II Model RA-113, B3, B4
Royal Sovereign
Rumson
Savoy
Sheffield
Sherbrooke Models RA-109-A3, A7
Sherbrooke Model RA-109A-FAS
Sherbrooke Model RA-130A
Sherwood
Stratford
Strathmore Model RA-117-A5
Sumter Model RA-117-A1
Sussex
Tarrytown
Tarrytown Models RA-113-B7, B8
Wellington
Westerly Model RA-112-A2, A5
Westbury
Westbury II
Westminster
Westminster II
Westwood

NON-INTERCARRIER RECEIVERS—Continued

DUMONT—Cont.
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Whitehall II
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Winslow Model RA-109-A1, A5

EMERSON
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571 (Ch. 120066)
571 (Ch. 120066B)
585 (Ch. 120025B)
585 (Ch. 120088B, 90B, 90D)
606 (Ch. 120066)
606 (Ch. 120066B)
618 (Ch. 120025B)
618 (Ch. 120090B, D)
Ch. 120025B
Ch. 120047
Ch. 120066
Ch. 120066B
Ch. 120088B
Ch. 120090B
Ch. 120090D

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R7C15, R7C25
R-1025
R-1050
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S4C40
S4T15
S4T30
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899
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12TZ20, 21, 22, 23
15TZ6, 15TZ7
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1100 Series
1200 Series
3912 TVFMP, 3915 TVFMP

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24C101
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814
815
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840
901
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HALLICRAFTERS
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632, 633, 634, 635
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870, 871, 872
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024 (Ch. 253)
044, 045, 046 (Ch. 253)
074, 076, 077 (Ch. 253)
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146 (Ch. 253DX)
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425, 426 (Ch. 253DX)
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428 (Ch. 253DX)
714, 724 (Ch. 253)
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777 (Ch. 253)
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Ch. 253
Ch. 253DX

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Chassis CT-221
Chassis CT-222
Chassis CT-224
Chassis CT-232
Chassis CT-235
Chassis CT-236
Chassis CT-237, CT-238
Chassis CT-239
Chassis CT-244, CT-245, CT-246
Chassis CT-250, CT-251
Chassis CT-252, CT-253
Chassis CT-257, CT-258
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Chassis CT-266, CT-267
Chassis CT-283
Chassis CT-284, CT-285
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Chassis CT-287, CT-288
Chassis CT-289
Chassis CT-290
Chassis CT-291, CT-293
Chassis CT-294
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Chassis CT-297
Chassis MCT-228

MEISSNER
TV-1
24TV

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VT105, VT105M
VT107, B, M
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10VT3
12VK18B, 12VK18R
12VT16, 12VT16B, 12VT16R
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Ch. TS-7
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NORELCO
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DX-950
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TV-106, TV-107, TV-108
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TV-928
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762
764, 764U
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783
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967, 986, 970

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2692-TV
2991-TV
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50-T1105, 50-T1106
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50-T1403, 50-T1404
50-T1406
50-T1430
50-T1432
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TC165, TC166, TC167, TC168
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2T60
2T81
4T101
4T141
6T53
6T54
6T64, 6T65
6T71
6T74, 6T75, 6T76
6T84
6T86, 6T87
7T103, 7T104
7T103B, 7T104B
7T112
7T112B
7T122, 7T123, 7T124
7T122B, 7T123B, 7T124B, 7T125B
7T132
7T143
8PCS41, B, C
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8T270
8TC270, 8TC271
8TK29
8TK320
8TR29
9PC41A, B, C
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9T77
9T79
9T89
9T105
9T126
9T128
9T240, K
9T246
9T256
9T270
9TC240
9TC245
9TC247
9TC249
9TC272
9TC275
9TW333
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630TCS
630TS
648PTK
648PV
721TCS
721TS
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730TV2
741PCS
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Ch. KCS-20B-1
Ch. KCS-20J-1
Ch. KCS21-1
Ch. KCS24-1
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Ch. KCS24B-1
Ch. KCS24C-1
Ch. KCS24D
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Ch. KCS29C
Ch. KCS32, KCS32A, KCS32B, KCS32C
Ch. KCS33A-1
Ch. KCS34, B, C
Ch. KCS-38, C
Ch. KCS40, A, B
Ch. KCS41-1
Ch. KCS42A
Ch. KCS43
Ch. KCS45, A
Ch. KCS47, A, AT, T
Ch. KCS47D
Ch. KCS49, A, AT, T
Ch. KCS49B, C
Ch. KCS49BF
Ch. KCS49CF
Ch. KCS60, T
Ch. KCS60A
Ch. KCS61
Ch. KCS62

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RC201
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REMBRANDT
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4939TV, 4940TV, 4941TV
4942
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4964, 4965
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Ch. 9L8A
Ch. 23TB10
Ch. 23TD10
Ch. 24TL10
Ch. 24TM10
Ch. 24TR10
Ch. 24TV9, 24TV9C
Ch. 25TK10A

STARRET
Gotham
Henry Hudson, Henry Parks
John Hancock
Robert E. Lee

STROMBERG-CARLSON
TS-15, TS-16, TS-125
TV-125

TECH-MASTER
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T-1720

TRANSVISION
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Ch. A-3
Ch. A-4, Sub 1

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2D1088A
2D1089A
2D1089B
2D1093A, 2D1094A

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630-DX24C
630-K3C
630-K24C

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H196A (DX)
H-207A
H-207A (DX)
H-207B
H-217B
H-225 (DX)
H-226
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Ch. V-2130-11DX, V-2130-12DX
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Ch. V-2130-31DX, V-2130-32DX
Ch. V-2146-11DX, V-2146-25DX
Ch. V-2146-35DX
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WILCOX-GAY
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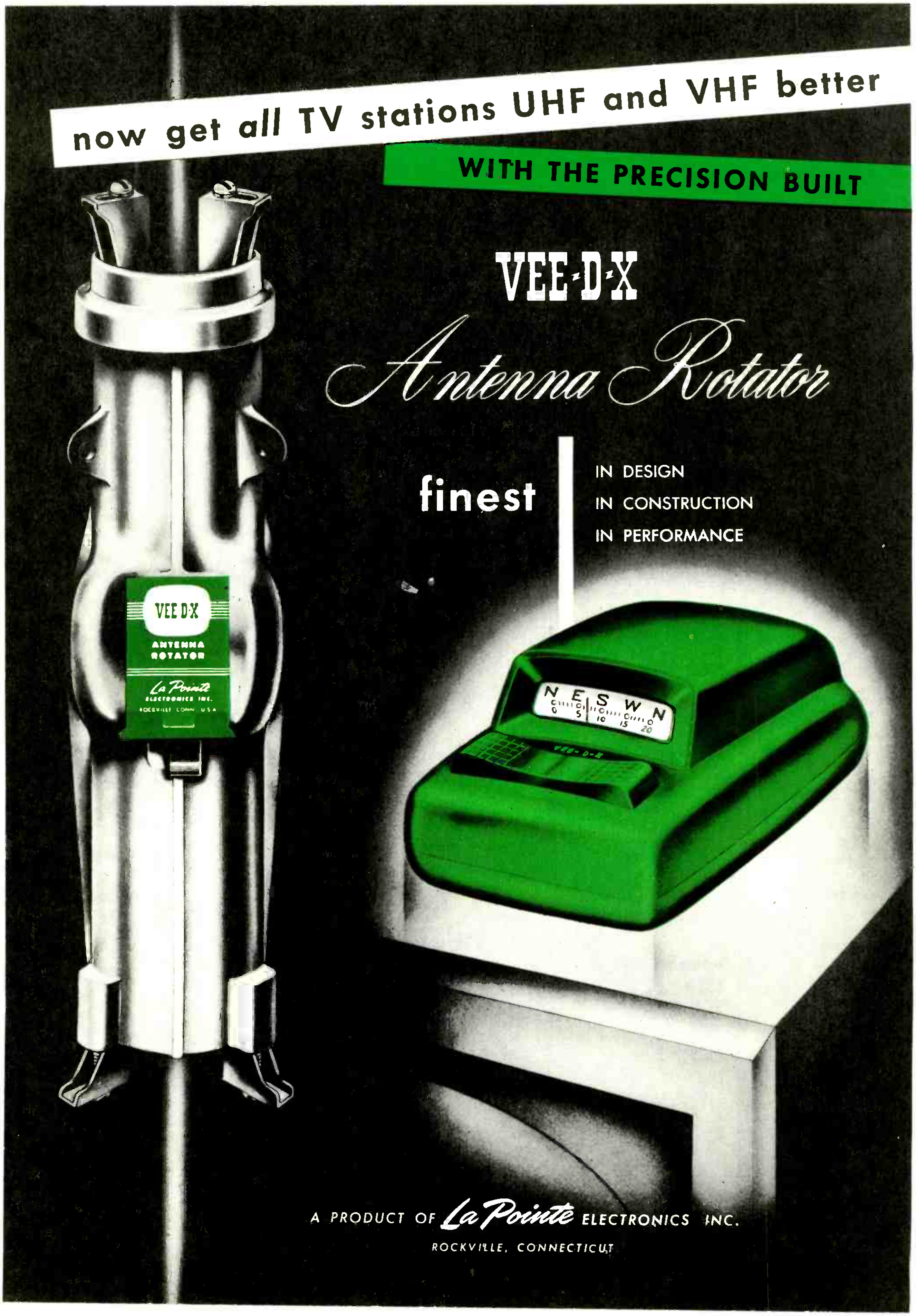
28T926E, 28T926R
28T960, 28T961, 28T962, 28T963
28T964R
37T996 RLP
37T998
42T999RLP
Ch. 28F20
Ch. 28F23
Ch. 28F25



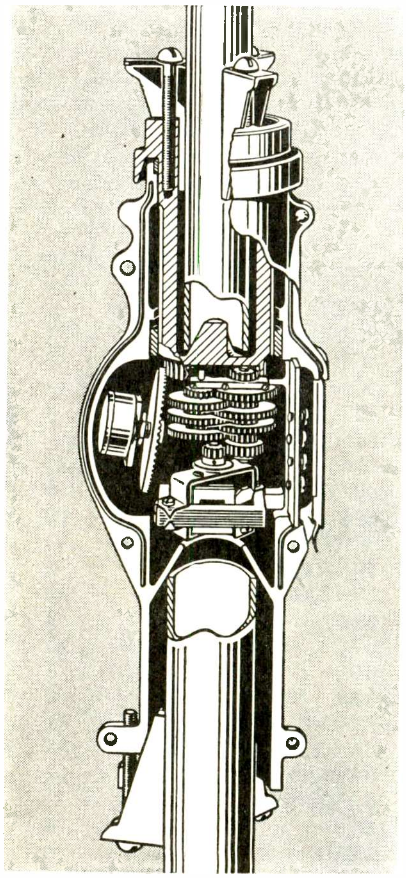
now get *all* TV stations UHF and VHF better
WITH THE PRECISION BUILT
VEE-D-X
Antenna Rotator
finest
IN DESIGN
IN CONSTRUCTION
IN PERFORMANCE
VEE D-X
ANTENNA ROTATOR
La Pointe
A PRODUCT OF La Pointe ELECTRONICS INC.
ROCKVILLE, CONNECTICUT

PREDICTION

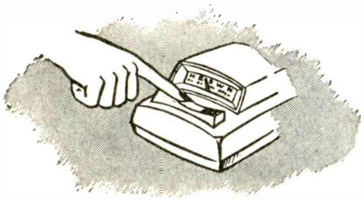
THE VEE-D-X ROTATOR WILL SOON BE THE NATION'S BEST SELLER!

Seeing is Believing!

Study this cutaway view. See for yourself why it is truly the finest of all rotators.



THE MAGNIFICENT DECORATOR STYLED CONTROL CONSOLE



Here is the perfect companion to the finest of all rotators. The unique fingertip-action control operates with a convenient downward pressure that completely eliminates any need to hold console to prevent its sliding. It is engineered for instantaneous clockwise and counterclockwise action. Its easy-to-read dial gives both compass and numerical points. Available in two popular colors: Heather Green for light colored cabinets, Cordovan Mahogany for dark.

This forecast is not given lightly — nor do we expect it to be accepted lightly. It is backed by sound business reasoning and the awareness that VEE-D-X engineering, in collaboration with other world famous manufacturers, have jointly produced the finest of all rotators. It is so far in advance of anything on the market that a comparison with existing rotators will only serve to substantiate these (not lightly given) claims.

Many months of research, planning and testing were spent on the VEE-D-X Rotator. Its many exclusive and precision incorporated features assure pin-point accuracy and complete dependability under all weather conditions. The VEE-D-X Rotator is precision made for precision performance — designed to provide TV reception at its very best.

VEE-D-X OFFERS YOU RIGHT NOW ALL THE FEATURES YOU'VE DREAMED OF IN A FINE ROTATOR

PRECISION-BUILT—The VEE-D-X Antenna Rotator is built with the same precision with which it was engineered. Nothing has been spared in quality construction to provide the utmost in dependability and long trouble-free operation.

ADVANCED STYLING — Streamlined case design — better looking, less wind resistance.

FINEST GEARING OF ANY ROTATOR — Unique. Compact. Efficient. The self-contained, flanged spur gear train of the VEE-D-X Rotator puts it in a class by itself. Flanged reinforced gear teeth cannot be stripped. Designed and developed in cooperation with world famous small gear specialists. It provides most dependable performance under all conditions.

BALANCED MOUNTING — In-line (axial) mounting. Relieves strain on mast and guy wires. Equalized load distribution—no cumbersome offset—improved rooftop appearance.

WEATHER-RESISTANT FINISH—Entire unit is completely finished with new weather-resistant Luster-On #15 that meets rigid Army Signal Corps specifications. Stays bright—will not corrode.

FINEST MAST CLAMPS OF ANY ROTATOR — The positive three jaw chuck-type mast clamp is a VEE-D-X feature that provides simplest installation and the largest clamping surface of any rotator.

POSITIVE MAST ALIGNMENT — Is assured with built-in, self-centering mast guides both top and bottom.

FAST, EASY LINE CONNECTIONS—Accommodate four wire line. Exclusive snap-in cover, slides into place — no screws to drop when installing.

FULL 365 DEGREE TRAVERSE — Eliminates necessity of reversing rotation at critical points at end of normal 360 degree traverse.

POSITIVE ANTENNA BRAKE—No over travel, assures pin-point accuracy the moment control actuator is released.

EXTREMELY POWERFUL — Will support a load of over 200 pounds—thereby eliminating any need for the extra expense of an auxiliary thrust bearing.

GUYED AT TOP—Three guy ring lugs are cast as an integral part of the case for maximum strength. Spaced 120 degrees apart—permits three or four wire guying.

DECORATOR STYLED CONTROL CONSOLE — Smaller, more compact, more beautiful than any other. Unique control actuator. Dial gives both compass and numerical reference points. Plastic case in choice of beautiful decorator colors — Heather Green or Cordovan Mahogany.

ACCURATE COMPASS INDICATION AT ALL TIMES — No screw driver adjustment required to compensate for voltage fluctuation.

FACTORY TESTED AND GUARANTEED—Every Rotator and Control Console is thoroughly tested electrically and mechanically and fully guaranteed.

Write For Literature!

VEE-D-X
Antenna Rotator
LaPointe Electronics Inc. Rockville, Conn

TV-TUBES (Cont'd. from page 41)

6CB6 has become much more popular. Another example can be cited in the use of the 6BG6G and 6BQ6GT type tubes. The left column indicates that each of these tubes has a rating of 15 for all receivers. In the right hand column, however, it can be seen that the rating of the 6BQ6GT has risen to 25 while the 6BG6G has fallen to 6. This again indicates that there is a definite trend toward a greater use of the 6BQ6GT as compared to the 6BG6G.

The numbers shown in this chart have been adjusted to the nearest whole unit. As was previously pointed out, any tube having a rating of less than one does not appear on the chart. Because of these two facts the grand total of these two columns will not necessarily come to an even 1,000 units. Actually the left hand column is 977 and the right hand column totals 990. Remember, however, that the rating of each tube is based on 1,000 units.

In the event that it may serve some purpose, the following is a list of tube types which were not shown in the chart because of their extremely low rating.

6AK6	6SR7
6AL7	6U4
6AR5	6X4
6BF6	7C4
6BY5	7C5
6H6	12A4
6L6G	12AU6
6S8GT	12BZ7
6SJ7	25AV5
6SK7	25Z6

The data contained in this listing is as accurate as we could possibly make it. We sincerely hope that it will be beneficial to you and if it is, we will show these listings with revised ratings, in each subsequent issue of the INDEX. We will also show new tube types as they are introduced in each period.

	46-53 Models	52-53 Models		46-53 Models	52-53 Models
1B3GT	39	43	6C4	11	11
1V2	1	--	6BZ7	1	3
1X2	6	2	6CB6	85	137
1X2A	4	7	6CD6G	7	9
5U4G	45	45	6CL6*	--	--
5V4G	8	--	6J5	3	3
5Y3GT	3	1	6J5GT	2	1
6AB4	3	3	6J6	35	31
6AC7	9	9	6K6GT	17	9
6AF4#	--	--	6S4	8	10
6AG5	41	11	6SH7	1	--
6AG7	3	4	6SL7GT	4	3
6AH4GT	1	2	6SN7GT	81	91
6AH6	7	10	6SQ7	3	3
6AK5	5	5	6T8	15	15
6AL5	80	80	6U8	3	7
6AQ5	13	14	6V3	2	3
6AQ7GT	--	2	6V6GT	23	21
6AS5	2	2	6W4GT	33	35
6AT6	4	3	6W6GT	7	12
6AU5GT	4	5	6X5GT	2	2
6AU6	140	128	6X8	2	4
6AV5GT	2	4	6Y6G	4	1
6AV6	14	16	7N7	3	1
6AX5GT	2	3	12AT7	16	15
6AX4	2	--	12AU6	1	--
6BA6	16	11	12AU7	44	25
6BC5	11	8	12AV7	4	5
6BE6	3	5	12AX4	2	4
6BF5	--	1	12AX7	4	5
6BG6G	15	6	12AZ7	--	1
6BH6	9	--	12BH7	7	11
6BJ6	2	--	12BY7	--	2
6BK5	--	1	12SN7GT	7	6
6BK7	3	6	25BQ6GT	3	5
6BL7GT	6	9	25L6GT	6	6
6BN6	2	2	25W4GT	2	2
6BQ6GT	15	25	25Z6	1	--
6BQ7	6	15	5642	2	3

* New type employed in RCA receivers.

New type employed in UHF receivers.

STATUS OF TV BROADCAST OPERATIONS

The list which follows is comprised of all those TV stations which have been granted construction permits by the FCC in the period between the end of February and the middle of April. If this list is added to the stations which were enumerated in the March-April issue of the PF INDEX and Technical Digest, a complete roster of construction permits issued up to April 18, 1953, may be formulated.

In addition to the new construction permits, we have also listed the stations which have gone on the air since the publication of the last PF INDEX. The maps which were shown in the PF INDEX and Technical Digest for March-April may be brought up to date simply by penciling in the small triangles and squares which appear at the listed locations.

Construction Permits Granted During March -Through April 18, 1953

ARIZONA
Yuma
KIVA Ch. 11

CALIFORNIA
Chico
KHSL-TV Ch. 12
Fresno
- - - - Ch. 47
San Diego
KFSD-TV Ch. 10
San Francisco
- - - - Ch. 20
San Luis Obispo
KVEC-TV Ch. 6
Tulare
KCOK-TV Ch. 27
Yuba City
KAGR-TV Ch. 52

COLORADO
Grand Junction
KFXJ-TV Ch. 5

DELAWARE
Dover
- - - - Ch. 40

FLORIDA
Fort Myers
WINK-TV Ch. 11
Panama City
WJDM Ch. 7

GEORGIA
Columbus
WDAK-TV Ch. 28
Warner Robins
WMAZ-TV Ch. 13

IDAHO
Nampa
KFXD-TV Ch. 6
Twin Falls
KLIX-TV Ch. 11

ILLINOIS
Bloomington
- - - - Ch. 15
Chicago
WIND-TV Ch. 20
Harrisburg
- - - - Ch. 22

INDIANA
Indianapolis
WNES Ch. 67
WJRE Ch. 26
Marion
WMRI-TV Ch. 29
Princeton
WRAY-TV Ch. 52
Waterloo
- - - - Ch. 15

IOWA
Cedar Rapids
WMT-TV Ch. 2
Davenport
- - - - Ch. 36
Des Moines
- - - - Ch. 17

LOUISIANA
Alexandria
- - - - Ch. 62
New Orleans
WBOK-TV Ch. 32
WMRY-TV Ch. 26

MARYLAND
Salisbury
WBOC-TV Ch. 16

MASSACHUSETTS
Boston
- - - - Ch. 50
Cambridge
WTAO-TV Ch. - -

MICHIGAN
Cadillac
- - - - Ch. 13

MINNESOTA
Austin
KMMT Ch. 6
Minneapolis
WTCN-TV Ch. 11
St. Paul
WCOW-TV Ch. 17
WMIN-TV Ch. 11

MISSISSIPPI
Columbus
WCBI-TV Ch. 28

MISSOURI
Cape Girardeau
KGMO-TV Ch. 18

MONTANA
Great Falls
KMON-TV Ch. 3
Missoula
KGVO-TV Ch. 13

NEVADA
Las Vegas
KLAS-TV Ch. 8

NEW JERSEY
New Brunswick
- - - - Ch. 47

NEW MEXICO
Albuquerque
KGGM-TV Ch. 13
Clovis
- - - - Ch. 12

NEW YORK
Albany
WROW-TV Ch. 41
Rochester
- - - - Ch. 27
WVET-TV Ch. 10
WHEC-TV Ch. 10

NORTH CAROLINA
Greenville
WNCT Ch. 9
Hendersonville
WHKP-TV Ch. 27
Mt. Airy
WPAQ-TV Ch. 55

NORTH DAKOTA
Bismark
KFYR-TV Ch. 5
- - - - Ch. 12

OREGON
Medford
KBES-TV Ch. 5

PENNSYLVANIA
Chambersburg
WCHA-TV Ch. 46
Lewistown
WMRF-TV Ch. 38

RHODE ISLAND
Providence
- - - - Ch. 16

SOUTH CAROLINA
Greenwood
WCRS-TV Ch. 21

TENNESSEE
Knoxville
- - - - Ch. 26

TEXAS
Abilene
IRBC-TV Ch. 9
Fort Worth
- - - - Ch. 20
Lufkin
KTRE-TV Ch. 9
San Antonio
- - - - Ch. 35
Sherman
- - - - Ch. 46
Victoria
KNAL-TV Ch. 19

UTAH
Salt Lake City
KUTV Ch. 2

VIRGINIA
Marion
WMEV-TV Ch. 50
Harrisonburg
WSVA-TV Ch. 3

W. VIRGINIA
Charleston
WKNA-TV Ch. 49

Stations now on the Air During March-Through April 18, 1953.

ARKANSAS
Little Rock
KRTV Ch. 17

COLORADO
Pueblo
KDZA-TV Ch. 3

CONNECTICUT
Bridgeport
WICC-TV Ch. 43

FLORIDA
Ft. Lauderdale
WFTL-TV Ch. 23

IOWA
Sioux City
KVTV Ch. 9

LOUISIANA
Baton Rouge
WAFB-TV Ch. 28

MASSACHUSETTS
Holyoke
WHYN-TV Ch. 55
Springfield
WWLP Ch. 61

MICHIGAN
Ann Arbor
WPAG-TV Ch. 20
Saginaw
WKNX-TV Ch. 57

MISSOURI
Springfield
KTTS-TV Ch. 10

NORTH DAKOTA
Minot
KCJB-TV Ch. 13

OHIO
Lima
WLOK-TV Ch. 73

OAKLAHOMA
Lawton
KSWO-TV Ch. 7

PENNSYLVANIA
Harrisburg
WHP-TV Ch. 55
New Castle
WKST-TV Ch. 45
Reading
WEEU-TV Ch. 33

TEXAS
Amarillo
KFDA-TV Ch. 10
KGNC-TV Ch. 4
Galveston
KGUL-TV Ch. 11
Wichita Falls
KFDX-TV Ch. 3

WISCONSIN
Green Bay
WBAY-TV Ch. 2

"UHF-READING, PENN." (Continued from page 43)

ers said that in cases where the best signal was a reflected one from the side of a hill, the picture viewed on the screen of the receiver would tend to be smeared. However, it was said that this signal in a number of cases was usable even though the smear effect was noticeable.

The most popular types of antennas being used for UHF are the bow-ties, either single or stacked, and the corner reflectors. Because of the difficulty in obtaining a good signal, the installation of a UHF antenna is usually on a different mast from the installation for VHF. According to reports from this area, it has not been a practice to attempt to receive the UHF signal with a VHF antenna.

The type of lead-in being used in most installations is the tubular. The Anaconda type of line is also used, but not to the degree that the tubular is being used. The probable reason is that of higher cost. One installer that we contacted uses the flat ribbon type lead-in but perforates it by his own design. He uses this line for both VHF and UHF and reports that the results are satisfactory.

Because of the loss of gain that is to be expected when lightning arrestors are used in UHF installations, the installers in the Reading area have not used lightning arrestors. Instead, in most cases, the mast is grounded for protection.

Matching units have been placed into use by some of the installers but they haven't been in use long enough for a report to be made as to the effects of the weather on these units.

In comparing the operation of UHF strips with the operation of converter units, most installers believe that the converter units give the more satisfactory results. They stated, however, that in areas where the signal is strong, the strips work very satisfactorily.

It seems that most of the UHF installations are with receivers that are purchased with built-in UHF. It was gathered from the interviews that not many external converters are in use.

Each installer said that the repair of converters has been nil. The only report against the performance of some of the converters was that a frequency drift occurs at times. However, after a few minutes of operation, the frequency drift usually ceases.

The ability of installers to receive Channel 61 in towns around Reading varies considerably. For instance, the installers in Lancaster, Pa. can usually receive a good signal without much probing. One installer said that he places his antennas at a height of twenty to thirty feet and the signal is usually very acceptable. Lancaster is farther away from the transmitter than Reading, but is situated on high terrain without being shielded by hills.

The condition varies in towns between Lancaster and Reading. Channel 61 has not been received in the community of Adamstown at all. This town is only a few miles southwest of Reading but is entirely shielded on the northwest by a hill in direct line with the transmitter. Channel 61 is received quite well in the community of Reamstown, which is near Adamstown, because this town is located on high terrain.

As can be seen from the experiences of the installers in the Reading area, far different results are obtained in rough terrain than in flat terrain. Our tests in the South Bend, Indiana,area showed that the placement of the antenna was not critical. In many locations in Reading, however, just the opposite is the case. Many installers had installed antennas prior to the time the UHF station started operation only to find that no signal could be picked up at that particular spot after the station came on the air.

How the UHF situation will develop in the coming months in the Reading area is difficult to estimate. Right now, the number of UHF installations is increasing very slowly. Since the residents of Reading can receive three VHF stations from Philadelphia and one from Lancaster, the sale of UHF has been rather slow. This is particularly true since in many locations they aren't assured of receiving a desirable picture.

We wish to pass on our sincere thanks to the service technicians and installers, who were so kind in spending time with us to furnish the information for this report.

W. W. HENSLER and C. P. OLIPHANT

TV SUPPLEMENTARY SHEET NO. 3

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
GAMBLE-SKOGMO (Coronodo)					
K-21 K-72 K-72L 43-9030 43-9031 43-9041	P-2D	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5D	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-12D	AG-8-S FKS-1/4	AM Rejection	1000 Ω carbon	$1.25
	* P-13	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	P-14	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	P-15	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	PD-9	RTV-347	Contrast Vol./Sw.	2000 Tap 1400/500K Ω Conc. Dual carbon SPST	$4.30
	* Some Models Use Alternate Part # P-17B Replacement Being AG-61-S/KSS-3				
15TV4-43-8948A	* TVC-528D	RTV-232	Contrast/ Vol./Sw.	1500/500K Ω Conc. Dual carbon--SPST	$3.70
15TV4-43-8949A	TVC-543D	AG-44-S FS-3	Hor. Hold	50K Ω carbon	$1.25
	TVC-544D	AG-61-S FS-3	Bright/ Vert. Hold	1 Meg. Ω carbon	$1.25
	TVC-545D	AG-61-S KSS-3	Height	1 Meg. Ω carbon	$1.25
	TVC-546D	AG-19-S KSS-3	Vert. Lin.	5000 Ω carbon	$1.25
	* Some Models Use Alternate Part # TVC-557D				
GENERAL ELECTRIC 12T3 12T4 12T7 12C107 12C108 12C109 (B Version)	RRC-096 K68J766-1	AG-85-S FKS-1/4	Height	3 Meg. Ω carbon	$1.25
	RRC-127 K71J112-1	A43-4000 FKS-1/4	Vert. Lin.	4000 Ω 2W-W.W.	$1.25
	RRC-128 K71J71-2	RTV-230	Contrast/ Vol./Sw.	2 Meg./500K Tap 280K Ω Conc. Dual carbon SPST	$3.70
	RRC-130 K71J69-1	RTV-276	Focus/ Bright.	100K/500K Ω Conc. Dual carbon	$3.10
	RRC-136 K71J397-1	RTV-157	Vert./ Hor. Hold	100K/125K Ω Conc. Dual carbon	$3.10
	RRC-140 K71J442-1	AG-40-S FKS-1/4	Drive Control	25K Ω carbon	$1.25
20C105 20C106 20T2 21C200	RRC-096 K68J766-1	AG-85-S FKS-1/4	Height	3 Meg. Ω carbon	$1.25
	RRC-127 K71J12-1	A43-4000 FKS-1/4	Vert. Lin.	4000 Ω 2W-W.W.	$1.25
	RRC-140 K71J442-1	AG-40-S FKS-1/4	Hor. Drive	25K Ω carbon	$1.25
	RRC-173 K82J327-2	AG-49-S RS-2	Hor. Hold	100K Ω carbon	$1.25
	RRC-174 K82J326-2	AG-49-S RS-2	Vert. Hold	125K Ω carbon	$1.25
	RRC-175 K82J255-2	AG-58-S RS-2	Bright.	500K Ω carbon	$1.25
	RRC-186 K83J475-1	RTV-375	Contrast Vol./Sw.	2 Meg./500K Ω Conc. Dual carbon--SPST	$3.70
HALLICRAFTER					
1000 1008 1019	25A858	AG-44-S FKS-1/4	Hor. Drive	50K Ω carbon	$1.25

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
CHASSIS W1000D X1000D Z1000D	25B711	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	25B712	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	25B888	RTV-237	Contrast/ Vol./Sw.	2500/1 Meg. Conc. Dual--carbon--SPST	$3.70
	25B895	RTV-235	Focus/ Bright.	2500/50K Ω 2W-W.W. carbon Conc. Dual	$3.10
	25B917	RTV-40	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
1002 1003 1004 1007 CHASSIS F1100D	25A858	AG-44-S FKS-1/4	Hor. Drive	50K Ω carbon	$1.25
	25B711	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	25B712	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	25B888	RTV-237	Contrast Vol./Sw.	2500/1 Meg. Conc. Dual carbon--SPST	$3.70
	25B917	RTV-40	Vert. Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	25B994	RTV-350	Focus/ Bright.	1.5 Meg./50K Ω Conc. Dual carbon	$3.10
1005 1006 1015 1016 1017 1018 1019 CHASSIS A1100D	25A858	AG-44-S FKS-1/4	Hor. Drive	50K Ω carbon	$1.25
	25A970	AG-83-S KSS-3	Focus	1.5 Meg. Ω carbon	$1.25
	25B711	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	25B712	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	25B890	RTV-239	Hor./ Vert. Hold	50K/1 Meg. Conc. Dual carbon	$3.10
	25B969	AG-63-Z FS-3/SWB	Vol./Sw.	1 Meg. Ω carbon--SPST	$1.25 .60
	25B971	RTV-351	Contrast/ Bright	2500/50K Ω Conc. Dual carbon	$3.10
1025 CHASSIS C1000D	25A858	AG-44-S FKS-1/4	Hor. Drive	50K Ω carbon	$1.25
	25B711	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	25B712	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	25B917	RTV-40	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	25B966	RTV-337	Contrast Vol./Sw.	2500/1 Meg. Tap 100K Ω Conc. Dual carbon SPST	$4.30
	25B967	RTV-338	Focus/ Bright	2500/1 Meg. 2W-W.W. carbon Conc. Dual	$3.10
HYDE PARK AR14L AR17L 17CD 17CRR 17ROG 20CD 203D 1000 1001 2nd Run	P-2	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon--SPST	$1.25 .60
	P-12	AG-8-S FKS-1/4	AM Rejection	1000 Ω carbon	$1.25
	PD-5	RTV-146	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	PD-6	RTV-253	Contrast/ Bright.	2000/100K Ω Conc. Dual carbon	$3.10

Form No. 751837010-5M-11/52

CLAROSTAT

This supplementary sheet is for use as an up-to-the-minute addition to your Clarostat RTV Manual. Manuals are available through your distributor or directly from Clarostat. Price $1.00.

CLAROSTAT MFG. CO., INC.
DOVER, NEW HAMPSHIRE

PF PHOTOFACT INDEX

AND TECHNICAL DIGEST

INDEX TO ADVERTISERS

May-June 1953 Issue

+ More or Less —

The innovation of television, and its rapid growth and expansion, has highlighted the necessity of good customer relations for the successful operation of an electronic service business.

Television, through installation work and repair service performed in the customer's home, has brought about an increase in personal contact between the technicians and the customers they serve.

The average radio presents no complex installation problem, preliminary set-up, or lengthy operating instructions to the customer. Repair service is generally performed at the bench in the shop. Table models, portables, etc., can normally be brought in and called for by the customer. Chassis, in even the console type models, lend themselves quite readily to pickup and delivery.

Television, on the other hand, normally requires some adjustment at the time of installation. The customer should receive some operating instructions, and in most cases some form of antenna installation is required.

There is also the possibility of additional installations and services, such as boosters, antenna rotators, and more recently UHF converters or conversion to UHF of an existing VHF receiver.

Surveys have also indicated that considerable servicing is performed in the customer's home. This is due to the fact that tube failures account for a high percentage of the troubles encountered and that the normal television receiver presents somewhat a problem in transporting to the shop for bench service. Providing the trouble can be found, repair and/or adjustments be accomplished readily and in a reasonable length of time, service should be rendered in the customer's home. Bench service is, of course, also necessary at times and it should be understood by the customer that better service can be provided by removal of the chassis or complete set.

This increase in personal contact between the technician and the customer has placed more of a responsibility for customer relations on the service technician. He's appearance, conduct and general handling of the customer will make either a good or bad impression.

To the customer, a service technician should appear neat, courteous and generally well-mannered.

As a professional man, the technician should be proud of his profession and the servicing industry he represents.

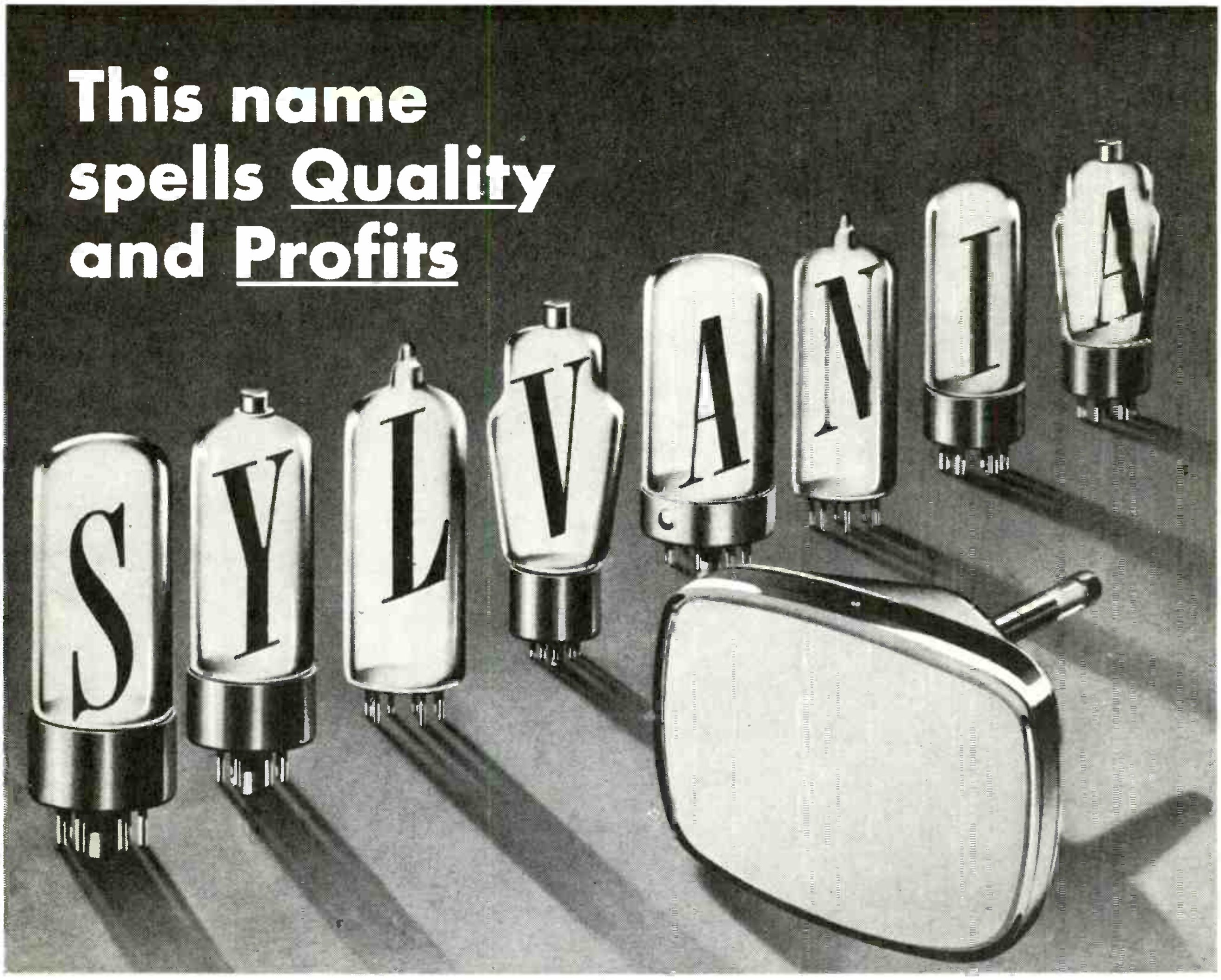
Since he is working at the customer's home, he should take precautions to prevent damage to the property and see that the work area is clean and neat before leaving.

The customer must feel that he can trust the technician and his shop to give him good service at a fair price. He should be "sold" on your organization.

Each installation or service call at the customer's home should be considered as an opportunity. An opportunity to better customer relations, an opportunity for additional sales and services.

The opportunities for better customer relations, for a successful and growing business are there; and the service technician like the well-known house-to-house salesman has his foot in the door.

- L. H. N.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