

# Technical Section



SPRING ISSUE 1962 □ VOL. 29, NO. 1

R. A. HUMPHREYS, TECHNICAL EDITOR This information in Sylvania News is furnished without assuming any obligations.

## SERVICING TV RECEIVERS HAVING AUTOMATIC BRIGHTNESS AND CONTRAST CONTROLS

BY  
H. L. RICHARDSON

### INTRODUCTION

The cadmium-sulfide (Cds) photoconductor has been known for many years. But, it is only recently that modern production techniques have made possible their mass production. Hence, photoconductors are now being used in many applications, and many more will be found in the future. We will concern ourselves here with only one particular application—that of providing automatic brightness and contrast control in television receivers.

The photoconductor may be considered as a resistor whose value depends upon the amount of light falling on its surface. Keeping this in mind, it is not at all difficult to see how a photoconductor operates. Most of us realize that materials commonly associated with electronics may be considered as conductors, insulators, or semiconductors. What is the difference between conductors and insulators? Since current consists at least partly of the flow of electrons, an insulator must somehow impede the flow while a conductor

should simply guide it. Actually, no one electron travels very far, but rather, goes a short distance and strikes a stationary one, sending it on its way and dropping into the spot just vacated.

In a conductor, the second electron starts moving quite easily; while in an insulator, more energy may be required than the moving electron can provide. If one thinks of the stationary electrons as resting in holes that are shallow in a conductor and deep in an insulator the picture becomes clear (Figure 1). In a semiconductor, the electrons rest in holes or potential wells intermediate in depth between those of a conductor and an insulator. An unusual property possessed by semiconductors is the ability of the electrons deep in their potential wells to be raised to higher energy levels by some outside source of energy. A photoconductor makes use of the photon energy of light to raise the electrons to a higher energy level, thus making it a better conductor or a lower resistance. When the light is removed, the elec-

trons drop back into their potential wells. It might be supposed that this drop would occur instantaneously, but such is not the case. Upon the removal of all light, the photoconductor resistance jumps rapidly, then slowly increases to a final dark resistance. This effect is severe only when going from high illumination to total darkness and need not be considered except in high speed applications.

### PHOTOCONDUCTOR CHARACTERISTICS

Figure 2 shows the construction of Sylvania photoconductors presently used in TV receivers to counteract the effects of ambient light variations. The light sensitive element consists of a cadmium-sulfide wafer which is pressed into the correct size by a hydraulic press under great pressure. The finger or comb pattern is deposited on the wafer by vacuum vaporizing a conductive material through a mask in the same manner as paint is sprayed through a stencil. The wafer is then sealed in glass, at

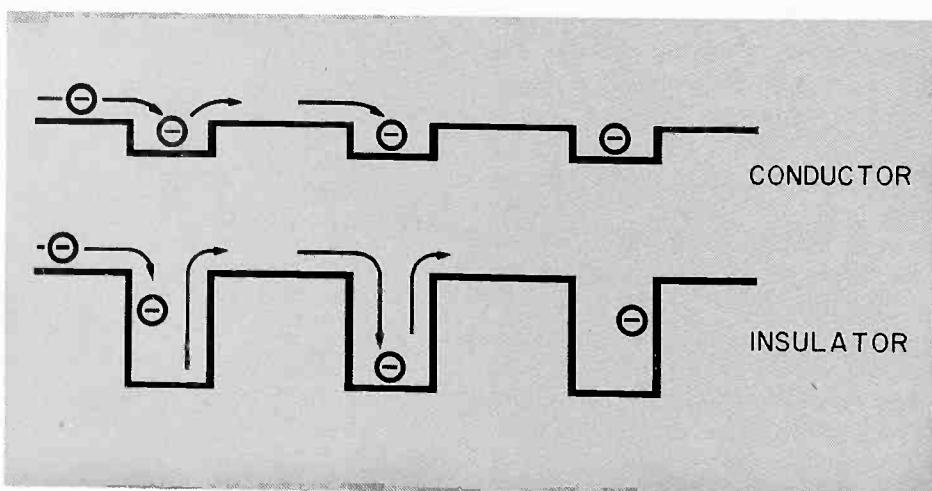


Figure 1—Action of Potential Wells.

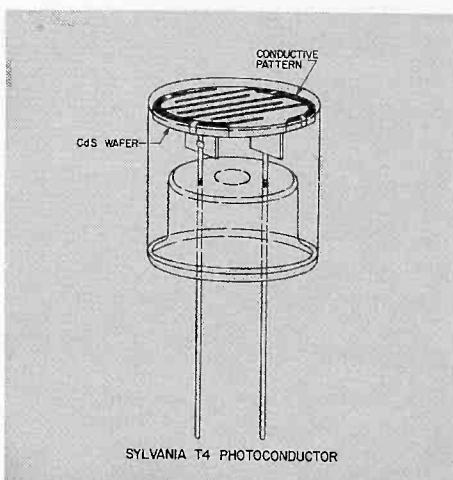
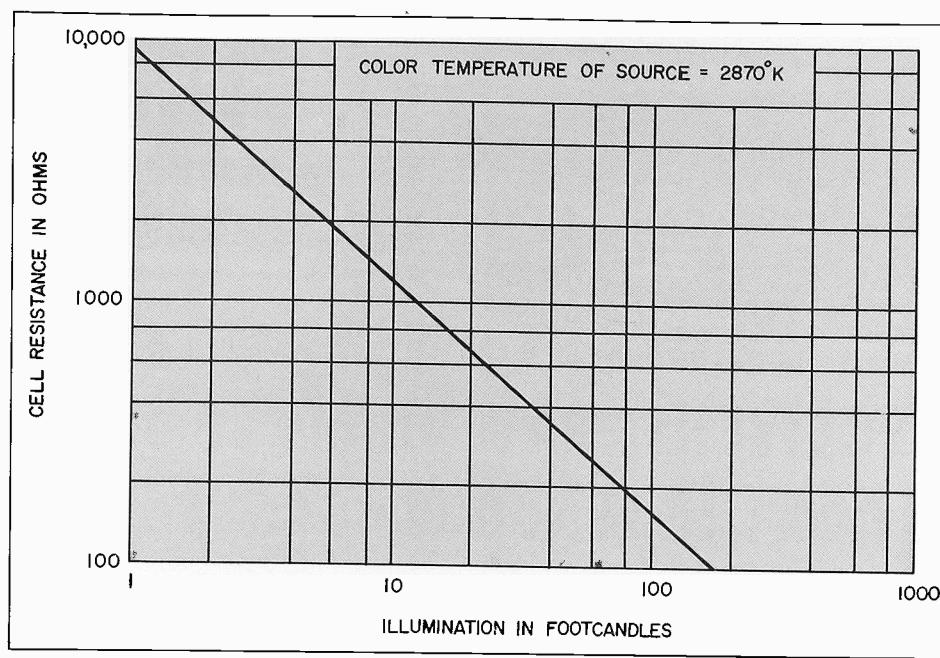


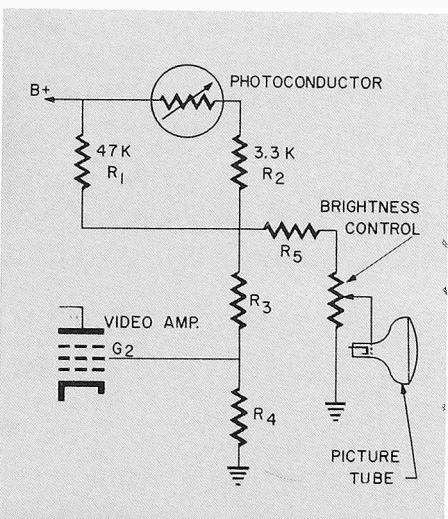
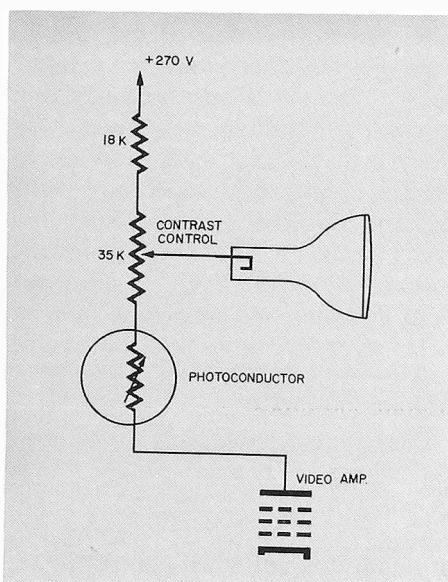
Figure 2—Typical Sylvania Photoconductor.



◀ Figure 3—Type 8100 Average Characteristics.

▶ Figure 5—Photoconductor used to vary the amount of video passed to the picture tube grid. ▶

▼ Figure 4—Photoconductor acts as voltage divider to vary video signal to the picture tube. ▼



◀ Figure 6—Photoconductor used to vary the gain of the video amplifier to achieve automatic control of brightness and contrast. ▶

which time the air is replaced by hydrogen. After aging and testing, the completed photoconductor, which measures one-half inch in both diameter and length, is ready for use.

As illustrated by the curve shown in Figure 3, a very great change in resistance is possible with moderate changes in illumination. Illumination is measured in footcandles and refers to the amount of light falling on a given area. To put these numbers in a familiar setting, it is just possible to read under 1 footcandle illumination, while at a distance of several inches from a 100 W bulb, the illumination is about 100 footcandles.

#### NEED FOR AUTOMATIC BRIGHTNESS AND CONTRAST CONTROLS

One problem encountered by the home viewer of a television receiver is the effect of changes in ambient light level upon the brightness and contrast of the picture. Although a good picture can be obtained under most normal lighting conditions, the home receiver is usually adjusted when it is turned on—and left there. As the room lighting changes, the viewer simply accustoms himself to a poorer picture. To minimize the effects of these changes, it is possible to employ a photoconductor to vary the contrast and brightness in response to changes in room lighting.

#### CIRCUITRY

Two representative circuits are shown in Figures 5 and 6. Both use a photoconductor and a fixed resistor

network to obtain a light controlled voltage divider. In the circuit of Figure 4, which is a simplified version of Figure 5, it can be seen how the photoconductor acts as a voltage divider to vary the amount of video signal passed to the picture tube cathode. If room illumination is high, then photoconductor resistance is low; and a maximum video signal appears at the picture tube. Under conditions of low room lighting, corresponding to high photoconductor resistance, much of the available video signal is developed across the photoconductor, leaving less at the picture tube. As the contrast is increased, an apparent increase in brightness takes place since the picture tube is driven to higher second anode current by the white portions of the scene, resulting in "whiter whites." Of course, the blacks are also driven harder; but, once the picture tube is cut off, the limit is reached. The apparent increase in brightness depends on many factors among which are picture tube characteristics and video amplifier linearity.

In this circuit, it is necessary to decrease the apparent change in brightness to maintain adequate picture quality. This is done by coupling a small DC voltage to the picture tube which biases it back at high contrast. In other words, a portion of the video amplifier DC plate voltage, including some video, is picked off by the photoconductor and applied to the picture tube after

being divided down to about half of its original value.

When the automatic feature is disabled (switch  $S_{1A}$  in off position), a

# Dealer Section

SPRING ISSUE 1962 □ VOL. 29, NO. 1

ALLAN POSPISIL, EDITOR — PUBLISHED FOR THE PROFESSIONAL RADIO-TV SERVICE DEALER

**THIS IS THE NEWEST  
WAY TO CARRY TUBES  
... IN SYLVANIA'S**

**COMPAC-CADDY**

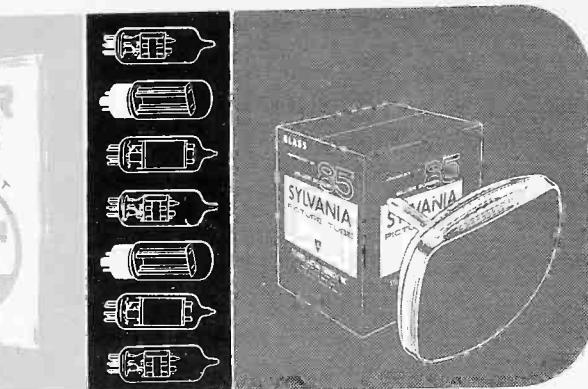
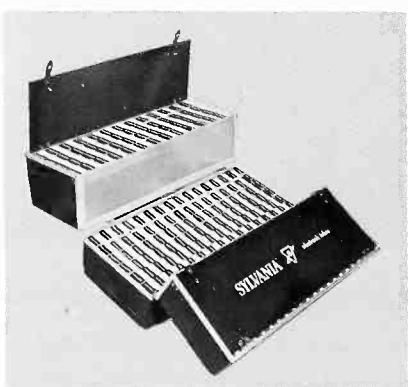
It weighs in at a feathery  $7\frac{3}{4}$  pounds, stands only a foot high, nine inches wide and less than two feet long—yet this lightweight, compactly designed Sylvania tube caddy can hold 300 tubes!

It's called the Sylvania COMPAC-CADDY and it's available now, *exclusively* from participating Sylvania Distributors.

Don't let its bantam weight fool you—this is a ruggedly-built caddy that can take the abuse of the busiest service dealer. COMPAC-CADDY is constructed of a tough thermo-plastic material called Royalite, developed by U. S. Rubber. It won't scuff; greases and oils don't affect it; it's tightly waterproof.

Fiberglass reinforcement strengthens the corners and polished aluminum provides a finishing trim to the COMPAC-CADDY.

Inside COMPAC-CADDY there's room for 300 tubes, space enough for a full-size inventory of fast-moving replacement types plus a few more. There's only one way you can become the satisfied owner of a Sylvania COMPAC-CADDY and that's by seeing your Sylvania Distributor. See him now before there's a waiting list!

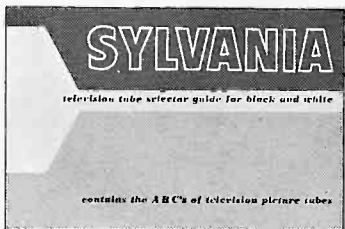




**SYLVANIA PICTURE TUBE  
COMPARISON CHART**

(ET 1050)—10¢

Approximately 350 types shown, including Bonded Shield, Color Tubes, and check tubes. Basing Diagrams, Data for heater, face, body, focus, deflection angle and neck diameter, anode volts, basing, ion trap and tube length.



**SYLVANIA TELEVISION  
TUBE SELECTOR GUIDE**

(ET 1051)—10¢

Information identical to Comparison Chart, available here in a handy pocket-size guide.

## BONDED SHIELD ONLY

### SYLVANIA WALL CHART LISTS

**BONDED SHIELD DATA**—This useful Sylvania chart provides all the technical data you'll need when you're replacing a Bonded Shield type picture tube. Furthermore, it lists the specific product advantages of Bonded Shield—more viewing area, improved picture contrast, reduced reflection, etc.—that you'll be able to tell your customers about. At your Sylvania Distributor's, or order directly from Sylvania (Order ET-3958; 3¢ each).

# WHAT DO YOU NEED TO KNOW ABOUT PICTURE TUBE, CRT CHARACTERISTICS?

The service dealer's world of ion traps, deflection angles, neck diameters, electrostatic focusing, etc., is made easier with the publication of three Sylvania technical aids—the Sylvania Picture Tube Comparison Chart, the Television Tube Selector Pocket Guide and the Cathode Ray Tube Characteristics Booklet.

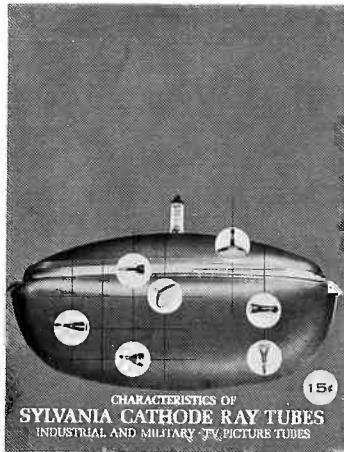
Utilizing the most recent tube releases and technical material, these three publications represent the latest compilation of CRT-Picture Tube types and characteristics information available in the industry today.

The data included was selected and presented in order to have maximum working usefulness to service dealers and technicians. Older, obsolete tube types have generally been dropped from the listings; infrequently used information has been eliminated. New types, including Bonded Shield, have been added; there are even sections devoted to color tubes now.

All these publications are available from your Sylvania Distributor or from Sylvania at the prices shown. If ordering directly from Sylvania (C.A.D.D., 1100 Main St., Buffalo 9, N. Y.) please include remittance.



*Three New  
Sylvania  
Technical  
Aids  
Provide  
Latest,  
Most Complete  
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**CHARACTERISTICS OF  
CATHODE RAY TUBES**

(ET 1351)—15¢

44-pages. Hundreds of types, including Industrial & Military, black and white, and color. Phosphor chart, basing diagram. More detailed data than shown in chart or pocket guide. (Because of the time required to print this extensive booklet, it may not be generally available for another week or two.)

# 10 NEW TYPES ADDED TO SILVER SCREEN 85 LINE

Sylvania Electric Products Inc. has just announced the addition of 10 new picture tube types to the famous Silver Screen 85 line. Three tube sizes are involved—19", 23" and 27".

The new types are described here. Familiarize yourself with them—when you need to replace one of these newer types, be certain to install a Sylvania Silver Screen 85. Your customers will enjoy brighter, sharper TV pictures when you do.

(To become familiar with these new types and their usage, cut out this chart and place it prominently in your shop.)



Tom Morgan, left, President of Northwest Radio Supply receives a plaque from Sylvania's Ray Guion. The plaque commemorates Northwest Radio's 30th Anniversary as a Sylvania Distributor.

## TYPE NO.      DESCRIPTION, USAGE

<b>19ACP4</b>	A 114° deflection, aluminized, non-ion trap tube employing a 6.3 volt, .600 amp heater. Used in Westinghouse receivers.
<b>19BHP4</b>	A 114° deflection, aluminized, non-ion trap tube employing a 6.3 volt, .600 amp heater. Used in G. E. receivers.
<b>19AYP4</b>	A 114° deflection, aluminized, non-ion trap tube employing a 6.3 volt, .450 amp heater. Used in RCA, Motorola and Silvertone receivers.
<b>23ALP4</b>	A 114° deflection, aluminized, non-ion trap tube employing a 6.3 volt, .450 amp heater. Used in Silvertone and Packard Bell receivers.
<b>23BJP4</b>	A 92° deflection, aluminized, non-ion trap tube employing a 6.3 volt, .600 amp heater. Used in RCA receivers.
<b>23BKP4</b>	A 92° deflection, aluminized, Bonded Shield picture tube employing a 6.3 volt, .600 amp heater. Used in RCA receivers.
<b>23BLP4</b>	A 92° deflection, aluminized, Bonded Shield picture tube employing a 6.3 volt, .600 amp heater. This is an anti-reflection version of the 23BKP4. Used in RCA receivers.
<b>23BVP4</b>	A 92° deflection, aluminized, Bonded Shield tube employing a 6.3 volt, .600 amp heater. Used in Philco receivers.
<b>23FP4</b>	A 114° deflection, aluminized, non-ion trap tube employing a 6.3 volt, .600 amp heater. Used in Westinghouse receivers.
<b>27VP4</b>	A 90° deflection, aluminized, non-ion trap tube employing a 6.3 volt, .600 amp heater. Used in Emerson receivers.

## SYLVANIA DISTRIBUTOR MARKS 30TH YEAR ★

On its 30th Anniversary as a Sylvania Distributor, Northwest Radio Supply of Portland, Oregon was presented with a commemorative plaque, marking three decades of "friendly relationship and successful association." Mr. Ray Guion, Sylvania District Manager for the Pacific Northwest, made the presentation to Mr. Tom Morgan, President of Northwest Radio Supply.

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You can cut down on servicing time . . . the two hard-cover volumes that make up this RTTA training course will show you dozens of servicing shortcuts. The material is a revised, updated version of the best-selling Sylvania-Sponsored RTTA home study course, "New Shortcuts to TV Servicing."

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Based on material from the original and highly-popular home study course, the hardcover "New Shortcuts to TV Servicing" features the very latest servicing techniques and procedures. New material has been added on portable and transistorized TV; hundreds of photographs and illustrations are included.

These books are available now from your Sylvania Distributor at only \$6.75. (The regular retail value is \$9.90). See him now—add these permanent working references to your technical library.

## "NEW SHORTCUTS TO TV SERVICING" — Table of Contents

**CHAPTER 1—FRONT END TROUBLES.** Tube troubles. Mechanical troubles. Drift. Check points. Microphonics. Poor fringe reception. Snow and weak sound. Distorted or missing sound. Sound bars. Poor definition. Blotches. Snivets. Poor contrast. Pix flashes. Jitter. Multiple images. Smearing. Critical sync. Noise. Interference.

**CHAPTER 2 — TROUBLESHOOTING THE I.F.** Speckling. Smear. Raster, no pix. Pix bending. Excessive brightness. Hum. Poor definition. Excessive contrast. Low or missing B plus. Tube shorts. Gassy tubes. Trap misadjustment. Shorted, leaky and open parts. Weak pix. Poor interlace. Ragged raster. Poor alignment.

**CHAPTER 3—PICTURE DETECTOR DEFECTS.** Critical sync. No contrast. Smear. Raster, no pix. Grainy pix. Multiple images. Hum bars. Interference patterns. Checking crystals, components, and video detector.

**CHAPTER 4—AUTOMATIC GAIN CONTROL DEFECTS.** Critical sync. Excessive contrast. Snow. No contrast. Flicker. Flutter. Hum bars. Raster, no pix. Defective agc. Negative pix. Clamp troubles.

**CHAPTER 5—VIDEO AMPLIFIER DEFECTS.** Sound bars. Smear. Raster, no pix. Jitter. Multiple images. Negative pix. Tearing. Bending. Poor sync. Contrast troubles. Poor pix quality. Poor definition. Trailing smears.

**CHAPTER 6—SYNC TROUBLES.** Wavy pix. Pix bending. Foldover. Pulling. Pix smear. No sync. Tearing. Hold control troubles. Compression. Stretched pix. Poor interlace. Jitter. Bounce. Bars in pix. Foldover. Tearing. Rolling. Partial loss of sync.

**CHAPTER 7—PICTURE TUBE AND PICTURE TUBE CIRCUIT TROUBLES.** Retrace lines. Raster, no pix. Excessive brightness. Screen dark. Poor definition. Weak pix. Bright bands in pix. Dark pix. Checking pix tubes. Leakage. Opens burning shorts. Brighteners. Ion magnet troubles. Focus troubles. Centering troubles. Corner shadow. Pix tube spot. Tilted pix.

**CHAPTER 8—HIGH VOLTAGE TROUBLES.** Corona. Blooming. Arcing. Dark screen. Excessive brightness. Insufficient brightness. Flashing pix. Excessive size. Blooming. Insufficient high voltage. Small pix. Boost troubles. Flyback troubles. Checking high voltage.

**CHAPTER 9—DEFLECTION TROUBLES.** Open yoke. Tilted pix. Short in yoke. Frozen yoke. Bow-tie pattern. Insufficient height or width. Tilted pix. Centering problems. Wedge shaped pix. Poor focus. Foldover. Bulge. Barreling. Raster shadow. Keystoning. Cross-modulation. Wavy lines. Pincushioning. Horizontal reverse. Neck shadow.

**CHAPTER 10—TROUBLES IN SOUND.** Fading. Distortion. Frying. Noise. No sound. Weak sound. Traps. Motorboating. Oscillation. Buzz. Sound i.f. troubles. Ratio detector troubles. Transformer and speaker troubles.

**CHAPTER 11—LOW VOLTAGE TROUBLES.** No B+. Defective selenium rectifiers. Glow in rectifier. No audio or brightness. No contrast. Poor focus. Pix sound bars. Open, leaky or shorted electrolytics. Multiplier troubles. Line voltage headaches. Dim or critical pix. Low volume. Hum.

**CHAPTER 12 — MISC. TROUBLES.** Cleaning pix tubes. Handling sets. Antenna troubles. Lead-in troubles. Cabinet repairs. This chapter will describe troubles not covered in other chapters.

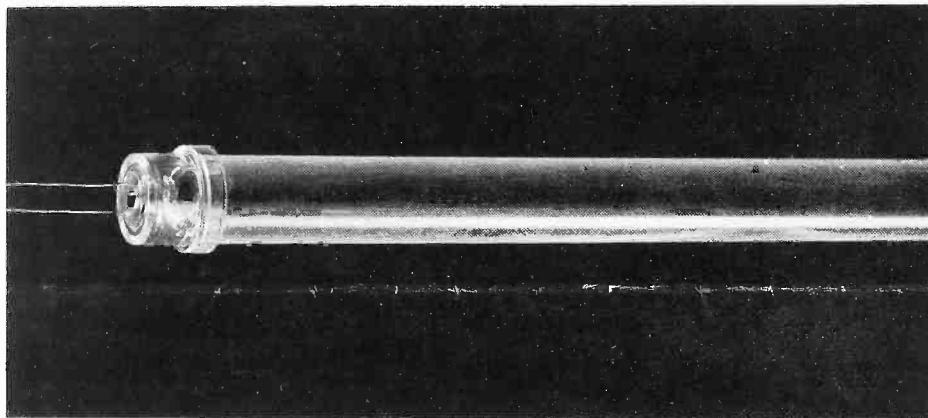
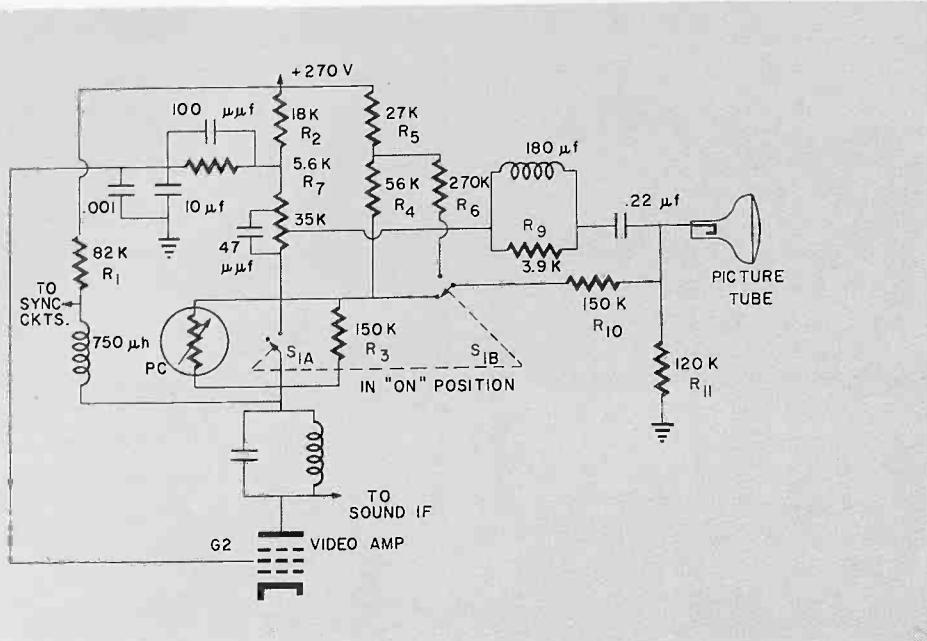


Figure 7—Photo of "light pipe".

fixed bias is applied to the picture tube along with some video. This allows partial DC coupling of the video to the picture tube, a circuit refinement which is becoming popular with many set makers.

The preceding example demonstrated how a photoconductor may be used to vary both the AC and the DC component of the signal applied to the picture tube by acting directly on the video signal. An alternative method uses a photoconductor to vary the gain of the video amplifier to achieve automatic control of brightness and contrast. Figure 6 illustrates how this is accomplished. Screen voltage for the video amplifier as well as picture tube grid bias is obtained from a photoconductor controlled voltage divider.

The operation of the circuit is best illustrated by considering the effect of changing illumination levels. At high

illumination, corresponding to bright ambient room lighting, the photoconductor resistance decreases. This results in more DC voltage being applied to the voltage dividers supplying the picture tube grid and video amplifier screen. As a result, the bias on the picture tube goes toward positive, causing increased brightness. At the same time, the video amplifier screen voltage is increased, thus operating the tube at higher gain, causing an increase in video signal, or higher contrast. The converse is true at low light levels corresponding to high photoconductor resistance.

In this particular circuit, the photoconductor may be mounted on the front panel of the receiver. It is placed in such a position as to allow light from the room, but not the picture tube, to fall on its surface. However, in those models in which

the photoconductor is part of the video circuitry, a plastic "light pipe" is used to conduct the light to the rear of the chassis, to reduce electrical circuit complexity. As shown in Figure 7, the photoconductor is permanently attached to the far end of the plastic rod.

Although the photoconductor is capable of very great changes in resistance between high and low illumination levels, the circuit designer frequently desires a smaller change, since only a 50% change in contrast and brightness is required to correct for a large variation in ambient lighting. This is accomplished in the circuit shown in Figure 6 by means of trimming resistors R1 and R2.

Consider two extreme cases of infinite and zero photoconductor resistance corresponding to zero illumination and very high illumination respectively. With the photoconductor at infinite resistance, the 47K resistor R1 limits the maximum value of the circuit resistance while, with the photoconductor shorted, the circuit consists of R1 and R2 in parallel. Thus the value of the network can vary from 47K down to a little less than 3.3K. Since screen current for the video amplifier must pass through the photoconductor or R1, the use of a parallel resistor means less current through the device, hence lower dissipation.

#### SERVICING TECHNIQUES

By virtue of the methods used by receiver manufacturers in connecting the device, the design will usually allow a good picture to be obtained even with a faulty photoconductor. If a service problem is encountered in which the photoconductor is suspected, the first step is to determine if the trouble lies in the device or some other portion of the circuit. Some models include a switch to disable the automatic brightness and contrast feature which allows the photoconductor to be quickly checked by observing the picture with it out of the circuit.

Once the difficulty has been traced to the photoconductor, an ohmmeter may be used to determine if it is operable. It must be remembered that this is a light sensitive device and an ohmmeter check of a good photoconductor will show a wide range of

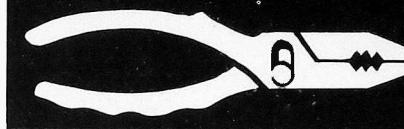
resistance depending upon lighting conditions. Rarely will the failure mechanism of a photoconductor show up as a short; however, a photoconductor may develop an open circuit due to damage to the cadmium-sulfide wafer which could be the result of dropping the device and cracking the wafer. The glass envelope is quite rugged and capable of withstanding more abuse than the fragile wafer.

It is important that no moisture enter the glass envelope, as radical changes in resistance will result. This can best be determined by measuring the resistance of the photoconductor in total darkness. Simply wrap the suspected device in a dark cloth with only the leads exposed and measure the dark resistance. It should be greater than 100K ohms. While all photoconductors presently manufactured by Sylvania are sealed in glass, it is possible that some TV receiver manufacturers are using those sealed with epoxy resin. This material may allow moisture to enter. For your

convenience, all Sylvania photoconductors contain the "Blue-Dot" feature long found in Sylvania flash bulbs. This is a blue colored dot which turns pink with as little as an 8% increase in humidity. A photoconductor displaying the slightest change in dot color should be discarded even though it appears to have normal characteristics; it will soon become very unstable.

Undoubtedly, some TV receiver owners will require education in what should be expected of automatic brightness and contrast controls. There should be no apparent change in picture quality when room lighting is changed. This is the purpose of the automatic feature which may be demonstrated by placing the hand over the photoconductor and observing the change in brightness and contrast. Many observers will be surprised that the change is not greater than it is; but, as mentioned earlier, only a 50% change is required from total darkness to very bright room lighting.

## SERVICE HINTS



### NO VERTICAL DEFLECTION

In servicing the RCA chassis KCS 94, 95 and 97, I found zero voltage on the grid of vertical output tube VIII (6AQ5) and about 200 volts on the plate. I then noticed the white horizontal line did not seem bright enough and checked voltage on the CRT which was too low. In tracing from pin 10 of the CRT, I found R182 resistor (270K ohms) open. Replacing the resistor restored picture to normal. This same condition and defect was identical in all three chassis.

Mack Kunzman  
San Francisco, California

### NO-KINK TEST LEADS

Most conventional test leads for instruments are of such a length that they often become snagged atop a cluttered workbench. We substitute for these leads the coiled wires used on cameras, see Figure 1. These coils contain two wires; both of which are soldered as one into the plug and test probe, thus insuring longer continuity.

When not in use, the camera leads snap back into place taking up very little space. Should the coils relax after extended use, they can be made tight again by rewinding them in the opposite direction.

Harry J. Miller  
Sarasota, Florida

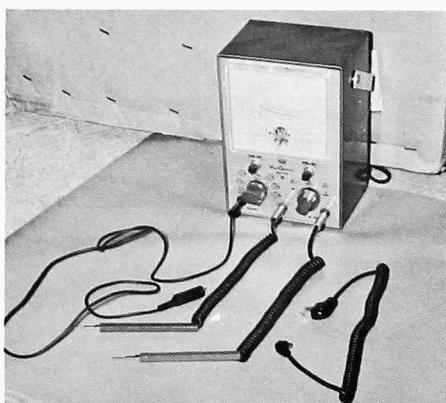


Figure 1—Coiled camera wires substituted for test leads.



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# Technical Section



SUMMER ISSUE 1962 □ VOL. 29, NO. 2

R. A. HUMPHREYS, TECHNICAL EDITOR This information in Sylvania News is furnished without assuming any obligations.

## BASIC MULTIPLEX PRINCIPLES

PART 1

BY W. D. MURPHY ■ SYLVANIA ELECTRIC PRODUCTS INC.

Sylvania Electronic Tubes Receiving Tube Operations

### INTRODUCTION

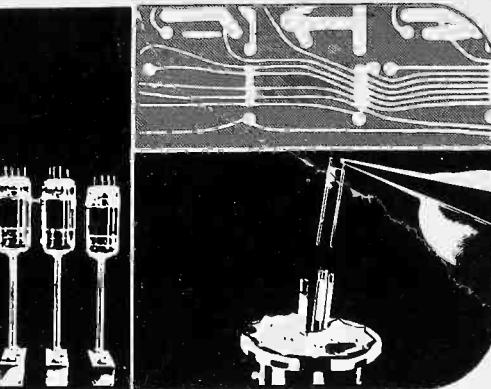
Following the adoption by the FCC of the multiplex FM stereo system, more and more FM stations have begun programming stereo; and a variety of receiving equipment is appearing on the market. In the very near future, servicemen will be called upon to service and perhaps adapt the customer's FM receiver for multiplex operation. This article is intended to familiarize you with the principles of the multiplex system, and thereby enlighten the task of servicing such equipment.

### THE BASIC SYSTEM AND COMPATIBILITY

The ultimate goal of any stereo system, be it Hi-Fi or a broadcast system, is to convey signals from "Left" microphone to "Left" speaker, and similarly "Right" to "Right," with no "Left" signal appearing at the "Right" speaker, and vice-versa.

This can be achieved by utilizing two independent systems. Some stereo broadcasts formerly employed this method; "Right" being transmitted by the station's AM equipment, and "Left" by the FM station equipment. This, of course, meant the listener had to tune in both AM and FM stations for stereo reception. The listener who only had an AM set could not hear the "Left" half of the orchestra during the stereo broadcast.

This leads to an important consideration in the stereo system development. It must not detract from the normal monophonic quality of the program for those not employing



stereo receivers. A very common parallel is "compatible" color TV, in which black and white TV receivers are not affected by the presence of color information, and likewise, a color receiver produces a monochrome picture from a normal black and white signal. So it must be with stereo: a standard receiver must reproduce a normal monophonic output from the stereo-cast, and the

stereo receiver must also be able to reproduce monophonic programs. The first requirement then is compatibility with existing equipment.

The technique of accomplishing these multiple objectives can be best understood by first acquiring a rough working knowledge of the overall system and then filling in the details. To assist the reader, a block diagram covering the generation and trans-

Figure 1

## STEREO GENERATOR

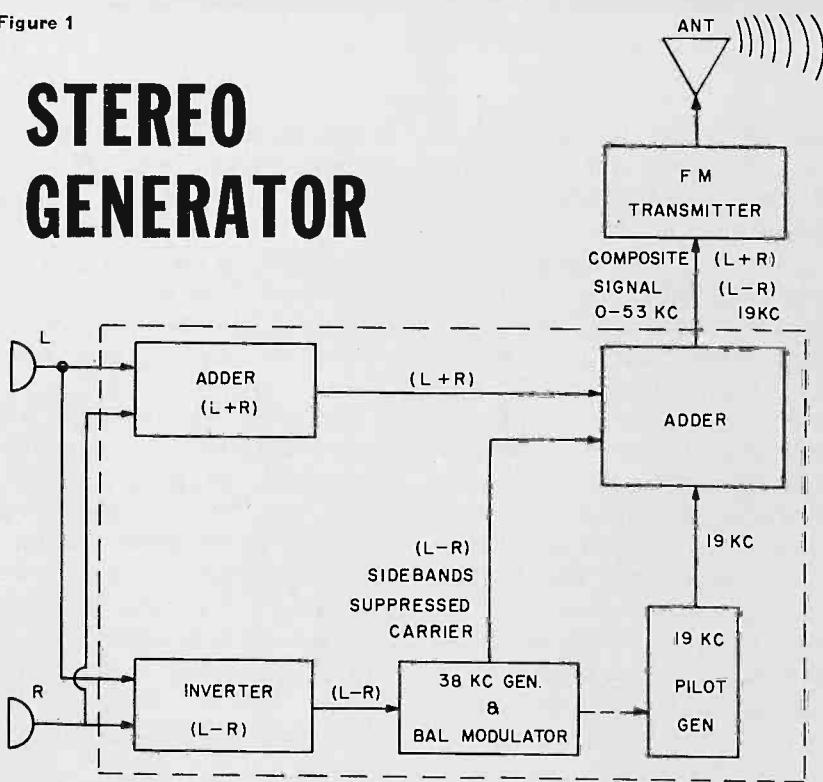


Figure 1—Simplified block diagram showing how composite stereo signal is generated by the FM station.

# STEREO DETECTOR

Figure 2

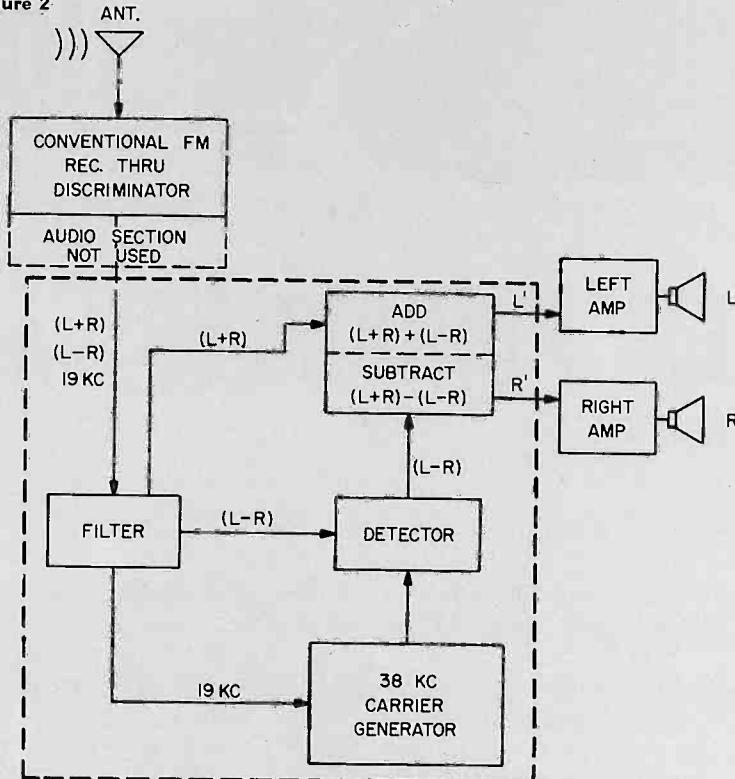


Figure 2—Simplified block diagram of stereo FM receiver and adaptor. The area enclosed by "broken lines" denotes additional circuits of stereo receivers and adaptors.

mission of stereo is presented in Figure 1. Beginning at the studio, the "Left" and "Right" stereo channels are established by the appropriate placement of two microphones. In order to meet compatibility requirements, it is not enough, however, to simply transmit "Left" and "Right" signals as such. To provide for full reception by conventional FM receivers, the station must continue to transmit a monophonic signal in the usual fashion during a stereocast. This monophonic signal is obtained simply by adding the two initially separated channels to form  $(L + R)$ . The same thing takes place when two or more microphones are used to pick up a large orchestra and feed a common amplifier. The listener then

is able to hear both "halves" of the program from a single speaker.

The  $(L + R)$  signal corresponds to the "Y" or luminance signal in color TV, which is the sum of the red, green, and blue outputs from the camera, to provide a black and white output for monochrome receivers during a color program.

To provide for stereo reception, a second signal must be simultaneously transmitted which will enable the "Left" and "Right" channels to be separated by the stereo receiver. At this point let's recall a bit more color TV theory. The color camera does not transmit independent red, blue, and green signals to the color receiver. Instead "color difference" signals are produced by electronically

subtracting the "Y" information from each signal. Thus  $R - Y$ ,  $B - Y$ , and  $G - Y$  signals are produced and transmitted by means of a subcarrier. Finally in the color television receiver, the  $R - Y$  is added to the "Y" signal to reconstruct the original "R" signal. The other color difference signals also add with the "Y" signal to produce their respective color signals. For stereo transmission let's use an "audio difference" signal, obtained by subtracting the "Right" from the "Left" channel, i.e.,  $(L - R)$ . Thus, two combined, but distinct signals  $(L + R)$  and  $(L - R)$  are transmitted by the FM station during a stereo-cast.

Separation of the "Left" and "Right" channels is accomplished by

adding and subtracting the  $L + R$  and  $L - R$  signals in the stereo receiver or adaptor, Figure 2. Some simple mathematics will explain this process: adding,

$$(L + R) + (L - R) = 2L \text{ or } L^1;$$

and subtracting,

$$(L + R) - (L - R) = 2R \text{ or } R^1.$$

It will be noted that the resultant stereo signals are  $2L$  and  $2R$ ; which shows that the monophonic signal ( $L + R$ ) and the stereo difference signal ( $L - R$ ) each contribute in equal amounts to the amplitude of the final "Left" and "Right" signals.

Following separation, the two audio signals are fed to respective audio amplifiers and speakers.

Referring again to Figure 2, it will be noted that, in essence, a stereo FM receiver and conventional monophonic FM receiver are the same through the discriminator. The area enclosed by "broken" lines denotes the additional circuits common to stereo receivers and stereo adaptors

for conventional receivers, exclusive of the "Left" and "Right" audio power amplifiers.

There is a great deal more to stereo transmission and reception than must be known to effectively service stereo equipment than is evident from the preceding rudimentary discussion.

#### THE COMPOSITE STEREO SIGNAL

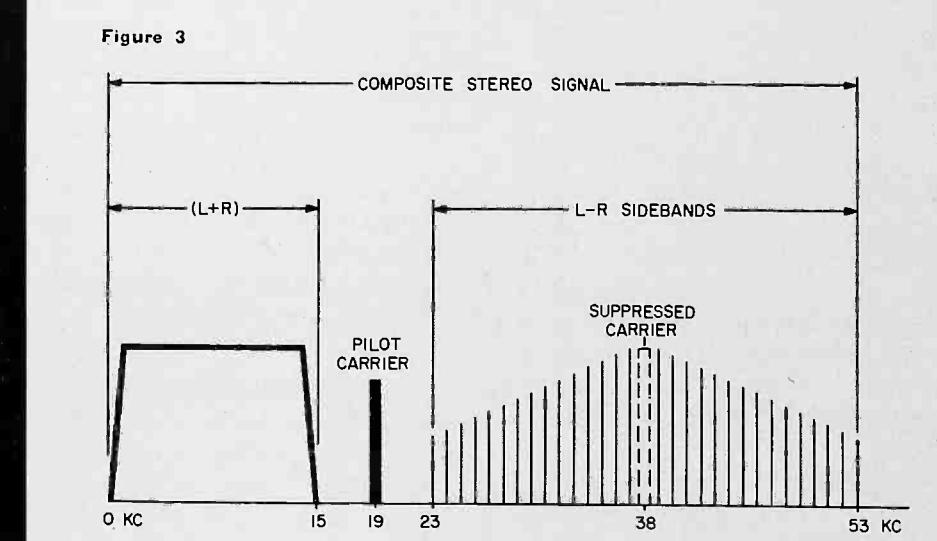
Figure 3 shows the various signals that are produced by the stereo generator in the FM station to provide for stereo reception. Monophonic FM broadcasts normally contain audio signals as high as 15 Kc. Much higher frequencies (up to 75 Kc) could be transmitted without exceeding governing regulations, if such signals would be of value. Referring to Figure 3, we see that the monophonic signal ( $L + R$ ) continues to occupy the first 15 Kc of the spectrum. The stereo difference signal, taking advantage of the higher frequency capabilities of the FM channel, is located above the monophonic signal—between 23 and 53

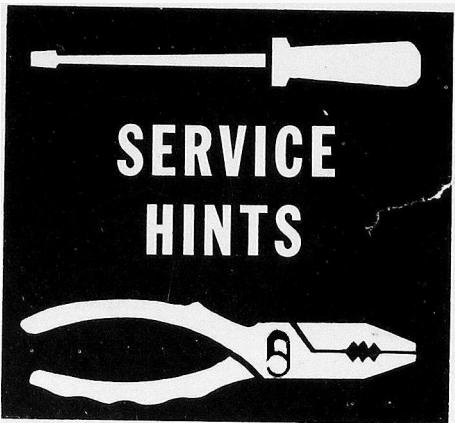
Kc. Like color, transmission of the ( $L - R$ ) signal requires the use of a subcarrier, which by an established standard has a frequency of 38 Kc. The subcarrier is amplitude modulated by the ( $L - R$ ) signal; and then the subcarrier is suppressed so that only the sidebands are transmitted. (This means, of course, that a 38 Kc carrier must be reinserted by the receiver to permit detection.) To provide equal quality for both stereo and monophonic reception, ( $L - R$ ) has the same bandwidth as ( $L + R$ ), i.e., 15 Kc.

Figure 3 shows that a 19 Kc signal is also transmitted during a stereocast. This signal is known as the pilot carrier and is necessary to correctly synchronize the stereo detection process in the receiver.

The second half of the article "Basic Multiplex Principles" will appear in the next issue of SYLVANIA NEWS. It will include a practical analysis of—basic detector circuitry and signal separation—and installation and servicing procedures.

**Figure 3**—Components of composite signal transmitted by FM station during stereo broadcast.





## SERVICE HINTS

### ANTENNA ELEMENTS BENT OUT OF SHAPE

In gale, windy, and seashore areas where dx antenna array elements tend to bend, plastic fishing line can be looped tightly around the element ends and anchored to the support spar ends. This worked nicely on a low frequency cut Yagi. In difficult installations where alighting birds bend the elements, they can also be braced with plastic lines.

J. Perkinson, Jr.  
Miami, Florida

### NEATER LUG INSTALLATIONS

Lugs and other terminals for heavy cable can be difficult to solder in place without damaging the insulation.

This can be avoided by drilling a hole in the lug; slipping the lug over the bared end of the cable; and then heating the terminal with a torch sufficient to melt the solder fed into the hole. This installation provides a neat and solid connection.

H. Josephs  
Gardenville, Pa.

### SELF-TAPPING SCREWS IN PLASTIC

When a hole in plastic material has worn to the point where a larger self-tapping screw is required, start the larger screw in the original hole only a few turns. Then apply a hot soldering gun to the screw and turn the hot screw into the softened plastic.

Leave the screw in place until the plastic cools; then back the screw out and you'll find you've tapped treads in the hole to fit the larger screw.

Stan Clark  
East Bradenton, Florida

### "UNIVERSAL BRUSH"

We use a "Universal Brush" for touch-up, applying cements, soldering acid, etc.; that saves us time and brushes and gives a clean brush for every job.

Through a 5-inch length of copper tubing, we pull a piece of cotton clothes line, letting it extend through one end about  $\frac{3}{8}$ ths of an inch. This is the brush. After using, clip off the end and pull the line through to get a clean end.

Stan Clark  
East Bradenton, Florida

### SOLDERING ALUMINUM TERMINAL LUGS

Aluminum components of TV antennas generally carry terminal lugs which are presumed to be riveted fast; but, after exposure to the weather, they corrode and when it is necessary to remove the lead-in wires, the lugs simply turn and there's a time-wasting job posed before you can get the wires off. Or, when the lugs loosen, the same difficulty is faced trying to tighten them.

Our practice before installing these antenna components is to solder all around the lugs so they become one with the arms of the antenna; then, they stay put.

Soldering the aluminum is easy with a heavy-wattage soldering iron; and, we use a Multicore, 5-flux acid with 60-40 wire solder. The aluminum then solders as readily as does copper. Be sure to remove all traces of the acid flux to prevent further corrosion.

Harry J. Milleri  
Sarasota, Florida

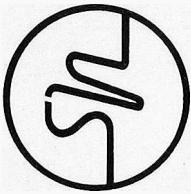
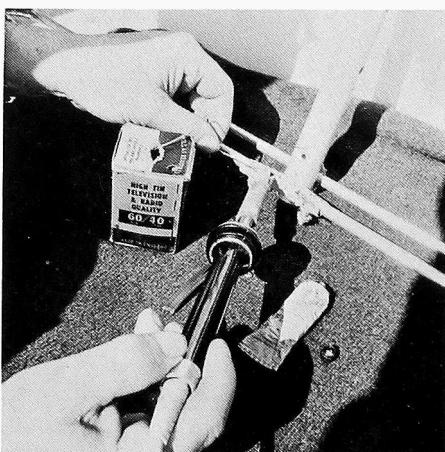
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SYLVANIA NEWS  
SUMMER ISSUE 1962

Form 3547 Requested  
Printed in U.S.A.



# Technical Section

FALL ISSUE 1962 □ VOL. 29, NO. 3



R. A. HUMPHREYS, TECHNICAL EDITOR This information in Sylvania News is furnished without assuming any obligations.

## BASIC MULTIPLEX PRINCIPLES PART 2

BY W. D. MURPHY ■ SYLVANIA ELECTRIC PRODUCTS INC.

### Sylvania Electronic Tubes Receiving Tube Operations

Part I described the basic principles of stereo transmission and reception. Part II discusses the detection process in greater detail, considerations in adapting monophonic FM receivers for stereo reception and servicing procedures.

Before covering new ground, a quick review of that covered in Part I is in order. The discussion began at the FM station studio where the "Left" and "Right" stereo channels are established by appropriate placement of "two" microphones. The outputs are then fed to the stereo generator where they are: (1) added together to form the monophonic signal ( $L + R$ ) to provide for normal reception by non-stereo receivers, and (2) subtracted to form the stereo difference signal ( $L - R$ ), essential to stereo reception. These two signals are then combined to form the composite signal that modulates the FM transmitter.

Figure 1 shows the components of the composite signal. The monophonic signal ( $L + R$ ) occupies the first 15 Kc of the spectrum. The stereo difference signal ( $L - R$ ) is located above the monophonic signal — 23 to 53 Kc. Only the sidebands of the ( $L - R$ ) signal are transmitted. The composite signal also includes a 19 Kc pilot carrier.

Figure 2 is a simplified block diagram of a conventional FM receiver equipped with a stereo adaptor. When integrated, these units constitute a complete stereo receiver. This illustration also indicates that through the discriminator or ratio detector, as the case may be, circuits of a monophonic receiver and stereo receiver are the same.

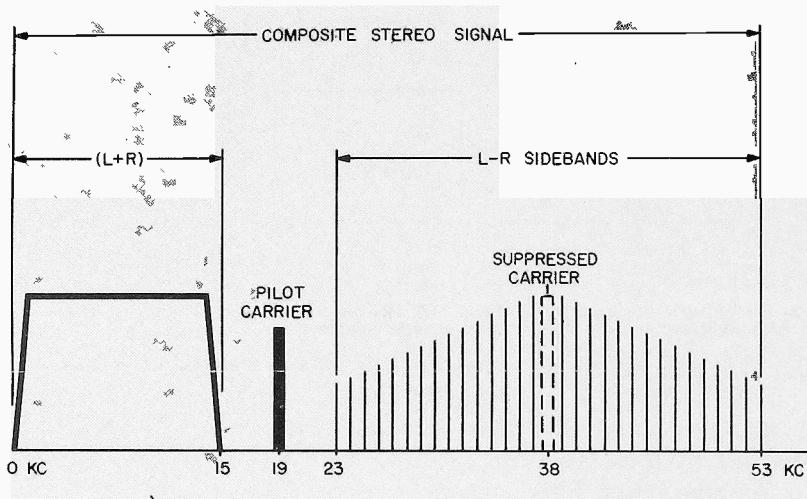


Figure 1—Components of composite signal transmitted by FM station during stereo broadcast. These components are also available at the discriminator output.

Most important to efficient servicing is an understanding of the perhaps unfamiliar circuits used to detect the ( $L - R$ ) stereo difference signal, and then from this signal and the detected ( $L + R$ ) monophonic signal, reclaim the left and right channel audio signals.

Since the differences between stereo and monophonic receivers are in those circuits which follow the discriminator, the ensuing explanation is most easily approached from the standpoint of a stereo adaptor.

#### ADAPTOR FUNCTIONS

The composite stereo signal is available at the discriminator or ratio detector output and is fed directly to the stereo adaptor. Referring to Figure 1, the signal is comprised of: 0 to 15 Kc—conventional audio signal ( $L + R$ ); 19 Kc—pilot carrier; 23 to 53 Kc—upper and lower sidebands of the stereo difference signal ( $L - R$ ).

The stereo adaptor performs the following functions:

1. Separates the components of the composite signal from one another.
2. Detects the ( $L - R$ ) stereo difference signal sidebands.
3. Amplifies the 19 Kc pilot carrier and applies it to the 38 Kc carrier generator, the output of which is fed to the ( $L - R$ ) detector.
4. Adds the detected ( $L - R$ ) signals to the detected ( $L + R$ ) conventional audio signal to produce the left and right channel audio signals.

With the aid of the adaptor schematic shown in Figure 3, let's now examine each of these functions more closely.

#### FILTERING

Separation of the components of the composite signal is essential so that each can be processed independently

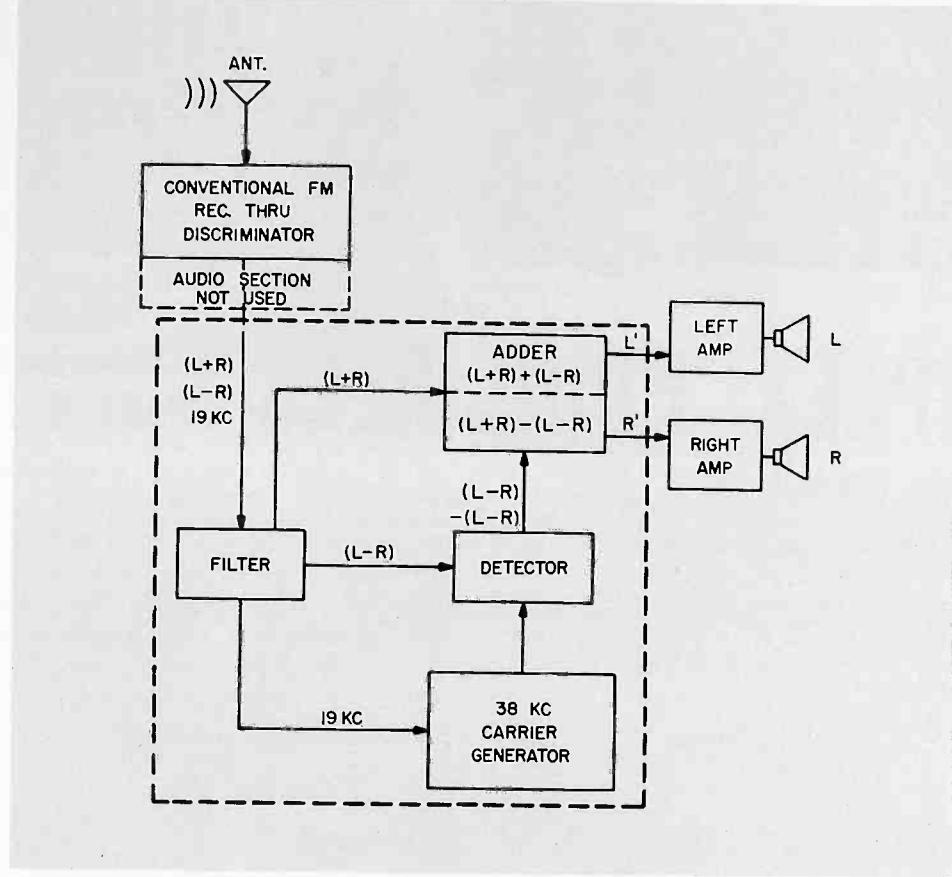


Figure 2—Simplified block diagram of stereo FM receiver and adaptor. The area enclosed by "broken lines" denotes additional circuits of stereo receivers and adaptors.

in the manner required. This is accomplished by three separate L/C filters. A high pass filter, which allows all signals above 23 Kc to pass unattenuated, directs the (L - R) sideband frequencies to the synchronous detector. Conversely, a low pass filter which passes only frequencies below 15 Kc, directs the (L + R) portion of the composite stereo signal to the adder circuit. A 19 Kc tuned circuit selects only the pilot carrier from the composite signal and applies it to the 38 Kc carrier generator.

#### SYNCHRONOUS DETECTION

The stereo difference signal (L - R) is transmitted without its 38 Kc carrier. Therefore, to detect this signal the carrier must be reinserted by the stereo adaptor. For proper detection, the "new" carrier must be exactly the same frequency and phase, relative to the (L - R) sidebands, as the original carrier that was suppressed at the transmitter. The 19 Kc pilot carrier serves as a reference to provide for this synchronization.

Figure 4 shows how detection of the (L - R) sidebands takes place. The synchronous detector may be thought of as a relay that is opened and closed by the locally generated 38 Kc carrier.

Assume that the "relay" contacts close only at the most positive peak of each cycle of carrier voltage, Figure 4A. Only during these times can the sideband signal pass through the contacts to charge Capacitor C. The voltage across C cannot discharge when the contacts are open. If the sideband signal of Figure 4C is applied to the detector, the detector output will be the same as the original (L - R) audio signal.

The importance of correct synchronization is also easily understood with the aid of Figure 4. Suppose that the carrier voltage reaches a maximum at a later time as shown by the dotted carrier of Figure 4A. Now each time the relay contacts are closed, the sideband signal is at zero voltage, and there is no output, Figure 4E. The carrier timing must be precisely maintained; and as

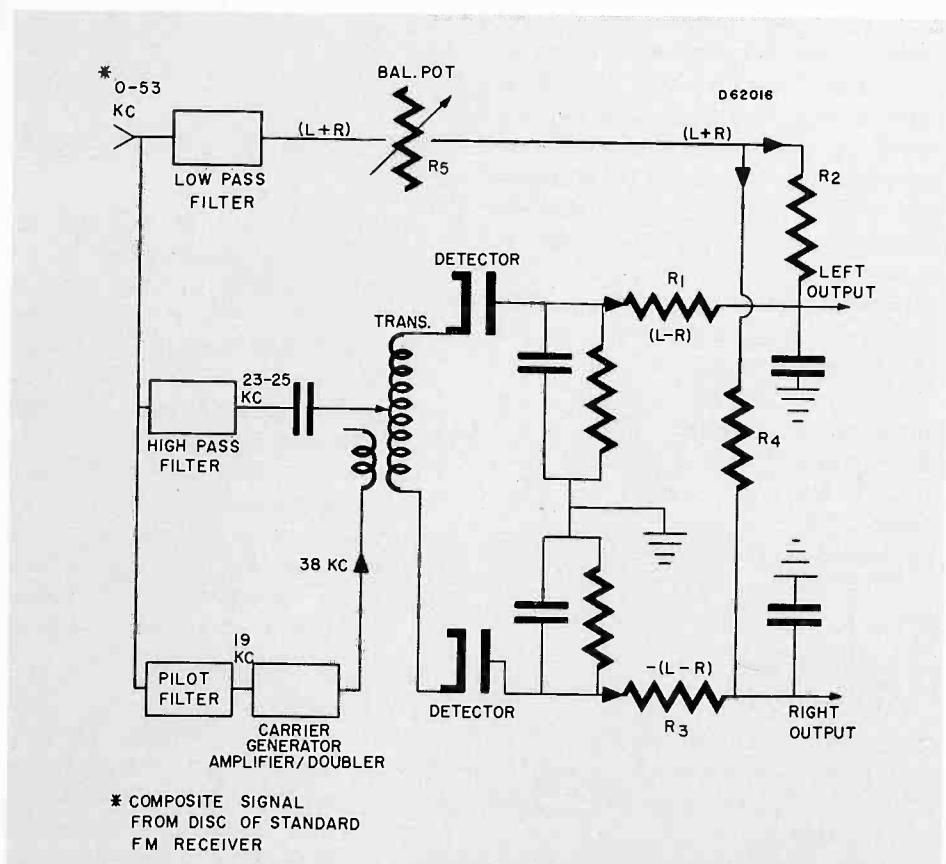


Figure 3—Partial schematic of stereo adaptor.

# Dealer Section

FALL ISSUE 1962 □ VOL. 29, NO. 3

JAN POSPISIL, EDITOR — PUBLISHED FOR THE PROFESSIONAL RADIO-TV SERVICE DEALER

## LIFE-BOOST CATHODE NOW STANDARD EQUIPMENT ON 90 SYLVANIA TUBE TYPES

The practical importance of a significant tube improvement depends upon how swiftly that improvement is incorporated into tube types on the market. An improvement in the manufacture or design is highly desirable, but until it gets out of the laboratory and into the tubes on your shelf it's of little or no real value to you or your customers.

That's why Sylvania engineers and manufacturing personnel have moved to incorporate Life-Boost Cathode into as many marketed tube types as rapidly as possible. The result is that Life-Boost Cathode is now standard equipment on over 90 Sylvania receiving tube types. That means that when you install any of the Sylvania types listed in Column 3

that tube is going to perform better than any of its predecessors, better than any competitive brand of the same tube type. Remember, Life-Boost Cathode is an exclusive Sylvania feature. Like Sarong and Bikini Cathodes, (prior Sylvania tube improvements and still exclusive with Sylvania tubes) Life-Boost Cathode and the superior performance it creates is only available with Sylvania Receiving Tubes.

Look over the list at right of Sylvania tube types currently incorporating Life-Boost Cathode. Keep the list handy and next time your tube order includes any of these types be sure you specify Sylvania. Only Sylvania tubes have Life-Boost Cathode.

### TYPES USING LIFE BOOST CATHODES

2AF4B	6/12DQ6B
3AF4B	6J4WA
6AF4A, B	12CA5
2/3/6DZ4	12ED5
6GK6	50C5
6BQ5	6BF5
6DQ5	6CA5
6AU8, A	25EH5
6BH8	50B5
7060	6AH6WA
8ET7	6CU5
6/9GN8	6/12DT5
10JY8	6/12/25BK5
6BL8	6DT5
6/25CD6	5687WA
25DN6	6AN5
6/12/25BQ6GTB, A	12DB5
6V6	6K6
12BZ6	6146
3/4/6CB6A	6146A
4/6DE6	6159A
6AH6	6883A
6BC5	6080WA
25F5	6080WB
35C5	BG-6080
6AS5	6082
4/6BZ6	6GR7/SR-3213
6CB6A	12BV7
6CF6	12BY7
3/6DE6	6ET7
5/6EW6	12BX7
6186	12BV7
7056	6ET7
5/6QM6	6BL7GTAA
32ET5A	6/12AV5GA

## Life-Boost Cathode: What It Is, How It Improves Performance

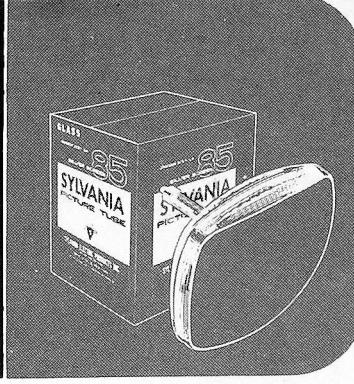
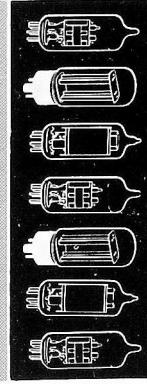
Life-Boost cathode results from an entirely new method of forming the basic cathode material. Conventionally, cathodes have been formed from melted metals. Life-Boost cathodes are produced from *powdered metals*, compacted and rolled into a thin-gauge cathode. Pure nickel powder plus carefully controlled powdered reducing agents are thoroughly blended and immediately rolled. Because no critical temperatures are involved, no impurities are introduced from crucibles and

containers, forging hammers or hot-rolling equipment. And, the powder process permits previously impossible or hard-to-attain combinations of wanted properties, such as electrical passivity and mechanical strength at high temperature.

The Life-Boost cathode alloy is much purer and more uniform than conventional cathodes. Alloys may be better controlled to promote uniformity and inhibit the formation of leakage paths, thereby extending

tube life. It also means better stabilized electron emission and regulated barium release throughout life—tube performance *stays* within specifications.

The end result is improved tube performance, extended tube life. And fewer callbacks for dealers. (Actual tests have already proved the superiority of tubes with Life-Boost cathodes. See the Summer Issue of Sylvania News for example of test results).



# COMPACT SYLVANIA PICTURE TUBE LINE NOW INCLUDES 54 "UNIVERSAL" TYPES

A new streamlined look about the Sylvania Picture Tube line has gone into effect with the issuance of a new price list effective October 1, 1962. The streamlining stems from Sylvania's continuing program to reduce the overall number of picture tube types needed by developing more "Universal" picture tubes. For instance, the current list of Sylvania picture tubes includes 54 "Universal" Silver Screen 85 tubes that replace a total of 217 types.

Similarly, Sylvania has eliminated nearly 50 picture tube types from the line within the past year.

This Sylvania program of providing a "compact" line of picture tubes will make life easier for the service dealer. Initially, there will be fewer types he'll have to worry about. Ordering tubes from

Distributors will be simplified.

The smart service dealer will be able to stock Sylvania picture tubes in his shop, carefully selecting those that are the most versatile, the most popular. For instance, the "Top Ten" Sylvania picture tubes will fill more than half of renewal installations. And this is an accurate, up-to-date estimate, based honestly on the most recent industry sales patterns. (You've seen other publicized figures that claim three or four types meeting more than 50% of your replacement needs. These are highly optimistic claims, based on outdated sales figures—as you know if you've tried to make do with those types and found yourself running to your distributor more often than you should have.)

The "Top Ten" Silver Screen 85 picture tubes that fill 52% of all

renewal sales are the 21CBP4A, 21ZP4B, 21ACP4A, 21YP4A, 21AUP4A, 24AEP4, 21DEP4A, 21DFP4, 21EP4B, and 21FP4C. The first three listed will fill 20% of your replacement needs, while the top five will fill 40% of renewal installations.

By stocking the most versatile of these types you'll be able to give your customers faster service in most cases. You will still have to get special types from your Distributor, but not as often as before. You'll save time and money by keeping the popular Sylvania types where you need them fast—right in your shop.

Make plans to put Sylvania's "Compact" line of picture tubes to work for you. Call your Distributor and begin your in-shop inventory of Sylvania picture tubes now.

## 21ACP4A

ALSO  
REPLACES

21ACP4    21AQP4  
21ACP4A    21AQP4A  
21AMP4    21BSP4  
21AMP4A

## Sylvania Picture Tube Labels List Replacements

You'll be seeing new labels like the one shown here on Sylvania picture tube cartons. As an adjunct to the compact picture tube line that

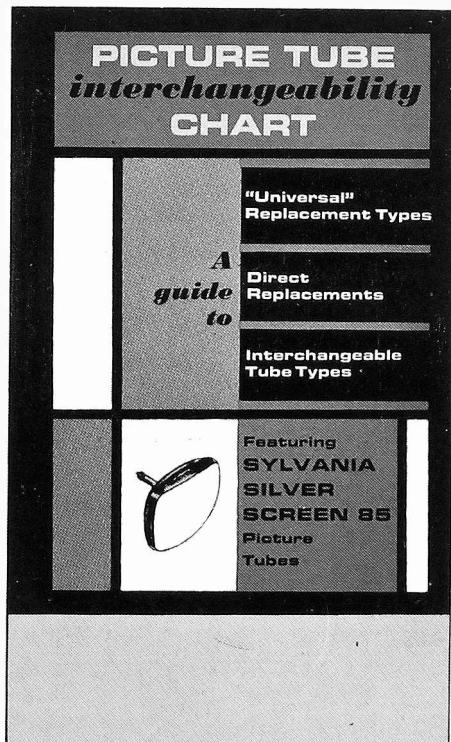
features many Sylvania "Universal" types, these labels list all the types replaced by the one tube you buy.

## New Interchangeability Chart →

Sylvania has just published a new Picture Tube Interchangeability Chart to coincide with its compact line of picture tubes that features many Sylvania "Universal" types.

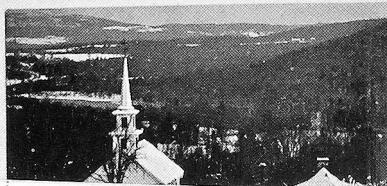
The chart is a guide to "Universal" replacement types, direct replacements and interchangeable tube

types. The chart is extremely easy to use: Simply refer to the industry type number that is to be replaced; alongside the type number is the Sylvania type that replaces it and a replacement classification that gives you what technical information is needed to effect the change.



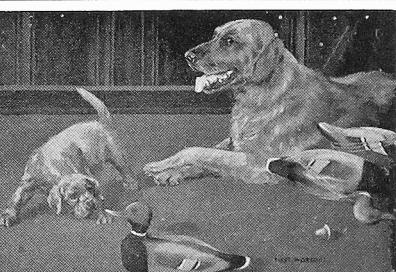
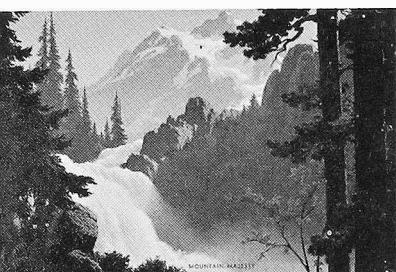
The chart can be used as a wall or counter chart, or folded for pocket use. It is now available from your Sylvania distributor.

# Sylvania Calendar



## Sells Dealer Service

*Useful Feature for Housewives*



beautiful illustrations  
actual pictures are  
in full-color!

		January		
		2	3	4 - 5
6	7	8	9	10
13	14	15	16	17 - 18
20	21	22	23	24
27	28	29	30	31

## ORDER TODAY!

MAKE PEOPLE THINK OF YOU WHEN THEY NEED  
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Buffalo 9, New York

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(Minimum order 100 calendars)

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                                  \$.....  
PRICE  
\$.....

PRICE

neath the illustration, a variety of helpful kitchen hints—tables of equivalent measures; cooking times for vegetables and meats. Also, on

each. That means it will only cost you about 1½¢ a month to put one of these calendars in a home that's a potential source of business for you.

✓ Kitchen hints, tasty recipes and cooking charts on each page!

✓ Prominent dealer imprint space!

✓ Your choice of 4 full-color illustrations!

One or two calls is all you need to pay back your investment, and chances are you'll get more than that and can look forward to continuing business from these new customers. Also, these calendars are a fine means of thanking present customers for their past business and helping to assure their continued patronage.

If your copy of this Sylvania News doesn't contain a calendar order form you can order from your Sylvania Distributor or directly from Sylvania. If ordering from Sylvania, be sure to indicate which of the four color illustrations you wish, clearly print your name and address (phone number, too) for the four-line imprint, and include your remittance. The cost is \$19.50 for the minimum order of 100. (If you would like mailing envelopes they are available at \$1.60 per 100.) Send all the information and remittance to Sylvania Electric Products, 1100 Main Street, Buffalo 9, New York. You'll receive your calendars, imprinted at no extra cost, in plenty of time for the new year.

*Best Wishes for A Happy  
and Profitable New Year!*

# COMPACT SYLVANIA PICTURE TUBE LINE NOW INCLUDE

A new streamlined look about the Sylvania Picture Tube line has gone into effect with the issuance of a new price list effective October 1, 1962. The streamlining stems from Sylvania's continuing program to reduce the overall number of picture tube types needed by developing more "Universal" picture tubes. For instance, the current list of Sylvania picture tubes includes 54 "Universal" Silver Screen 85 tubes that replace a total of 217 types.

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## 21ACP4A

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The chart is a guide to "Universal" replacement types, direct replacements and interchangeable tube

Choose one  
of these  
of  
tik.



ON CHRISTMAS EVE



ANNOUNCING

# YOUR SYLVANIA HOME CALENDAR FOR 1963

This calendar projects your own SIGN into the homes of customers and prospects. It's a year long INVITATION for new business and a show of APPRECIATION for past business. You can't top this form of advertising at any cost, and certainly not at the low Sylvania cost available to you.

### FEATURES

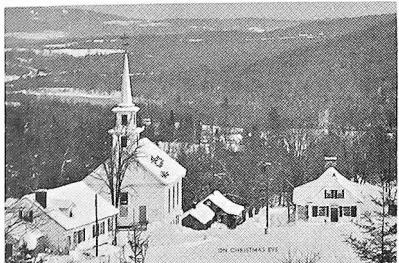
■ Handy memo space for full date!

alongside the type number is the Sylvania type that replaces it and a replacement classification that gives you what technical information is needed to effect the change.

The chart can be used as a wall or counter chart, or folded for pocket use. It is now available from your Sylvania distributor.

# Sylvania Calendar for 1963

*Kitchen Hints, Recipes Are*

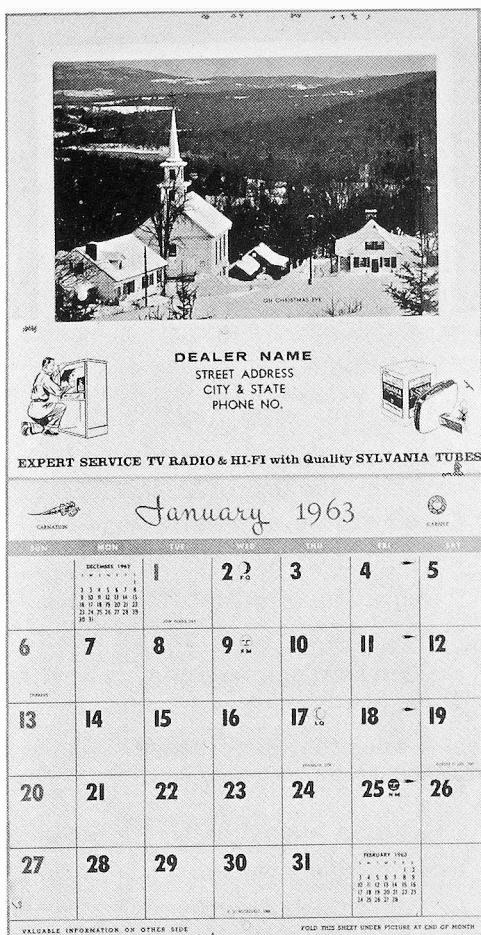


It may be premature to make your plans for New Year's Eve, but it's not too early to begin planning to advertise your services for the important new year that's just around the corner.

What more apropos way to start off your 1963 campaign than with a handsome, useful advertising calendar presented to friends, customers and prospective customers? A calendar that ideally fills the bill is the Sylvania Dealer Home Calendar for 1963.

The Sylvania calendar features a beautiful full color picture. You can choose one of four illustrations, shown on this page in black and white. One of the selections is an attractive Christmas scene, particularly appropriate if you distribute your calendars at Christmas time.

The calendar has several important features that make it especially useful to the housewife and help assure its use. First of all, it contains, underneath the illustration, a variety of helpful kitchen hints—tables of equivalent measures, cooking times for vegetables and meats. Also, on



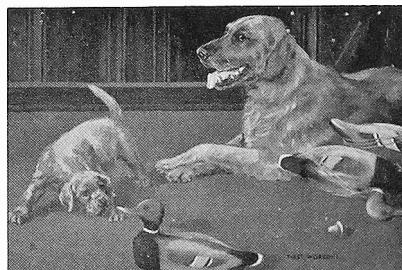
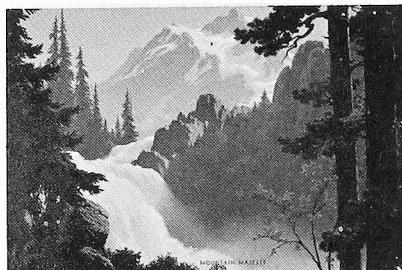
the back of each monthly calendar page are seasonal recipes, tasty and timely. The last page of the calendar has space to record important addresses and telephone numbers. Notice also that there is enough space around each date so that the housewife can make notes of the day's appointments, reminders of things to do that day, birthdays and other important dates.

And, of course, notice that your imprint is always visible, reminding the housewife that your shop is the one to call for all TV, radio and Hi-Fi repairs. In addition, on the back of the calendar, which is sure to be noticed when the calendar is received, is an advertising panel that promotes you as an expert, experienced dealer who installs quality Sylvania tubes.

The best thing about the Sylvania 1963 Dealer Home Calendar is that it is one of the most economical advertising buys you can make. One hundred of these calendars (the minimum order) is only \$19.50, or 19½¢ each. That means it will only cost you about 1½¢ a month to put one of these calendars in a home that's a potential source of business for you.

## Sells Dealer Service

*Useful Feature for Housewives*



One or two calls is all you need to pay back your investment, and chances are you'll get more than that and can look forward to continuing business from these new customers. Also, these calendars are a fine means of thanking present customers for their past business and helping to assure their continued patronage.

If your copy of this Sylvania News doesn't contain a calendar order form you can order from your Sylvania Distributor or directly from Sylvania. If ordering from Sylvania, be sure to indicate which of the four color illustrations you wish, clearly print your name and address (phone number, too) for the four-line imprint, and include your remittance. The cost is \$19.50 for the minimum order of 100. (If you would like mailing envelopes they are available at \$1.60 per 100.) Send all the information and remittance to Sylvania Electric Products, 1100 Main Street, Buffalo 9, New York. You'll receive your calendars, imprinted at no extra cost, in plenty of time for the new year.

*Best Wishes for A Happy and Profitable New Year!*

# COMPACT SYLVANIA PICTURE TUBE LINE NOW INCLUDE

A new streamlined look about the Sylvania Picture Tube line has gone into effect with the issuance of a new price list effective October 1, 1962. The streamlining stems from Sylvania's continuing program to reduce the overall number of picture tube types needed by developing more "Universal" picture tubes. For instance, the current list of Sylvania picture tubes includes 54 "Universal" Silver Screen 85 tubes that replace a total of 217 types.

Similarly, Sylvania has eliminated nearly 50 picture tube types from the line within the past year.

This Sylvania program of providing a "compact" line of picture tubes will make life easier for the service dealer. Initially, there will be fewer types he'll have to worry about. Ordering tubes from

## 21ACP4A

### Sylvania Picture Tu List Replacements

You'll be seeing new labels like the one shown here on Sylvania picture tube cartons. As an adjunct to the compact picture tube line that

### New Interchangeabil

Sylvania has just published a new Picture Tube Interchangeability Chart to coincide with its compact line of picture tubes that features many Sylvania "Universal" types.

The chart is a guide to "Universal" replacement types, direct replacements and interchangeable tube

Choose one  
of these  
of  
tikul.  
nky



ON CHRISTMAS EVE



ANNOUNCING

# YOUR SYLVANIA HOME CALENDAR FOR 1963

This calendar projects your own SIGN into the homes of customers and prospects. It's a year long INVITATION for new business and a show of APPRECIATION for past business. You can't top this form of advertising at any cost, and certainly not at the low Sylvania cost available to you.

### FEATURES

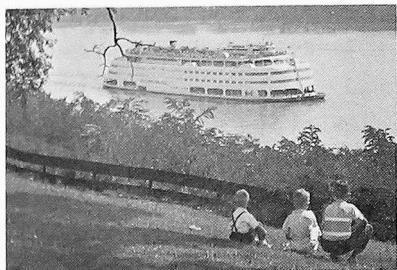
✓ Handy memo space for full date!

alongside the type number is the Sylvania type that replaces it and a replacement classification that gives you what technical information is needed to effect the change.

The chart can be used as a wall or counter chart, or folded for pocket use. It is now available from your Sylvania distributor.

# Sylvania Calendar for 1963

Kitchen Hints, Recipes Are

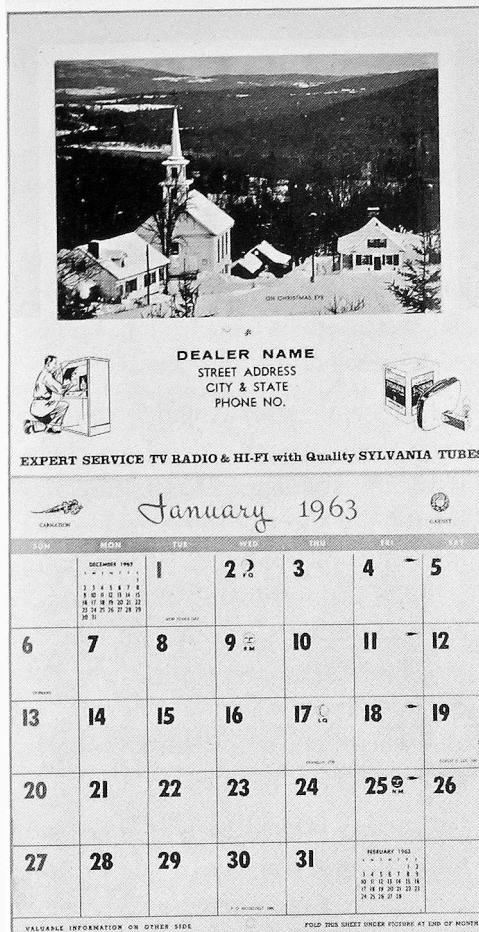


It may be premature to make your plans for New Year's Eve, but it's not too early to begin planning to advertise your services for the important new year that's just around the corner.

What more apropos way to start off your 1963 campaign than with a handsome, useful advertising calendar presented to friends, customers and prospective customers? A calendar that ideally fills the bill is the Sylvania Dealer Home Calendar for 1963.

The Sylvania calendar features a beautiful full color picture. You can choose one of four illustrations, shown on this page in black and white. One of the selections is an attractive Christmas scene, particularly appropriate if you distribute your calendars at Christmas time.

The calendar has several important features that make it especially useful to the housewife and help assure its use. First of all, it contains, underneath the illustration, a variety of helpful kitchen hints—tables of equivalent measures, cooking times for vegetables and meats. Also, on



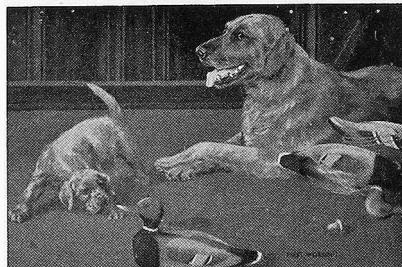
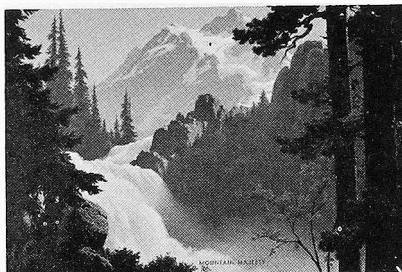
the back of each monthly calendar page are seasonal recipes, tasty and timely. The last page of the calendar has space to record important addresses and telephone numbers. Notice also that there is enough space around each date so that the housewife can make notes of the day's appointments, reminders of things to do that day, birthdays and other important dates.

And, of course, notice that your imprint is always visible, reminding the housewife that your shop is the one to call for all TV, radio and Hi-Fi repairs. In addition, on the back of the calendar, which is sure to be noticed when the calendar is received, is an advertising panel that promotes you as an expert, experienced dealer who installs quality Sylvania tubes.

The best thing about the Sylvania 1963 Dealer Home Calendar is that it is one of the most economical advertising buys you can make. One hundred of these calendars (the minimum order) is only \$19.50, or 19½¢ each. That means it will only cost you about 1½¢ a month to put one of these calendars in a home that's a potential source of business for you.

## Sells Dealer Service

*Useful Feature for Housewives*



One or two calls is all you need to pay back your investment, and chances are you'll get more than that and can look forward to continuing business from these new customers. Also, these calendars are a fine means of thanking present customers for their past business and helping to assure their continued patronage.

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*Best Wishes for A Happy  
and Profitable New Year!*

# NEW BULB COATING MATERIAL CUTS DOWN SHORTS, LEAKAGE!



*New  
Look About  
Sylvania  
Receiving Tubes  
Means  
New  
Reliability*

Take a close look at a new Sylvania 6/8BA8A or 6/8AW8A. Chances are you'll notice a difference. The change is in the internal bulb coating and it results in improved reliability, in increased safe-guarding against early field failures.

Until now, open-structure pentode types such as these utilized a carbonized bulb coating. The coating was one of the most effective means the manufacturer had for maintaining stability and improving other characteristics during early life. In closed-space tube types, however, there was the likelihood of carbon "flaking"—and when that happened, DC shorts and/or leakage resulted.

Sylvania elected to take a second look at this obvious need for improvement and came up with a "new look" in receiving tubes—a bulb coating that's basically a silver oxide compound. For the most part it's

transparent, although variations in density may enable you to perceive the presence of this new coating.

The silver oxide coating performs the same protective function of providing stable tube characteristics. The difference is that it adheres to the glass. Its better adherence properties eliminate flaking and the resultant shorts and leakage.

Look carefully, next time you use a Sylvania 6/8BA8A or 6/8AW8A, for evidence of this new, improved bulb coating. The Sylvania BA8A and AW8A families are using this better bulb coating 100%. Other Sylvania types are in the test stage and may soon incorporate the improved coating.

Look to Sylvania for this new look in improved receiving tube performance. Always look to Sylvania for reliability and long life in receiving tubes.



**PORTRLAND, MAINE:** Richard Capon (left) of Dick's TV in Portland is happy to receive his quota of valuable S&H Green Stamps from Don Ricker, Purchasing Agent of Maine Electronics Supply of 148 Anderson St., Portland. Dick earned the Green Stamps by purchasing Sylvania receiving tubes.



**SAN MATEO, CALIFORNIA:** Across the country, another happy service dealer waits for his S&H Green Stamps with his order of Sylvania receiving tubes. Gene Hittsman (far left) of Reliance TV, San Mateo, Vick Fallis and Amos Reed of Associated Radio's San Mateo branch.

*from  
Maine  
to  
California  
dealers collect  
GREEN  
STAMPS  
from  
Sylvania  
Distributors*

Are you getting S&H Green Stamps when you buy Sylvania tubes? Look for the signs and posters that participating Sylvania distributors are displaying to show they are behind Sylvania's Service 'n Save Stamp Plan. Most Sylvania Distributors

across the country are offering these valuable stamps every time you specify Sylvania receiving tubes. Be sure to get your share. (The Service 'n Save Stamp Plan is not available in states where prohibited by law.)

mentioned earlier, this is the function of the pilot carrier.

Since the pilot carrier frequency is exactly 19 Kc, it can be doubled to the carrier frequency of 38 Kc; amplified and applied directly as the carrier for synchronous detection, as shown in Figure 3. Another system uses the 19 Kc pilot merely to synchronize a 38 Kc local oscillator.

Referring to the practical circuit of Figure 3, a diode is used instead of a relay. It should also be noted that there are actually two such detectors—one giving  $(L - R)$  output, while the other is "timed" to give an inverted version of the signal, or— $(L - R)$ . The second detector is provided to simplify the adding network. The signal from the carrier generator is applied to both detectors through the transformer, switching them "off" and "on" at a 38 Kc rate. The  $(L - R)$  sideband signal is applied through the center tap of the transformer.

#### ADDER NETWORK

The outputs of both detectors are then combined, by means of resistor networks  $R_1, R_2$  and  $R_3, R_4$ , with the  $(L + R)$  audio signal to obtain the left and right channel audio signals:

$$(L + R) + (L - R) = L'$$

$$\text{and } (L + R) - (L - R) = R'$$

Thus, the two original signals are now available for further amplification in separate audio amplifiers.

#### COMPATABILITY

A stereo broadcast received on a non-stereo receiver will produce a perfectly normal monophonic output. The  $(L + R)$  portion of the composite stereo signal is no different than the signal received during non-stereo broadcast. The  $(L - R)$  stereo difference signal and the pilot carrier are simply ignored by a conventional receiver.

The other compatibility requirement is that a stereo receiver produce a normal monophonic output from a non-stereo broadcast. Referring back to Figure 3, there will not be any output from the synchronous detector in the absence of the  $(L - R)$  stereo difference signal, and the  $(L + R)$  monophonic signal is fed in equal amounts to the left and right channel amplifiers via the adder

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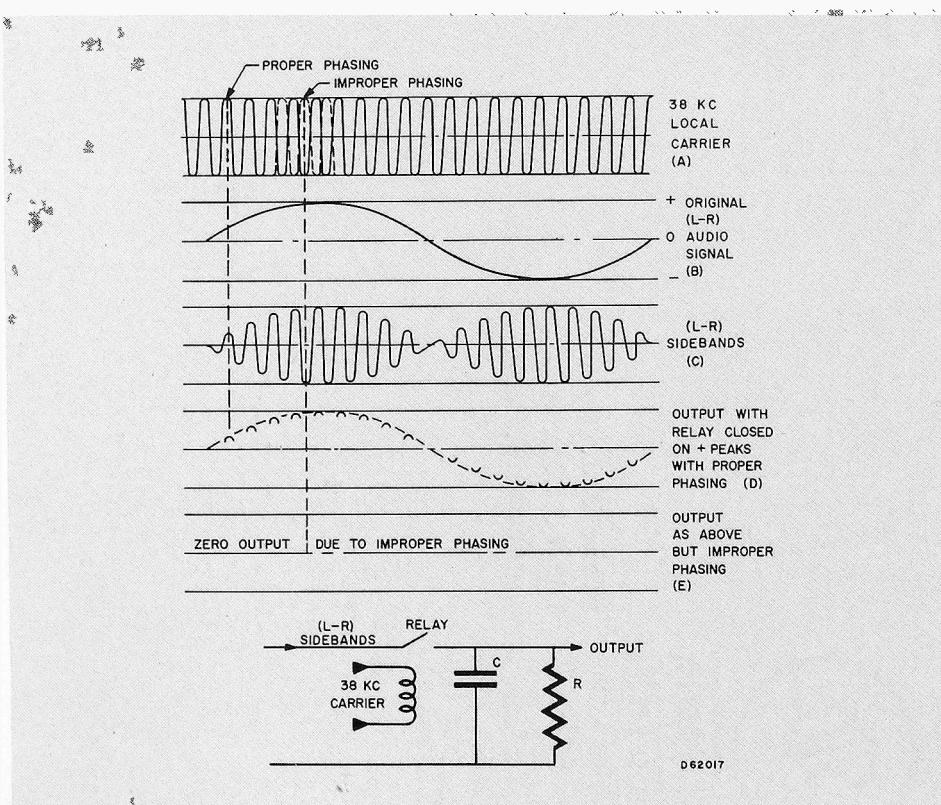


Figure 4—Operation of synchronous detector.

network. Provision is also made whereby the synchronous detector is completely disabled during a non-stereo broadcast to prevent miscellaneous noises in the range of 23 to 53 Kc from being passed to the audio amplifiers.

#### INSTALLATION AND SERVICING

To override noise in the FM system, all audio frequencies above 2 Kc are amplified more than those below 2 Kc prior to being fed to the FM transmitter. Thus, high frequencies modulate the transmitter heavier than the "lows." At the receiver, something must be done to reduce the "highs" to their normal level. This is usually accomplished by a simple resistor/capacitor filter that is connected across the discriminator output. To prevent attenuation of the stereo signal it is important that the adaptor input be connected to the discriminator ahead of this filter. The "highs" and "lows" are restored to their proper proportions in the adaptor following the adder circuits.

To obtain maximum quality stereo

reception, great care must be taken to assure that the best possible signal is available at the receiver antenna terminals. "Ghosts" are well known to all TV servicemen, and are caused by multiple reception of the transmitted signal from nearby reflective objects. These same reflections occur with FM signals, and can cause severe phase differences to occur among the various frequencies present in the transmitted stereo signal. Many problems of distortion, poor separation and noisy stereo reception can be traced directly to this cause. Antenna techniques used for fringe area TV reception should be used for best stereo reception.

Other servicing problems are perhaps characterized by normal monophonic reception and poor or no stereo reception. The presence of the 19 Kc pilot carrier can be verified by the "stereo indicator light", with which most receivers and adaptors are equipped. Should the pilot carrier be present, the 38 Kc carrier generator and synchronous detector should next be checked.

An oscilloscope is invaluable as a signal tracing tool. Stereo information will be recognized as "fuzz" riding along on the (L + R) audio signal at the discriminator output. The pilot carrier can be identified during periods of no audio as a 19 Kc sine wave of about 10% the peak amplitude of the (L + R) audio signal.

Several commercial stereo test generators are also available. These generators provide "Left" only, "Right" only, pilot carrier, stereo and monophonic signals, and will also greatly aid in signal tracing and servicing.

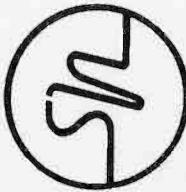
Although many different circuits are used in commercial stereo receiving equipment, all operate on the same basic principles. A form of synchronous detection must be used, although perhaps not following the exact pattern described in this article. In addition, late techniques dispense with LC filtering of the composite stereo signal. These variations will be discussed in future articles.

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1100 MAIN ST.  
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SYLVANIA NEWS  
FALL ISSUE 1962



Form 3547 Requested  
Printed in U.S.A.

# Technical Section



WINTER ISSUE 1962 □ VOL. 29, NO. 4

R. A. HUMPHREYS, TECHNICAL EDITOR This information in Sylvania News is furnished without assuming any obligations.

## TV TUNER REPAIR AND ALIGNMENT

PART 1

Tuner repair and alignment begins with trouble-shooting of the defective receiver. The first problem is to decide if the defect actually is in the tuner itself or if it is a trouble in another part of the receiver. In many cases, when the tuner is defective, the television technician will replace a defective tuner rather than attempt its alignment or repair. This is because tuners are complex devices and because the procedures for tuner alignment are not universally understood.

Let's start with a defective TV receiver. There are any number of trouble symptoms which would be caused by a defect in the tuner or which could be caused by troubles other places in the receiver. For

example: poor picture quality, multiple images, distorted sound, picture sync and picture smear are all potential defects which may be in the tuner but which could possibly be elsewhere in the receiver.

We are concerned here only with tuners so let's assume that you have eliminated all other portions of the receiver and you're sure the problem is in the tuner. You probably have checked all tubes, the critical voltages, and perhaps even substituted another IF signal from a different or test receiver which gave a good picture on your defective set. So—now to the tuner.

Tuners can be grouped into three main classes; as in Figure 1, wafer-switch tuners have a group of coils

in series so a certain portion of this entire large coil is tapped for each channel. More inductance is used, for low frequencies, less for higher frequencies. Mechanical troubles in this type of tuner are defective coils, detents, or a switch. As shown here there are four coils switched in for each channel.

Turret tuners have a separate strip for each channel; each channel strip carries the required coils as in Figure 2. Possible mechanical defects are loose contacts, dirty contacts, improper detent action, and loose springs holding the channel strips in place.

Figure 3 shows the sliding type of tuner where moveable contacts are rotated over a continuous inductance

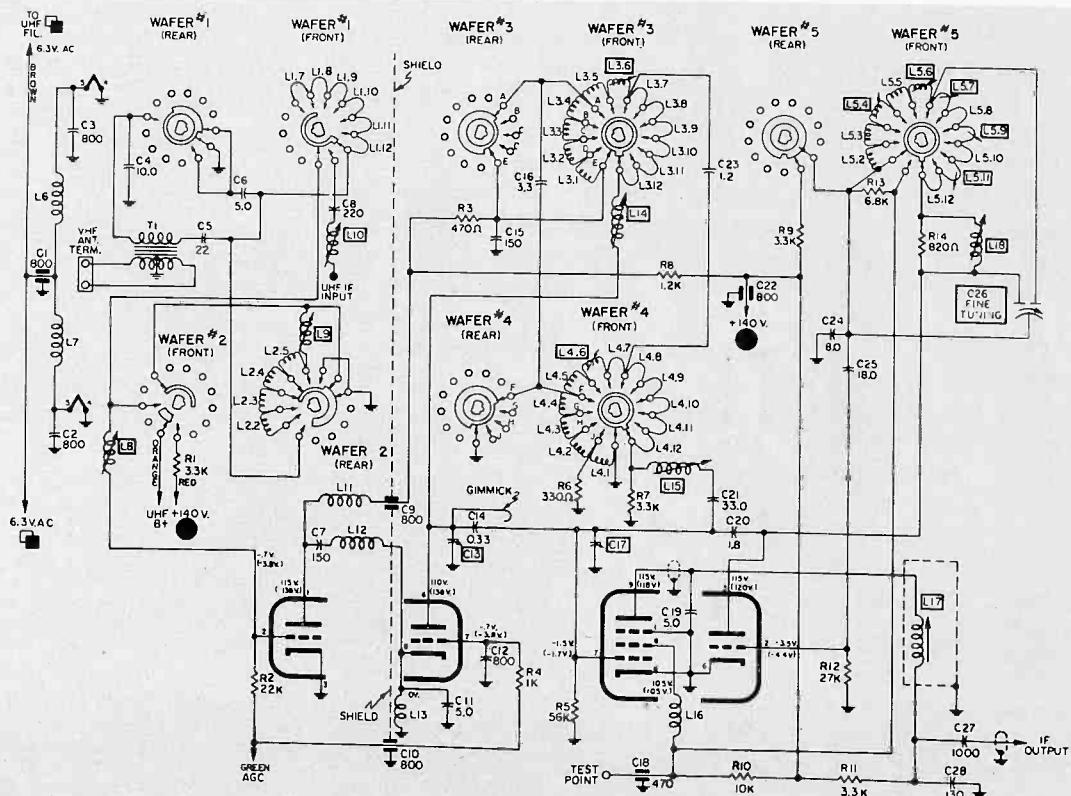


Figure 1—Circuit of wafer-switch type tuner. A group of coils is connected in series and a certain portion tapped for each channel.

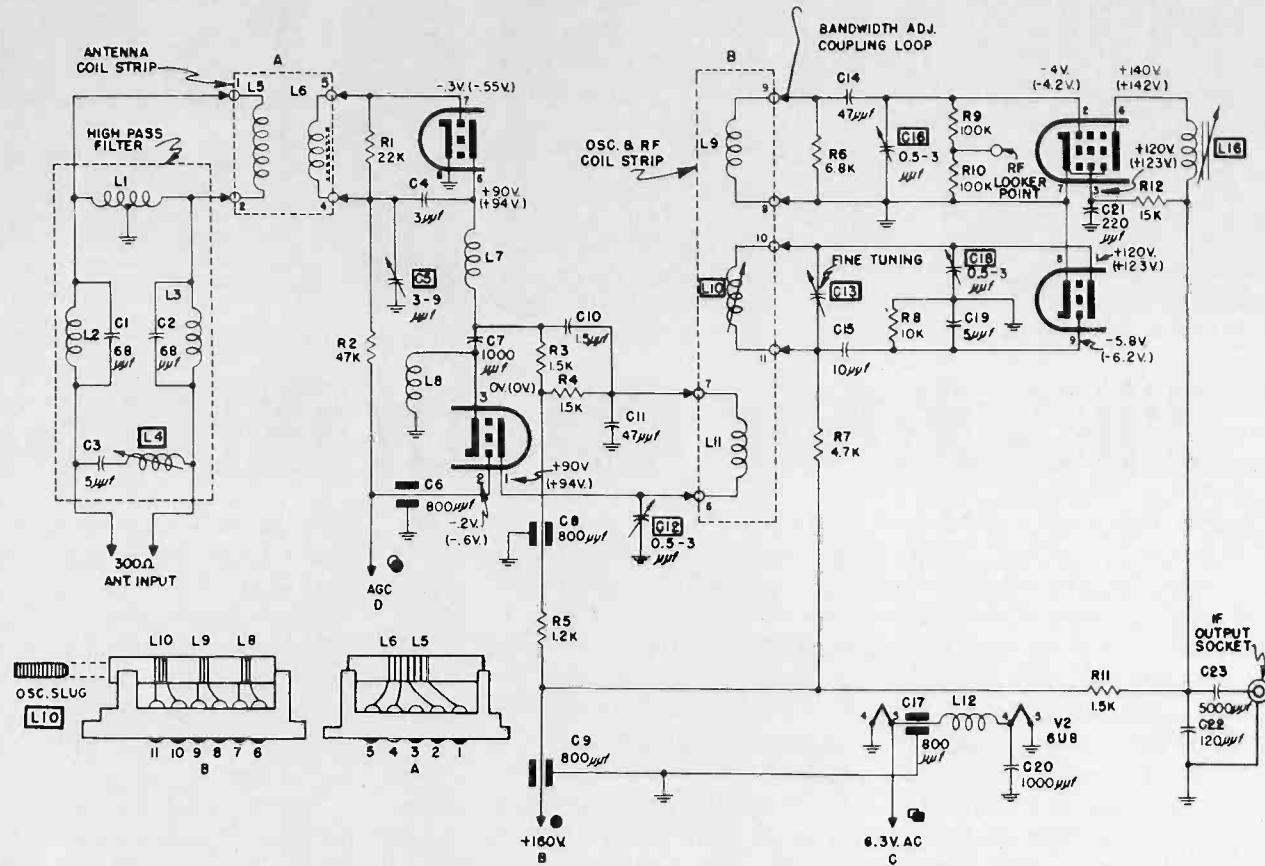


Figure 2—Example of turret tuner. This type has a separate strip for each channel; each channel strip carries the required coils.

for proper tuning. This is the continuous tuner where a moving tap takes off the required inductance. Troubles here include a broken sliding contact or sliding core, defective or dirty contacts, and a dial assembly which is not operating properly.

Even if you suspect the tuner, the tubes should be checked by substituting tubes known to be good and the voltages for plate, screen, filament, and agc should be checked. Note that there are test points for B+, agc, and filaments.

Tuner defects are of two basic types, mechanical and electrical.

#### MECHANICAL DEFECTS

Some possible mechanical troubles are mentioned above. Mechanically defective tuners are as common as electronic troubles; these defects are of three basic types.

1. Microphonics
2. Channel-selector noise
3. Intermittent sound and picture

**MICROPHONICS:** There are many places for this trouble and many causes. Microphonics appear in a set where there is a source of mechanical vibration. This vibration of a component part or a tube changes

the frequency (usually of the local oscillator) and this can show up in the sound or picture. All parts of the tuner should be mounted in a solid manner for a loose tube shield, a loose tube element, or any component such as a capacitor, inductor, or resistor can cause microphonics if it is free to vibrate.

You can often spot microphonics by sustained speaker howl when you tap the cabinet or increase the volume. In some cases microphonics show up as sound bars in the picture or a speaker howl when you turn either the fine tuning or channel selector. Locating the source of the microphonics is the best clue to their repair.

**CHANNEL-SELECTOR NOISE:** the noise resulting from this source can often be seen and heard. Usually this is a sign of poor electrical contacts of the switches and this is more likely to occur in a set which has been in operation for some time. The first step is to clean the contacts with a prepared contact cleaner and then use a small amount of commercial lubricant or mineral oil. Even clean and lubricated contacts must touch properly to prevent noise; this should

be carefully checked. In some cases the detent can cause noise if it binds rather than turn in a free manner. Lubrication usually will cure this.

**INTERMITTENTS:** as in all TV servicing, intermittents are possible in almost all components and their connections. These are difficult to locate but simple to repair. In tuners most intermittents will occur during channel selection; some of the causes are the internal construction of the tubes themselves, poor tube socket contacts or switching contacts, or the scourge of service technicians, the cold solder joint which can appear wherever components are soldered in place. No one has a cure for intermittents other than painstaking examination of all of the possibilities. Once the intermittent is located the repair usually is not difficult. Poor electrical connection between tube pins and socket clips are often a cause of trouble. Tightening the socket clips usually will solve the problem, although replacement of the socket is sometimes necessary to effect permanent repair.

#### ELECTRICAL DEFECTS

Electrical defects are also associated

with tuners and can best be isolated to a stage considering the function and purpose of each stage.

**RF AMPLIFIER:** Gain is important in this, the first stage of the receiver, for no amount of IF gain can compensate for a poor signal-to-noise ratio from the first stage. If the RF amplifier has low gain or is defective, it can, of course, produce symptoms which would be seen as insufficient gain in the picture or the sound. A defective component which prevents the stage from amplifying or which shorts out the signal will give the indication of no picture or sound on any channel. Other defects associated with the RF stage include the possibility of hum bars in the picture caused by a filament to cathode short or a feed-through of the B+ to the agc which will result in either a poor picture or no picture at all.

**LOCAL OSCILLATOR:** The RF oscillator is the second key stage

which can be defective. Operation of the oscillator stage can best be determined by measuring the voltage drop across the grid-leak resistor with a VTVM. Any operating oscillator will have a self-bias which makes the grid negative; the television receivers voltage is about -5 volts. When this voltage is present, it indicates that the oscillator is operating although it is possible it is operating at the wrong frequency. Oscillator drift or change in the normal oscillator frequency can be caused by the defective temperature compensating capacitors or coupling capacitors.

Adjustment of the oscillator frequency is usually required if the oscillator tube is replaced. The turret type of tuners allow adjustment of the individual oscillator frequencies on each channel without affecting the other channels. In the wafer type of tuners, the adjustment for one channel affects all of the other channels since each of the coils is in series. There is no individual channel

adjustment for the continuous type of tuners.

**MIXER:** Since the RF amplifier and oscillator are both fed to the mixer to produce the intermediate frequency, a defective mixer will cause some of the same symptoms as a defective oscillator or a defective RF amplifier. Mixers have as their usual defect a change of the values of the components which causes a loss of the picture or sound. With a normally operated oscillator, the mixer grid voltage should be negative and should be about half that of the oscillator grid voltage or slightly less.

#### ALIGNMENT

Now we have a receiver which has been checked out and a defect located in the tuner. Suppose that you have replaced a component or for some other reason you decide alignment is required. Here's what equipment is required:

1. A stable RF generator with proper calibration, the gener-

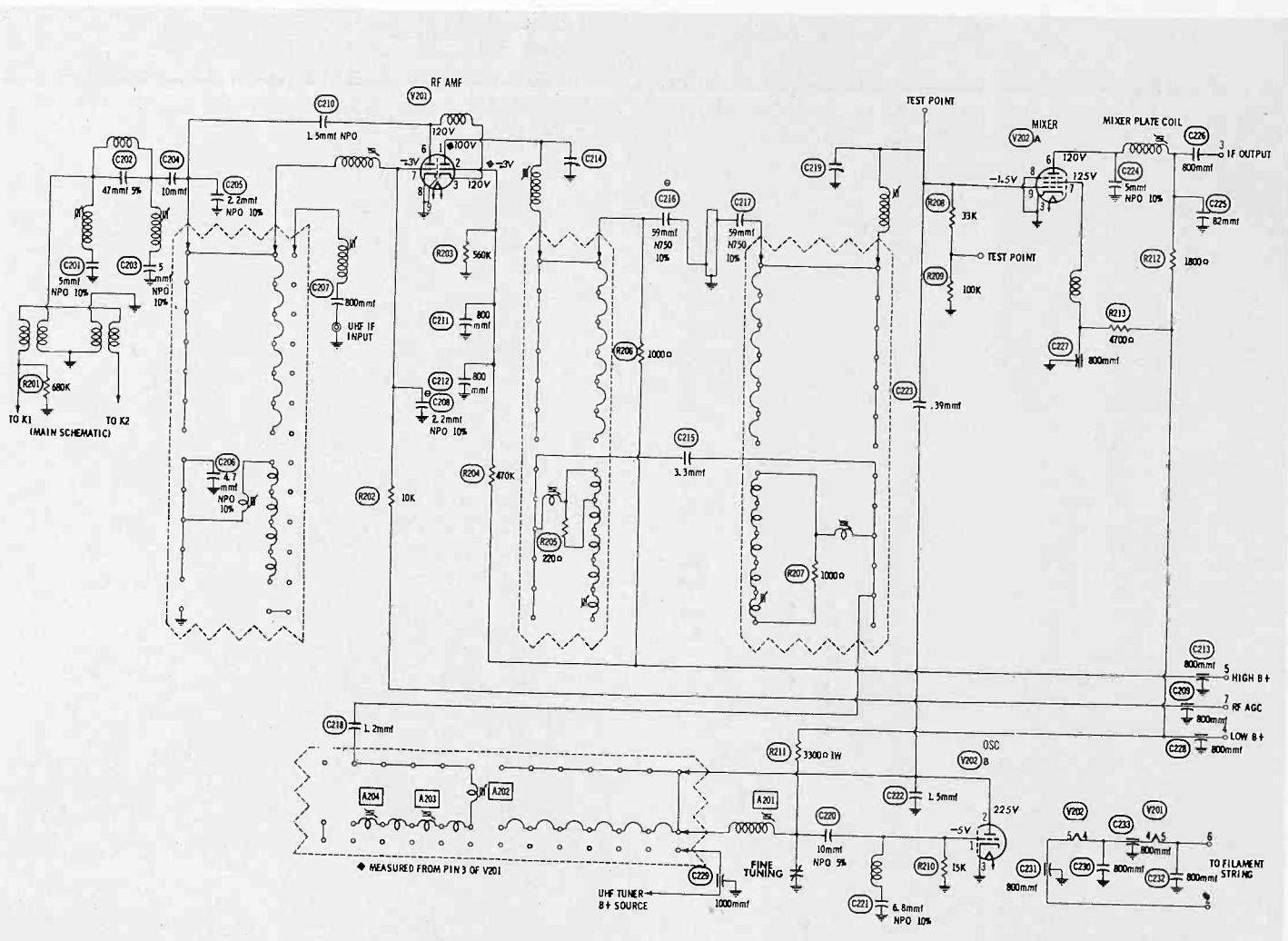


Figure 3—Circuit of sliding type tuner where movable contacts are rotated over a continuous inductance for proper tuning.

ator should be able to sweep about 10 mc with very little tilt. A 5% tilt is the maximum allowed.

2. Markers are also needed for proper alignment; these can come from the generator or a separate source. Markers are needed for the picture carrier and sound carrier for each channel.
3. A bias box is required to take the place of the agc during alignment. Figure 4 shows a bias box which can be constructed to obtain the necessary dc voltage. Depending upon the receiver, the voltage can be up to -10 volts which is more

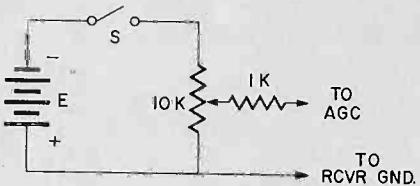


Figure 4—Simple "bias box" to take the place of agc during alignment.

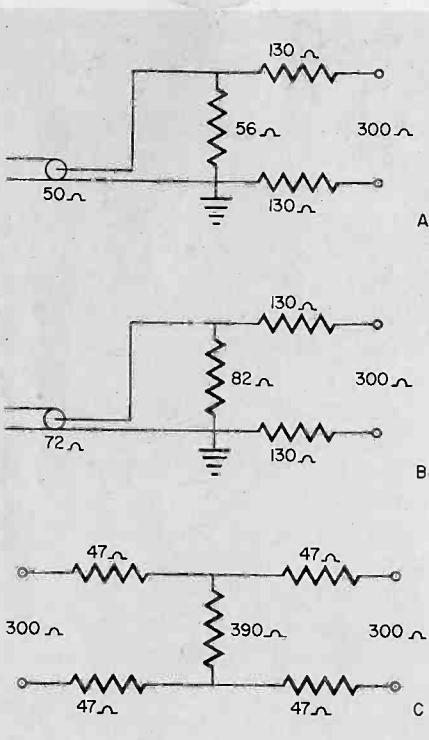


Figure 5—Simple pads to match between the sweep generator and the input to the tuner. (See text)

than enough, since the standard agc bias ranges from about -1.5 volts to -2.5 volts according to

the manufacturer's recommendations.

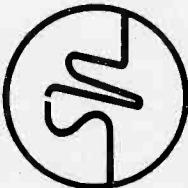
4. A terminal matching pad is needed between the sweep generator and the input to the tuner. This is necessary to match the sweep generator impedance and the receiver input impedance. Figure 5 shows three such pads; A connects from an unbalanced 50 ohm coaxial input to a 300 ohm balanced while B shows a 72 ohm unbalanced matching a 300 ohm balanced. C of Figure 5 shows a pad from a 300 ohm signal generator isolating it from the 300 ohm receiver input.
5. A calibrated oscilloscope is necessary to display the result of the signal generator through the tuner. Since most sweep generators are swept at a 60 cycle rate, the scope need only reproduce a 60 cycle square wave adequately. It does not need to be wide band.

*Part II of the article "TV Tuner Repair and Alignment" will appear in the next issue of SYLVANIA NEWS and will describe alignment procedures.*

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