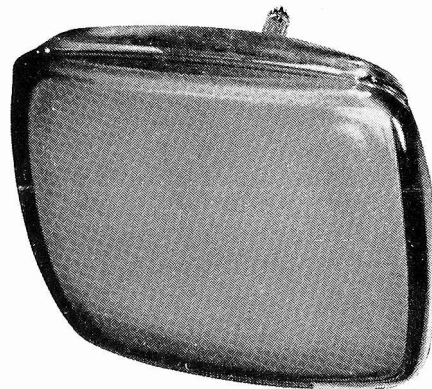
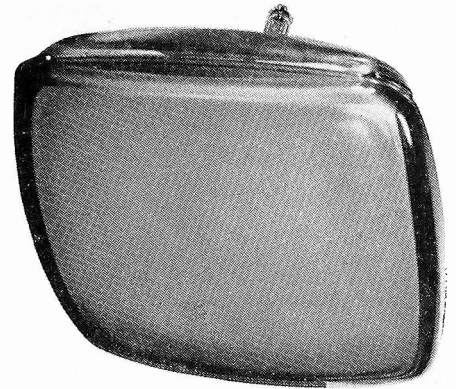
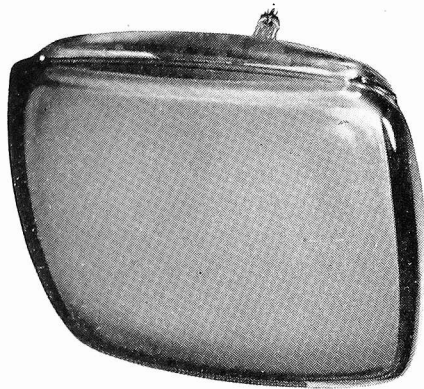


# TECHNICAL SECTION

JANUARY 1960  
VOL. 27, NO. 1

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

## THE BONDED SHIELD PICTURE TUBE



**AN ENTIRELY NEW DESIGN**

By  
**R. A. Humphreys**

Within the last two years, the consumer witnessed the fulfillment of his request for a reduction in both the size and weight of television receivers. This improvement was made possible by the development of the 110 degree picture tube with its shorter neck, smaller cone and lighter weight per unit of screen area. Sylvania's TPF (Tri-Potential Focus) electron gun contributed to a further reduction in cabinet depth by shortening the picture tube neck length still more, Figure 1.

The improvements in television receivers desired by the consumer, however, were not limited to compactness and portability. In addition, he (or she) sought: (1) A screen that would not "fog up," or at least one

that could be easily cleaned; (2) Reduced reflection and glare; (3) A more rectangular screen; (4) A flatter screen to reduce distortion; and (5)

A brighter picture with higher contrast. In answer, Sylvania offers the Bonded Shield Picture Tube—an entirely new design.

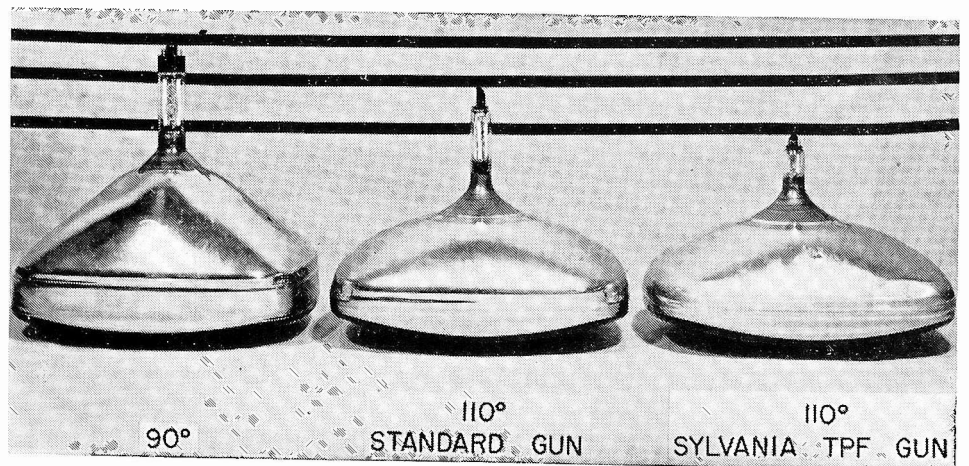


Figure 1—Comparison of 90° and 110° picture tubes. Shorter, less bulky 110° designs promoted more compact, lighter-weight receivers.

Vol. 1: \$1.00-Vol. 2: \$1.00-Vol. 3: \$1.00-Vol. 4: \$1.00-Vol. 5: \$1.00  
 Binders with Complete File of Technical Sections

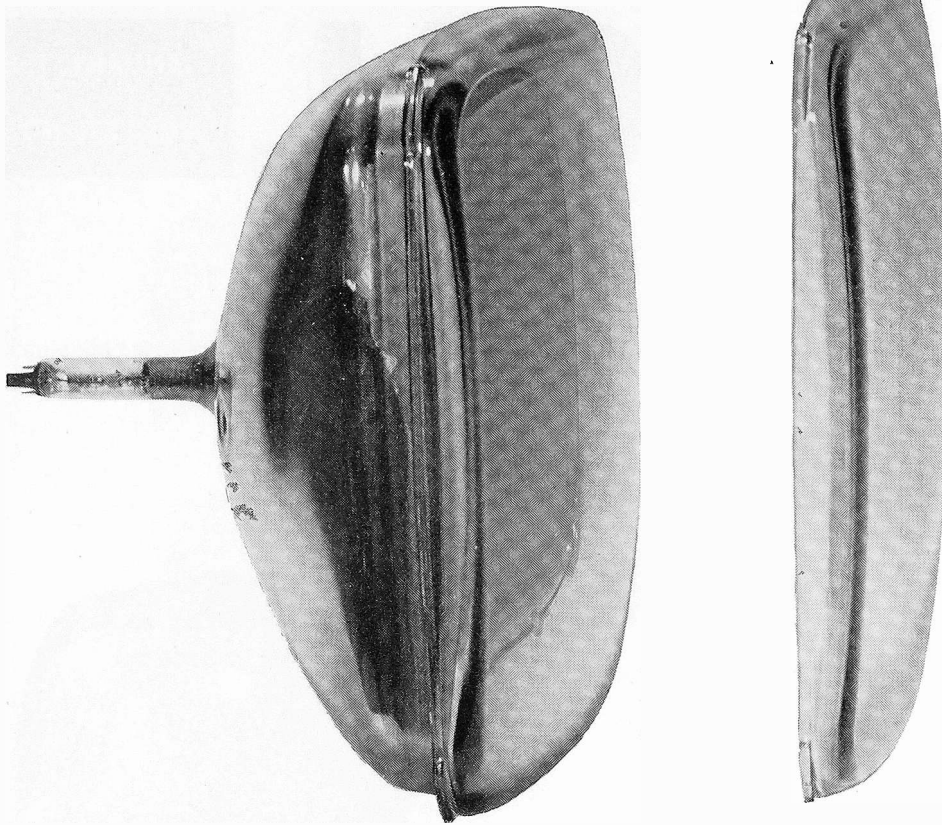


Figure 2—(left) Wrap-around safety panel in-place to form Bonded Shield tube; (right) The new panel by itself.

### Differences Contributing to Improved Picture Quality

The Bonded Shield design features an integral, wrap-around safety panel, thus eliminating the traditional separate plastic or glass safety panel. Figure 2 shows the new panel separately, and in place to form the Bonded Shield tube.

The new panel, which is made of glass, is manufactured with the same precision as the faceplate and matches the faceplate in contour.

Figure 3 shows the sandwich-like construction of the face of a completed Bonded Shield tube. The panel is permanently and strongly bonded to the basic picture tube assembly with a newly developed, epoxy laminate by an exclusive Sylvania process.

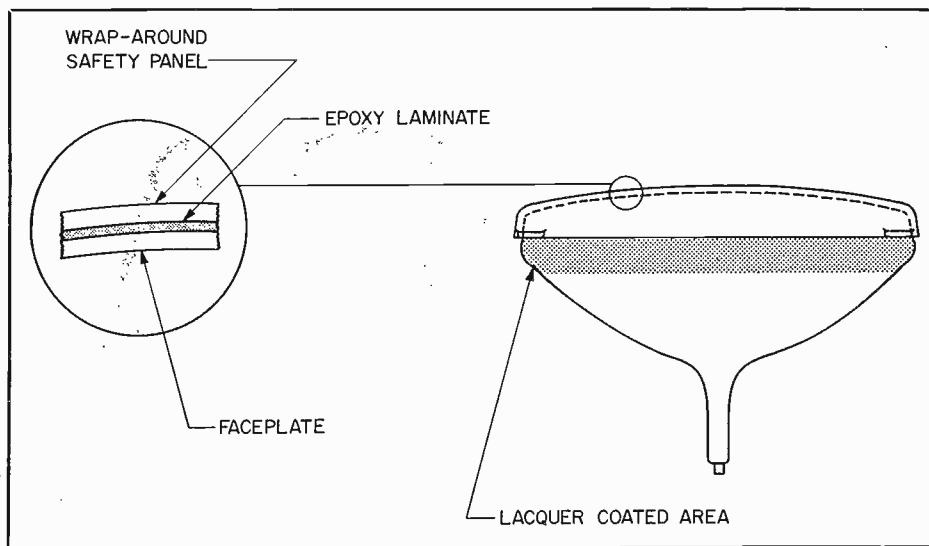


Figure 3—Cross section of Bonded Shield tube showing sandwich construction of face. Also shown is lacquer band that protects critical area of bulb behind wrap-around panel.

The epoxy laminate has the same index-of-refraction as the glass used for the faceplate and wrap-around panel. The bond that is formed is therefore optically perfect, as well as physically strong.

A more rectangular screen with increased viewing area is another feature inherent in the new design. The difference between the Bonded Shield design and a standard 21-inch picture tube in this respect is vividly shown in Figure 4. The increase in viewing area totals 20 square inches. The increase in diagonal measurement amounts to approximately two inches.

### Improvements in Picture Quality

#### STOPS DIRT AND FOG

As a result of the high voltages employed, television receivers are notorious dirt collectors. With a separately mounted safety panel, dust particles and moisture, precipitated from the air, accumulate on the

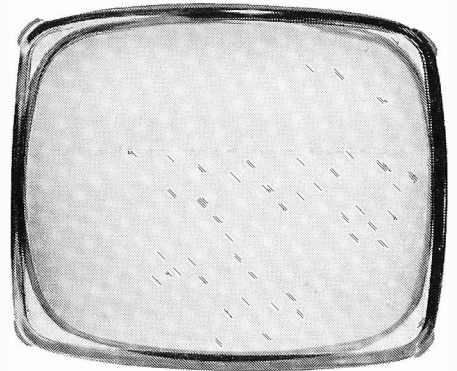


Figure 4—Comparison with standard 21'' tube shows more rectangular shape of Bonded Shield screen and larger viewing field. Also note unique, integral mounting lugs.

picture tube faceplate and inner surface of the safety panel, Figure 5A. The film that is formed reduces picture brightness, contrast and resolution. While cleaning the two surfaces involved will restore picture quality, this seemingly simple chore frequently requires the talents of an experienced serviceman.

Bonding the safety panel directly to the faceplate eliminates this problem area completely. The new wrap-around panel can be wiped free of normally accumulated dust by the housewife without fear of scratching or otherwise destroying optical quality.

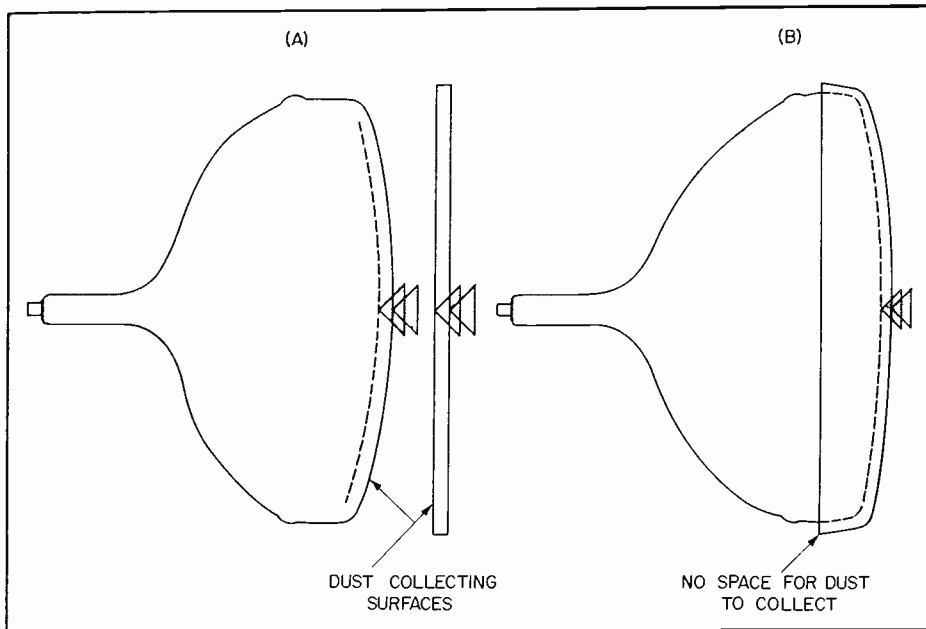


Figure 5—(A) Separate safety panel results in four reflective surfaces and fogging; (B) Bonded Shield concept eliminates two reflective surfaces and dust collecting area.

### REDUCED REFLECTION AND GLARE

Reflection is another source of picture degradation and general viewing discomfort. With a separate safety panel, there are four surfaces that reflect light back to the viewer. As shown in Figure 5A, they are the front and back of the safety panel and the front and back of the faceplate. Bonding the safety panel to the face of the picture tube with an epoxy laminate cuts the number of reflecting surfaces in half. In effect, this improvement increases both brightness and contrast, and reduces glare.

### MORE NATURALLY SHAPED SCREEN

Being accustomed to rectangular windows, mirrors, etc., the consumer has a natural preference for a rec-

tangular television screen. As shown in Figure 4, the Bonded Shield tube is considerably improved in this respect.

### INCREASED VIEWING FIELD

The 20 square-inch larger screen of the Bonded Shield tube represents an increase in the viewing field, not just the size of the screen. Figure 6 clearly shows the amount of added picture information that can be seen, and again emphasizes the more rectangular shape of the Bonded Shield screen.

### SQUARER CORNERS IMPROVE CONTRAST

When the rounder screen of a standard picture tube is fully scanned horizontally and vertically, the corners are being over-scanned. The amount of overscan is shown in Figure 7A by the shaded areas. The

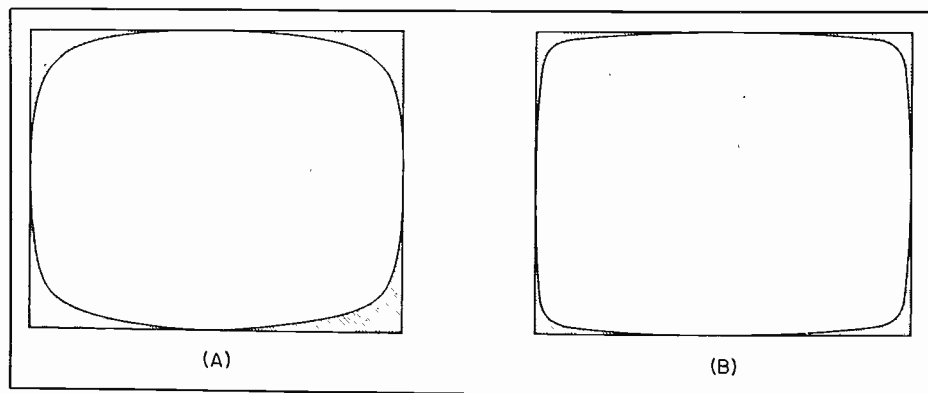


Figure 7—Shaded areas represent corner over-scan. Reduction with Bonded Shield tube (B) improves picture contrast.

electrons represented by these shaded areas strike the walls of the bulb where they are reflected to the screen. The effect is reduced picture contrast, particularly in the corners of the screen. The straighter sides and squarer corners of the Bonded Shield design appreciably reduce the amount of corner overscan, Figure 7B, and measurably improve picture contrast.

### FLATTER SCREEN REDUCES DISTORTION

The Bonded Shield tube also features a flatter screen to reduce distortion at wide viewing angles. The improvement that can be expected is clearly illustrated by the scale comparison of horizontal screen curvatures shown in Figure 8.

### Other Important Features

#### IMPLOSION PROOF

Complete implosion protection is another welcome feature of the Bonded Shield tube, and is especially

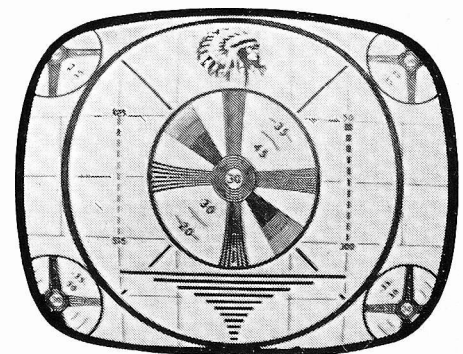
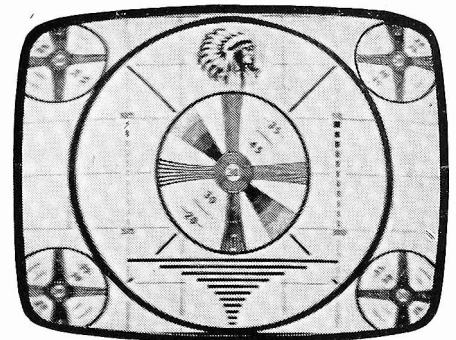


Figure 6—New shape of Bonded Shield screen (top) adds 20 square inches to viewing field of regular 21" tube (bottom).

important to the serviceman who must handle this component daily in his work.

Abrasion and moisture are two factors that measurably reduce the strength of glass. The former is

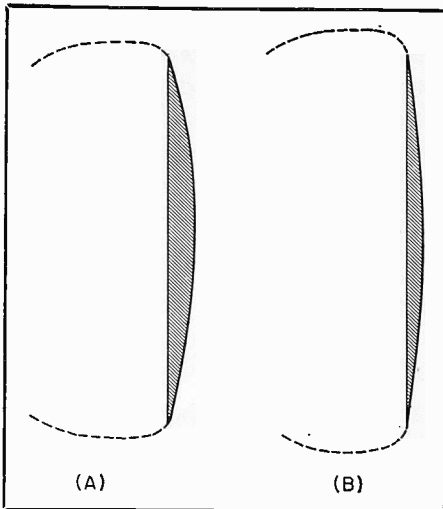


Figure 8—Comparison of screen curvatures. Flatter face of Bonded Shield design (B) permits viewing at wider angles without distortion.

most likely to be introduced during handling while the latter is a function of environment. In previous bulb designs, the influence of these two factors is minimized by thick glass walls and convex curves. With the Bonded Shield design, the wrap-around safety panel, epoxy laminate and lacquer coating, Figure 3, completely protect critical areas of the bulb.

Extensive testing by Sylvania and the Underwriter's Laboratories indicate that when a Bonded Shield tube is broken, there is no violent implosion or flying glass.

While the Bonded Shield tube is inherently much stronger than previous picture tube designs, it is still made of glass and should be treated accordingly. The critical area of the bulb, beginning at the back edge of the wrap-around safety panel and extending beyond the seal, Figure 3, although protected by a coating of lacquer against accidental scratching, should still be treated with care. Every effort should be made to avoid contacting this section of the bulb, particularly with metal objects.

#### SIMPLE, UNIQUE MOUNTING

*Here is a feature that should please the serviceman.*

The safety panel is equipped with four glass mounting lugs, Figure 4. Utilization of the lugs results in the typical, exceptionally simple tube clamping arrangement shown in Figure 9. Four small strap-clamps straddle the lugs and are bolted to

the escutcheon. A soft pad between the clamps and lugs evenly distributes the pressure applied by the clamps.

The glass lugs, incidentally, are plenty strong enough to do their intended job. Receiver drop-tests have repeatedly shown that the mounting hardware will tear loose from wood cabinets before the lugs will break.

#### Set Conversion

As consumers become aware of the definite improvements in picture quality that are realized with Bonded

UNDER NO CIRCUMSTANCE SHOULD A PICTURE TUBE DESIGNED FOR USE WITH A SEPARATE SAFETY PANEL BE PLACED IN A RECEIVER THAT DOES NOT HAVE SUCH A PANEL.

#### Specific Tube Types

The first Bonded Shield picture tube being produced in volume is Sylvania's type 23CP4. Briefly, this is a non-ion trap, electrostatically focused, 110° deflection tube. Other features include an Aluminized

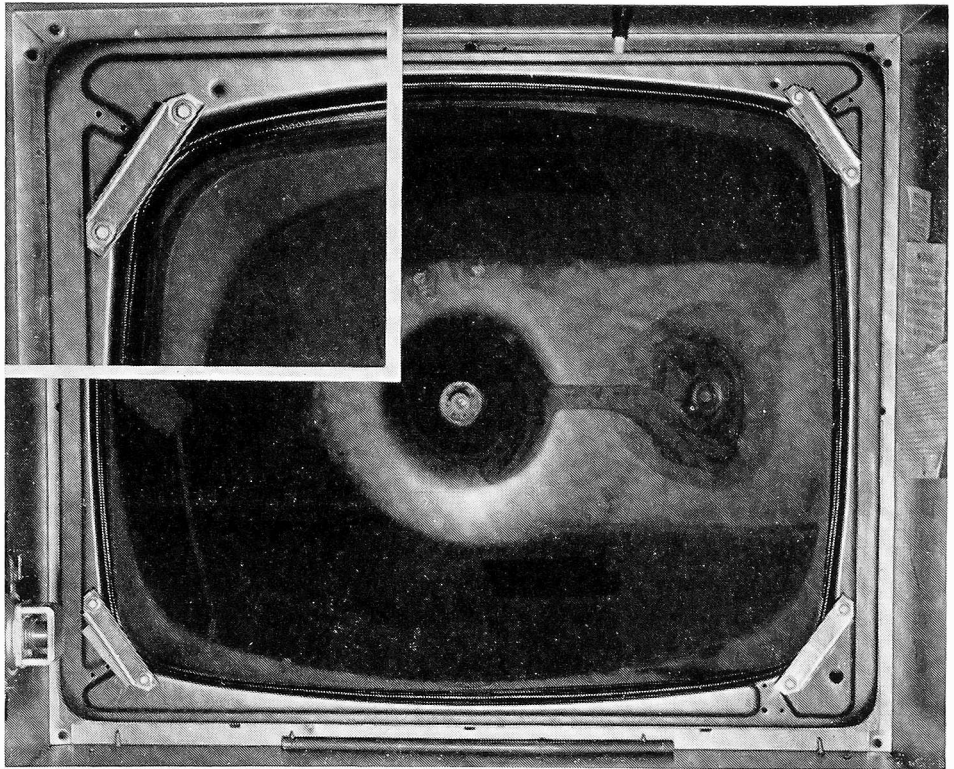


Figure 9—Simple mounting arrangement afforded by built-in glass lugs.

Shield picture tubes, some will wonder if their present sets can be converted.

From the preceding illustrations, it is apparent that conversion, although not impossible, is impracticable in most cases. Both the escutcheon and mask would have to be extensively remodeled to accommodate the squarer, flatter face of the Bonded Shield tube. Further, the tube clamping arrangement would probably need extensive revision.

While there is little likelihood that anyone would want to substitute an earlier design for a Bonded Shield type, a word of caution is justified.

Screen and a Gray Filter-Glass faceplate.

A Bonded Shield tube employing the Sylvania TPF electron gun is also available. Numbered 23DP4, this type has a 1½ inch shorter neck than the 23CP4.

Complete technical data for both types were recently issued in the form of inserts for the Sylvania Technical Manual and Engineering Data Service.

In conclusion, the new-concept Bonded Shield picture tube is a major advance that opens the door to new cabinet styles combined with added viewing safety and pleasure.

# TECHNICAL SECTION

FEBRUARY 1960  
VOL. 27, NO. 2

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

## DISTORTION AND HUM IN AUDIO AMPLIFIERS

(PART I)

By W. J. SEMBER, Receiving Tube Operations

characteristics; the effects of improper operating conditions thereon; and the deterioration of performance caused by using tubes beyond their useful life.

### SIMPLE HARMONIC DISTORTION

Simple Harmonic Distortion in a single-ended amplifier will be discussed first, since it provides a basis for the later subjects of Intermodulation Distortion and Push-Pull Operation. Figure 1 shows the transfer characteristic of a single-ended power output tube. The operating point is shown and the A.C. plate current is drawn to indicate that the tube is operating with a small signal; hence, the grid

This is the first of a two-part article devoted to the causes and effects of distortion and hum in audio amplifiers. A second article will discuss some techniques of servicing audio amplifiers, and methods of measuring the various quantities discussed herein.

have similar non-linear characteristics which contribute to Intermodulation distortion, this discussion will be confined mainly to tube

With the rapidly growing interest in high fidelity and home music systems, a new field is opening to the serviceman who is ready and able to repair this equipment. Background material on the causes and effects of distortion and hum, the two largest areas of complaint about high fidelity and related equipment, should aid the serviceman in understanding these critical areas, and thus enable speedy, profitable repair.

There are two types of distortion encountered in audio work; Simple Harmonic and Intermodulation Distortion. Both of these have their cause in essentially the same source; a curvature of the amplifier transfer characteristics. Although Audio Transformers and semiconductors

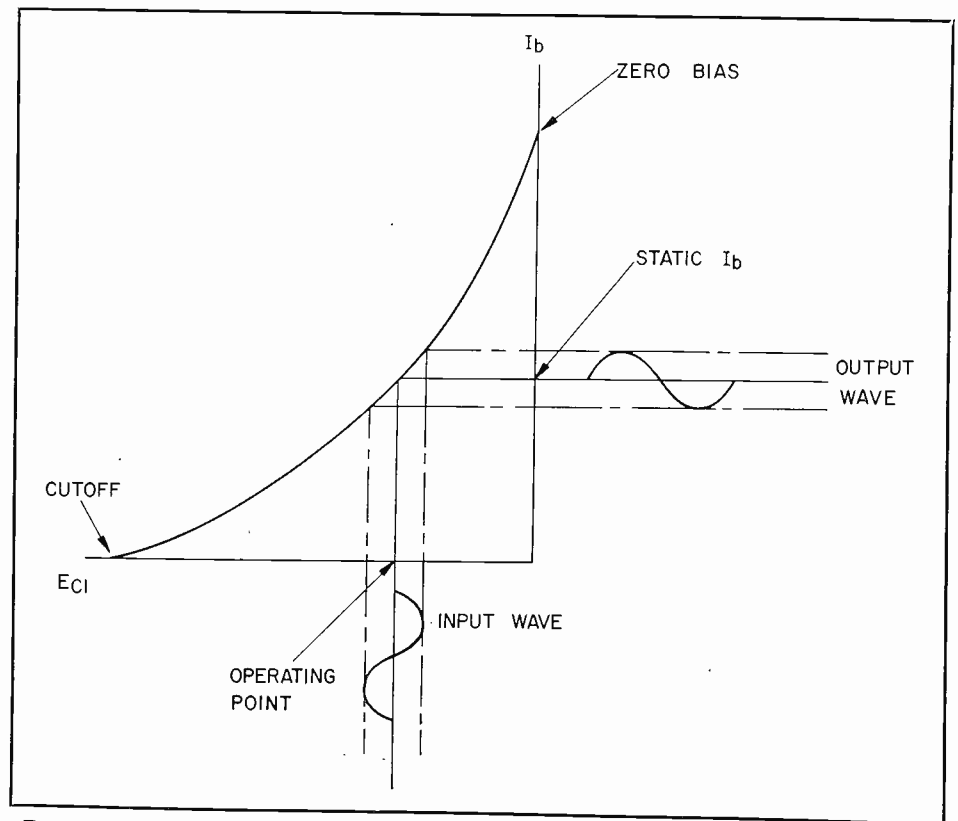


Figure 1—Transfer characteristic of a single-ended power output tube with small signal.

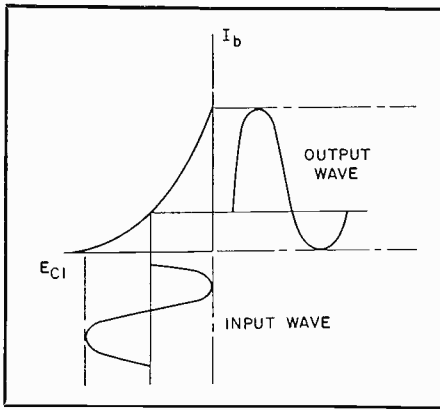


Figure 2—Transfer characteristic of a single-ended power output tube at maximum signal.

voltage is sweeping only a small, relatively straight portion of the curve. In this case, the output wave reproduces the input waveshape almost exactly, and therefore the distortion is low.

Figure 2 shows what happens when this amplifier is driven to full output. The amplifier is biased halfway between zero bias and cutoff, and the signal drives the full distance between these points. Since the transfer characteristic is non-linear, the output wave is not the exact duplicate of the input waveshape, and is said to be distorted. A stretching or peaking of the wave occurs near zero bias, and a flattening occurs near cutoff. If the input waveshape is sinusoidal, the output wave is no longer sinusoidal, but a complex waveform composed of a fundamental sine wave and additional sinusoidal components which are multiples of the fundamental frequency. These frequencies, being multiples of the fundamental, are termed "harmonics," and are the products of distortion; hence, the "harmonic distortion" term. Only the second and third harmonics of the fundamental are of interest, since they are usually the largest in magnitude. The second harmonic occurs due to distortion near cutoff, and the third harmonic is generated due to distortion near zero bias. The R.M.S. sum of these harmonic voltages, expressed as a percent of the voltage in the fundamental, is the Total Harmonic Distortion in an amplifier.

A balanced push-pull circuit may be similarly observed as shown in Figure 3. The overall transfer characteristic of the amplifier is

shown in dotted lines. Due to the fact that the two tubes conduct alternately, the overall transfer characteristic has no real cutoff point or curvature approaching cutoff; hence, there should be no second harmonic distortion component. Since the overall transfer characteristic is relatively straight, the distortion over the entire operating range is also low. However, unbalanced push-pull tubes may have a second

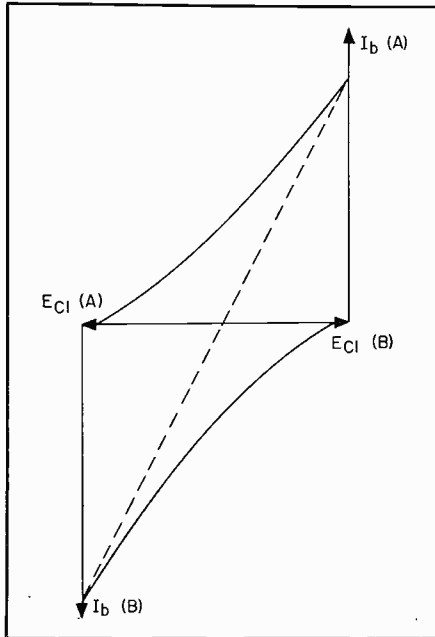


Figure 3—Transfer characteristic of a pair of balanced push-pull power output tubes, showing overall characteristics.

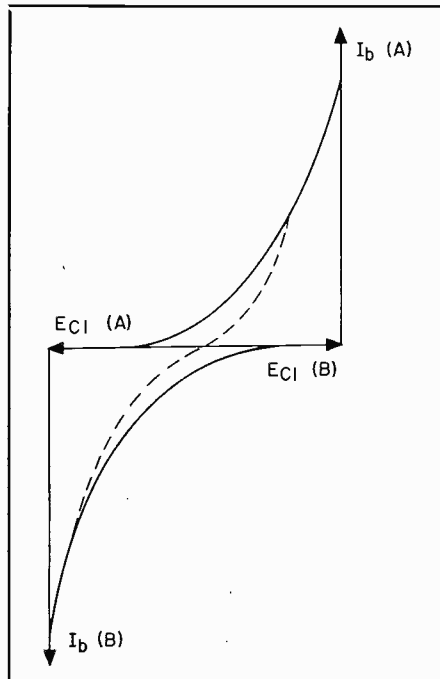


Figure 4—Transfer characteristic of a pair of unbalanced push-pull power output tubes.

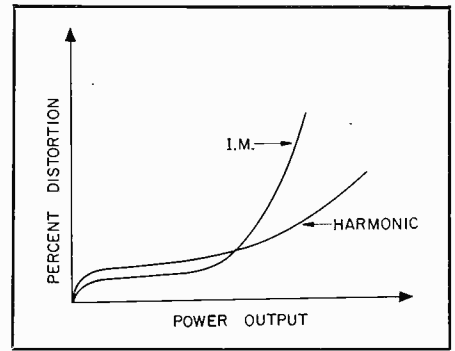


Figure 5—Comparison of I.M. and harmonic distortion in push-pull tubes.

harmonic component, since their transfer characteristic may appear as shown in Figure 4. The curvature near the operating point will introduce considerable second harmonic distortion.

### INTERMODULATION DISTORTION

Intermodulation Distortion also has its origin in a curved transfer characteristic, whether in single-ended or push-pull operation. Although a non-linear characteristic is necessary for detection, it also produces modulation. This undesirable product may occur within an amplifier when more than one tone is being amplified at the same time. The distortion introduced in this manner is termed "Intermodulation Distortion," or I.M. This may be defined as the distortion products produced when one signal within an amplifier modulates another signal within the same amplifier. The I.M. is then the magnitude of the undesirable sidebands produced by this modulation. For example, if two different test tones, such as 400 and 1000 cycles are fed into an amplifier which has a non-linear transfer characteristic, 600 and 1400, 200 and 1800 cycle notes will be observed in the output, along with the original test tones. These are harmonics of neither of the applied waves, but sidebands produced by the modulation of the 1000 cycle note by the 400 cycle note. The R.M.S. sum of the voltages in these sidebands, expressed as a percentage of the voltage in the 1000 cycle wave is then the percent of Intermodulation Distortion.

Although there is no direct mathematical relationship between I.M. and Harmonic Distortion, the I.M. is generally the larger of the two at

high power levels. The approximate relationship between the two for a pair of tubes in push-pull operation is shown in Figure 5. The I.M. is slightly lower at low signal levels; but, as the power output increases, the I.M. climbs sharply, while harmonic distortion increases more gradually as the amplifier approaches rated power.

Single-ended amplifiers have relatively high I.M., while push-pull amplifiers are capable of very low I.M. if the overall transfer characteristic is relatively straight. This is true because the single-ended amplifier must be content with its curved transfer characteristic, while push-pull tubes aid each other in producing a straight overall transfer characteristic. Incidentally, in high quality audio work, where balance in the output tubes is adjustable, an I.M. meter is perhaps the best method of balancing the output. If balance is determined for minimum I.M., then the transfer characteristic is considered to be as straight as possible.

#### 4:1 METHOD OF MEASURING I.M.

Intermodulation Distortion is difficult to measure with any real degree of accuracy or consistency. There are several valid ways of measuring it, and all give different results. One method, however, which has received wide acceptance, uses a test tone near the lower frequency limit of the amplifier, and a second test tone near the upper frequency limit. The lower frequency tone is adjusted to be 4 times the magnitude of the upper

frequency note; hence, the method is called the 4:1 Method of Measurement. Both tones are adjusted simultaneously to drive the amplifier to the desired power output, keeping the 4:1 ratio.

As an example, suppose 100 and 7000 cycles are chosen as the two test tones. These are fed into the input of the amplifier such that the 100 cycle note is 4 times the R.M.S. value of the 7000 cycle note. At the output of the amplifier, then, these test frequencies and their harmonics will be observed. However, other frequencies, which are the products of the intermodulation between these two notes will also be observed. In this case, the products of interest are those around the 7000 cycle wave; 6800, 6900 and 7100, 7200 cycles. The R.M.S. voltage sum of these intermodulation products, expressed as a percentage of the voltage in the 7000 cycle wave, is the Intermodulation distortion in the amplifier.

#### SOURCES OF HUM

The second large area of complaint on home music systems is hum and/or noise. Hum is an extremely complex subject of which there are many aspects. There are three paths in the typical audio amplifier where hum might enter the signal path in sufficient quantity to be audible. These are: (1) The A.C. wiring within the chassis, (2) The D.C. power supply in the amplifier, and (3) the heaters of the tubes, especially those in high gain stages. Hum from an inadequately filtered D.C. supply is easily recognized if the amplifier employs a full-wave rectifier, since it will have a 120 cycle component. Hum from the other two sources is difficult to segregate, since both have essentially a 60 cycle component, and hum from either or both of these sources may be entering the signal path at the same time. In fact, an amplifier with low hum may be that way because hum is canceling within the amplifier; that is, hum generated in the front end of an amplifier may be canceled by out-of-phase hum voltage generated further along in the amplifier. Thus, a low-hum tube in one application may be a high-hum tube in another application, which makes it difficult to predict whether a tube

(although controlled in manufacture for exceptionally low hum) will exhibit low hum in every application; although, in most applications it will produce less hum.

#### EFFECTS OF NOISE

Noise is taken to mean any extraneous sound other than hum. This includes hissing, snapping, or popping. A hissing noise may be caused by gas or leakage between the elements of tubes in high gain stages; or by resistors in these same stages producing thermal noise, especially if they are near a source of heat or are passing large dc currents. This thermal noise from resistors produces a "rushing" or "hissing" in the speaker which is very similar to that produced by interelement leakage. Snapping and popping noises are generally caused by thermal expansion of tube elements with warm-up. This type of noise can become quite objectionable during the first few minutes of operation of an amplifier. Again, high gain stages should be suspected; and pentodes, because of their greater number of elements, are more prone to this type of noise than are triodes.

Additional information concerning some techniques of audio amplifier repair, and methods of measuring the various quantities discussed herein will appear in the March 1960 issue of SYLVANIA NEWS.

## SERVICE HINT

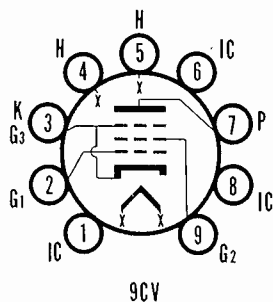
#### CLOCK RADIO KNOBS

Here's a service hint for clock radio knobs that have the notch worn off. Heat a short length of solid hook-up wire with a soldering iron and push it through the knob and knob shaft. Cutting the wire to the proper length permits the knob to function properly. The advantage in using this hint is that it preserves the decoration and/or match in knobs.

Howard Adams  
Hanover, N. H.

### ERRATUM

The Basing Diagram 9CV, is incorrectly shown in the recently published Receiving Tube Characteristics Booklet. The Diagram is correctly shown below.



## SUPPLEMENTARY TUBE TESTER SETTINGS

Listed below are important additions to the roll charts for Sylvania Tube Tester Models 139 and 140. Make sure your charts are completely accurate and up-to-date by adding these important facts now.

### FOR TUBE TESTER MODELS 139 AND 140

TYPE	A	B	C	D	E	F	G	TEST
1DN5	1.4	2	4	48	1	016	49	T
	1.4	2	4	48	7	—	55	T
1J3	1.4	0	2457	0	8	—	69	V
2EA5	2.5	0	2	0	4	36	25	W
2EN5	2.0	0	—	0	1	—	41	T
	2.0	0	—	0	3	—	41	T
3EA5	3.3	0	2	0	4	36	22	W
4DE6	5.0	0	—	0	4	36	22	V
5CR8	5.0	0	9	0	3	35	37	V
	5.0	0	6	0	1	5	32	X
5EA8	5.0	0	—	0	3	36	40	V
	5.0	0	—	0	1	5	22	X
5EH8	5.0	0	4	0	5	3	23	X
	5.0	0	4	0	4	79	85	T
5FV8	5.0	0	—	0	2	2	24	X
	5.0	0	—	0	3	57	40	V
6AF3	6.3	0	3	0	4	—	18	Y
6CA5	6.3	0	5	0	3	26	20	X
	6.3	0	2	0	3	56	20	X
6CY7	6.3	0	3	0	1	6	16	W
	6.3	0	3	0	3	7	64	W
6DE4	6.3	0	7	1	3	—	18	Y
6DR7	6.3	0	6	0	1	3	29	U
	6.3	0	3	0	1	6	29	U
	6.3	0	3	0	3	7	45	T
6DN7	6.3	0	678	1	7	5	50	Y
	6.3	0	278	1	3	3	80	W
6DT5	6.3	0	4	0	4	026	25	Y
	6.3	0	6	0	4	024	25	Y
6DT8	6.3	0	—	0	1	3	24	W
	6.3	0	—	0	3	7	24	W
6DW5	6.3	0	4	0	4	026	20	Y
	6.3	0	6	0	4	024	20	Y
6EA5	6.3	0	2	0	4	36	22	W
6EA8	6.3	0	—	0	3	36	38	V
	6.3	0	—	0	1	5	32	U
6EB5	6.3	0	—	0	1	—	49	T
	6.3	0	—	0	3	—	49	T
6EH8	6.3	0	4	0	5	3	23	X
	6.3	0	4	0	4	79	29	V
6ER5	6.3	0	4	0	4	2	29	X
	6.3	0	3	0	4	2	29	X
6ES5	6.3	0	4	0	4	2	27	X
	6.3	0	3	0	4	2	27	X
6FV6	6.3	0	—	0	4	36	26	X
6FV8	6.3	0	—	0	2	2	24	X
	6.3	0	—	0	3	57	40	V
8BQ5/X684	7.5	0	2	0	6	35	23	Y
8EB8	7.5	0	—	0	4	79	35	Y
	7.5	0	—	0	5	3	47	T



# SYLVANIA NEWS

*Thirtieth Anniversary Issue*

BILL LEVINE, EDITOR    THIRTIETH YEAR OF PUBLICATION    • MARCH • APRIL 1960 • VOL. 27, NO. 3  
Published in the interest of the Independent Service Dealer on the 15th of the month, © 1960, Sylvania Electric Products Inc.

## New Godfrey Display Has Built-In Sales Power For Independent Sylvania Dealers

When Arthur Godfrey says, "They just don't make 'em any better than the Silver Screen 85<sup>®</sup> Picture Tube!" you can be sure his words carry weight with the consumer.

In fact, that's exactly what Godfrey—one of America's most convincing salesmen—has been saying on his popular radio network show and in widely read advertisements in the SATURDAY EVENING POST.

Now he can be saying it in *your* store window, to *your* customers, selling the Silver Screen 85 Picture Tubes *you* carry, building more business for *you*. How? . . . with Sylvania's newest window advertising unit, the **Arthur Godfrey Display**.

This handsome, full-color Godfrey sign measures 3' x 3'. The three elements—the center panel, the picture of Godfrey, and the serviceman picture—fit together in seconds and create a lifelike three-dimensional effect. A protective varnished coat gives the sign a long, attractive life.

### DEALERS BENEFIT THREE WAYS

Dealers who use this sign, in conjunction with the Sylvania decal, will be benefiting threefold. First, there is real value in the display itself as an attractive advertisement.

Secondly, it's a direct tie-in with the Arthur Godfrey radio show, heard weekday mornings by millions of Godfrey fans. Sylvania commercials, delivered in a highly believable, off-the-cuff manner by Godfrey himself are heard each Monday and alternate Wednesdays. Listeners in your town are sure to be doubly impressed by the impact of the Godfrey commercials and the Godfrey display in your window.

Thirdly, the new Sylvania sign ties in with the full page SATURDAY EVENING POST advertisements, featuring Godfrey's picture and his own comments. Look for the ads yourself (April 2, 30 and May 28). More than six million Americans will be reading them, learning how you and Silver Screen 85 Picture Tubes can improve their viewing pleasure.

### ORDER YOUR DISPLAY NOW

Take advantage of Sylvania's big national advertising campaign featuring one of America's most persuasive performers. It's the hardest-hitting consumer campaign in the industry and you ought to be in tune with it.

See your Authorized Sylvania Distributor soon—get this effective display for your shop window!



**NEW GODFREY WINDOW DISPLAY** is big (3' x 3') and colorful. Pop-out photo of Godfrey and serviceman picture fit easily into main panel, give three dimensional impact.

# Advanced Construction Design of Sylvania 5V3 Means Longer Life, Fewer Call-Backs

Costly call-backs are virtually eliminated and customer satisfaction practically guaranteed when you replace with Sylvania 5V3 rectifiers, newly engineered with special long plate construction designed to materially increase tube life.

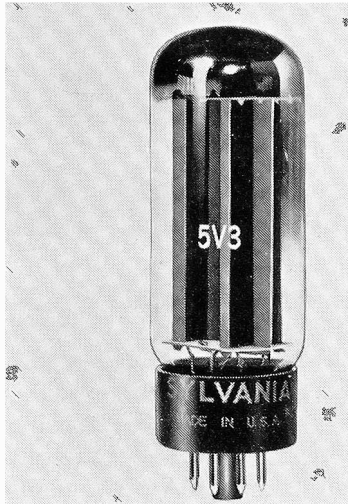
Most 5V3 rectifiers have comparatively short lives, an inherent problem due to high plate dissipation and back emission. Sylvania engineers have beaten this problem by redesigning the plate and filament elements.

The new construction features a longer, sturdier, cooler operating plate and a new, heavier filament ribbon.

## REDUCES POSSIBILITY OF DEPOSITS

Lengthening the plate construction reduces dissipation of the plate and affords a cooler operating temperature as well.

By using a heavier filament in Sylvania's 5V3 rectifier, the watts per



unit area input on the filament is reduced, producing cooler operation which cuts down the possibility of coating being deposited on the inner plate surface.

These important features of improved plate dissipation and reduced

coating deposits on the plate virtually eliminate back emission problems—cause of many early tube failures.

## TESTS PROVE RESULTS

Sylvania laboratories have made extensive tests of the new 5V3 rectifier with this result: the new 5V3—after 2,000 hours of operation—performs better in every way.

Here's a recap of the ways Sylvania's new 5V3 operates:

- Less back emission
- Cooler operation
- More stable operation
- Reduced deposits
- Improved performance
- Longer life
- More reliability
- Fewer call-backs

These are more reasons why you should specify Sylvania when you want top quality receiving tubes engineered for customer satisfaction.

# Happy Birthday To Us! Our 30th!

This month marks a milestone for SYLVANIA NEWS—30 years of publishing in behalf of the Independent Service Dealer. The form and format have changed considerably in this three-decade span, but not the intent, expressed this way in Vol. 1, No. 1, of SYLVANIA NEWS, March 1930: "This newspaper will be devoted to news and sales information . . . the latest developments in tube engineering." This statement continued to be the guiding policy of SYLVANIA NEWS at the start of this 31st year, to bring you the facts and ideas to help you prosper.

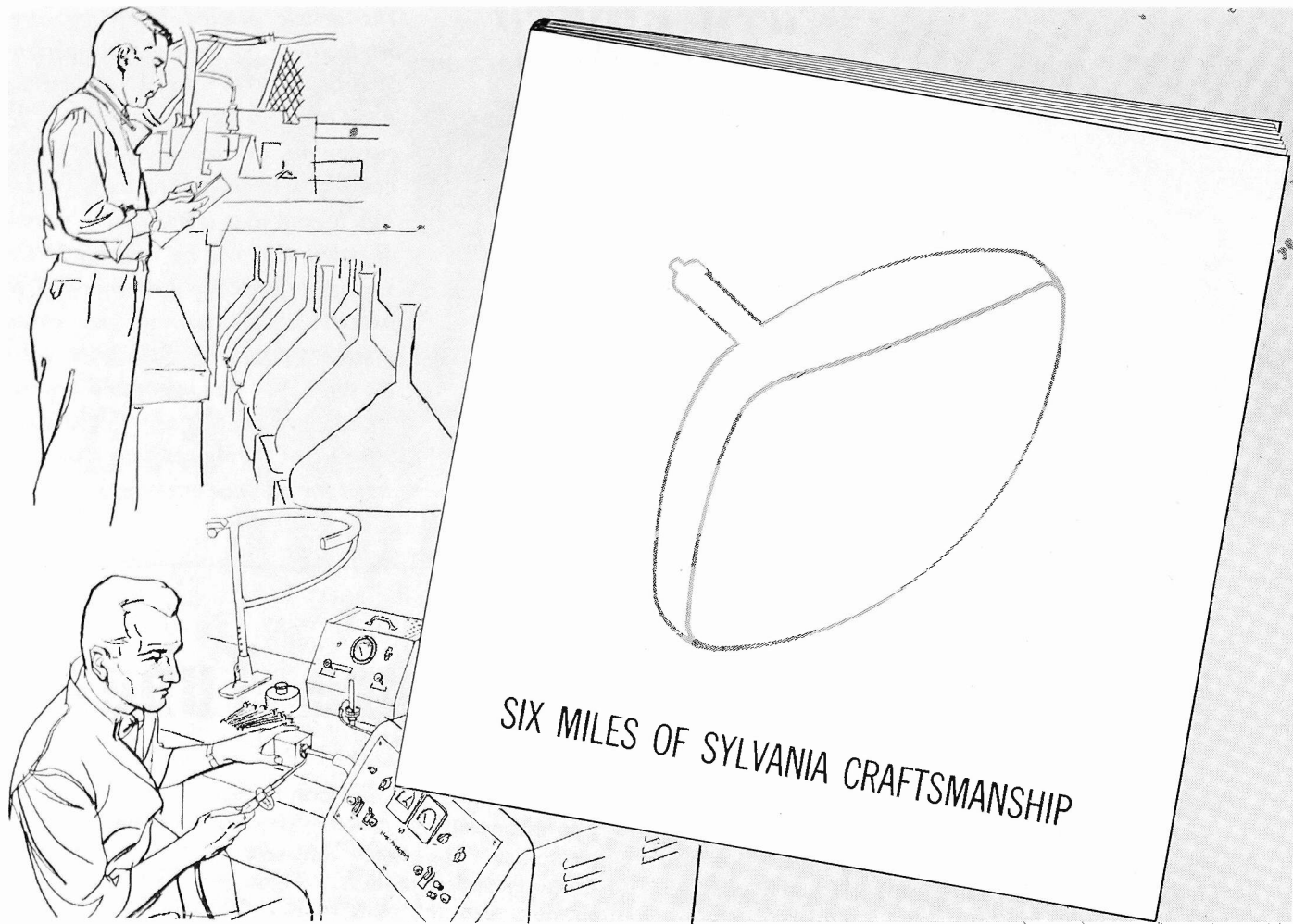


HEADLINES ANNOUNCED Sylvania News' debut 30 years ago this month.

## SYLVANIA NEWS WAS FIRST

The NEWS is the oldest publication of its kind in the electronics industry. Circulation of the first issue, for jobbers and salesmen only, was 3,500. When dealers demanded to be included, circulation leaped to 13,000. Today, readership is at an all-time high of nearly 250,000.

For 1960 the future is bright. This 30th Anniversary Issue is published on the threshold of a decade that holds tremendous promise for the electronic industry and the Independent Service Dealer. On our birthday, allow us to wish you the greatest possible success during the coming year.



# Sylvania's Newest Booklet Tells The Story Behind SILVER SCREEN 85 Picture Tubes

Every Silver Screen 85® picture tube travels approximately two miles in manufacture. Count Sylvania's three ultra-modern picture tube factories and you've got "Six Miles of Sylvania Craftsmanship"—the story of the manufacturing techniques that enable Sylvania to build, and you to sell, the finest possible picture tube.

That story is told in a new booklet, "Six Miles of Sylvania Craftsmanship." A valuable addition to any dealer's library, it's told in easy-to-understand terms that will interest your set owner-customers as well.

**THE LONG ROAD TO QUALITY**  
"Six Miles of Sylvania Craftsmanship"

traces the long, quality controlled path followed by every Silver Screen 85 picture tube. Included are complete descriptions, with photographs, of the tube's three main elements—the electron gun, the phosphor screen, and the glass bulb.

The booklet clears up much of the existing confusion—within the industry as well as on the consumer level—that surrounds the manufacture of television picture tubes.

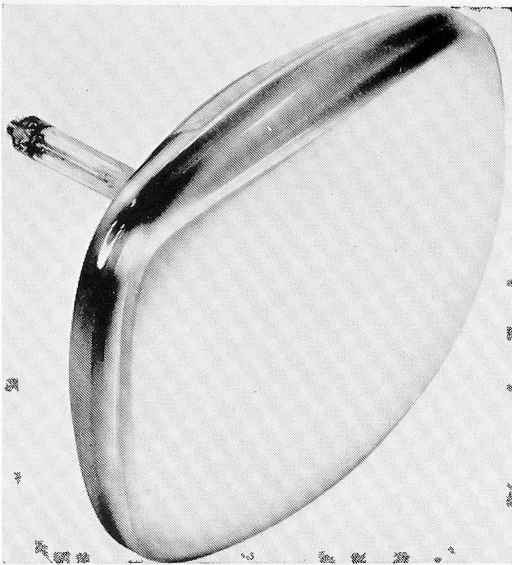
Illustrated with actual assembly line photos, the 24-page booklet highlights many Sylvania manufacturing exclusives, and the results of comparison tests that prove Silver Screen 85's superiority over rebuilt picture tubes.

These facts can assist you to sell more Silver Screen 85's and to brighten your own profit picture.

"Six Miles of Sylvania Craftsmanship" is now available from your Authorized Sylvania Distributor. Be sure to order a supply today.

#### PLAN AHEAD

Sylvania's 1961 Dealer Home Calendar promises something special in the way of year 'round advertising. Be sure to look for the details in the May-June issue of Sylvania News.



## “TV GUIDE” MAGAZINE LOOKS AT REBUILT PICTURE TUBES

*The article printed below appeared originally in the January 30-February 5 issue of “TV Guide” magazine. Read it carefully. It’s a revealing discussion of the place rebuilt picture tubes have in today’s renewal market. You’ll note that it contains a number of points that will be valuable in convincing prospective customers of the overall superiority of namebrand picture tubes like Sylvania’s Silver Screen 85®. You might find it worthwhile to cut out this article, paste it on a sheet of cardboard and have it on hand for all your customers to see.*

# Rebuilds Vs. New Picture Tubes

A set owner whose receiver had recently conked out called in a TV serviceman. The serviceman accurately diagnosed the trouble as a dead picture tube and quoted \$54 as the price of a new one.

Did the set owner get the new tube he was paying for? In this case he did. Unfortunately, set owners are not always so lucky. While experience has proved that most TV repairmen are honest, there are still those illegal operators who will palm off a rebuilt tube as a brand-new replacement.

What is a rebuilt tube and where does it come from? It is made from the dead picture tube that the serviceman obligingly removes from your home. He sells it for four dollars to a distributor, who sells it back to a tube manufacturer or rebuilder.

Every tube manufacturer buys back burned-out picture tubes, but the reliable brand-name tube makers reuse *only the glass*. After thoroughly cleaning the tube and removing the phosphor screen from the front a new chemical screen is applied and new electronic elements are inserted.

This used-glass bulb thereafter is processed on the same production line with the new-glass tubes. Even though the glass has been used before, the tube is identical in every other respect with a new one and has the same guarantee. The process can be compared with the cleaning and reuse of milk bottles. It’s how the glass is cleaned and what is put back into it that counts.

Some tube makers don’t clean out the old phosphor coating. Some will not use new electronic elements. The tubes that are so produced are properly called rebuilds. These tubes are inferior to new picture tubes made with either new or used glass.

While most set owners are unaware that rebuilt tubes are available, the tube industry estimates there are now some 150 brands of rebuilt tubes on the market. The Federal Trade Commission has several times attempted to police the labeling of rebuilds. Most of those sold today, however, still bear deceptive labels ranging from “This is a brand-new rebuilt” to “This is a brand-new tube.”

Not that there is anything wrong with a rebuilt tube, if it is priced properly. The average suggested retail price of 21-inch rebuilds processed by national brand-name manufacturers is \$43 installed, about \$11 less than the average suggested price of a brand-new tube. And a good rebuilt, based on normal use of about four hours daily, should provide two to four years of good service, compared with the five-year life expectancy of a new tube.

A first-quality tube should contain no used material or parts—except that used glass is permissible. The customer should insist that the serviceman use a tube made by a name-brand manufacturer and that he provide the manufacturer’s written guarantee. If such proof is not provided, the chances are that the tube contains used parts.

(Reprinted Courtesy of “TV Guide” Magazine.)

# TECHNICAL SECTION

MARCH  
APRIL 1960  
VOL. 27, NO. 3

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

## DISTORTION AND HUM IN AUDIO AMPLIFIERS (PART II)

By W. J. SEMBER, Receiving Tube Operations

In the first of this series of two articles, some background material on the actual causes and effects of distortion and hum was presented. This second and last article will assign some numbers to the discussions presented in the first article, as well as provide some basic techniques for servicing audio amplifiers.

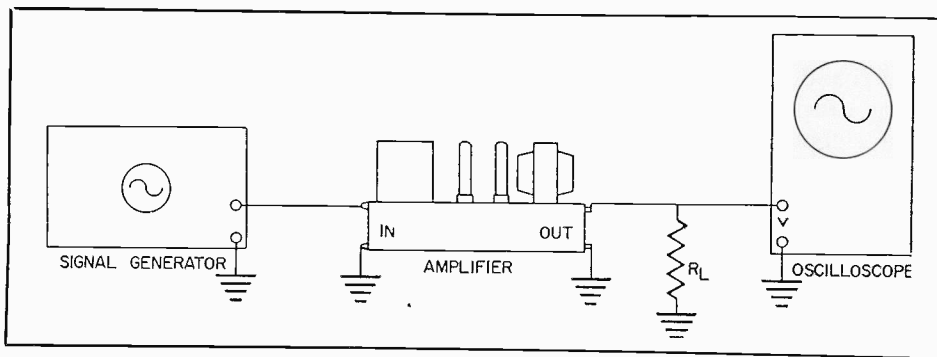


Figure 1—Basic parts layout for servicing audio amplifiers.

The basic layout of parts necessary to service audio amplifiers is shown in Figure 1. An oscilloscope is employed mainly because distortion and hum on an audio wave can be viewed at percentages much lower than those values at which they become audible. An audio generator is used to provide a sine-wave signal to the amplifier, and the audio power from the output transformer is dissipated in a load resistor. The voltage across this resistor is used to provide the vertical display on the oscilloscope; and, the output wave thus obtained is used to evaluate the amplifier performance.

A load resistor should always be used on a pentode power amplifier when the speakers are disconnected to prevent the development of high screen current with signal. The ohmic

value of the load resistor is not too critical for servicing purposes; and, if the value of the speaker impedance for a particular amplifier is not known, a value of five to eight ohms is a good choice. However, this resistor should have a sufficient wattage rating to prevent excessive heating during testing. An AC VTVM should be used for determining the power level at which the tests are being conducted, using the relationship:

$$P_o = \frac{V^2}{R}$$

where:

- V = RMS voltage across the load
- R = Load resistor in ohms

A typical output waveshape from the circuit shown in Figure 1 is presented in Figure 2. Operation of the amplifier is satisfactory, since very little distortion of the sine-wave is

evident. Figure 3 shows the output waveshape of a push-pull amplifier which is operating in the overload or clipping region. The flattening which is evident on the peaks of the signal indicates a high third harmonic content. Very little distortion is

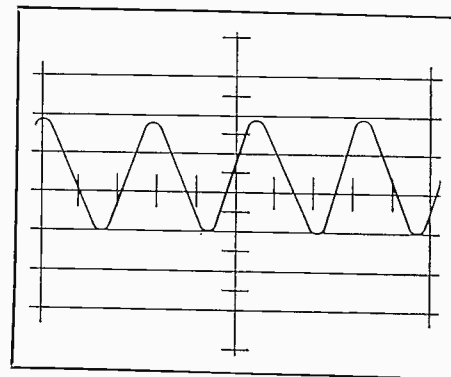
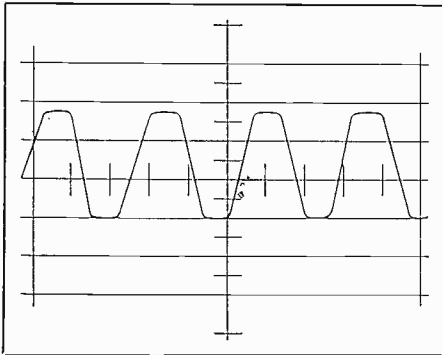


Figure 2—Typical sine-wave output waveshape from the circuit shown in Figure 1. No appreciable distortion is evident.

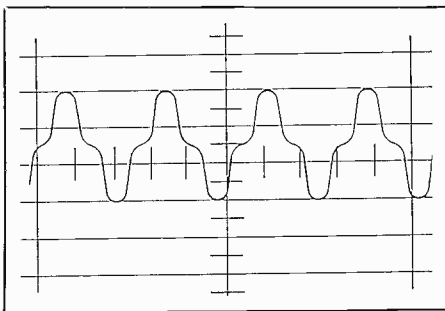
evident near the zero axis of the sine-wave; thus, second harmonic content is low. Actual measured percentages of distortion on this wave were eight percent third harmonic and 1.5 percent second harmonic distortion.



**Figure 3**—Amplifier beginning to overload.  
2nd Harmonic distortion = 1.5%.  
3rd Harmonic distortion = 8.0%.

A pair of tubes in push-pull which show high second harmonic distortion is shown in Figure 4. In this case, the amplifier is severely overdriven; and, the bias on the two output tubes is not balanced. The transfer characteristic of this pair of tubes would look like that shown in Figure 5. The unbalanced bias is evidenced as distortion at the cross-over point or the approximate zero axis of the sine-wave. Measured distortion on this pair of tubes was 5.7 percent second harmonic and 13.7 percent third harmonic distortion. The standard test frequency of 1000 cycles was used to obtain these figures.

Harmonic distortion may be described by the average listener in a great variety of ways. That is, since harmonics are overtones, they may or may not be objectionable, depending on their effects. The harmonics of low notes may be described as

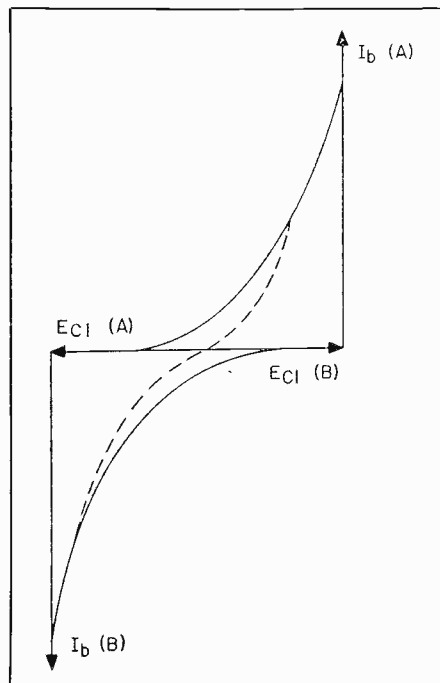


**Figure 4**—Overloaded amplifier showing effects of serious unbalance in output tubes.  
2nd Harmonic distortion = 5.7%.  
3rd Harmonic distortion = 13.7%.

mushy or harsh, while the harmonics of higher frequency notes may be described as hissing or ringing. The characteristics of an amplifier will also affect the production of harmonics; for example, an amplifier with a large amount of bass boost will tend to nullify the effects of harmonics of low frequency notes, and conversely, an amplifier with treble boost will amplify the effects of harmonics of mid and high frequency tones. One factor which speaks for this method of servicing is that an amount of distortion in the order of ten percent is virtually inaudible to all but the most experienced ear, yet this amount may easily be seen on an oscilloscope. In addition to checking mid-range distortion, it may be a good idea to evaluate the amplifier at the low and high frequency ends of the audio spectrum.

#### METHODS OF MEASURING I. M.

Intermodulation distortion may be checked in the service shop by using the method shown in Figure 6. The two signals are added without intermodulation by the balanced bridge circuit. An audio transformer is used as one leg of the bridge to provide the signal for the amplifier. This transformer should have a 1:1 ratio, and it should be of relatively good



**Figure 5**—Transfer characteristic of a pair of unbalanced push-pull power output tubes.

quality to prevent intermodulation. The resistors in the legs of the bridge should be as nearly matched as is possible to prevent any possibility of interaction between the generators. If only one audio generator is available, the 110 AC line may be used to provide the low frequency tone if suitable isolation and a variable voltage is provided. As described in Part I, the high pass filter is used to remove the low frequency tone from the output wave to prevent it from obscuring the oscilloscope pattern. One type of high pass filter which may be used for this application is shown in Figure 7. This consists of two simple "L" type filters in parallel to provide an attenuation of 12 db per octave. The circuit constants shown were chosen to provide optimum results when the test frequencies for the I.M. measurement are 60 and 6000 cycles. This same filter may be used for any value of high frequency above 6000 cycles.

To perform the actual measurement, the voltage of the low frequency note is adjusted to be four (4) times the voltage of the high frequency at the input to the amplifier. The oscilloscope is then synchronized to the low frequency of the modulation envelope, and patterns such as those sketched in Figure 8 will be observed. These will be recognized as the normal modulation envelope that is obtained from a modulated RF wave. The depth of the modulation provides an indication of the amount of intermodulation which is present within the amplifier. The pattern shown in Figure 8A indicates no intermodulation is present; Figure 8B shows the pattern observed when intermodulation is present.

LeBell<sup>1</sup> has derived a quantitative method for determining the amount of I.M. present on a pattern such as that shown in Figure 8, by correlating the depth of the modulation, or the depth of the modulation "notch," with measured quantities of I.M. distortion. The method of obtaining the percent "notch depth" is shown in Figure 9; and, this notch depth is related to the I.M. as shown in Figure 9. It should be noted that the curve is a straight line with a 1:5 slope in the region below 50 percent

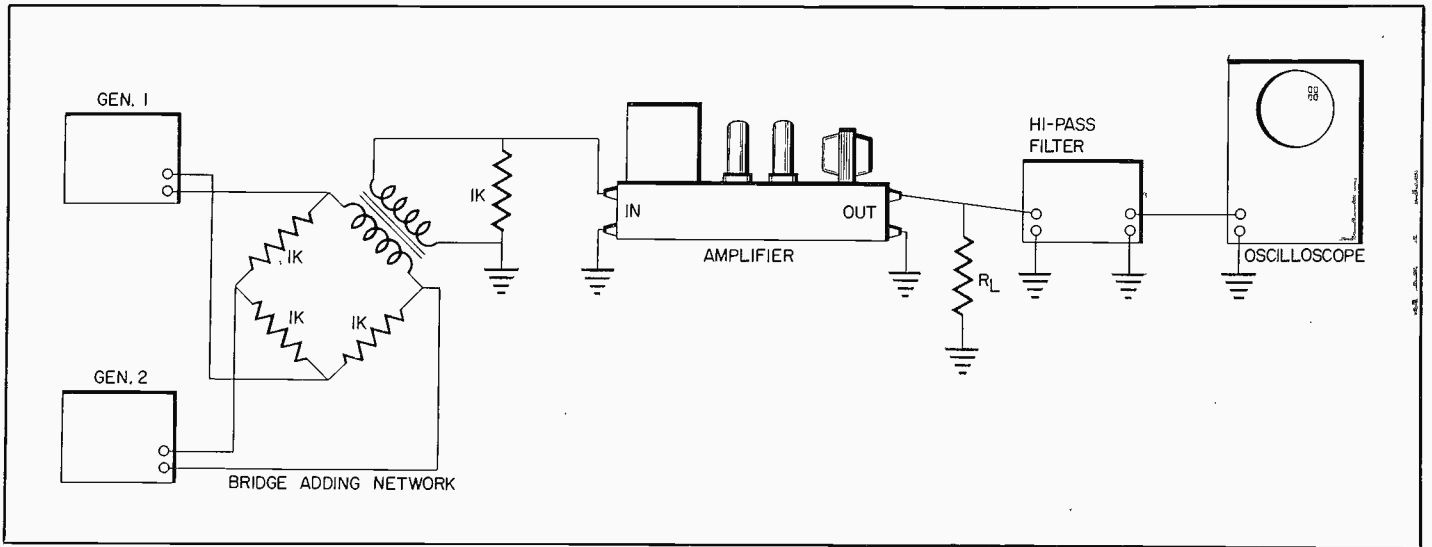


Figure 6—Practical parts layout for determining I.M. distortion.

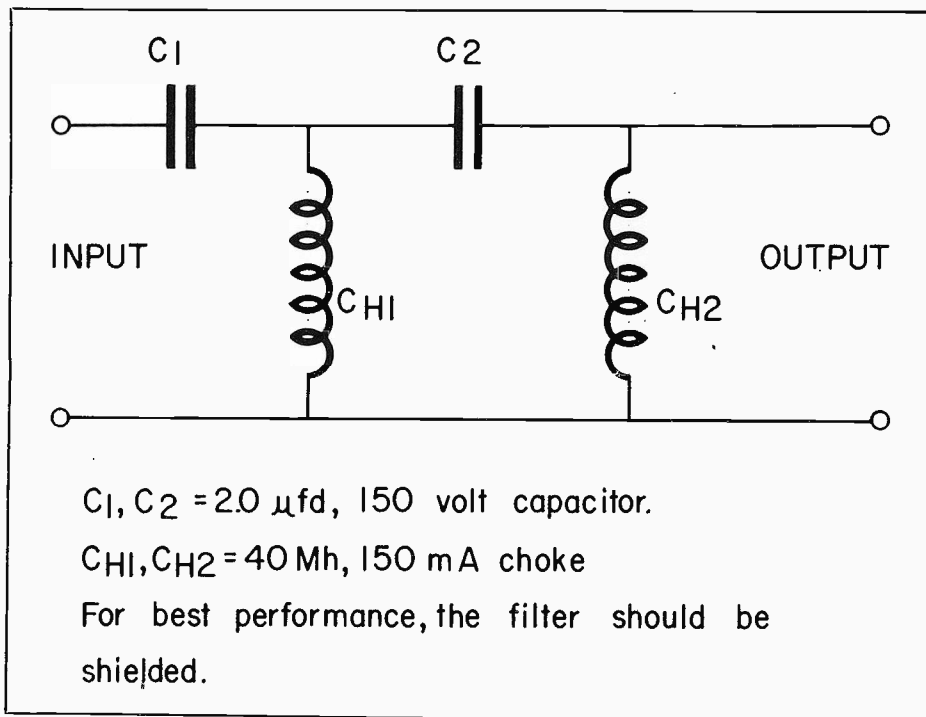


Figure 7—High pass filter for I.M. measurements.

notch depth. Thus, one-fifth of the notch depth is the approximate amount of I.M. present up to the point where the notch is one-half the depth of the modulated wave. LeBell's method is said to give results which are approximately equal to those obtained by the 4:1 method using the RMS sum of the individual intermodulation products.

Caution should be exercised when using the power line as the source of the low frequency 60 cycle note for the I.M. measurement. It should be remembered that any hum in the amplifier will increase the apparent

percentage of I.M., since the hum will make the wave appear to have a higher 60 cycle component. The circuit shown in Figure 1 may be used to check amplifier hum by shorting the input terminals of the amplifier being tested and observing the scope for possible hum output.

Intermodulation distortion will probably be described by the set owner as a buzzing or harsh sound from the amplifier, seemingly "on top" of the program material.

The causes of Harmonic and Intermodulation Distortion in amplifiers are directly related; for when one is

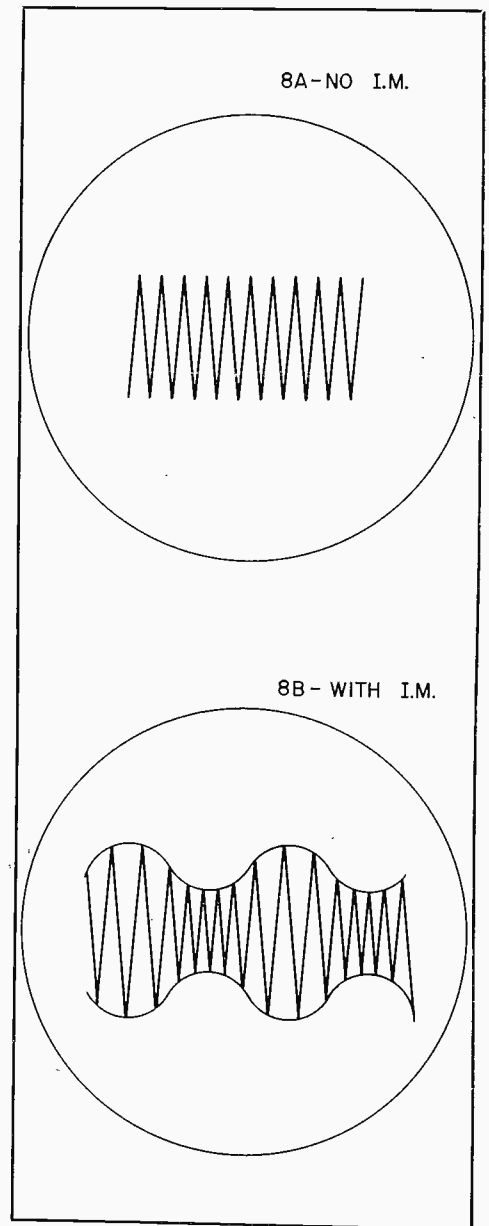


Figure 8—Oscilloscope patterns<sup>2</sup> obtained from circuit shown in Figure 6.

present, the other usually occurs. While slumping tube characteristics should be suspected, there are many other sources within the amplifier which may cause distortion to increase. Leaky coupling capacitors, which put a positive bias on the grid of the following stage, will cause clipping on the peaks of the signal. Grid emission in any stage will cause

this same symptom. Changes in the values of plate and cathode resistors in the amplifier may also cause excessive distortion. Low B+ voltage and changes in the screen voltage on output pentodes will upset balance and produce excessive distortion.

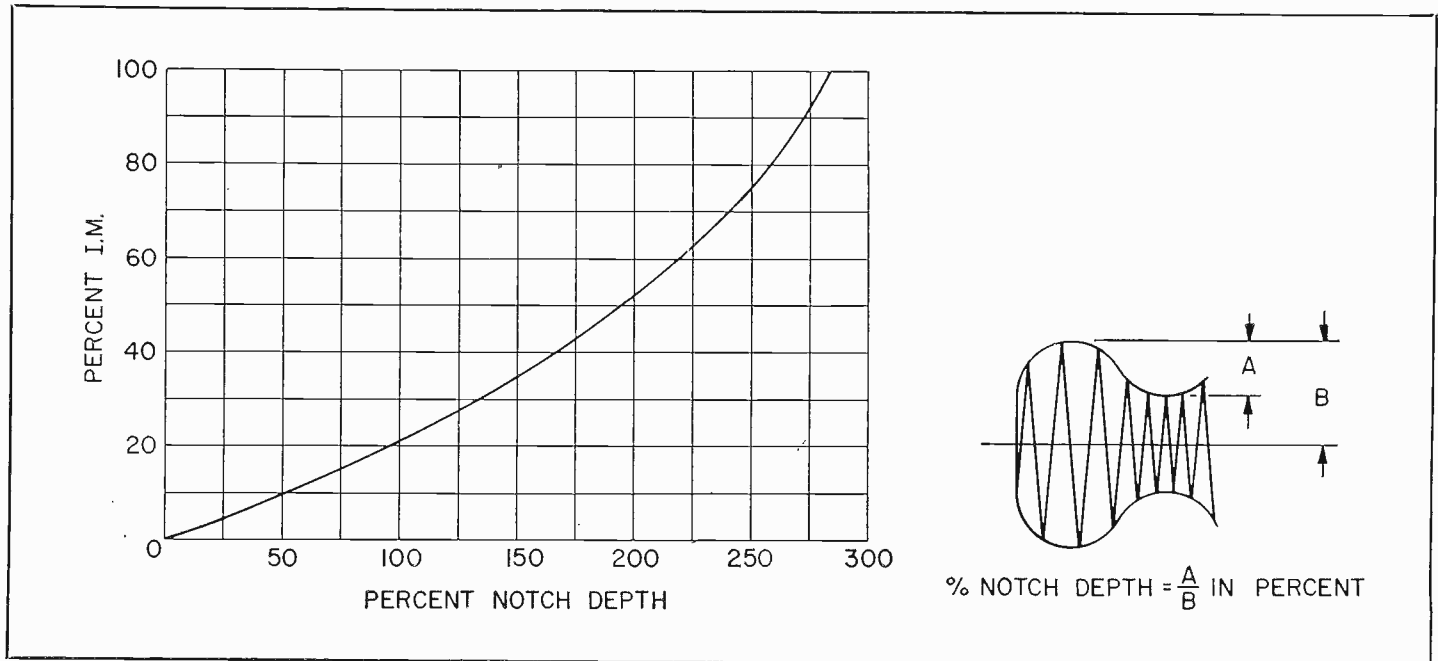
It is hoped that the methods and procedures outlined above and in the previous article will assist the service-

man to better understand the problems which may be encountered in audio circuits; and thus enable speedy, profitable repair.

<sup>1</sup>C. J. LeBell: "A New Method of Measuring and Analyzing Intermodulation," Audio Engineering, July 1951.

<sup>2</sup>C. J. LeBell: Loc. Cit.

Figure 9—Determining and using Percent Notch Depth to find I.M.<sup>2</sup>



## NEW ROLL CHARTS NOW AVAILABLE

New tube tester roll charts are now available from Sylvania, Williamsport, Pa. Each roll chart carries a nominal charge of \$1.50. Service dealers should mail their order and remittance together; Distributors should mail their purchase order.

The following list indicates how you should order charts for a particular tube tester. The number of

the new chart is listed below:

Tube Tester Model	Chart Number
137, 139, 140	PC15845-P
219, 220	PC18325-M
620	PC25700-E

Place your orders for the New Sylvania Tube Tester Roll Charts now.

## SERVICE HINTS

### MOTOROLA MODEL 84MF

We have encountered several auto radios that will play for approximately two hours in the car prior to blowing a fuse. The same radios, when taken out of the car and the cover removed, will play all day. We found the trouble was caused by the terminal on the transistor bias control being too close to the base of the control. After playing for a while, the metal would expand enough to

short out the connection and blow the fuse.

*Bob Moore*  
Union City, Tenn.

### ZENITH MODEL 26-297 RADIO CONSOLE

In case of intermittent audio operation, suspect the 470-ohm wire-wound bias resistor in the push-pull output stage. What makes this defect unusual is simply that the

audible symptoms resemble almost any kind of circuit breakdown; a defective tube, coupling capacitor, output transformer or even a rubbing voice coil. The intermittent drop in speaker output is accompanied by noise and severe distortion and only vaguely suggests a defective bias resistor.

*William Rittenour*  
Huntington 5, W. Va.



Presidential Election Handbook And Baseball Handbook Build Good Will . . .

# Sylvania's Two Handbooks Put Dealers Into Consumer Homes - Where Sales Begin!

Dealers can make their shop name a byword in the homes of prospects and customers by giving wide distribution to Sylvania's two newest consumer giveaway booklets—the Presidential Election Handbook and the 1960 Baseball Handbook.

These information-packed booklets focus on America's two national pastimes . . . baseball and politics. Dealers can capitalize on the sustained public interest in the 1960 version of these popular events by getting an ample supply of these good will booklets and putting them into circulation early.

Both handbooks feature a prominent imprint space on the cover and a number of ad pages within, promoting the Independent Sylvania Dealer and the Sylvania tubes he carries. This is your chance to make friends of strangers, and customers of friends.

## BASEBALL BOOK HOT OFF THE PRESSES

The 1960 Baseball Handbook is just out, and it's the kind of booklet dealers often report finding near the TV set when making home service calls.

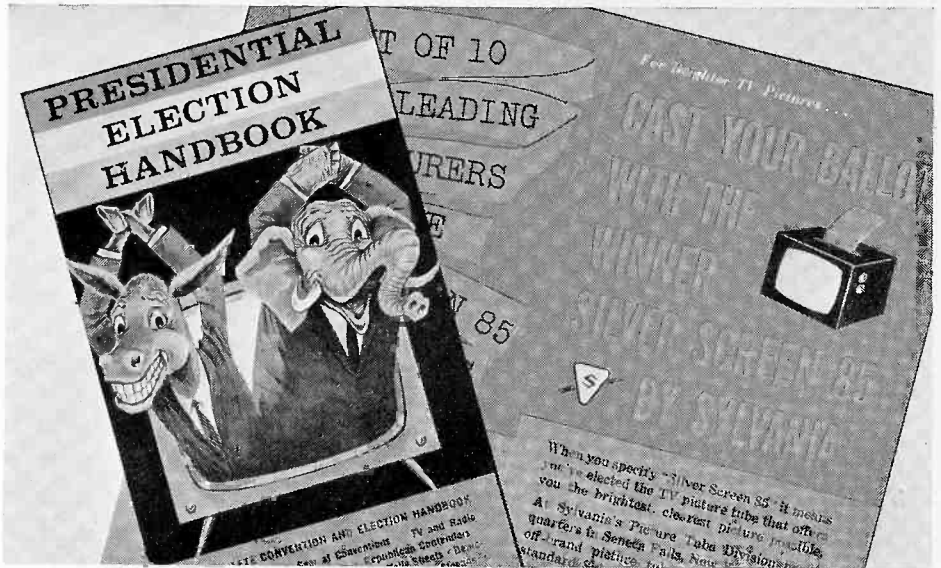
In this 48-page booklet, the baseball-television fan will find complete major and minor league schedules—plus features such as scouting reports on all the major league teams, highlights of 1959's season and World Series play, and many more facts and items to which the avid fan will refer all season long.

By imprinting your shop name, address, and phone number on the cover, you've got a personalized advertising medium that will be a hit right up until World Series time.

The season starts this month. Make sure you're in the line-up. Contact your Authorized Sylvania Distributor to get your supply of 1960 Baseball Handbooks.

## ELECTION HANDBOOKS A PROFIT-GETTER

The number one national issue all



1960 PRESIDENTIAL ELECTION HANDBOOK has attractively designed cover with dealer imprint area along the bottom. It's one of the hottest give-aways going.

year long will be the 1960 Presidential Election. Cash in on the political excitement by circulating Sylvania's non-partisan Presidential Handbook, a 48-page digest of election facts and background, score sheets and information about TV coverage, and many other exciting features.

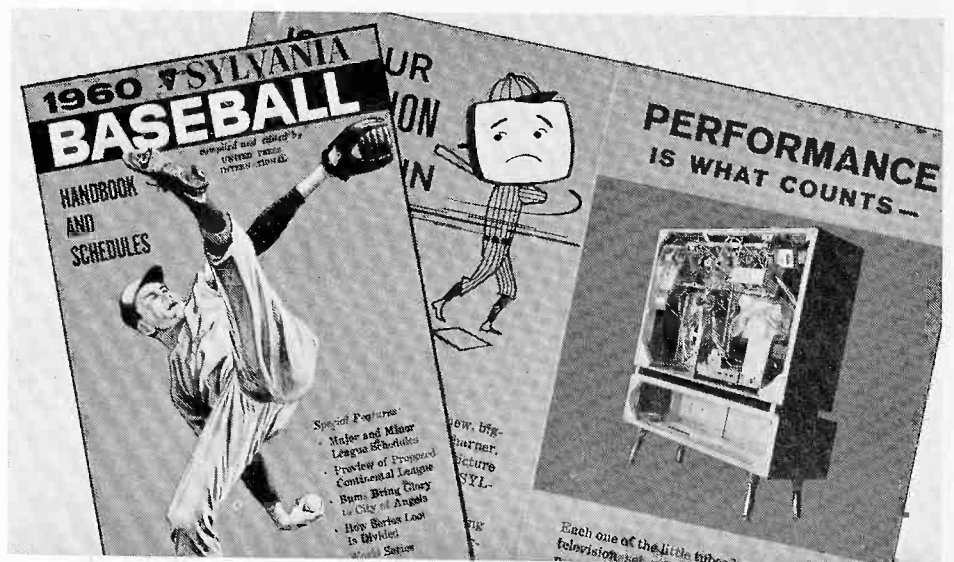
This booklet is bound to be an invaluable source of information for consumers and a profitable source of

business for you.

In addition to election facts, there is space for a dealer imprint on the cover and five big ad pages inside.

Cast your ballot for bigger business now by distributing the 1960 Presidential Handbook! Your Authorized Sylvania Distributor has them for you.

Cost of both handbooks is the same: \$5.00 per 100. Imprinting is \$1.50 per 500.



1960 BASEBALL HANDBOOK has plenty to attract the sports-minded consumer. Your own imprint on the cover is a season-long reminder of Radio-TV servicing headquarters.

BETTER BUSINESS TECHNIQUES IN 12 LESSONS!

# Sylvania's New Business Course Is Designed For Radio-TV Service Dealers

If you haven't signed up for the Sylvania-sponsored R.T.T.A. Business Course, do it now!

How would you like to operate your business more efficiently, more successfully, more profitably! You can by enrolling in Sylvania's exclusive home study program, "Complete Business Practices for Radio-TV Dealers."

All the practical aspects of running a radio-TV service business are carefully explained in easily understood terms. You study at your leisure, answering the exam questions at the conclusion of each of the 12 lessons. Your answers are individually corrected; all errors are fully explained. When you've completed the entire course, a certificate of achievement is awarded.

#### COURSE PAYS OFF QUICKLY

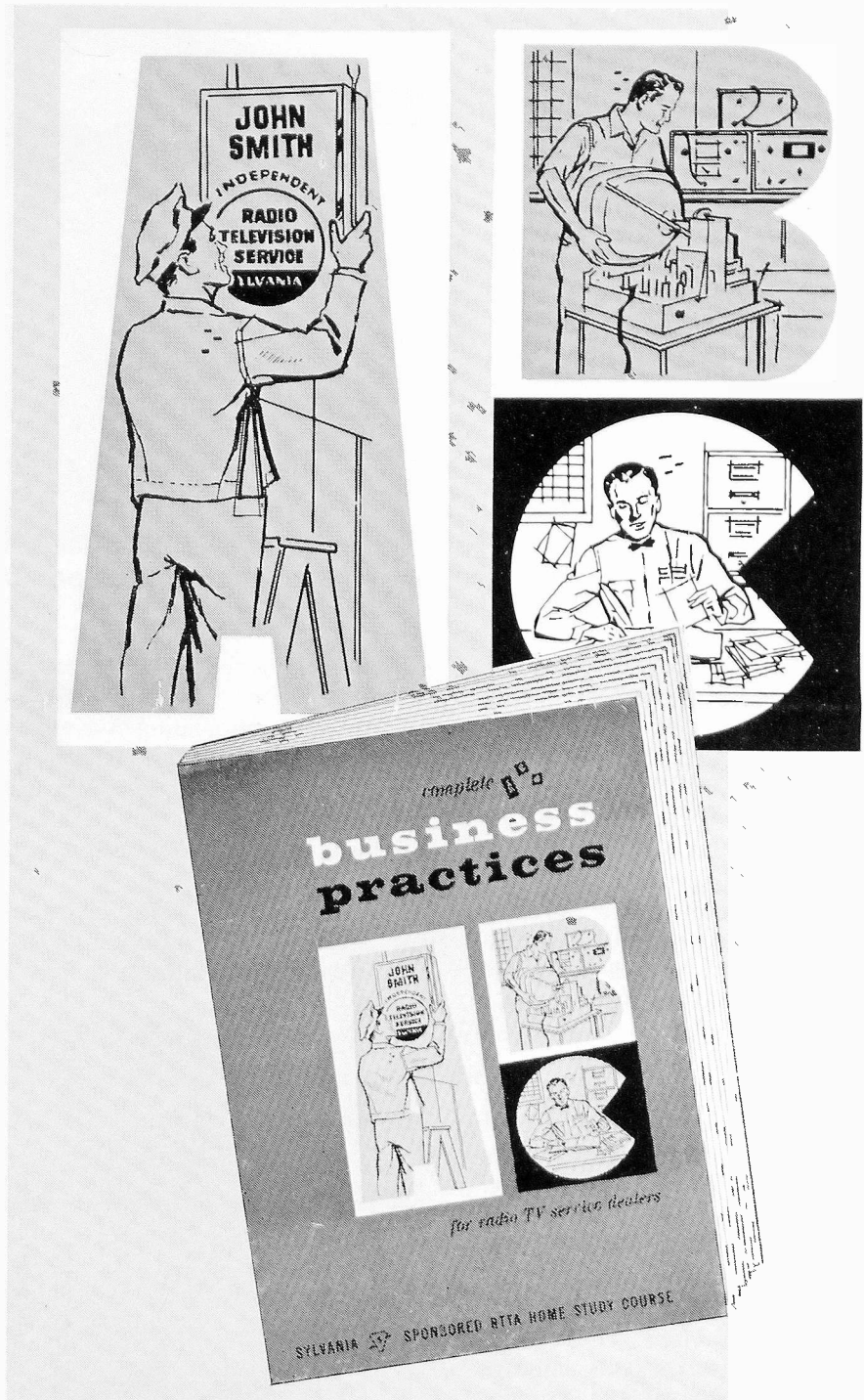
Here's one bit of business know-how you'll learn immediately: The cost of the course is deductible from your income tax as a business expense.

Incidentally, there's a whole chapter devoted to the subject of taxes. This one lesson alone is packed with enough money saving information to repay you the initial price of the course many times over.

#### HUNDREDS OF SUBJECTS COVERED

Featured in this valuable course are many other important facts of business life for the radio-TV serviceman—what records to keep . . . how to control inventory . . . advertising that sells . . . how to build good will . . . the business insurance you need . . . collecting debts . . . getting and keeping qualified personnel . . . plus literally hundreds of more tips and hints for the business-minded dealer.

This course was prepared by Sylvania under the direction of the Radio-Television Training Association. Dealers who have previously



taken the Sylvania-sponsored Black and White and Transistor Servicing Courses, know the value of these home study programs.

Sylvania's "Complete Business Practices for Radio-TV Dealers" is

another in the series of home study courses aimed at boosting the profits of the independent service dealer.

See your Authorized Sylvania Distributor today to learn how you can enroll.

# DOES LOCAL ADVERTISING PAY?

*IT DOES FOR THESE INDEPENDENT SYLVANIA DEALERS . . . IT CAN FOR YOU!*

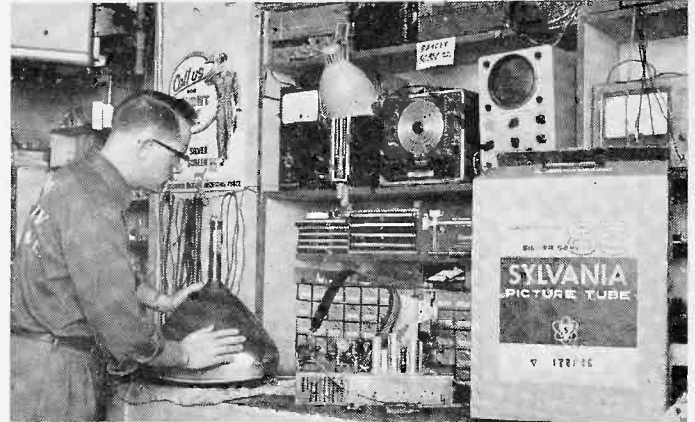
## *"I Learned First-Hand That Sylvania's Picture-In-The-Tube Ads Are Seen"*

BY WILL BROSIUS  
COONS RADIO & TELEVISION SERVICE  
GRAND JUNCTION, COLORADO

"We qualified for a series of ads sponsored by our distributor, L. B. Walker Company, that appeared in the Grand Junction Daily Sentinel. Since I make all the outside service calls myself, I got a chance first-hand to learn whether people were actually seeing these picture-in-the-tube ads.

"The photograph that was used in the ad showed me without my glasses. It was because of this that I learned Sylvania's picture-in-the-tube ads really are seen. My customers would ask me, 'How come you aren't wearing your glasses in that picture in the newspaper?' With readers catching a small thing like that, I think I can say that these ads get read and increased business is the result.

"This ad campaign does one other thing that I feel is important. It makes people conscious of Silver Screen 85. I have been selling anywhere from six to ten Silver Screen 85 picture tubes a month for the last five years, and I have never had a single in-warranty failure. It's quality like that I want my customers to know about!"



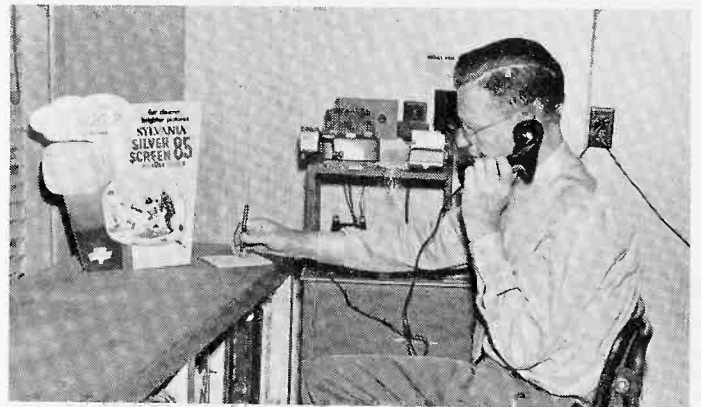
## *"My Customers Ask For Silver Screen 85 Thanks to Local Television Advertising"*

BY ED MATTHEWS  
A & M RADIO  
HURON, SOUTH DAKOTA

"Every time somebody says to me 'I saw your picture on TV,' it further convinces me of the value of local advertising.

"My purchases of Sylvania picture tubes and receiving tubes have qualified me to be a regular advertiser on a local weather show that our distributor, Stan Burghardt, sponsors on KDLO-TV.

"How do I know this advertising helps me? Well, our customers are more conscious of Silver Screen 85 picture tubes than any other brand. Many of them actually specify Silver Screen 85, and this gives us the opportunity to sell a first-line picture tube with a fair markup. Not only that, but I'd say we're getting business that we might never have gotten without the TV plug."



# HERE'S HOW YOU CAN EARN FABULOUS "CORNING WARE"

When you purchase Sylvania Silver Screen 85® Picture Tubes and Sylvania quality Receiving Tubes from your Authorized Sylvania Distributor, you're earning valuable



savings toward a complete set of fabulous "Corning Ware"—amazingly versatile cookware that is unconditionally guaranteed against breakage from extreme temperatures. You can use these dishes for frying, broiling, baking, freezing, serving and storing.

Your distributor can fill you in on the details but it's your purchase of Sylvania tubes that produces the outstanding savings on these nationally advertised saucepans, dishes and skillets.

The woman of the house will love the man of the house when he brings home "Corning Ware."



## SYLVANIA NEWS

SYLVANIA ELECTRIC PRODUCTS INC.  
1100 Main Street • Buffalo 9, N. Y.

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Buffalo, N. Y.

For

David E. Zarfin  
11905 Ivahar Street  
Wheaton, Md.

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VOL. 27, NO. 3

MARCH-APRIL 1960

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SYLVANIA ELECTRIC PRODUCTS INC.

MANUFACTURERS OF SYLVANIA RADIO TUBES, SEMICONDUCTORS, CATHODE RAY TUBES, ELECTRONIC DEVICES, FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, ELECTRIC LIGHT BULBS, PHOTOLAMPS, CAMERA EQUIPMENT, RADIO AND TELEVISION RECEIVERS.

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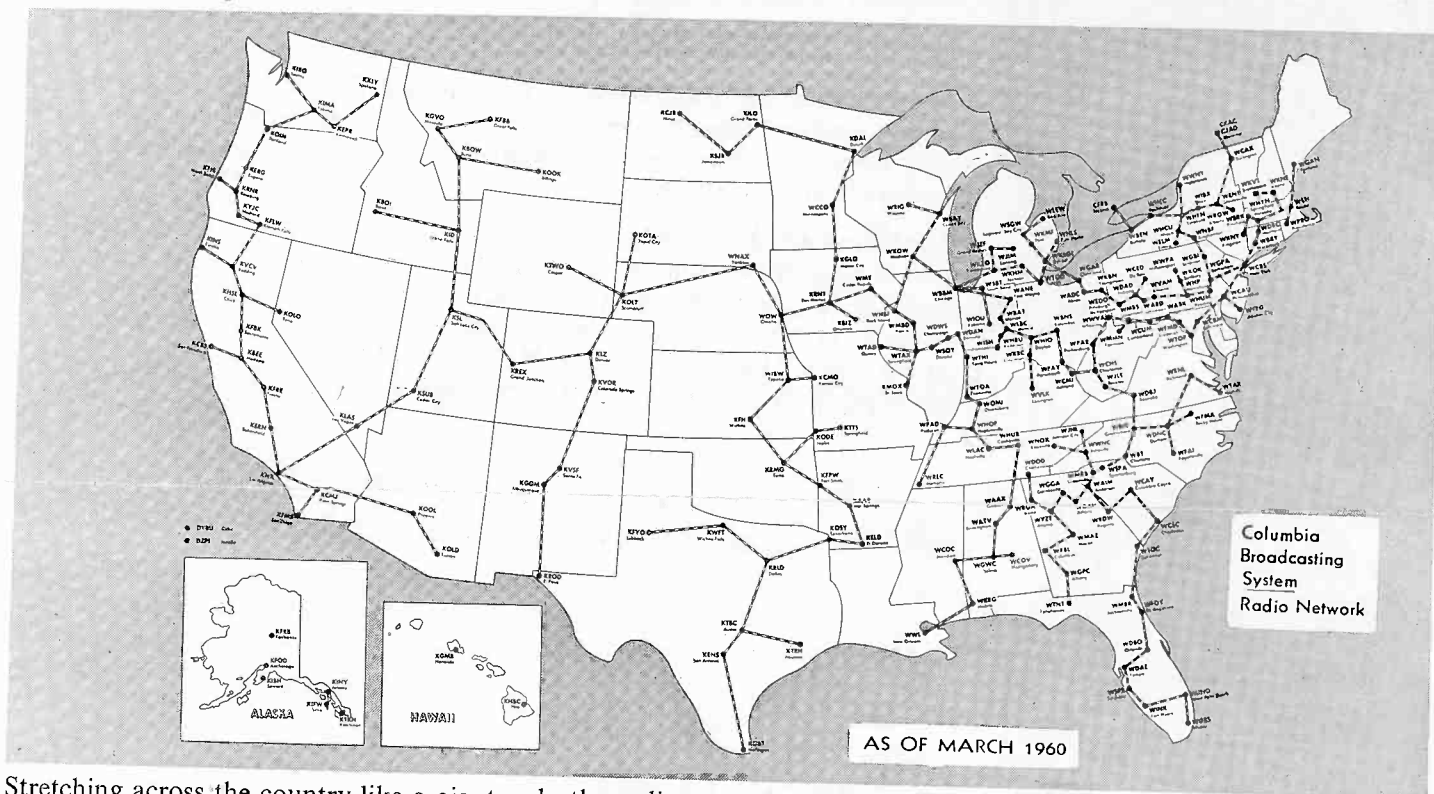
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# SYLVANIA NEWS

ALLAN POSPISIL, EDITOR THIRTIETH YEAR OF PUBLICATION • JULY - AUGUST 1960 • VOL. 27, NO. 5  
Published in the interest of the Independent Service Dealer © 1960, Sylvania Electric Products Inc.

## here's where | GODFREY SELLS SYLVANIA TUBES, DEALER SERVICE COAST-TO-COAST



Stretching across the country like a giant web, the radio network of the Columbia Broadcasting System reaches 95% of all U. S. radio homes. That's the big, coast-to-coast market Sylvania covers with Arthur Godfrey

advertising on Mondays and Wednesdays. Find your local station on this map and keep tuned to the Arthur Godfrey program—let your walk-in customers hear him selling *your* service!

## here's how | GODFREY COMMERCIALS BUILD DEALER SALES



*Collar an Arthur Godfrey listener and chances are you'll discover a Sylvania fan!*

Conjecture? Wishful thinking? Far from it! In fact, the facts are that Godfrey listeners are sold on Sylvania, thanks to a steady schedule of Sylvania commercials on the Godfrey show and to the inimitable selling talents of Godfrey himself.

### JUST THE FACTS, MA'AM!

To determine how effectively Arthur Godfrey is reaching his listeners, Sylvania hired Fact Finders Asso-

ciates, nationally known research specialists. They asked the questions, compiled the answers and came up with the facts that show how Godfrey is creating even greater demand for the products you sell—Silver Screen 85<sup>®</sup> Picture Tubes and Sylvania Quality Receiving Tubes!

Now turn the page and learn the facts about the electronic industry's most successful national advertising campaign—a campaign designed to help Independent Sylvania Service Dealers sell more!

**SPECIAL FEATURE THIS ISSUE**  
**BACK-TO-SCHOOL SEASON MEANS**  
**RE BUSINESS!—see page 9**

# GODFREY'S SILVER SCREEN 85 COMMERCIALS INCREASE YOUR SLICE OF THE PICTURE TUBE MARKET

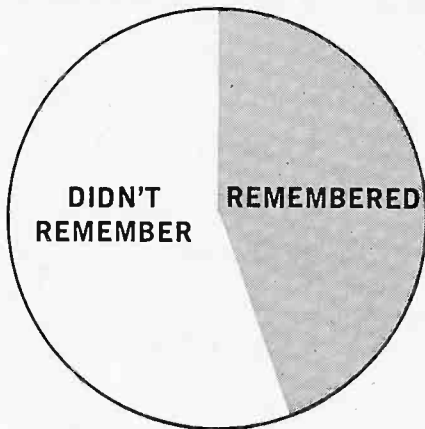
Several weeks ago a Middletown, New York TV service dealer told a Sylvania salesman that the majority of his customers were asking about Silver Screen 85® Picture Tubes. "Arthur Godfrey," he said, "is a big factor behind all the interest."

That same kind of comment has been popping up with increasing regularity throughout the country as

Sylvania's 1960 National Advertising Campaign reaches and impresses more and more American set owners.

## NATIONAL SURVEY PROVES GODFREY'S EFFECT

Here are some of the highlights from a national survey, independently conducted by Fact Finders Associates, showing the effective impact of Godfrey's Silver Screen 85 commercials on his listeners:



## GODFREY LISTENERS HAVE GOOD MEMORIES

Nearly half of all Arthur Godfrey listeners remembered that Godfrey advertises "television tubes," even though Sylvania commercials have been heard only three times every two weeks! Starting soon, Sylvania commercials will be heard *twice* each week.

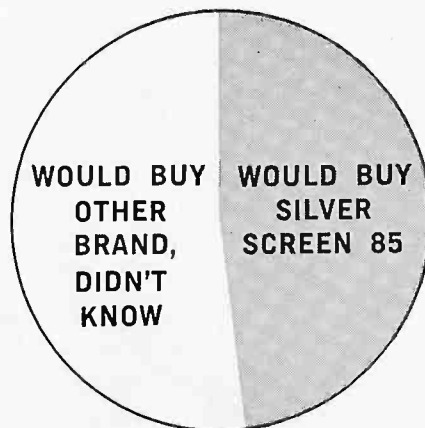
Are there many Godfrey listeners? It's estimated that over a given six-month period more than seven and a half million homes tune in to hear the Arthur Godfrey program over the Columbia Broadcasting System Radio Network. Millions of other consumers and set-owners are reached through advertising in the SATURDAY EVENING POST with ads that feature Arthur Godfrey endorsing Sylvania Silver Screen 85 Picture Tubes.



## GODFREY LISTENERS REMEMBER SYLVANIA ADVERTISING

Of those listeners who remembered that Arthur Godfrey advertises "television tubes" more than three out of five—62%—recalled specifically that he was advertising Sylvania! Furthermore, the majority of these remembered specific comments about Sylvania Silver Screen 85 Picture Tubes such as, "They're the best," "Gives sharper, longer lasting picture," and "Gives clearest, brightest picture you ever had!"

No doubt, Godfrey's unique, personal and believable style of selling account for the fact that so many of his listeners retain knowledge of specific statements about Silver Screen 85 picture tubes.



## GODFREY LISTENERS WOULD BUY SILVER SCREEN 85

Of those listeners who know that Godfrey advertises Sylvania, nearly half—47%—would buy a Silver Screen 85 if their present picture tube burned out tomorrow.

Measured another way, nearly four times as many of these listeners would buy a Sylvania Silver Screen 85 Picture Tube as would buy the two next most popular brands combined!



# NEW GODFREY POSTER IS FREE TIE-IN FOR ALL INDEPENDENT SERVICE DEALERS

Now that Arthur Godfrey's highly effective impact on American set-owners has been factually determined, Independent Dealers across the country have more reason than ever to tie in locally with display advertising featuring this top entertainment personality.

Timed to coincide with the release of this new information, Sylvania announces a brand new Godfrey poster that's available *free* to all dealers. The poster measures 26" x 20" and sells *your* service and Sylvania tubes—as Arthur Godfrey does regularly on the radio network of the Columbia Broadcasting System. Find out when Godfrey is heard in

your area. Letter a small sign with the time and station, and display it alongside the Godfrey poster.

Displayed in your shop window, this poster is an excellent means to build up your list of steady customers. See your Sylvania Distributor or write to Sylvania Electric Products Inc., CADD, 1100 Main Street, Buffalo 9, N. Y.

Remember, it's *free*, and designed to make Arthur Godfrey your shop's personal salesman!

**NEWEST WAY** to tie in with Arthur Godfrey - Sylvania advertising is this Arthur Godfrey poster (No. 2095), available free from your Sylvania Distributor.

**STOP HERE FOR EXPERT SERVICE** 

with **SYLVANIA Tubes...Repairs**  
for any make or model Radio-TV



**LISTEN TO ARTHUR GODFREY TIME MONDAY THROUGH FRIDAY ON THE CBS RADIO NETWORK**

## SYLVANIA HAS FULL LINE OF PROFIT-BUILDING GODFREY SIGNS FOR DEALER DISPLAY



**ARTHUR GODFREY WINDOW DISPLAY (No. 1139)**

This full-color, three-dimensional display is a handsome advertisement for Sylvania Silver Screen 85 Picture Tubes and for the service dealer in whose window it appears.

**ARTHUR GODFREY GLASCENE KIT (No. 1138)**

Here's a colorful, three-piece glascene display that carries three important messages, with the main emphasis on dealer "quality service."

**ALL THESE DISPLAYS ARE AVAILABLE FROM YOUR SYLVANIA DISTRIBUTOR**

# DEALERS' IDEAS AND IMAGINATION ARE THE BIGGEST WEAPON IN BATTLE FOR BUSINESS

Waycross, Georgia—a quiet Southern town (population 23,000) about one hundred miles southwest of Savannah—is home base for a modest network of “Do-It-Yourself” tube checkers, one in Waycross and one in each of seven small surrounding towns. Most are located in drugstores; one stands in an all-night gas station.

There's also a radio-TV service shop in Waycross and the dealer who runs it hasn't thrown his arms up in despair. In fact, he's pretty happy about the tube checkers because he owns them, and because his servicing business *tripled* in the first six months he had them in operation.

Ed Duncombe is his name and his shop is Dunk's Radio & TV. He's been operating the tube checkers for 18 months, and almost as soon as they went up he began pulling in new servicing jobs from all over the local area.

## PAYING OFF FAST

Ed Duncombe figures that his “branch” shops are reaping handsome dividends. Each tube checker cost him approximately \$250—and



**ED DUNCOMBE**, a dealer in Waycross, Georgia, tripled his service business with a chain of eight “Do-It-Yourself” tube checkers, including this one in a local drug store.

at the rate of business they do, and thanks to the new servicing business directly attributable to them, the machines are paying off their initial expense by about one machine a month.

While all but one of Ed Duncombe's tube checkers are located in drugstores, it's the one spotted in an all-night gas station that does the best business.

Ed Duncombe doesn't miss any tricks. He reminds local set owners

of his tube checkers by advertising them in the town's newspaper. He uses the machines themselves as a medium to advertise his own service, reminding customers that if it's not the tube, the set must need servicing.

Many other Independent Dealers around the country are making profitable gains with similar arrangements. In any case, the implications are clear that all dealers can profit from testing TV tubes and advertising the fact that they do!



## NIGHT OWL HOURS PAY OFF FOR THIS DEALER

It's not that Joe Hurd, a dealer in Flint, Michigan, is a night owl. He just likes to hear his cash register ring. And lately, it's been ringing with profitable frequency since he decided to close his doors during the day and keep them open at night.

Joe was getting some stiff competition from “Do-It-Yourself” tube checkers in the area. He met the problem in a different manner than Ed Duncombe of Waycross, Georgia, whose if-you-can't-beat-'em-join-'em solution is described above. Joe feels that one of the biggest problems facing the electronic service industry today is that dealers aren't doing enough to encourage and welcome

consumer trade into the service shops.

But we'll let Joe Hurd tell his own story:

“For some time now, I've had a completely different attitude toward the “Do-It-Yourself” tube checkers, and it just might be worth passing along.

I took the bull by the horns and changed my “shop-open” hours from all day long to the unheard of hours of 5 p.m. to 9 p.m. every day except Saturday and Sunday. Four hours a day instead of nine hours. This was done to get the tube business of the “Do-It-Himself” guy who works all day. We knew the main reason he had to take his tubes to the drugstore was because we couldn't expect him to miss programs all week waiting for Friday evening when we were open.

Well, here's what's happened, and I like it. I might even go so far as to say “bless

the do-it-yourself tube checker for encouraging him to get into his set and pull the tubes.” He has to do that first, you know, before he can bring them in anywhere to be tested.

Of course I don't kid myself by trying to do a job of testing TV tubes with a tester no better than the drugstore job. My tester will show up the prime causes of TV troubles, such as secondary emission, low level shorts, gas ionization, etc., all this with pre-wired sockets for speed and a tester which he can readily follow so he feels nobody's fooling him with some fancy lever pushing.

These tube customers have been a source of a lot of new service customers also. Thanks again to the do-it-yourself tube testers. So, don't knock the thing that will literally drive the inveterate do-it-yourselfer into your shop. Just unlock the door so he can get in.”



# TECHNICAL SECTION

JULY-AUGUST 1960  
VOL. 27, NO. 5

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

## WHAT'S NEW IN CATHODE RAY TUBES\* (Part 1)

by  
 Ross K. Gessford, Sr. Chief Engineer  
 William A. Dickinson, Section Head—Design  
 Joseph H. Loughlin, Coordinator of Engineering  
 Picture Tube Operations

Binders With Complete File of Technical Sections

The following is the first of a two-part article which makes known the technical advances in television picture tubes that have taken place in the last decade. Part I will deal primarily with advances in television picture tubes whereas Part II will relate the advances made in special purpose cathode-ray tubes plus information on a new display technique known as electroluminescence.

During the past ten years well over 100 million television picture tubes have been manufactured in a wide variety of shapes, sizes, deflection angles, screen variations and electron-gun structures. Sales of specialized cathode-ray tubes for use in closed-circuit television, industrial electronics, data processing, navigation, education, medicine and national defense have also totaled in the millions of dollars.

During the 1950's there was broad progress in monochrome television picture tubes aimed at producing improved tubes selling at lower prices. Notable trends were associated with the envelopes or bulbs of which the tubes were made. Television receiver production started in the mid 1940's with the 10-inch round glass bulb which was manufactured

by hand methods. Gradually bulb manufacturing methods were mechanized. A recent advance has been the 23-inch implosion-proof tube with squared corners introduced by tube manufacturers early in 1959 and already incorporated into the 1960 lines of several television set manufacturers.

### TUBE SHORTENING

In spite of steady increases in viewing area of the tube screen, tube lengths have decreased steadily. Early rectangular tubes had beam deflection angles across the diagonal of about 70 deg. Improvement of deflection yokes and increase in efficiency of deflection circuits permitted increase to 90 deg. deflection, with consequent reduction in tube body length from 15½ in. to 12½ in. for a 21-in. tube. In 1956, another step increased the deflection angle to 110 deg. This change reduced the 21-in. tube body length to about 9 in., and necessitated reduction in tube neck diameter and modification of the contour of the funnel-neck, over which the deflection yoke seated, to allow use of more effective and efficient yokes.

Table I shows the increase in television picture tube area and accompanying reduction in length of typical tubes manufactured in quantity in 1950 and 1960.

\*Reprinted, by permission, from the April 29, 1960 issue of Electronics, a McGraw-Hill Publication, copyright 1960.

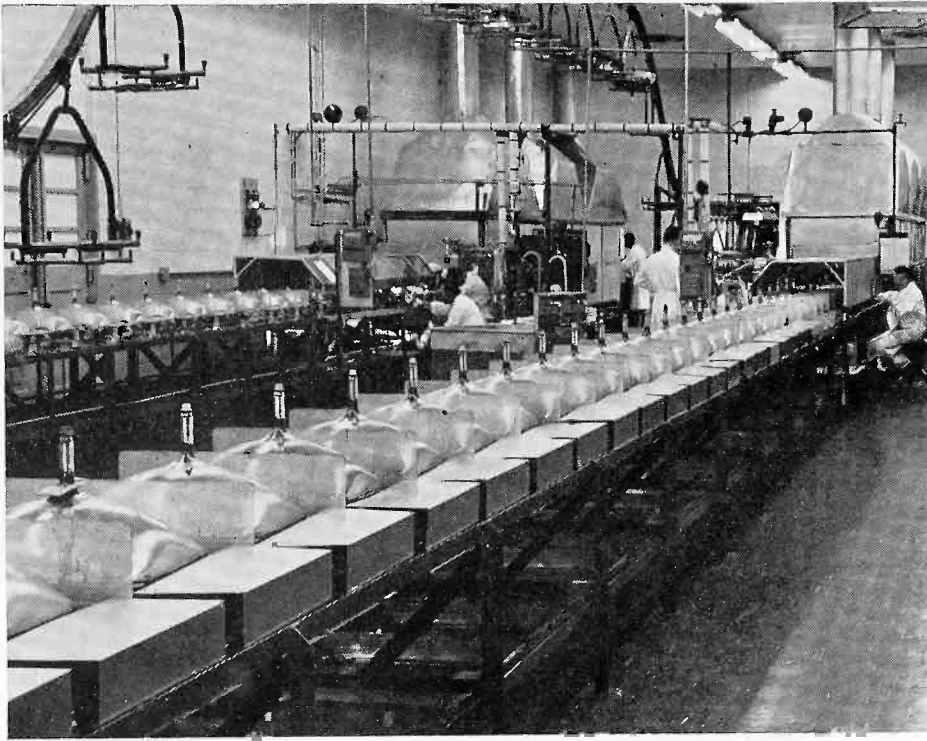
**Table I**  
 How Television Picture Tubes Have Increased in Area and Decreased in Length From 1950 to 1960

Type	1950	
	Area	Length
17BP4	149 sq. in.	19 1/4 in.
20CP4	220 sq. in.	21 7/16 in.
Type	1960	
	Area	Length
17DKP4	155 sq. in.	10 11/16 in.
21EQP4	262 sq. in.	12 9/16 in.
23CP4	282 sq. in.	15 3/16 in.
24AVP4	332 sq. in.	1 13/16 in.

### FACEPLATE IMPROVEMENT

Other developments in television picture tubes during the 50's have improved the quality of the television picture. Faceplate glass quality has improved steadily. The size and number of blisters (bubbles) and inclusions in the glass have been reduced substantially, and faceplate surface defects have been almost eliminated.

Along with projects to overcome the effect of reflective surfaces, developments have been undertaken to improve safety. Until 1959, all television receivers had been equipped with protective windows designed to contain possible tube implosions. Both glass and plastic windows had been used, and they degraded the television picture by interposing surfaces for reflection and collection of dust, as well as occasionally by surface defects.



**MANUFACTURING** line for laminating improved-type cathode-ray-tube faceplates. Tube has integral ears on coverplate to simplify mounting in receiver; design permits tube face to project well forward in receiver.

In 1959, a tube improvement appeared, consisting of a form-fitting glass shield cemented to the tube face with a layer of synthetic resin, making the face essentially a thick, laminated safety glass. It is practically impossible to make a tube of this construction implode, and the coverplate will withstand very heavy blows without damage to itself or to the tube.

At present, the tubes are being made in 23-in. diagonal size in a more rectangular shape. A 19-in. tube for portables will be available this year. Further development of this principle can be expected in the direction of reducing tube weight and improving picture quality.

#### ALUMINIZED SCREENS

Before 1950, only a few tube types used aluminized screens, but the advantages obtainable by this process are so great that since about 1953 practically all picture tubes have been aluminized. In a nonaluminized tube, a high percentage of the light from the fluorescent screen is radiated back into the bulb. Some of this wasted light returns to the face by reflection from the internal surface and reduces contrast by falling on the dark areas of the picture.

Aluminizing provides a thin, bright, optically reflective, electron-permeable aluminum film just behind the fluorescent screen, which increases screen brightness by reflecting the back-emitted light out toward the viewer. It also nearly eliminates the back lighting which degrades contrast. Aluminizing maintains the

screen at essential anode potential at high anode operating conditions, and since it protects the screen from developing ion blemish, it has allowed the omission of ion traps from electron guns currently being used. Removal of the ion trap eliminates the need for an external ion trap magnet, making tubes easier to adjust on receiver lines, and contributes to shortening the tube neck.

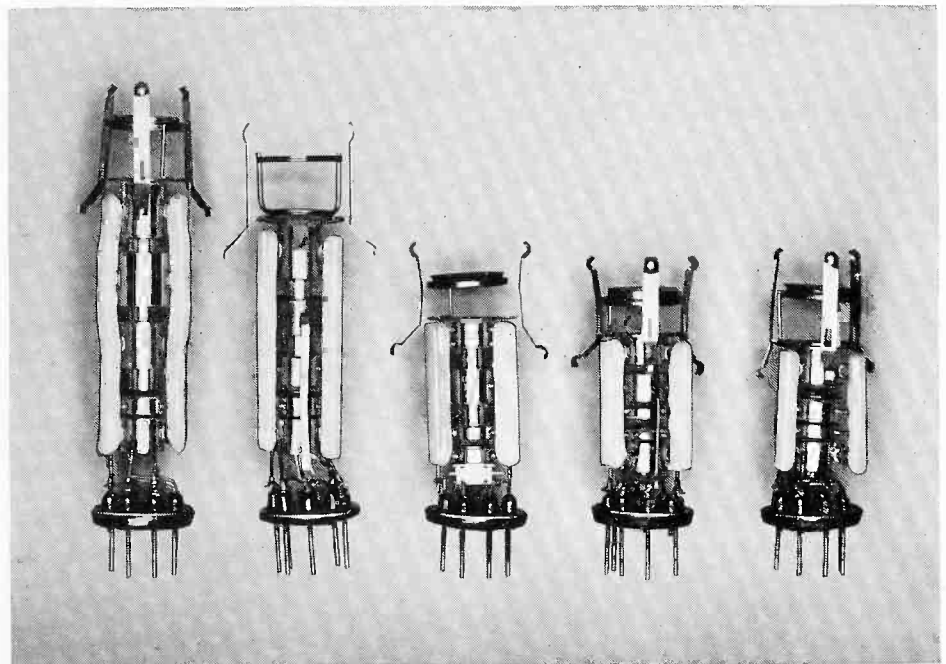
#### ELECTROSTATIC FOCUSING

Another major gun change has been the switch from magnetic to electrostatic focusing. This change required considerable industry effort to attain uniformity in focusing characteristics, and to prevent leakage and arcing within the tube.

Electrostatic focus tube design has improved steadily. Voltage ratings have increased, and guns have been shortened without sacrifice of the resolution capability. New fabrication techniques and automation have improved uniformity of tube characteristics. Electrostatic focus guns are particularly suitable for wide deflection angle tubes, since, as compared with magnetic focus guns, they have smaller beam diameter in the deflecting field, resulting in less defocusing of the beam at the extremes of deflection.

#### BUILT-IN CAPACITOR

An array of picture tube types is now



**GUNS** for 110-deg. picture tubes. Left to right: conventional double-ended anode, conventional single-ended anode, semiflat, short conventional gun and tripotential focus structures

available, consisting of combinations of the various features listed above, plus many others that have been produced to satisfy the desires of the receiver designers. Most tubes are now rated for series heater string operation, and 300, 450 and 600-ma types are available. Some progress has been made in reducing video drive voltage, and several types are now available which operate at 50 to 100 volts on the accelerating grid (grid No. 2) versus 300 to 450 volts on conventional types. Types are available with anode voltage ratings as low as 8 Kv min. and others as high as 22 Kv max. Most picture tubes have an external conductive coating over the funnel which together with the internal conductive coating on the bulb walls forms a high voltage capacitor, which is used as a filter capacitor in the high voltage supply. This external coating also shields the receiver from electrical disturbances present on the internal coating of the tube.

No survey of television display devices would be complete without mentioning projection television tubes. Seven-inch-diameter tubes, rated at 80 Kv anode voltage and having screen brightness up to 30,000 ftL are available for theater pro-

jection systems. A few projection tubes have been built for custom installation in homes and clubs.

#### TUBES FOR PORTABLE TV

Late in the decade, a great deal of work was done toward developing truly portable television receivers with self-contained power supplies. The requirements on the picture tubes for such a receiver are stringent. Tubes must be conservative of power—particularly the heater and the scanning system—and must operate with the low video signal voltage available from transistors. Picture brightness and contrast must be high since the receivers will be expected to operate satisfactorily outdoors in bright sunlight.

One portable receiver has appeared that uses a 2-in. diameter picture tube in a spherical mirror viewing system. Development is proceeding on big-picture portable sets. A heater-cathode design requiring only about 0.2-watt heater power, about 5 per cent of customary value, has been demonstrated. Several methods of reducing video signal requirements to less than 10 volts have been described. Post-deflection accelerators and scan magnifying lenses have been proposed for reducing scan power requirements.

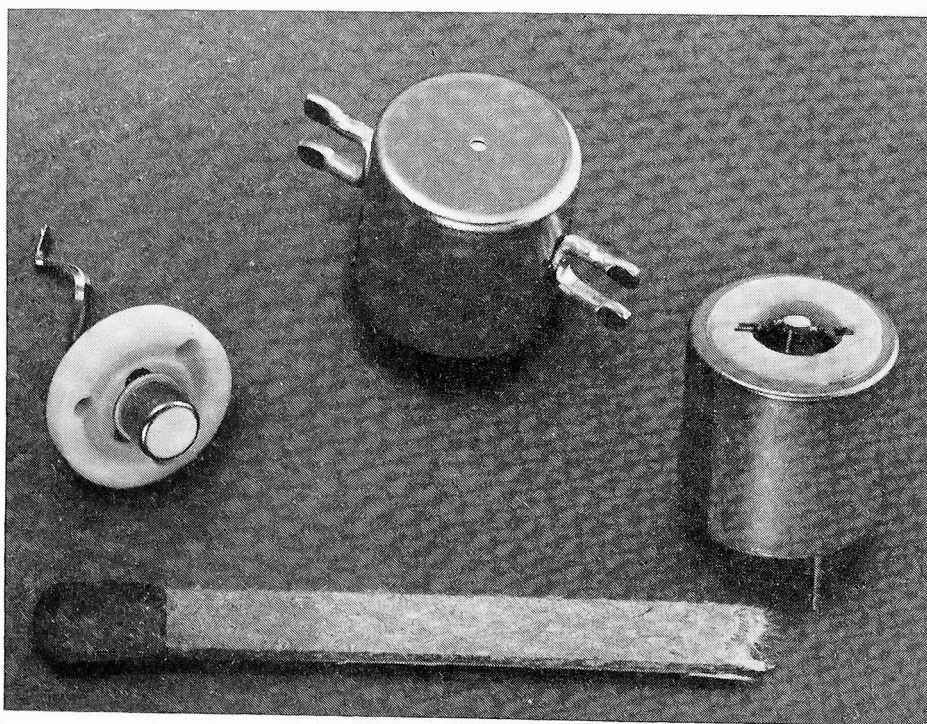
#### COLOR PICTURE TUBES

The metal color tube was developed into a commercially mass-produced form in the 1950's by a succession of developments in tube design.

The shadow mask color tube features a viewing panel or screen composed of triangular groups of three small phosphor dots, each a different color (green, blue and red), placed in front of specific holes in a mask. Three electron guns are used, one for each of the three phosphor dot colors, with the dot configurations arranged so that they are excited individually upon impingement by the electrons emitted from the corresponding electron gun.

In forming the fluorescent color array on the internal surface of the faceplate, the glass faceplate was covered with a coating of a photosensitive substance and a fluorescent material. The coating was dried and the coated faceplate was then jig-assembled with its shadow mask which had over 300,000 circular openings. One opening in the mask was associated with each triad of colored fluorescent dots in the finished tube. The faceplate and mask were properly positioned with a collimated light source electron optically corrected and the coating was exposed to light rays radiating from this source. Those portions of coating that were exposed to light became hardened. After exposure, those portions of coating that were not exposed to light were removed by development. This process was done three separate times using a zinc sulfide blue phosphor, a zinc orthosilicate green phosphor and a zinc phosphate red phosphor. For each exposure operation, the light source was offset a predetermined distance so that the colored phosphor dots in each triad were separated and properly oriented with respect to the gun and the shadow mask.

In the second half of the decade, the 21-in. round glass shadow mask color tube was introduced to mass production. This tube required new production assembly techniques, particularly in joining the screened panel section to the bulb cone section. While early glass bulbs had metal



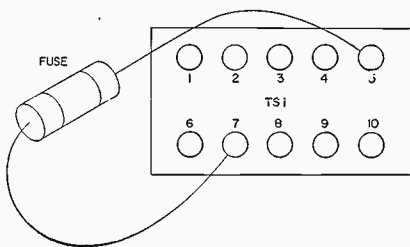
**LEFT TO RIGHT:** Conventional cathode assembly, conventional control-grid assembly and new 0.2-watt heater-cathode assembly for portable TV tubes.

flanges attached to each section and welded together to unite the sections, this welding operation was soon superseded by a frit-sealing operation in which the cone and panel were sealed together with a devitrifying glass frit. Registration of the electron beams on the phosphor dots was improved through the use of more sophisticated optics in exposing or printing the screen as well as improvements in the control of phosphor dot size. This 21-in. glass color tube superceded the 21-in. metal type in production during the late 1950's.

## SERVICE HINTS

### FUSE CONNECTION

On General Electric TV Models 14T007, 14T008, 14T009, 14T010, 14T011, 14T012 and 14T014 (M line) and some others, the fuse is under the chassis. If the line fuse blows, it can be connected on the connecting

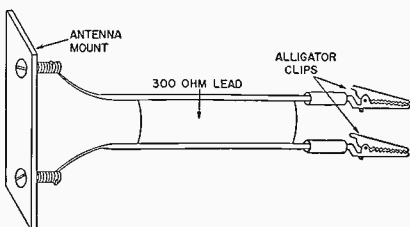


block between pins 5 and 7 of TS1 without removing the chassis, as shown above from Sam's Photofact.

*R. Bestoso*  
Middletown, R. I.

### "ANTENNA MOUNT"

Most service shops use a "clothes-pin" clip to connect to the antenna lugs on the back cover of TV receivers. Oftentimes though, when the back cover is removed and/or the chassis pulled, the antenna lead is nothing more than a piece of 300 ohm lead with the ends bared. Your "clothes-pin" clip is useless.



**Solution:** Solder a 4 or 5 inch piece of 300 ohm lead to a regular 2-lug fibre antenna mount. Alligator clips fastened to the opposite end of this short piece of lead-in will clip to the chassis antenna lead. The "clothes-pin" clip can now be coupled direct to the fibre mount.

*Hancock Radio-Tv*  
Keokuk, Iowa

### PHILCO NO. T-45 RADIO

In case transistors T-1504 or T-1542 become defective and have to be replaced, be sure to check the ohmic value of resistor R8. R8 is the resistor that allows the second IF transistor to draw the correct amount of collector current (2 ma). R8 is a critical resistor in that an appreciable amount of resistance change will result in shortened life of the transistors and poor set performance.

*A von Zook*  
Corralitos, Calif.

### PHILCO TV MODEL 50-T1403

Intermittent and, it might be added, apparently incurable picture pulling in this set may be due to sync-pulse distortion in the 6V6 output stage of the video amplifier. In the set that came under my observation, there were no discoverable component defects that might be causing this trouble. The picture distortion was usually most noticeable after the set had been operating for about two hours. The degree of pulling would range from a minor curvature in certain picture elements, especially at the top of the screen, to severe bending. It was noted that changing the setting of the contrast control in the cathode circuit of the 6V6 in either direction sometimes produced or cleared up momentarily the picture distortion.

A simple circuit alteration was found to provide a satisfactory solution to the problem. The sync take-off on this chassis is made at the junction of a voltage divider in the plate circuit of the 6V6. To make the alteration, remove the 390-ohm and 1800-ohm resistors and replace with a resistor representing the approximate sum of these values. Connect the .047-mfd. input capaci-

tor of the 6SN7 sync separator and amplifier to the output of the video detector through a 2400-ohm isolating resistor. This connection should be made at the junction of the peaking coil and the 2400-ohm sound take-off resistor.

*William Rittenour*  
Huntington 5, W. Va.

### PHILCO 7L40-7L70 SERIES TV

If the 220 ohm, 2 watt cathode resistor of the 6CU5 sound output tube is burned very badly, check the following: the video IF tubes, 2 6DE6's and a 6AM8, for shorts; the 100  $\mu$ f electrolytic, C100B, the 6AW8 video amplifier (pentode section) and, last the coupling capacitor, a .008 ceramic. Even though this is "bridged" by a pair of resistors, it is a "semi-direct coupled" circuit. Leakage in this circuit will upset the bias of the 6CU5 enough to cause it to draw excessive plate current. This is a 'stacked-B+' circuit, and the +150 volt line originates at the 6CU5 cathode.

*Jack Darr*  
Mena, Arkansas

### ERRATUM

The Zenith Model 26-297 Radio Console Service Hint which appeared in the March-April issue is incorrectly labeled. The correct Model number for this AM-FM Console is 8BLZ.

### ERRATUM

The circuit diagram of the 12-volt Citizen's Band crystal controlled converter, published in the May-June issue, is incorrect in that the three (3) capacitors having the values .001  $\mu$ f should read .001  $\mu$ f.

**CAUTION:** "The Service Hints published in SYLVANIA NEWS Technical Section are those of the individual contributors and have not been tried by Sylvania and therefore are not endorsed either expressly or by implication."

# BACK-TO-SCHOOL SEASON IS OPPORTUNITY FOR PROFITABLE HI-FI-RADIO SERVICING

Junior is off to college—and standard equipment with a major portion of America's college-bound youth is a record player or radio. College students probably log more time at the dials of a booming hi-fi than any other single group.

That's an opportunity—and this is the time—for service dealers from coast-to-coast to make profitable inroads on this lucrative market.

## NO COLLEGE IN YOUR TOWN?

No college in your town doesn't mean there's no college market there. Get a list of June high school graduates (three good sources—school authorities, the school yearbook, the local newspaper) and aim your campaign at them. Direct mail post-cards are probably most effective. ("College bound? If you're taking a record player or radio along, let us



check it over before you go!")

You'll also want to include on your mailing list the names of students *returning* to college (high school authorities can probably help you to obtain these names.)

Two other effective avenues to reach the college students in your town are available. An ad in the local newspaper could bring immediate response. (College students are avid readers of local newspapers for news of other college students.) Put a sign in your shop window and on your truck ("Attention college students!") to gain further attention.

## REMEMBER THE HIGH SCHOOL SET

The high school set, too, is a promising area for more radio-phonograph servicing jobs. If the high school newspaper accepts advertising, use it. Maybe you can make arrangements to spot a sign in several of the local teen-age hangouts—the drugstore, ice cream shop, bowling alley, etc. Local radio, certainly, is another very appropriate way to reach the high school market. If you have any children in the high school age bracket, you know radio's hypnotic power over them.

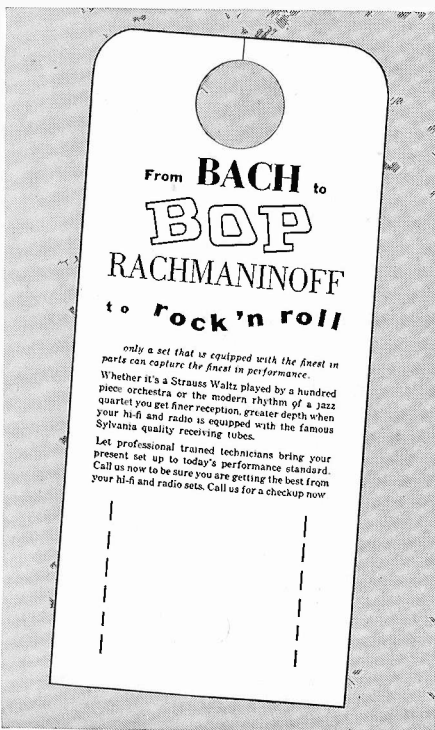
And remember, today's high school students are tomorrow's collegians.

## IS THERE A COLLEGE IN YOUR TOWN?

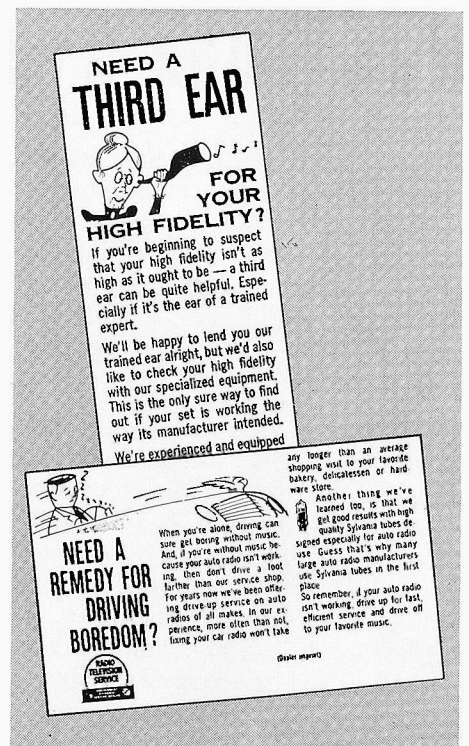
If yours is a college town, there are several good ways of attracting more servicing business from the students.

An especially effective promotional piece is a hi-fi service doorknob hanger (see photo bottom left) that's available from your Sylvania Distributor. Go through the college dormitories and leave one imprinted with your shop name and phone number on every door.

The college newspaper, and the college or local radio station are ideal media to advertise your services. Your Sylvania Distributor can supply you with ad mats (see photo bottom right) emphasizing hi-fi and car radio service, two profitable markets among college students.

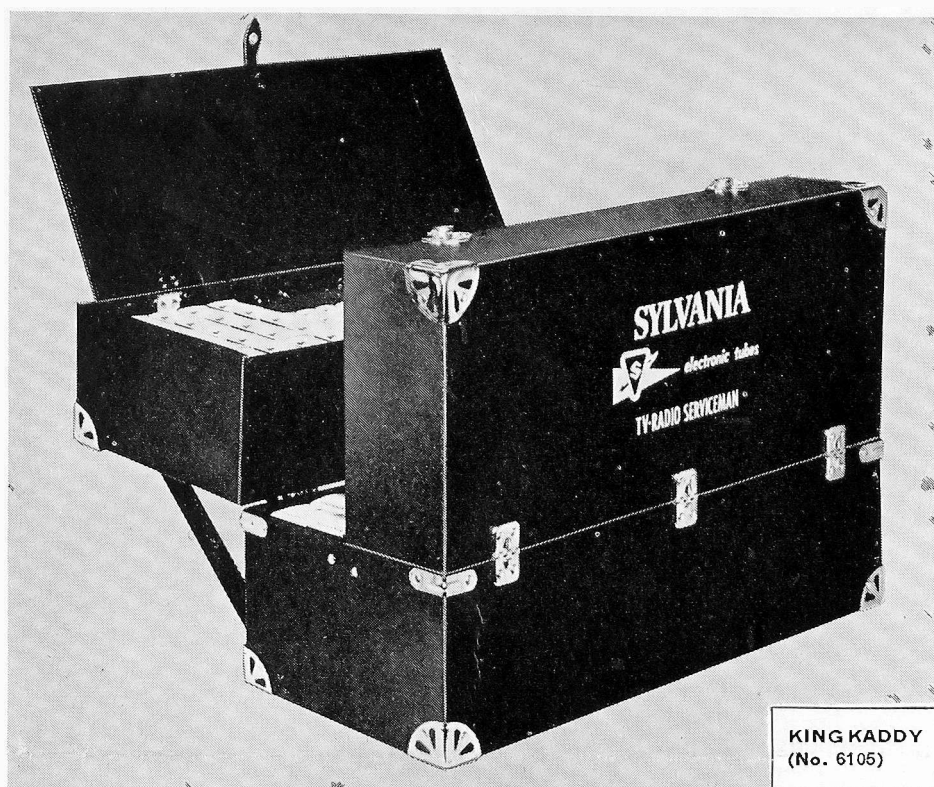


**DOOR KNOB HANGER (No. 1303)** promoting hifi servicing is natural for today's music-minded college market.



**HIFI AND CAR RADIO (No. 1073), (No. 1361)**, ad mats or post cards build high school and college servicing jobs.

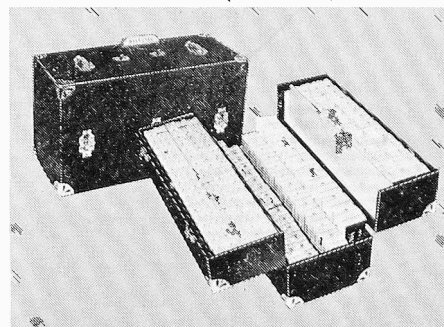
# SYLVANIA ADDS NEW KING KADDY; THREE CADDIES NOW AVAILABLE



You're looking at Sylvania's brand new King Kaddy, an indispensable aid to the radio-TV service dealer. It's compact (22" x 9" x 14 $\frac{3}{4}$ ") yet holds 300 tubes. It's light weight yet it's sturdily built of top-grade three-ply plywood and covered with scruff-proof vinyl leatherette to withstand rugged use.

This good looking caddy, featuring the Sylvania emblem and space for your imprint, is now available on an exclusive basis from your Sylvania Distributor at only \$13.95.

## JUNIOR CADDY (No. 6103)



DELUXE TNT (No. 6102)

AND KING KADDY MAKES THREE—Rounding out Sylvania's line of tube caddies are the Deluxe TNT Kit at \$20.50 and the Junior Tube Caddy at \$7.95. Both are exclusive with your Sylvania Distributor.

## New Tube Types Added To Distributor Line

Distributors from coast-to-coast are now stocking the several recent additions to Sylvania's receiving tube line. Make a note of the availability of these Sylvania-designed tubes, and always specify Sylvania Quality Receiving Tubes when ordering from your distributor.

**TYPE 1N2**—A T-12 filamentary half-wave diode. The 1N2 is similar to, and in most cases a direct replacement for, Type 1B3GT. This new type, employing a larger bulb and anode to reduce the possibility of arcing, is superior in reliability. Its application is as a high voltage rectifier in television receivers; current usage is in Silvertone models.

**TYPE 6AQ8**—A T $6\frac{1}{2}$  double triode similar to and interchangeable with Sylvania Type 6DT8. Foreign Type

ECC85 and the 6AQ8 are the same. The application of the 6AQ8 is as an RF amplifier and self-oscillating mixer; current usage is in Sylvania FM tuners and in Silvertone and Emerson stereo FM tuners.

**TYPE 6E28**—A high mu triple triode in T $6\frac{1}{2}$  construction. This is the first triple triode design and is specifically for combined functions of RF amplifier, oscillator and mixer in the VHF range. Olympic and Admiral sets have this type in their FM receivers.

**TYPE 6ES8**—A T $6\frac{1}{2}$  remote cutoff double triode with high gain performance. It employs the frame grid construction and is a retrofit for Foreign Type ECC89. Its application is as a cascode amplifier in television

tuners. Current usage is in Motorola and Philco models.

**TYPE 12/17DQ6B**—A T-12 beam power pentode similar to the DQ6A versions, but with a higher rating due to more rugged construction. These types are also controlled for heater warm-up time. Its application is as a horizontal deflection amplifier in television receivers. The 17-volt version is used in Sears sets while the 12-volt version is used in Emerson and Sears sets.

**TYPE 22DE4**—This is a Sylvania-designed T-9 half-wave rectifier. This type has higher rated characteristics than other damper types due to improved plate material and a larger plate. Its application is as a damping diode in television receivers. Its current usage is in Silvertone models.

# SYLVANIA'S SUMMER SPORTACULAR WINS APPLAUSE OF SPORTS-MINDED DEALERS



Who says Christmas comes but once a year?

Sylvania's Summer Sportacular is playing Santa Claus right now to thousands of Independent Service Dealers all over the country, enabling them to take their pick of a variety of popular sporting goods with their regular purchases of Silver Screen 85® Picture Tubes and Sylvania Quality Receiving Tubes.

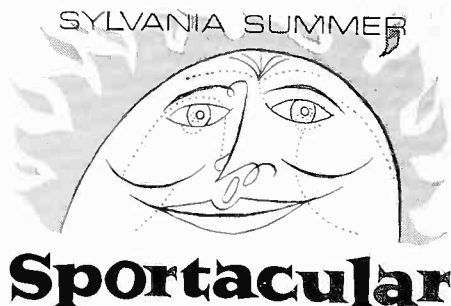
### TOP QUALITY GIFTS

Sylvania's Summer Sportacular features gifts from some of the biggest names in sporting goods manufacture—Wilson . . . Shakespeare . . . Sportcraft. Whatever sport is your favorite (or a favorite with your family), you'll find a Summer Sportacular gift to help you enjoy it more.

There is equipment for baseball, basketball, football, swimming, tennis, golf, bowling, fishing, camping, pingpong, croquet and badminton. There's even a backyard swimming pool!

All these items, sold at top retail prices in sporting goods stores throughout the nation, may be yours free or at great savings if your regular Sylvania Distributor is participating in the Summer Sportacular. If he is, you qualify for sporting gifts each time you buy Silver Screen 85 Picture Tubes and Sylvania Quality Receiving Tubes. Naturally, the size of your purchase determines which gifts you may choose.

Have more fun this Summer (and next Summer, too)! Start now to take advantage of Sylvania's Summer Sportacular!



# CHARLIE'S CORNER

Greetings!

You know, television—even with all the Summer replacement shows and repeats—is still far and away the most popular form of entertainment. Kids, for instance, watch it so much that some of them think the English channel is the one that shows British movies.



■ Say, Sylvania's Transistor Servicing Course is getting around. It's being used as a text at the University of Chaimweitzman (that's in Israel). The distributor who ordered it, Universal Radio Supply of Los Angeles, reports that the University is "highly pleased; very thrilled with it." With transistor radios so popular these days, this might be the time to do a little boning up on the subject yourself. ■ The picture is of Sam Price, San Angelo, Texas, and the name of his shop—Pioneer Television Service—is an apt one. Sam goes back a long way in the business. For instance, Sam was experimenting with TV in the 1930's, had an idea how to send music over regular telephone lines in 1925. And take a look at the "pioneering" Sylvania tube he's holding. This business has sure come a long way . . . ■ Time to sign off. See you next issue.



# SYLVANIA NEWS

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MANUFACTURERS OF SYLVANIA RADIO TUBES, SEMICONDUCTORS, CATHODE RAY TUBES, ELECTRONIC DEVICES, FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, ELECTRIC LIGHT BULBS, PHOTOLAMPS, CAMERA EQUIPMENT, RADIO AND TELEVISION RECEIVERS.

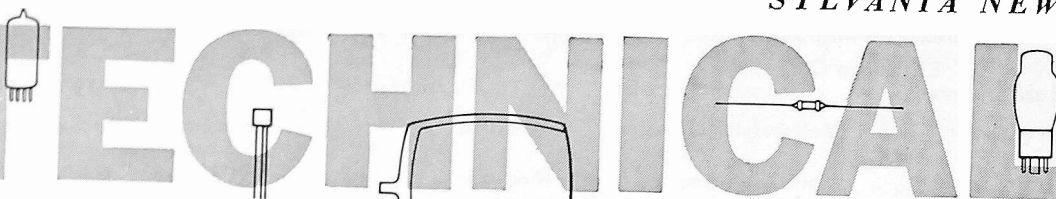
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## TECHNICAL INFORMATION

What's New in Cathode Ray Tubes  
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# TECHNICAL

SEPTEMBER  
OCTOBER 1960  
VOL. 27, NO. 6

## SECTION

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

# WHAT'S NEW IN CATHODE RAY TUBES\* (Part II)

by

*Ross K. Gessford, Sr. Chief Engineer*

*William A. Dickinson, Section Head—Design*

*Joseph H. Loughlin, Coordinator of Engineering*

*Picture Tube Operations*

In the first of this series of two articles, the technical advances in television picture tubes that have taken place in the last decade were discussed, including such subjects as Tube Shortening, Faceplate Improvement, Color Picture Tubes, etc. This second and last article will relate the advances made in special purpose cathode-ray tubes plus information on a new display technique known as electroluminescence.

### TUBES FOR OSCILLOGRAPHY

While the preceding discussion deals with the development of display devices for their largest single application, television, the past 10 years also have seen the development of a great variety of widely differing cathode-ray display tubes for a host of specialized applications, many of them new.

As the requirements on oscilloscopes for testing electronic equipment became more stringent, they were reflected in tighter requirements on the cathode-ray tubes used in this equipment.

New types appeared with reduced spot size, improved deflection sensitivity, improved deflection linearity and reduced pattern distortion. Notable among these were the helical

anode post accelerator types, in which a post-deflection beam accelerating field is distributed along the length of the tube by a conducting helix on the inner bulb wall. These tubes are capable of 6:1 post-acceleration ratios, and combine the optimum in deflection sensitivity, deflection linearity resolution and brightness.

For particular applications, a number of multigun tubes having from 2 to 5 guns were introduced commercially, as were tubes with flat faceplates, tubes with rectangular screens, tubes with deflection plate connections brought out through the bulb walls to reduce capacitance and inductance in their circuits, high accuracy nonaccelerator types and many other variations. Tube manufacturers supply most of their types with any of a variety of fluorescent screens. (See Table II.)

Radar indicator tubes and cathode-ray tubes for other military gear became more specialized and were built to closer tolerances and with improved quality, especially the quality of the glass bulbs and the fluorescent screens. Direct view storage tubes have been developed for high brightness radar displays, taking the place of tubes with long persistence Fluorescent screens.

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Several ultrahigh resolution tubes having trace widths less than 0.001 in. have been developed for photographic recording of high-definition radar information.

The emergence of electronic computers has required developing high-accuracy scope tubes for display of analog information and other tubes for storage and for readout of digital information. Several tubes were introduced which form alphanumeric characters by passing the beam through appropriately shaped apertures. The Charactron, used in Sage situation displays, can write up to 64 different characters at any point on its screen and also present analog data. The Typotron is a character display device uniting tube with storage so that alphanumeric information can be written on the screen and held as long as desired.

### TRAVELING-WAVE CRT

An interesting new type of display tube, the Wamoscope, was declassified in 1956. The Wamoscope incorporated most of the features of a microwave receiver in a single envelope. The tube consisted of three parts: a traveling wave tube section, a velocity-sorting detector and a cathode-ray screen. This special tube allowed the direct display of microwave frequency radar information and the like.

A development of the late 1950's

TABLE II—Characteristics of EIA-Registered Standard Phosphors

Phosphor	Emission Color		Persistence	Application
	Fluorescence	Phosphorescence		
P-1	Yellowish green	Yellowish green	Medium	Cathode-ray oscillographs and radar
P-2	Yellowish green	Yellowish green	Medium	Cathode-ray oscillographs
P-3	Yellowish orange	Yellowish orange	Medium	Monochrome television picture tubes
P-4	White	White	Medium to medium short	
P-5	Blue	Blue	Medium short	Photographic recording
P-6	White	White	Short	Obsolete—originally used in television receivers
P-7	White	Yellowish green	Blue, med. short Yellow, long	Radar
P-8	Obsolete	Replaced by P-7	Dark trace, very long	Outside source of light is used for observation; persistence from seconds to several months
P-9	Obsolete			
P-10				
P-11	Blue	Blue	Medium short	Photographic recording
P-12	Orange	Orange	Long	Radar
P-13	Reddish orange	Reddish orange	Medium	Military displays where repetition rate is 2 to 4 seconds after excitation is removed
P-14	Purplish blue	Yellowish orange	Blue, medium short Greenish yellow, medium	
P-15	Green	Green	Visible, short Ultraviolet, very short	Television pick-up of photographs by flying spot scanning
P-16	Bluish purple	Bluish purple	Very short	Television pick-up of photographs by flying spot scanning
P-17	Yellow white to blue white	Yellow	Blue, short Yellow, long	Military displays
P-18	White	White	Medium	Low frame rate television
P-19	Orange	Orange	Long	Radar indicators
P-20	Green to yellow green	Green to yellow green	Medium to med. short	High visibility displays
P-21	Reddish orange	Reddish orange	Medium	Color television
P-22	Tricolor phosphor screen		Medium	
P-23	White	White	Medium	Low temperature white—(Sepia) interchangeable with P-4
P-24	Green	Green	Short	Flying spot scanner tubes
P-25	Orange	Orange	Medium	Military displays where repetition rate is 10 seconds, to 2 minutes after excitation is removed
P-26	Orange	Orange	Very long	Radar display
P-27	Reddish orange	Reddish orange	Medium	Color television monitor service
P-28	Yellow green	Yellow green	Long	Radar display
P-29	Two-color phosphor screen		Medium	Indicator in aircraft instruments

that promises much future usefulness is the Videograph, or high speed electronic printer, the heart of which is a cathode-ray tube having a target consisting of an array of many fine wire conductors sealed through the bulb face. Charge patterns written on the target by the beam are transferred to sensitized paper outside the tube face where they are developed by the Xerography process. The system can presently print the equivalent of three 8½ by 11 in.

pages of typing a second.

#### PHOSPHORS

Phosphors for cathode-ray tubes are inorganic crystalline materials capable of converting electron energy into luminescence. The fluorescence and the phosphorescence (persistence) characterize the useful properties of these phosphors. The physical and chemical aspects of a phosphor determine the nature (color, brightness and persistence) of

the luminescence. Most cathode-ray and television picture tube screens are composed of phosphor particles whose particle size usually lies between 2 and 20 microns. Most of the phosphors listed in the table were developed or improved in brightness and/or color uniformity in the last 10 years.

#### SCREENS

Higher resolution cathode-ray tubes have been made possible by reduced

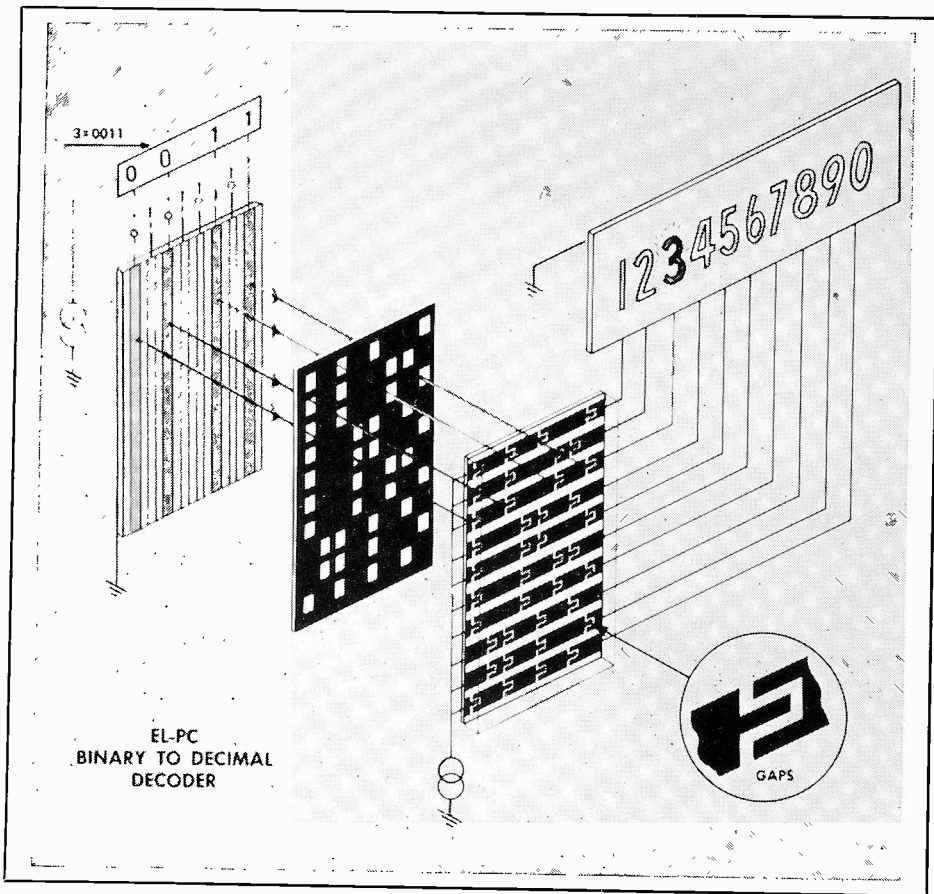


FIGURE 1—Binary-to-decimal decoder.

electron beam diameters and by improved phosphor and screening techniques which allow less apparent spot size growth. Actual spot size measured on the face of a regular cathode-ray tube always appears larger than the actual electron beam. This effect can be attributed to light scattering by the phosphor particles adjacent to the particles actually excited by the electron beam. By preparing screens of much smaller particle size phosphors and using tighter control of the screening techniques, this increase in spot size due to light scattering is minimized. Such screens are known as fine grain screens and have produced from 3000 to 6000 lines resolution on a 5-in. tube.

Another approach to producing an idealized screen for fine spot or high resolution tubes is the so-called transparent screen. Phosphors can be evaporated inside a glass envelope in the same manner as aluminum films. Vapor kinetic processes may also be used. Extremely thin evaporated screens are transparent and are composed of crystals so minute as to

be invisible at very high magnification. When an electron beam strikes such a screen, resulting spot size is nearly a direct measure of the electron beam diameter. These transparent screens have been produced commercially.

#### ELECTROLUMINESCENT DEVICES

The last decade marked the commercial development of a light-producing display device known as the electroluminescent lamp. The light source for this lamp is the result of the phenomenon called electroluminescence which specifically defines the conversion of electricity into light within a phosphor. The electroluminescent lamp is a planar or area solid-state device. Because it has no filament, catastrophic failure is not a problem.

The electroluminescent lamp is a flat plate luminous capacitor activated by an alternating current. In early construction, it consisted of a sheet of glass rendered conductive on one side by the application of a transparent conductive film. This film, in turn, was coated with a thin

layer of a special phosphor (electroluminescent) dispersed throughout a solid or liquid organic dielectric. In turn, the phosphor-dielectric layer was coated with a metallic conductor. Lead wires, attached to the conductive film on the glass and to the metal foil, completed the capacitor.

Further development led to the replacement of the organic dielectric by a glass dielectric and to the replacement of the glass base with a metal plate. This metal sheet serves as one conductor and provides mechanical strength and physical rigidity to the completed lamp. A ground coat layer of solid ceramic material to act as an insulator and reflector is fired onto this base sheet. Next, the ceramic dielectric containing suspended electroluminescent phosphor is applied. This is the light-emitting layer. A transparent electrically conducting layer is then applied to the dielectric-phosphor coating and serves as the other plate of the capacitor. One electrical connection is made to the metal and the other to the transparent conductive layer. Finally, a finish layer of transparent glass is applied over the conducting layer to protect the lamp from mechanical damage and to provide a protective insulating outer surface.

This electroluminescent light source can also be employed to create dynamic solid-state panel display devices since light is emitted where, and only where, there is capacitive coupling. By approximate patterning of the top or bottom conductive films in given areas any shape, configuration or group of areas may be made to light individually or in unison. Numeric and alphanumeric panels developed late in the 1950's are examples of the use of electroluminescence.

Electroluminescence can be used in combination with other phenomena, such as photoconduction, to produce many useful devices. A photoconductive material serves as a resistor as long as it is in the dark, and becomes a conductor when light shines on it. Actually, a film of photoconductive material is a light-sensitive switch.

The capability of adding a photoconductive control or switch element to the electroluminescent sandwich

produces a tool that can be used as a solid-state switching device. This basic photoconductive - electroluminescent switch makes it possible to build circuits to process complex logical functions. (See Fig. 1). These circuits are capable of converting information without the need of mechanical switches or diode networks.

#### ERRATUM

What's New in CRT's (Part I)

In Table I of the July-August issue, the length of Type 24AVP4 should be corrected to read  $14\frac{13}{16}$  inches.

## SERVICE HINTS

**CAUTION:** "The Service Hints published in SYLVANIA NEWS Technical Section are those of the individual contributors and have not been tried by Sylvania and therefore are not endorsed either expressly or by implication."

#### ISOLATION OF HORIZONTAL OSCILLATORS

Probably one of the most difficult sections to service in a TV receiver is the horizontal section. One major cause for this difficulty is the fact that the horizontal oscillator receives its B+, in many receivers from the damper tube boost. This makes it difficult to determine whether the difficulty lies in the oscillator, drive, or damper section.

To help isolate the trouble, remove the boost voltage lead after linearity control coil. This is the point from which the horizontal oscillator, drive tube screen and vertical section receive B+. Then supply B+ from a separate power supply or another TV receiver to these sections.

In most cases, damper troubles can easily be isolated from oscillator and drive faults through this procedure, saving the serviceman many hours of troubleshooting.

*Tele-Labs*  
Brooklyn 3, N. Y.

#### HANDY STYLUS INSPECTOR

I find my home movie projector extremely handy when inspecting phonograph needles. I simply position the tip of the needle near the light and thereby obtain a magnified image on the screen. This method enables you to determine the condition of the tip with ease.

*James R. Green*  
Brounland, W. Va.

#### PREVENT BATTERY CORROSION DAMAGE

When installing new batteries in portable receivers, I wrap them in the small liquid-tight plastic food bags obtained at grocery stores. Thus, should the battery develop a leak, the plastic bag will prevent the acid from ruining the cabinet or damaging nearby parts.

*James R. Green*  
Brounland, W. Va.

#### PLASTIC TAPE—TUBE EXTRACTOR

The "outside" of plastic tape will not slip on glass. I use it, between finger tips, to pull tubes from crowded quarters where you can only get hold of the uppermost portion of the glass bulb.

*Kenneth Lappin*  
Urbana, Illinois

#### SOLDERING IRON OR STEEL COMPONENTS

When you run into trouble soldering to galvanized iron, cast iron or steel components, remove the hair bristles from the tin-handled brush commonly used to spread liquid acid flux, and replace the bristles with a bundle of fine copper wires cut from a piece of stranded cord. Connect the tin handle to the positive side of a 2 or 3 volt battery source, and the negative terminal to the work. Then use this "copper" brush to apply the liquid flux. This coats the metal with a plating of copper, to which the solder

then adheres quickly, firmly and easily.

*Harry J. Miller*  
Sarasota, Florida

#### SLIPPING CLUTCHES

Slipping clutches in car radios, having push buttons and cork clutches can be repaired without rebuilding the clutch by using GC dial cord dressing. Apply to cork face and keep clutch plates apart until dry. This method will result in good non-slip action.

*Stewart E. Leightner*  
Jackson, Michigan

#### PHILCO 21T204 TV

Intermittent loss of vertical height, with a black band at the bottom of the picture, was 'cured' by replacing the vertical output tube: this had no effect at all, as did replacement of the vertical oscillator! The trouble was finally traced to an intermittent filament in one of the two 5U4 rectifiers. The clue that brought about the correct repair was a loss of *focus* at the same time the trouble showed up.

*Jack Darr*  
Mena, Arkansas

#### RCA KCS-104, 104A CHASSIS TV

If the vertical hold action in this series is okay when first turned on, but slowly drifts over a 20-30 minute period until the picture cannot be stopped with the hold control at all, check for a very small leakage in the coupling capacitor between the vertical integrator and the vertical oscillator grid. This is a .0047  $\mu$ f unit, in most sets. This leakage is very small, and will show up on only the most sensitive capacitor testers. To be safe, replace not only this capacitor, but the two in the 'feedback' network, from output section plate to input section. These are .015  $\mu$ f and .0027  $\mu$ f. Always use at least 600 volt capacitors; and check the replacements very carefully for leakage before installation.

*Jack Darr*  
Mena, Arkansas

# TECHNICAL SECTION

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

## THE 8YP4 AS A "UNIVERSAL" CHECK TUBE

Sylvania's 110° universal test tube Type 8YP4 may be substituted for any standard 110° picture tube except "SF" types which employ a different heater rating. Many servicemen have asked whether the 110° 8YP4 can be substituted for larger neck picture tube types. Such substitution is possible, but extra effort is required as outlined in the following article.

There are three types in Sylvania's line of TV receiver check tubes, each specifically designed and recommended for use in certain deflection applications. The 5AXP4 is recommended for 52° and 70° applications; the 8XP4 to 90°; and the 8YP4 for 110° deflection applications. However, we do receive inquiries from time to time asking if the 110° 8YP4 can also be used as a check tube for 90°, 70° and 52° deflection applications. This can be accomplished provided the serviceman is willing to: (1) accept the attendant reduction in raster size; (2) overcome the slight mounting problem associated with the difference in neck size (diameter); and (3) construct several socket adapters for the 8YP4 to accommodate the picture tube basings currently in use on 90°, 70° and 52° tubes.

### SOLVING THE RASTER PROBLEM

Figure 2 shows the amount of scan that is produced when the 110° 8YP4 is substituted in receivers in which

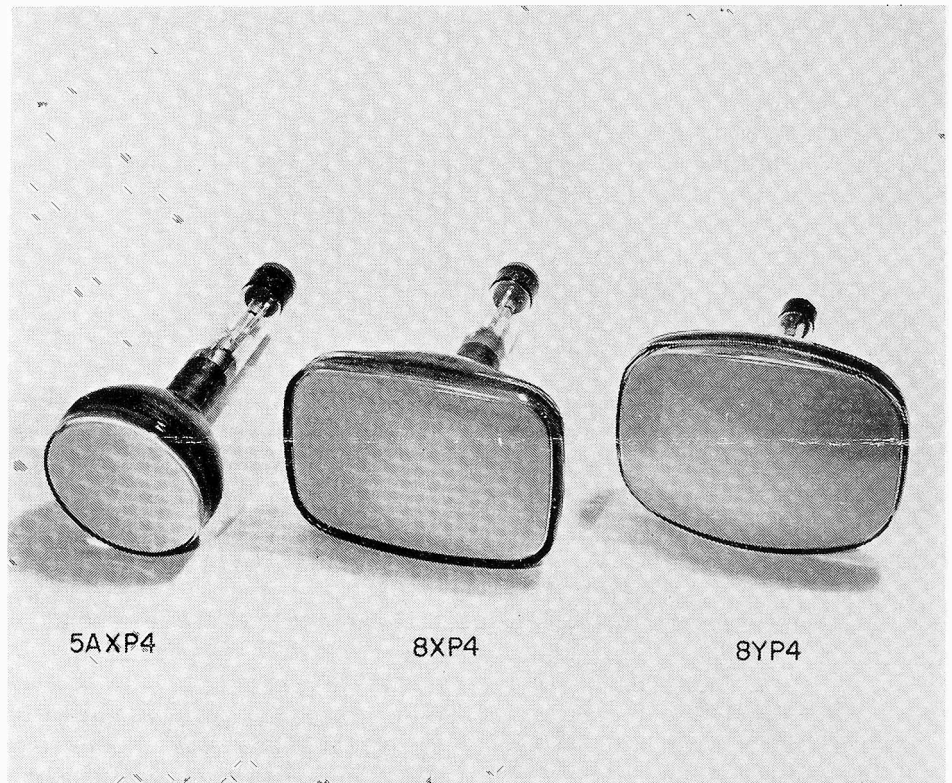


Figure 1.—Sylvania's line of TV Receiver check tubes. The 5AXP4 is recommended for 52° and 70° applications; the 8XP4 to 90°; and the 8YP4 for 110° deflection applications.

90°, 70° or 52° picture tubes are fully scanned. The small amount of neck shadow, evidenced by the shaded areas in Figure 2, is insignificant. Reference marks can be recorded directly on the face of the tube with a suitable marking crayon or a separate lucite mask similar to the one supplied with the 8YP4 can be prepared.

### MOUNTING PROBLEM— Simple to Overcome

The 8YP4, like regular 110° picture tubes, has a neck which is  $\frac{3}{16}$ " smaller

in diameter than the necks of 90°, 70° and 52° tubes. When substituted for these tubes, some sort of shim is needed to properly center the 8YP4. This shim can be constructed of practically any odd-and-end in the shop—provided, of course, the material is non-metallic. For instance, three (3) pieces of wood  $\frac{3}{16}$ " square and approximately 3" long, spaced 60° apart around the tube neck would suffice. Or a piece of thin cardboard or heavy paper could be rolled and glued to form a cylindrical bushing having a wall thickness of  $\frac{3}{16}$ ". There

are many ways of overcoming this problem—some of which might prove to be good Service Hint material.

To provide for rigid mounting, the tube should be held in place by means of a suitable clamp. An old ion-trap, with the magnet removed, will serve in this capacity. This will insure adequate tube protection and prevent the tube from sliding out of position.

#### SOCKET ADAPTORS

The Sylvania 8YP4 is supplied with a rigid-pin socket adaptor to accommodate 110° tubes employing rigid-pin bases. However, it will be necessary to construct several socket adaptors to accommodate the picture tube basings currently in use on 90°, 70° and 52° tubes.

#### CONCLUSION

The serviceman, who chooses to employ the 8YP4 as his only check tube, may substitute it as described above, for picture tubes having any of the following heater ratings: 6.3 volt—600 ma; 6.3 volt—450 ma; or 8.4 volt—450 ma. When through trouble-shooting, final touch-up adjustments of picture controls should always be made with the regular picture tube installed in the TV receiver.

## SERVICE HINTS

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#### TUBE USED AS CONTINUITY CHECK

When my TV Test Picture tube is in use in another set and I need continuity in a series filament TV string that exhibits audio trouble (or any other trouble that doesn't require viewing the Picture tube screen), I substitute a 6SN7 to complete the circuit. This is accomplished by clipping off all except the filament pins. This arrangement might be used in cases where the Picture tube has been left in the cabinet at the Customer's house or even where the test tube presents a space problem on the bench. One precaution is necessary—and that is to tape-down the second anode lead so as to prevent arcing or shock.

*Chuck Belote*  
St. Louis 37, Mo.

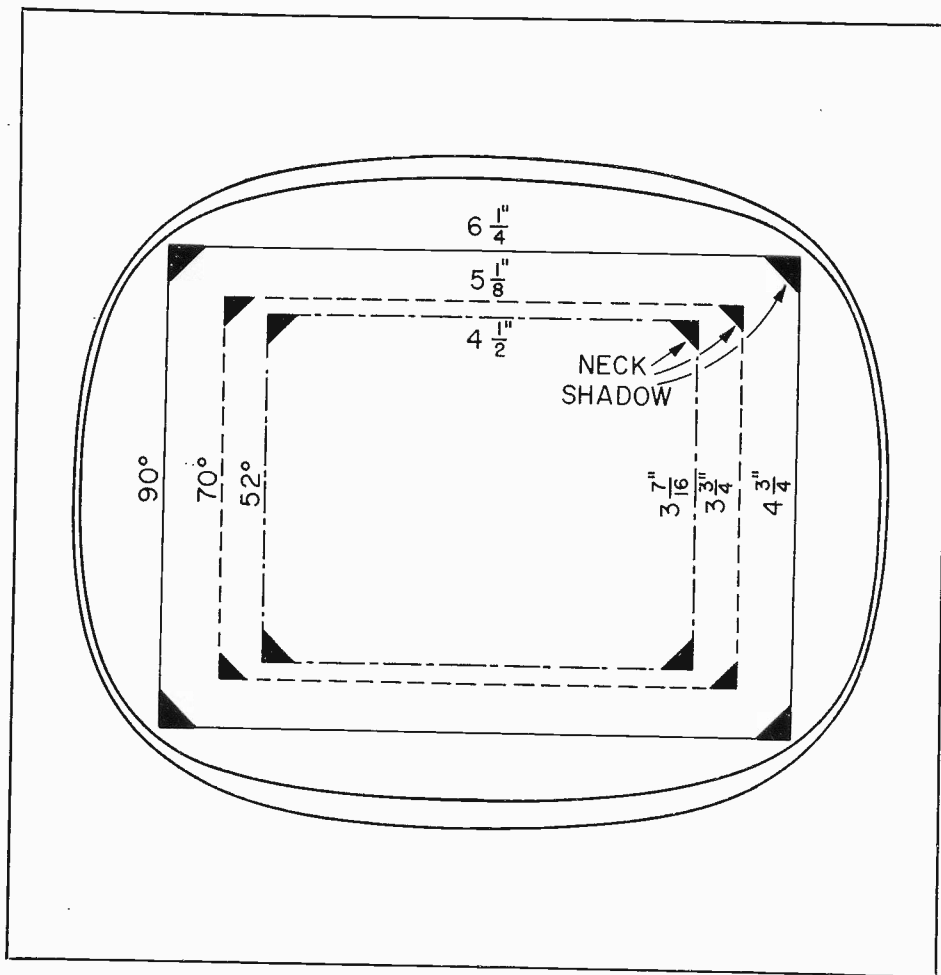


Figure 2.—Shows the amount of scan that is produced when the 8YP4 is substituted in receivers in which the regular picture tubes are fully scanned.

## Supplements To 11th Edition Technical Manual

Early in 1959, Sylvania introduced a new expanded supplemental data service to provide the Serviceman with a means of keeping abreast of the steadily increasing number of Receiving, Picture and Industrial Cathode-Ray tubes. This program provided for a minimum of six supplement packets of 30 types each to be distributed over a two year period. The subscription service is provided at no extra cost to purchasers of the 11th Edition Manual which sells for \$3.00. It is also available at a cost of \$1.00 to those who choose to maintain the 10th Edition.

To date, five packets of approximately 30 supplements each have been distributed to subscribers. A listing of these supplements in numerical alphabetical sequence, follows for the benefit of those who wish to make certain that their manual is up-to-date. In the event

subscribers registered with Sylvania find that they are missing particular supplements, replacements can be obtained from Sylvania Central Advertising Distribution Department, 1100 Main Street, Buffalo 9, New York—be sure to state the type number and the appropriate packet number.

Owners of the 11th Edition Manual are reminded that the return-addressed registration card supplied with each new manual must be filled out and mailed before they will receive the supplement subscription service.

In event your address has changed since you returned the 11th Edition Manual Registration Card or subscribed to the supplement service, advise the aforementioned Department of Sylvania immediately. When doing so, *remember that you must state both your old and new address.*

## RECEIVING TUBES

TUBE TYPE	PACKET NO.
1DN5.....	2
1N2.....	3
2E26.....	2
2EN5.....	1
6AF3,12.....	2
6AQ8.....	5
6AX4GTB.....	4
6CA4,EZ81.....	2
6CA5,12,17,25,50.....	4
6CA7.....	3
6DE4,17,22.....	4
6DJ8,7.....	4
6DN7.....	1
6DQ6B,12,17.....	4
6DR7,10,13.....	2
6DT5,12,25.....	2
6DT8,12.....	3
6DW5,12.....	1
6DZ7.....	3
6EA5,2,3.....	2
6EA7.....	5
6EA8,5.....	2
6EB5.....	5
6EH5,12,25,50.....	1
6EH8,5.....	2
6EM5,8.....	2
6EM7.....	3
6ER5,3,2.....	4
6ES5,3,2.....	4
6ES8,4.....	4
6ET7,8.....	4
6EU8,5.....	5
6EV5,3,2.....	4
6EV7.....	5
6EW6,4.....	2
6EW7,10.....	5
6EX6,21.....	3
6EY6,7.....	3
6EZ8.....	3
6FH5,3,2.....	4
6FV6.....	2
6FV8,5.....	2
6GH8,5.....	5
6GJ8.....	5
6GK6.....	5
6GM6.....	5
6GN8,8.....	3
6GS8,4,3.....	4
6HC8,17.....	5
6L6GC.....	3
10EG7.....	3

TUBE TYPE	PACKET NO.
12DK7.....	5
12DQ7.....	3
12DS7.....	1
12DU7.....	1
12DV7.....	1
12DY8.....	2
12DZ6.....	1
12EC8.....	2
12EK6.....	1
12EN6.....	1
12FK6.....	1
12FM6.....	5
12FR8.....	3
12FX8.....	3
18FW6.....	1
18FX6.....	1
18FY6.....	1
18HB8,35.....	4
32ET5.....	2
36AM3.....	2
50FY8.....	3
5763.....	2
5881.....	3
6146.....	2
6267.....	3
6550.....	3
6973.....	3
7025.....	1
7189,A.....	3
7199.....	2
7543.....	3
7687.....	5
7754,7695.....	5

## PICTURE TUBES

TUBE TYPE	PACKET NO.
8KP4.....	5
9QP4A.....	1
14AJP4.....	2
14NP4,A.....	1
17CKP4.....	2
17CRP4.....	1
17CYP4.....	5
17DCP4.....	1
17DJP4.....	1
17DKP4.....	1
17DLP4.....	4
17DQP4.....	2
17DRP4.....	5
17DSP4.....	5
17DTP4.....	4

TUBE TYPE	PACKET NO.
17DXP4.....	3
21DEP4A.....	5
21DKP4.....	1
21DQP4.....	2
21DSP4.....	5
21ENP4.....	1
21EQP4.....	1
21ERP4.....	2
21EVP4.....	4
21EXP4.....	2
21EYP4.....	4
21FAP4.....	4
23CP4.....	3
23DP4.....	3
23EP4.....	5
23JP4.....	5
23RP4.....	4
23SP4.....	5
23UP4.....	5
24AUP4.....	1

## CATHODE RAY TUBES

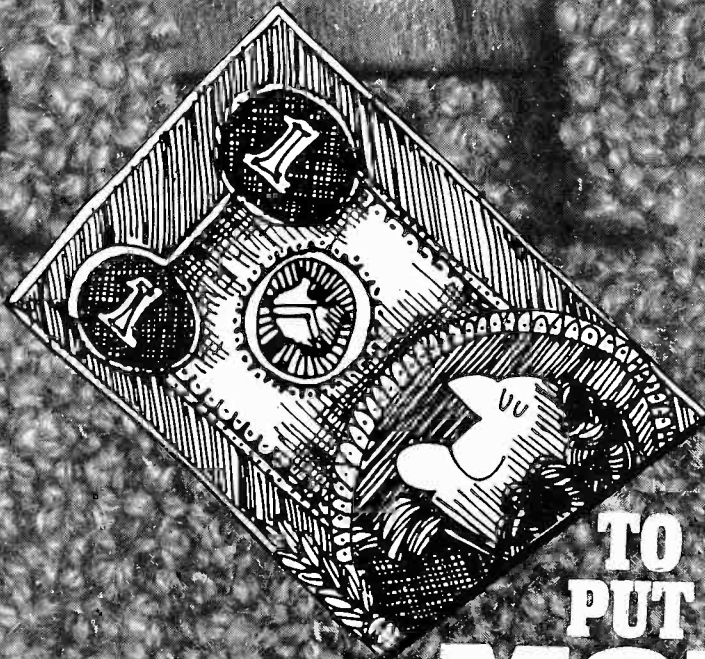
TUBE TYPE	PACKET NO.
3ACP.....	2
3ADP.....	2
3AQP.....	4
3ASP.....	3
3BEP.....	4
3BGP1,3BGP*.....	5
3SP1,3SP*.....	5
3WP.....	4
4MP.....	4
5AMP.....	4
5BCP.....	4
5BGP.....	2
5BHP.....	2
5BTP.....	4
5CVP.....	4
5WP.....	3
6DP.....	1
7AEP.....	4
8LP4.....	4
10KP7*,A,B.....	3
12DP7A*,C.....	3
12SP,12SP7D.....	3
14BAP4.....	5
17DWP4.....	5
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TO  
PUT  
**MORE**  
**MONEY**  
IN  
DEALER  
POCKETS...

SYLVANIA PRESENTS  
A BIG CHANGE  
IN THEIR  
CONSUMER AD PROGRAM



**SYLVANIA NEWS**

Published in the interest of the Independent Serv-  
ice Dealer © 1961, Sylvania Electric Products Inc.

FRANK A. BOEHM, EDITOR JAN.—FEB. 1961

# Sylvania Sponsors 3 Top-Rated Radio Shows and Schedules 40 Ads for TV Guide!

**TO REACH MORE PEOPLE**

"So visit your serviceman, and be sure to ask for Sylvania tubes."

This message will be heard and read by millions of TV set owners in 1961. Arthur Godfrey sells your service every week on his morning radio show. Don McNeil and his Breakfast Club sells you and Sylvania every week. Seven times a weekend, every other week, Mike Nichols and Elaine May join the selling effort on the popular Monitor Radio Show.

And to top it off—40 Sylvania ads in TV Guide during 1961!

## COUNTRY'S NO. 1 SALESMAN SELLING FOR YOU

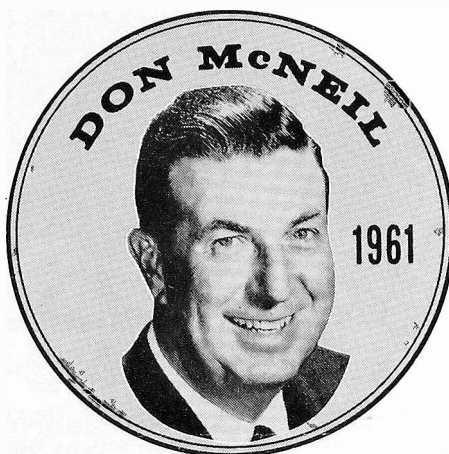


"Your old TV will need some new parts eventually," says Godfrey, . . . "when that happens the serviceman to call is your nearby dealer . . . and tell him to bring Sylvania tubes."

That's the way Arthur Godfrey will be selling you, the TV serviceman, every week in 1961. You benefit when Godfrey talks to his listeners. To cash in big on Godfrey's selling power, run a tie-in radio commercial on the days Godfrey advertises Sylvania. These tie-in scripts mention your name and phone number several times. The scripts are free (See order form on page 11). Your only cost is for local radio

**TO SELL YOUR SERVICE IN 1961**  
time, and it costs much less than you might imagine. Godfrey window banners and posters are available to you free also.

## HEATING UP CUSTOMERS ON THE BREAKFAST CLUB



Millions of American wives welcome Don McNeil and his Breakfast Club every morning. When the ladies listen this year, they'll hear Sylvania commercials—commercials promoting you, the service dealer. Don McNeil has had 25 years' of experience selling on radio. Every week he'll be telling his loyal following to "trust the TV serviceman who sells Sylvania tubes . . . be sure to specify the Sylvania Silver Screen 85<sup>®</sup> Picture Tube when your old one goes on the blink." Free tie-in commercial scripts are available for the Don McNeil show too. Link your store message to the nationally advertised Sylvania commercial. It's a lot of advertising for a little money.

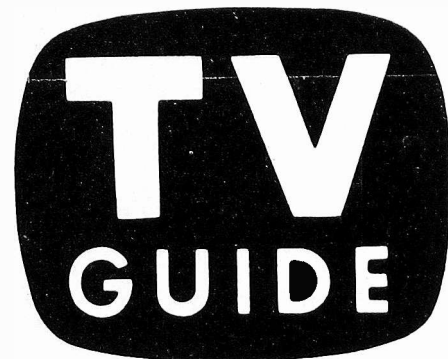
## SELLING YOUR SERVICE ON THE POPULAR MONITOR SHOW

Mike Nichols and Elaine May are the hottest comedy team in show business. People who like to laugh will be hearing Nichols and May on



Monitor in 1961. Sylvania and the service dealer will be theme of 7 commercials on this show, every other weekend. These weekend commercials will reach additional millions of listeners to sell you and your Sylvania tubes. To steer your local Monitor listeners direct to your store, run local radio commercials. (See page 11). The scripts are free.

## 40 SYLVANIA ADS HERE THROUGH THE YEAR!



Sylvania will run 40 ads in TV Guide—almost an ad every week. TV Guide reaches the largest possible audience for your customers. TV Guide reaches people who are TV conscious and it reaches them all week long. Ad after ad will get Sylvania's name before these TV owning readers. When TV Guide readers tune in the Sylvania message, you'll find it more profitable than ever to carry Sylvania tubes.

See the Sylvania ads in TV Guide, hear the Sylvania commercials on Arthur Godfrey's show, Don McNeil's Breakfast Club and the Mike and Elaine spot on Monitor. It's good reading, good listening—good business for you.

Can You Fix ANY Radio? This New RTTA Course Will Help You.

# ADVANCED TECHNIQUES OF RADIO SERVICING

To help you cash in on radio's boom, Sylvania is sponsoring a new RTTA course—Advanced Techniques of Radio Servicing. Your Sylvania distributor can give you all details. He'll tell you how to save money on the price of the course through your purchases of Sylvania Picture Tubes and receiving tubes.

## WHAT THE COURSE OFFERS YOU . . .

### OUTLINE FOR SERVICING RADIO RECEIVERS

**Lesson 1 — WORKING WITH TRANSISTORS** ■ Getting started with transistors ■ Reference points ■ Positive and negative grounds ■ The B plus and B minus bus ■ Moving the reference point ■ Direction of current flow ■ Polarity ■ The forward-biased diode ■ Approaching the transistor ■ Relationship of base and emitter ■ Adding resistors to the transistor circuit ■ Voltage drops ■ P-N-P and N-P-N transistors ■ Reverse biasing ■ Diodes and transistors ■ Signal and output ■ Identifying basic transistor types ■ How to handle transistors ■

**Lesson 2 — TESTING TRANSISTORS AND TRANSISTOR CIRCUITS** ■ Testing transistors in the receiver ■ Transistor voltages ■ Basic troubles ■ Abnormal voltages at transistor elements ■ Measurements in transistor circuits ■ Checking transistors out of the circuit ■ Resistance checking transistors ■ Forward and reverse resistance ratios ■ In-circuit testing ■ Transistor testers ■ How to make voltage tests ■ Tracing transistor circuits ■ The emitter circuit ■ Printed circuit board radio components ■ Soldering on printed circuit boards ■ Replacing resistors and capacitors ■ Removing component boards ■ Arcing ■

**Lesson 3 — SERVICING TRANSISTOR RADIOS** ■ Stage by stage testing ■ Types of batteries ■ Stage gain ■ Parts in transistor circuits ■ Weak output ■ The push-pull audio amplifier ■ Checking the transformers ■ Distortion ■ Measuring output power ■ Using a single tracer ■ Driver troubles ■ The detector ■ Getting rid of A.G.C. voltage ■ Problems of the I.F. stages ■ Replacing transformers ■ Checking the front end ■ The converter ■ Quick checks ■ Mixer and local oscillator ■ Transistor receiver speed servicing chart ■ The most common causes of trouble ■

**Lesson 4 — REPAIRING AUTO RADIOS — (part 1)** ■ Types of auto radios ■ Some basic circuits ■ Auto radio power supplies ■ Filament systems ■ Ground systems ■ The line filter ■ Synchronous and non-synchronous vibrators ■ Power supply troubleshooting chart ■ The transistor d.c. to d.c. converter ■ Analyzing the

receiver ■ The output stage ■ Output transistors and output tubes ■ Driver stage ■ Driver stage troubles ■ The detector and how to service it ■ Auto radio I.F. stages ■ Converters and mixers ■ Front end troubles ■

**Lesson 5 — REPAIRING AUTO RADIOS — (part 2)** ■ Installing auto radios ■ Glove-compartment radios ■ Floor installations in sports cars ■ Behind the dash installations ■ Combination auto radio and portable receiver ■ Mirror type receiver ■ The hybrid auto radio ■ Installing antennas ■ Front and rear seat speakers ■ Mechanical aspects of auto radios ■ Search tuners ■ Interference and interference elimination ■ How to remove auto radios ■ Miscellaneous servicing hints ■

**Lesson 6 — SERVICING A.M. RECEIVERS** ■ Types of A.M. receivers ■ A.M. receiver circuitry ■ Single ended and push pull output stages ■ Servicing chart for the output stage ■ Speaker arrangements ■ Troubleshooting chart for driver circuits ■ The detector and how to locate its troubles ■ Troubleshooting chart for I.F. circuits ■ Converters, mixers and local oscillators ■ Troubleshooting charts for the front end ■ R.F. amplifiers and how to service them ■ American and European tubes ■

**Lesson 7 — FM RECEIVER SERVICING** ■ Differences between A.M. and F.M. operation ■ Types of F.M. sets ■ Advantages of F.M. operation ■ The output stage ■ Crossover networks ■ Multiple speaker operation ■ Troubles in push-pull stages ■ Audio troubleshooting charts ■ Phase inverter circuits ■ Localizing troubles in the inverter ■ Types of detectors ■ The discriminator ■ Detector circuit troubleshooting charts ■ Limiters and what they do ■ I.F. stage troubleshooting charts ■ The front end ■ Converters ■ Mixers ■ R.F. amplifier servicing ■ Tuning problems ■ Drift ■ F.M. antennas ■

**Lesson 8 — SERVICING A.M. and F.M. TUNERS** ■ Differences between A.M. and F.M. types ■ Circuit analysis of the F.M. tuner ■ Differences in tuner design ■ Integrating the tuner into a system ■ Master control of tuner primary power ■ Servicing problems of A.M., F.M. tuners ■ Combined tuners ■ F.M. tuners (converters) for automobile operation ■ Tuner power supplies and how

to fix them ■ Antennas for tuners ■ Tuning indicators and their troubles ■ Tuner controls ■ A.G.C. systems ■

**Lesson 9 — SERVICING COMMUNICATIONS RECEIVERS** ■ Types of communications receivers ■ Differences between communications receivers and broadcast band sets ■ Methods of band switching ■ Band coverage ■ Signal to noise ratio ■ Installation problems ■ Checking for performances ■ Antennas and power supplies ■ Interference problems ■ Servicing troubles in the communications receiver ■ Types of tuning indicators and their troubles ■ Stage by stage check of the receiver ■ Replacing components ■

**Lesson 10 — SERVICING MARINE RADIO EQUIPMENT MOBILE RECEIVERS — (part 1)** ■ Marine radio operating frequencies ■ Transistor vs. tube receivers ■ Marine receiver sensitivity ■ Corrosion problems ■ Moisture-proofing ■ Long wave receivers ■ Marine beacon stations ■ Short-wave sets ■ Battery troubles ■ Detective ship's wiring affecting receiver operation ■ Tube failures ■ Communications receivers for marine use ■ Marine receivers on v.h.f. F.M. marine operation ■ Fixed vs. variable tuning ■ Testing marine receivers for troubles ■ Squelch circuits ■

**Lesson 11 — SERVICING MOBILE RECEIVERS (including Citizens' Band Radio)** ■ The fixed tuned superheterodyne receiver ■ Squelch operation ■ Output of mobile receivers ■ Types of receiver circuits ■ Single and double conversion superhets ■ A.M. and F.M. mobile receivers ■ Crystal control circuits in mobile sets ■ Squelch, discriminator and audio sections and their troubles ■ Checking mixer, I.F. and limiter stages ■ Checking double conversion receivers ■ Intermediate frequencies of mobile sets ■ Reception on more than one channel ■ Switching troubles ■ Narrow band operation ■

**Lesson 12 — MISCELLANEOUS RECEIVERS** ■ Police and aircraft receivers ■ Foreign receivers ■ A.M., A.M.-F.M. table and console model sets ■ Battery operated sets ■ Shortwave sets ■ Identifying tubes and components in foreign sets ■ Making replacements ■ Typical troubles ■ American equivalents ■ Three way receivers ■

Profit Picture Bright And Wide With The 6BQ6GTA

## Improvements In New Sylvania Tube Offer Long Life, High Output, Sharper Grid Voltage Cutoff!

Sylvania's latest tube improvement to protect dealer profits is the 6BQ6GTA. This new tube helps give your customers a brighter TV picture. Plate current capabilities in the 6BQ6GTA have been increased. Plate to screen current ratio has been improved. A special screen-grid coating provides excellent heat dissipation eliminating interelement shorts caused by excess heat without causing cathode "poisoning" — a major cause of short tube life.

The tube has been arc tested to 6000 volts, well above normal operating conditions to assure full and

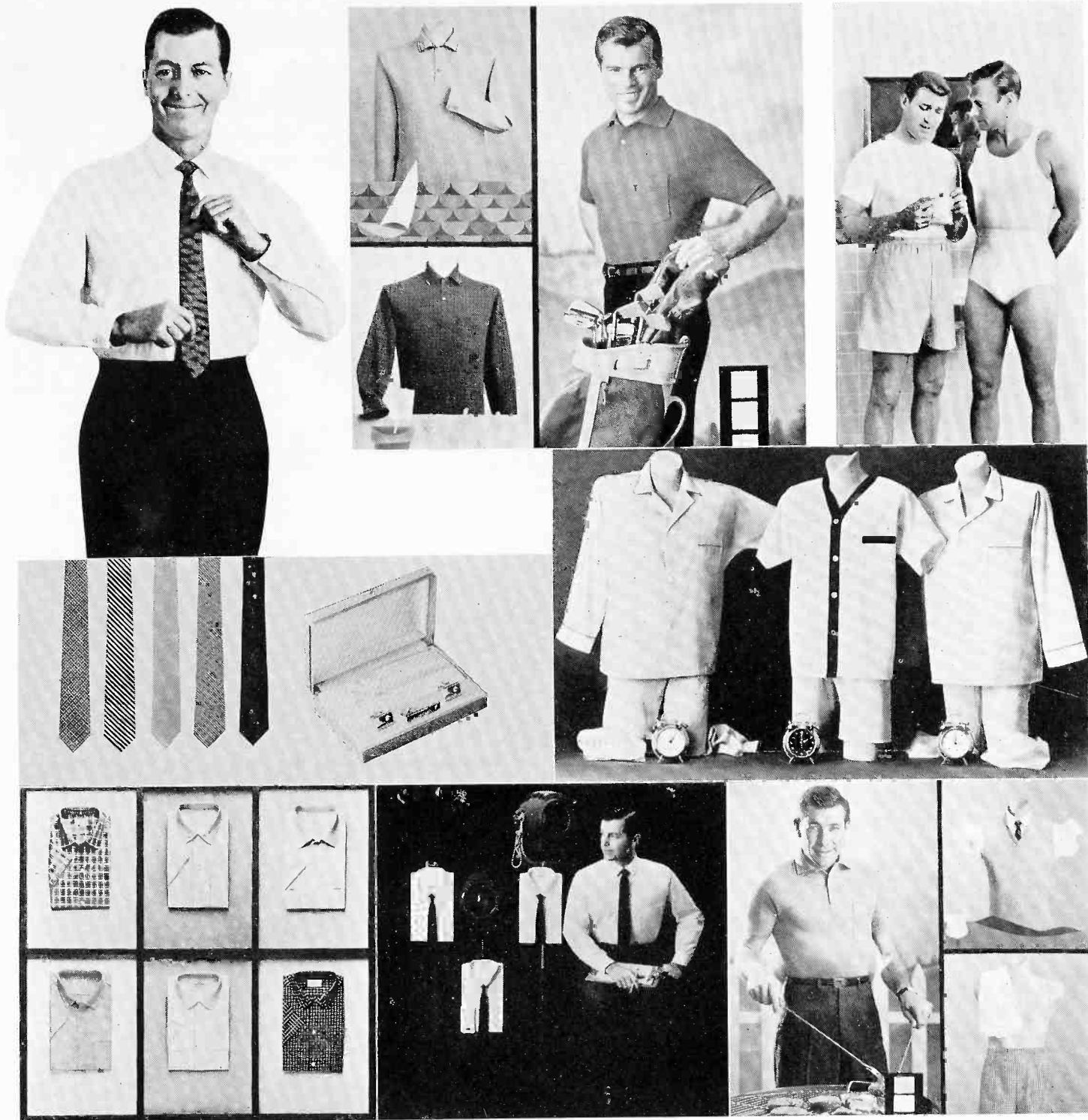
reliable service. As a check on tube performance, production samples are subjected to life tested conditions in simulated horizontal deflection circuits that are well in excess of those that exist in your customers TV sets.

Next time you stock up on tubes, order a supply of these improved Sylvania 6BQ6GTA tubes. They'll brighten TV pictures for your customers—brighten profits for you.

### A SERVICING PLUS

Sylvania has tapered the pins to enable you to insert the tubes easily in hard-to-reach sockets.





## SYLVANIA DISTRIBUTORS OFFER VAN HEUSEN MEN'S WEAR FOR TUBE PURCHASES

**Everything From Underwear to Neckties!** Picture yourself with any of the handsome haberdashery you see on this page. Look good? *This is only part of it!* You take your pick of 64 different items—SHIRTS . . . SPORTSWEAR . . . UNDERWEAR . . . TIES . . . MEN'S JEWELRY . . . PAJAMAS. All handsome, quality men's wear from Van Heusen, one of the most famous names in clothing.

The deal is a neat one for Sylvania TV repairmen. Buy 6 Sylvania picture tubes or 150 receiving tubes—and you qualify for a Van Heusen premium! If your distributor is participating in this offer, he'll supply you with all the facts and simple order forms. Look into it now . . . the promotion ends March 31.

# DON'T

DON'T SHOW THIS BOOKLET TO SET OWNERS

# ... UNLESS YOU WANT MORE SERVICING BUSINESS

A new booklet that tells your customers the "DO'S and DON'TS" of getting reliable TV service. After reading the "Don'ts," your customer knows what to "DO"—call you!

This booklet will spread your reputation as a reliable TV technician. The "TV—on the Blink?" booklet is

### Don't call a repairman UNTIL YOU KNOW YOU REALLY NEED ONE

Tells set owners the simple checks that eliminate money-wasting "false-alarm" trips for you—"be sure set is plugged in . . . check the antenna . . . tune the set properly."

### Don't try to fix it yourself UNLESS YOU KNOW WHAT YOU'RE DOING

This warns set owners of the danger and expense of fix-it-yourself repairs. The message is unmistakable—"Let the TV repairman do it . . . he's the best man for the job."

### Don't be fooled by "bargain" repairs UNTIL YOU KNOW THE PRICE OF A "BARGAIN"

Moral here is, "The TV repairman who charges an honest fee for an honest job is the only 'Bargain' that makes any sense." (Helps you get healthier profits.)

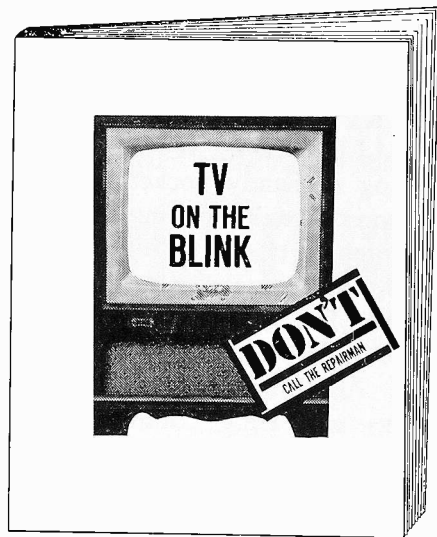
### Don't settle for off-brand or questionable tubes UNTIL YOU KNOW WHY IT PAYS TO SPECIFY A QUALITY BRAND—SYLVANIA

Here are reasons why set owners can trust the repairman who features quality brand tubes like Sylvania.

### Don't call us for TV repairs UNLESS YOU WANT RELIABLE SERVICE AT AN HONEST PRICE

This one is the clincher. What set owner wouldn't want reliable service at an honest price.

ready for ordering. Don't order it . . . UNLESS YOU WANT MORE SERVICING BUSINESS! Cost is only \$5.00 per 100 copies—imprinting the labels \$1.50 per 500. Free envelopes are provided for mailing or handing out the booklet to your choice customers. See order form on page 11. It offers you a FREE sample copy of this unique booklet!



FRONT COVER

Plastic TV Screen Blinks as book is tilted. The words "TV—on the Blink?" flash on the screen in sequence. Guarantees customer attention!

### FOR PROMPT, EXPERT TV SERVICE.. CALL US

To keep our phone number handy, attach these four stickers to the back of your TV, radio and hi-fi equipment. Put one sticker in your personal phone directory.

ATTACH TO YOUR RADIO	DEALER NAME STREET ADDRESS CITY & STATE PHONE NO.
ATTACH TO YOUR TV	DEALER NAME STREET ADDRESS CITY & STATE PHONE NO.
ATTACH TO YOUR HI-FI	DEALER NAME STREET ADDRESS CITY & STATE PHONE NO.
ATTACH TO YOUR PERSONAL PHONE DIRECTORY	DEALER NAME STREET ADDRESS CITY & STATE PHONE NO.

BACK COVER

Four stickers with your imprint to make your name stick—right on the back cover.

Copy above stickers tells customer to keep TV technician's name handy by attaching these four stickers (1) to the back of his TV (2) to his radio (3) to his hi-fi equipment (4) in his personal phone directory.

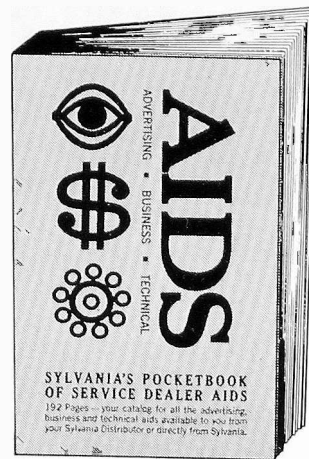
**FREE POSTER** To help get this new 12-page booklet into set owners hands, a FREE window poster has been prepared. You get one of these posters automatically with every 100 booklets you order.

# NEW .. Sylvania's Pocketbook of Service Dealer Aids ... 192 Page Catalog

TV repairmen who just want the facts will find them fast in SYLVANIA'S POCKETBOOK OF SERVICE DEALER AIDS. It's a 192-page catalog in handy pocketbook size.

Suppose you're looking for a way to untangle the paperwork of your TV repair business. Or maybe you want a free window poster? You name it—from Record Forms and Free Ad Mats to Characteristics Books and Tube Caddies—it's all described and illustrated in Sylvania's Pocketbook of Service Dealer Aids. Call your Sylvania Distributor. He

has copies of this handy dealer aids catalog now, or you can order the book from C.A.D.D., Sylvania Electric Products, 1100 Main Street, Buffalo 9, N. Y. Price just 5¢. If you order by mail, make use of the handy order form on page 11.



## JUST A SAMPLE OF WHAT'S LISTED IN SYLVANIA'S POCKETBOOK OF SERVICE DEALERS AIDS

- Dealer signs • Dealer clocks • Window banners • Bumper strips • Glascene window kits • Ad mats and Post Cards promoting your service • Local radio commercial scripts • Giveaways • Booklets promoting your service • Record forms • Dealer uniforms • Technical charts • Home study courses.

## FOR TIGHTER CONTROL ON YOUR INVENTORY

# SYLVANIA'S DEALER INVENTORY CONTROL BOOKS

Think back Mister TV Repairman. Are you often caught short of tubes just when you need them most? Do you over-order on certain tube types so that your inventory ties up too much of your money?

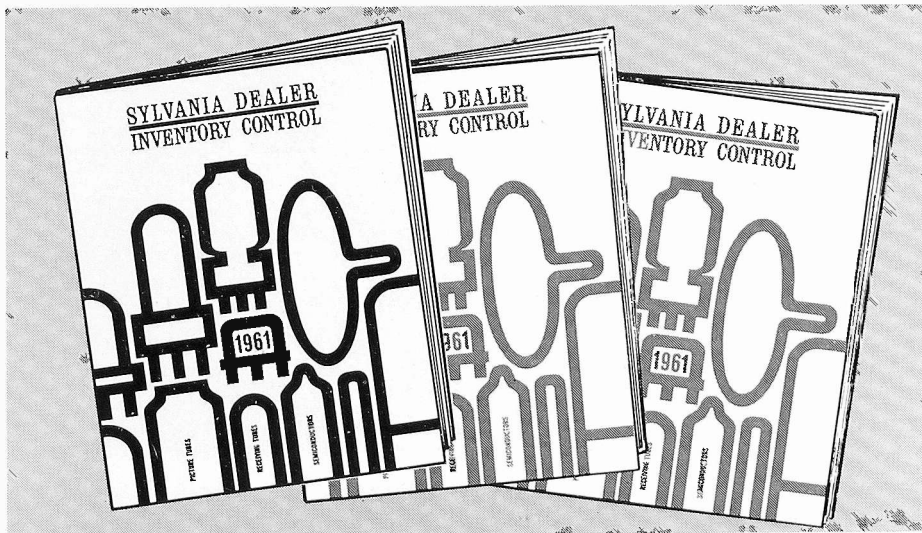
You are wasting valuable dollars if you're having inventory headaches.

Sylvania's Inventory Control Book is the answer you need.

### UP-TO-DATE

Revised and updated annually, the 1961 Inventory Control Book contains the most recently-added tube types. It's the most modern inventory control book in the industry. You get a complete listing of radio and TV receiving tubes, TV picture tubes and semiconductors. All types are listed alpha-numerically for easy control of your inventory. Each of the main product lines are inventoried in separate sections. You'll find plenty of space to include the new types as they are introduced.

No chance for the book to get botched up. A "sample" section



**Dealer Inventory Control Book** Saves dealer wasted time and dollars, Makes efficient inventories a cinch to keep.

shows the dealer the ideal way to keep inventory records. And, of course, Sylvania distributor salesmen can answer any question concerning the books.

To make ordering easy, 24 post cards are provided in the book. You merely fill in the tube type

and quantity you want and mail the card to your Sylvania Distributor. Sylvania's Dealer Inventory Control Book saves time, saves dollars. Yet it costs only a dime. Order from Sylvania (see order form on page 11) or get the book from your Sylvania Distributor.

# TECHNICAL SECTION

**JANUARY  
FEBRUARY 1961  
VOL. 28, NO. 1**

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

## INDUSTRIAL-MILITARY RECEIVING TUBE CROSS REFERENCE CHART

In response to the many requests from our readers, we have prepared a Cross Reference Chart which relates Industrial-Military tubes to their Commercial prototypes.

For your convenience, the Chart is divided into two sections; the first being a Cross Index which will enable you to immediately identify an all-numerical type with its Commercial prototype. You can then refer to the second section of the Chart which features an abbreviated comparison of the differences in electrical ratings, average characteristics and mechanical construction of similar popular Industrial-Military types.

It should be noted that only primary differences have been considered. No comparison has been made of special controls such as hum and interface resistance. Further, the Industrial-Military versions are specifically designed to withstand such rugged environmental conditions as shock; vibration; high temperature; high altitude; extremely long life and/or on-off service. However, not all of the Industrial-Military tubes listed on the Chart feature all of the above design considerations. Some Industrial-Military tubes are designed for a particular application and as a result may exhibit only

certain of the above environmental controls.

When confronted with an unfamiliar Industrial-Military tube, this Chart will enable the reader to quickly pin-point its Commercial prototype and other similar Industrial-Military versions. Reference to the Sylvania Technical Manual will, in most cases, identify the basing, bulb size and general tube characteristic information.

The reader is cautioned not to rely on this Chart as a basis for direct substitution; but, should refer to the individual tube data published by tube manufacturers for the complete description of each version.

### INDUSTRIAL AND MILITARY RECEIVING TUBES / CROSS INDEX

INDUSTRIAL AND MILITARY VERSION	COMMERCIAL PROTOTYPE	INDUSTRIAL AND MILITARY VERSION	COMMERCIAL PROTOTYPE	INDUSTRIAL AND MILITARY VERSION	COMMERCIAL PROTOTYPE
407A	2C51	5881	6L6G	6064	6AM6
408A	6AK5	5915	6BE6	6066	6AT6
5591	6AK5	5930	2A3	6067	12AU7
5654	6AK5	5931	5U4G	6072	12AY7
5656	6AK5	5932	6L6G	6073	0A2
5670	2C51	5933	807	6074	0B2
5691	6SL7GT	5992	6V6GT	6080	6AS7G
5692	6SN7GT	5993	6X4	6082	6AS7G
5693	6SJ7	6004	5Y3GT	6087	5Y3GT
5725	6AS6	6005	6AQ5	6094	6AQ5
5726	6AL5	6028	6AK5	6097	6AL5
5727	2D21	6042	6SN7GT	6099	6J6
5749	6BA6	6045	6J6	6101	6J6
5750	6BE6	6046	25L6GT	6106	5Y3GT
5751	12AX7	6057	12AX7	6113	6SL7GT
5814A	12AU7	6058	6AL5	6132	6CH6
5838	6X5GT	6059	6BR7	6134	6AC7
5839	6X5GT	6060	12AT7	6135	6C4
5852	6X5GT	6061	6BW6	6136	6AU6
5871	6V6GT	6063	6X4	6137	6SK7

ol. 1: \$1.00-Vol. 2: \$1.00-Vol. 3: \$1.00-Vol. 4: \$1.00-Vol. 5: \$1.00

Binders With Complete File of Technical Sections

INDUSTRIAL AND MILITARY VERSION	COMMERCIAL PROTOTYPE	INDUSTRIAL AND MILITARY VERSION	COMMERCIAL PROTOTYPE	INDUSTRIAL AND MILITARY VERSION	COMMERCIAL PROTOTYPE
6180 6186 6189 6197 6201	6SN7GT 6AG5 12AU7 6CL6 12AT7	6664 6669 6676 6677 6678	6AB4 6AQ5 6CB6 6CL6 6U8	7059 7060 7061 7105 7137	6U8 6AU8 12AB5 6AS7G 6J4
6202 6203 6265 6336 6384	6X4 6X4 6BH6 6AS7G 6AR6	6679 6680 6681 6829 6830	12AT7 12AU7 12AX7 12AV7 0A2	7167 7244 7245 7258 7316	6CY5 6J6 6J4 6AN8 12AU7
6385 6386 6394 6485 6486	2C51 2C51 6AS7G 6AH6 6AS6	6831 6913 6927 6928 6968	0B2 12BH7 6J6 6AQ5 6AK5	7320 7408 7543 7581 7717	6BQ5 6V6GT 6AU6 6L6G 6CY5
6516 6520 6626 6627 6660	6AM5 6AS7G 0A2 0B2 6BA6	6973 7025 7036 7054 7055	6CZ5 12AX7 6BE6 12BY7 6AL5	7724 7728 7729 7730 7731	14GT8 12AT7 12AX7 12AU7 6U8
6661 6662 6663	6BH6 6BJ6 6AL5	7056 7057 7058	6CB6 6BZ7 12AX7	7732 7733	6CB6 12BY7

## INDUSTRIAL - MILITARY TYPE / REFERENCE CHART

COMMERCIAL PROTOTYPE	INDUSTRIAL-MILITARY VERSION	CLASS	DIFFERENCES IN RATED CHARACTERISTICS (SEE TEXT)	COMMERCIAL PROTOTYPE	INDUSTRIAL-MILITARY VERSION	CLASS	DIFFERENCES IN RATED CHARACTERISTICS (SEE TEXT)
0A2	0A2, (Mil) GB-0A2WA 6073 6626 6830	Cold-Cathode Diode	NONE except GB-0A2WA and 6626 for which Min. Starting Voltage = 165 Vdc. Instead of 185 Vdc. 6830 has flying leads.	5R4G (Cont'd.)	5R4WGA, WGB, WGY (Mil)		size. 5R4GY, WGA, WGY (Mil) employ ST16 bulbs. 5R4GYA (Mil) employs a T12 bulb and the 5R4-WGB (Mil) a T14 bulb
0A3	0A3 (Mil)	Cold-Cathode Diode	NONE	5U4G	5U4G, GB (Mil) 5931 GB-5931 5931 (Mil)	Duo-Diode	NONE except GB-5931 and 5931 (Mil) are higher rated approx. 10%.
0B2	0B2, WA (Mil) GB-0B2WA 6074 6627 6627/0B2WA (Mil) 6831	Cold-Cathode Diode	NONE except 6627, 6627/0B2WA (Mil) for which Min. Starting Voltage = 130 Vdc. Instead of 133 Vdc. 6831 has flying leads.	5Y3GT	5Y3WGTA (Mil) GB-5Y3WGTA 6004 6004 (Mil) 6087 6106 6106 (Mil)	Duo-Diode	Types 5Y3WGTA (Mil), GB-5Y3WGTA, 6106 and 6106 (Mil) are higher rated approx. 10%. Types 6087, 6106 and 6106 (Mil) employ cathodes. Types 6004 and 6004 (Mil) have plate caps.
0C3	0C3, W (Mil)	Cold-Cathode Diode	NONE	6AB4	6664	Triode	Type 6664 has a wider range heater.
0D3	0D3, W (Mil)	Cold-Cathode Diode	NONE	6AC7	6AC7, W, WA (Mil) 6AJ7/6AC7 (Mil) 6134	Pentode	NONE except 6AJ7/6AC7 (Mil) for which transconductance is approx. 10% higher.
2A3	2A3 (Mil) 5930 5930 (Mil)	Triode	NONE except bulb size. 2A3 has ST16 bulb whereas 5930's employ T12 bulbs.	6AG5	6AG5, 6186/ 6AG5WA (Mil) GB-6186	Pentode	NONE
2C51	2C51 (Mil) GB-407A 5670 GB-5670 5670 (Mil) 6385 6386	Duo-Triode	NONE except heater characteristics. Heater currents of 2C51, 2C51 (Mil) = 300 ma. Heater currents of 5670, 5670 (Mil) and 6386 = 350 ma. Heater currents of 6385 = 500 ma. GB-407A has a 50V, 100 ma. heater.	6AH6	6AH6 (Mil) 6485	Pentode	NONE except Type 6485 is controlled for computer applications.
2D21	2D21W, 5727/ 2D21W (Mil) 5727 GB-5727	Tetrode Thyratron	NONE	6AK5	5591 GB-408A 5654 GB-5654 5654/6AK5W (Mil) 6028 6028 (Mil) 6968	Pentode	Types 6028 and 6028 (Mil) have lower H-K voltage rating and approx. 10% higher plate dissipation. Type 6968 is controlled for triode cut-off. GB-408A has a
5R4G	5R4GY, A (Mil)	Duo-Diode	NONE except bulb				



COMMERCIAL PROTOTYPE	INDUSTRIAL- MILITARY VERSION	CLASS	DIFFERENCES IN RATED CHARACTERISTICS (SEE TEXT)
6AK5 (Cont'd)			20V, 50 ma heater. Type 5591 has a 150 ma heater whereas the remaining types employ 175 ma heaters.
6AL5	5726 GB-5726 5726/6AL5W/(Mil) 6058 6097 6663 7055	Duo-Diode	NONE except Type 7055 employs a 13.2V heater. Type 6663 has a wider range heater.
6AM5	6516	Pentode	NONE
6AM6	6064	Pentode	NONE
6AN5	6AN5, WA (Mil)	Pentode	NONE
6AN8	7258	Triode- Pentode	NONE except Type 7258 employs a 13.5V, 210 ma heater.
6AQ5	6005 GB-6005 6005/6AQ5W (Mil) 6094 6094 (Mil) 6669 6928	Beam- Pentode	Type 6005 has lower H-K voltage = 90 Vdc. Types 6094 and 6094 (Mil) employ T-6½ bulbs and 600 mil heaters whereas the remaining types employ a T-5½ bulb and 450 ma heaters; H-K voltage = 450 Vdc and basing differs. Type 6669 has a wider range heater. Type 6928 has a 360 ma heater and is lower rated approx. 10%.
6AR6	6AR6, 6098/ 6AR6WA (Mil) 6384 6384 (Mil)	Tetrode	NONE except Types 6384 and 6384 (Mil) are higher rated approximately 15%.
6AS6	6AS6, 5725/ 6AS6W (Mil) 5725 GB-5725 6187 6486, A	Pentode	Types 6AS6, 5725/6AS6W (Mil), GB-5725, 6187 and 6486A are higher rated approx. 10%. Types 6486 and 6486A employ 250 ma heaters and T-6½ bulbs; basing differs.
6AS7G	6AS7G, 6080, WA, WB (Mil) 6080, WA 6082 6336, A 6394, A 6520 7105	Duo-Triode	Type 6082 has a 26.5V, 600 ma heater whereas Type 6AS7G employs a 6.3V, 2.5 A heater. Type 6336 employs a 4.75 A heater and is higher rated approx. 15%. Type 6336A has a 5.0A heater and is higher rated approx. 15%. Type 6394 has a 26.5V, 1.2A heater and is higher rated approx. 15%. Type 6394A is a 26.5V, 1.3A heater version of Type 6336A. Type 6520 has 600 volts insulation between grid and plate. Type 7105 is a 12.6V, 1.25A heater version of Type 6080WA.

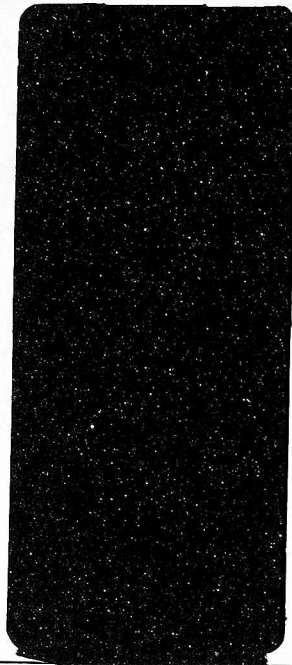
COMMERCIAL PROTOTYPE	INDUSTRIAL- MILITARY VERSION	CLASS	DIFFERENCES IN RATED CHARACTERISTICS (SEE TEXT)
6AT6	6AT6 (Mil) 6066	Duo-Diode- Triode	NONE
6AU6	6AU6WA, WB (Mil) GB-6136 7543	Pentode	NONE except Type 7543 is controlled for low noise-low hum applications.
6AU8	7060	Triode- Pentode	NONE except Type 7060 employs a 13.5V, 280 ma heater.
6BA6	5749 GB-5749 5749/6BA6W (Mil) 6660	Pentode	NONE except Type 6660 has a wider range heater.
6BE6	5750 GB-5750 5750/6BE6W (Mil) 5915, A 5915 (Mil) 7036	Heptode Converter	Types GB-5750 and 5750/6BE6W (Mil) are higher rated approx. 10%. Types 5915, A, 5915 (Mil) and 7036 are lower rated approx. 10%. Type 7036 is a 5915A in a half inch longer bulb.
6BH6	6BH6 (Mil) 6265 6661	Pentode	Type 6265 employs a 175 ma heater and higher plate dissipation. Type 6661 has a wider range heater.
6BJ6	6BJ6, A (Mil) 6662	Pentode	NONE except 6BJ6A (Mil) is higher rated approx. 10%. 6662 has a wider range heater.
6BQ5	7320	Beam- Pentode	Type 7320 plate and screen voltages are higher rated approx. 10%.
6BR7	6059	Pentode	Type 6059 is controlled for low hum-low noise application (also similar to Type 6J7).
6BW6	6061	Pentode	NONE (also similar to Type 6V6GT).
6BZ7	7057	Duo-Triode	Type 7057 employs a 13.5V, 180 ma heater.
6C4	6C4, W, WA, 6100/6C4WA (Mil) 6135 GB-6135 6135 (Mil)	Triode	NONE except 6135's employ 175 ma heaters.
6CB6	6676 7056 7732	Pentode	NONE except Type 6676 has a wider range heater. Type 7056 employs a 13.5V, 150 ma heater.
6CH6	6132	Pentode	NONE
6CL6	6CL6 (Mil) 6197 6677	Pentode	Type 6197 is controlled for computer applications. Type 6677 has a wider range heater.
6CY5	7167 7717	Tetrode	Type 7167 employs a 13.5V, 90 ma heater. Type 7717 employs a wider range heater.

COMMERCIAL PROTOTYPE	INDUSTRIAL- MILITARY VERSION	CLASS	DIFFERENCES IN RATED CHARACTERISTICS (SEE TEXT)	COMMERCIAL PROTOTYPE	INDUSTRIAL- MILITARY VERSION	CLASS	DIFFERENCES IN RATED CHARACTERISTICS (SEE TEXT)
6CZ5	6973	Beam- Pentode	Type 6973 is higher rated approx. 10%.	6X5GT	6X5WGT (Mil) GB-6X5WGT	Duo-Diode	All types higher rated approx. 10%. Type 5838 has a 12V, 600 ma heater. Type 5839 has a 26.5 V, 285 ma heater. Type 5839 (Mil) employs a 26.5 V, 225 ma heater. Types 5852, 5852 (Mil) employ 1200 ma heaters.
6J4	6J4, WA (Mil) GB-6J4WA 7137 GB-7137 7245, A GB-7245, A	Triode	NONE except 7245A's employ a half inch shorter bulb. 7137's employ 225 ma heaters; lower Gm & Mu.	7F8	7F8W (Mil) GB-7F8W	Duo-Triode	Both types higher rated approx. 10%.
6J6	6J6WA (Mil) 6045 6099 (Mil) 6101 GB-6101 6927 7244, A GB-7244, A	Duo-Triode	Type 6045 has a 350 ma heater. Type 6099 (Mil) has balanced sections. Type 6927 has a 330 ma heater and is lower rated approx. 10%. 7244A's employ a half inch shorter bulb.	12AB5	7061	Beam- Pentode	Type 7061 employs a 13.5V, 210 ma heater.
6L6G	6L6WGB (Mil) 5881 5932 GB-5932 5932 (Mil) 7581	Beam- Pentode	All types rated 10 to 20% higher than 6L6G. Type 7581 has controlled zero bias characteristics and a low-loss base.	12AT7	12AT7WA (Mil) 6060 6201 GB-6201 6679 7728	Duo-Triode	NONE except Type 6679 employs a wider range heater.
6SJ7	6SJ7WGT (Mil) GB-6SJ7WGT 6SJ7Y 5693 5693 (Mil)	Pentode	NONE except 5693's are lower rated approx. 10%.	12AU7	12AU7 (Mil) 5814, A (Mil) GB-5814A 6067 6189/12AU7WA (Mil) GB-6189 6680 7316 7730	Duo-Triode	NONE except 5814s, employ 175/350 ma heaters. Type 6680 has a wider range heater. Type 7316 is controlled for computer applications.
6SK7	6SK7GT (Mil) 6SK7WA (Mil) 6137	Pentode	NONE	12AV7	12AV7 (Mil) 6829 6829 (Mil)	Duo-Triode	NONE except 6829's are lower rated approximately 10%.
6SL7GT	6SL7WGT (Mil) GB-6SL7WGT 5691 5691 (Mil) 6113	Duo-Triode	NONE except 5691's employ 600 ma heaters.	12AX7	12AX7 (Mil) GB-5751 5751, WA (Mil) 6057 6681 7025, A 7058 7729	Duo-Triode	NONE except 5751's employ 175/350 ma heaters and are lower rated approx. 10%. Type 6681 has a wider range heater. Types 7025, A are controlled for low noise - low hum applications. Type 7058 employs a 13.5V, 155 ma heater.
6SN7GT	6SN7WGT, A (Mil) GB-6SN7WGT 5692 5692 (Mil) 6042 6180	Duo-Triode	NONE except plate dissipation is lower rated approx. 10% for all types. Type 6042 has a 25V, 150 ma heater.	12AY7	12AY7 (Mil) 6072 6072 (Mil)	Duo-Triode	NONE except 6072s' employ 175/350 ma heaters and have slightly higher Mu.
6U8	6678 7059 7731	Triode- Pentode	NONE except Type 6678 has a wider range heater. Type 7059 employs a 13.5V, 195 ma heater.	12BH7	6913	Duo-Triode	Type 6913 is controlled for computer applications.
6V6GT	6V6Y, GTY (Mil) 5871 5992 5992 (Mil) 7408	Beam- Pentode	Type 5871 is lower rated approx. 10%. 5992's employ 600 ma heaters and are lower rated approx. 10%. Type 7408 has controlled plate knee voltage and cutoff.	12BY7	7054 7733	Pentode	NONE except Type 7054 employs a 13.5V, 275 ma heater.
6X4	6X4W, A (Mil) GB-6X4WA 5993 5993 (Mil) 6063 6202 6203 6203 (Mil)	Duo-Diode	Types 6X4W, A (Mil), 5993 (Mil) and 6203 (Mil) are higher rated approx. 10%. Types 6063 and 6202 are lower rated approx. 10%. Types 5993, (Mil) employ 800 ma heaters. while the 6203's employ 900 ma heaters. Types 5993 and 6203 employ different basings.	14GT8	7724	Duo-Diode- Triode	NONE
				25L6GT	25L6GT (Mil) 6046	Beam- Pentode	NONE except 6046 is controlled for long periods of nonconduction.
				28D7	28D7, W (Mil) GB-28D7W	Duo-Beam- Pentode	NONE
				807	807 (Mil) 5933 GB-5933 5933, WA (Mil)	Beam- Pentode	NONE except bulb size. 807's employ ST-16 bulbs whereas 5933's employ T-12 bulbs.

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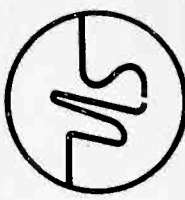
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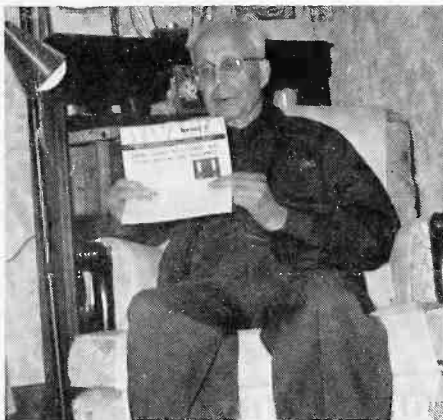


Kids pick up some real pointers from watching TV. A little fella in our family has a pet name for food he won't eat. Calls it, "The Untouchables."

\* \* \*

You young fellers, 70 years old or under, oughta see the picture on the right. Joe DeLaet, age 77, retired last year from Srepc Inc. of Dayton, Ohio. Joe worked with the company 20 years. Put in a full day's work 'till he retired. Joe DeLaet still visits Srepc most every week and still reads Sylvania News cover to cover.

Sure hope no dealer missed readin' page 9 of this issue. That new book is really somethin'. A plastic TV screen on the cover blinks like it was a real TV screen that needs fixin'. Page 3 talks about an RTTA course that clears up the confusion in radio servicing. On page 10, there's a dandy pocketbook of dealer aids.



\* \* \*

A guy in our town went fishin' for a long holiday week-end. Ended up with a couple of black bass and a red-



The picture with the fish is no joke son. That's a 562 pound tuna hangin' from its tail. Imagine bringin' this home! Last summer, DeMambro Radio Supply Company, Worcester, Massachusetts awarded some dealers a free fishing trip for buying a quota of tubes. As you can see from the picture, the boys had a pretty fair day. Believe it or not, a tuna almost as big as this got away.

Left to right in the picture: Ray Harrity, Arthur Bell, Bill Sulkoski, John C. Ghan of DeMambro, Gene Casey, Joe Backinkas, Eddie Sulkoski. Almost forgot, Gene Casey hooked the fish.