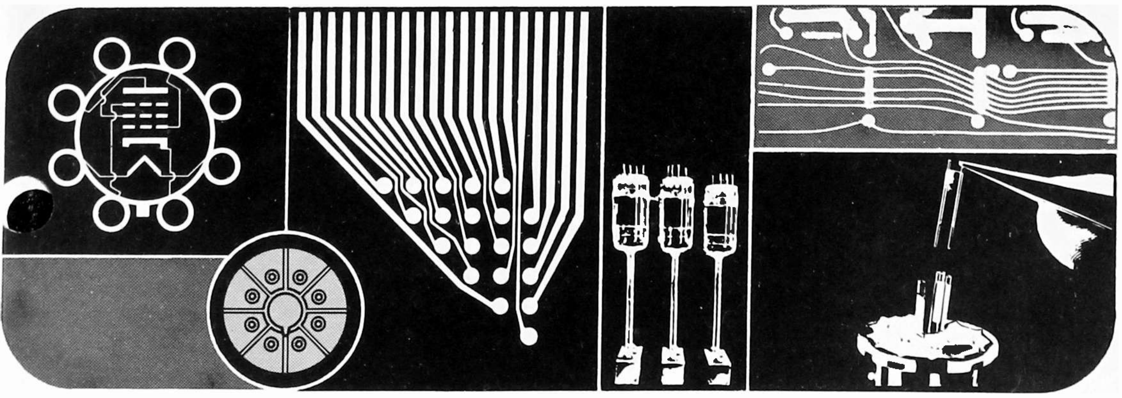

SYLVANIA NEWS

Technical Section

December, 1967 □ VOL. 34, NO. 4

RONALD L. CARR, TECHNICAL EDITOR . . . This information in Sylvania News is furnished without assuming any obligation.

COLOR TV . . . .
HIGH VOLTAGE REGULATION
Part 1

by L. J. Songer and C. Droppa

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In color receivers, the picture tube beam current may be two or three times greater than a comparable monochrome set. Therefore, beam current changes due to brightness variations will cause appreciable change in the high voltage level. Because many circuits are dependent on the horizontal deflection system for proper operation, the dc and pulse voltages derived from the system must remain relatively constant. It is readily apparent then, that as brightness varies, HV regulation is a must for proper color operation . . . preventing appreciable changes in height, width, focus, hue and convergence.

To meet the HV regulation requirements of color, various circuits have evolved. Three systems currently in use include: (1) shunt, (2) pulse controlled, and (3) electronic bias feedback types. Each produces the required regulation, but in a different manner.

This article deals only with the Shunt and Pulse Controlled HV regulator systems. Electronic Grid Bias Feedback circuits will be the topic of Part II (a future issue of SYLVANIA NEWS). In addition to a general description and basic theory of operation, recommended set-up procedures and troubleshooting tips are included.

SHUNT TV REGULATION

General Description

The shunt type of HV regulation system, which has been in use a number of years, employs a type 6BK4 HV regulator. As shown in the simplified functional diagram of Figure 1, this type of system, in essence, has an automatically controlled resistor (HV regulator) connected in parallel with the picture tube. The picture tube can also be considered as an automatically variable resistor. Both are connected to the dc high voltage supplied by the HV rectifier. As brightness varies, the automatic action of these variable resistors maintain a constant dc high voltage because they keep a constant load on the horizontal deflection system.

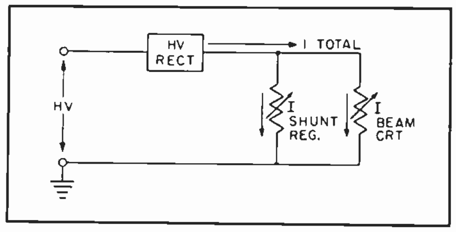


Figure 1—Simplified Functional Diagram—Shunt HV Regulation Systems.

Theory of Operation

As shown in the simplified circuit of Figure 2, the type 6BK4 HV regulator and corresponding circuits are connected across the dc high voltage supply. The cathode of the 6BK4 is returned to B+ and its grid is referenced to the boost supply through R_1. To insure correct bias between grid and cathode, R_1 in the boost circuit and R_2 in the grid return to ground should be a matched pair.

As with any television receiver, when brightness decreases, picture tube beam current also decreases. This causes the dc high voltage and, consequently, the boost voltage to increase. The increase in boost voltage is reflected to the grid of 6BK4 via R_1, causing it to increase con-

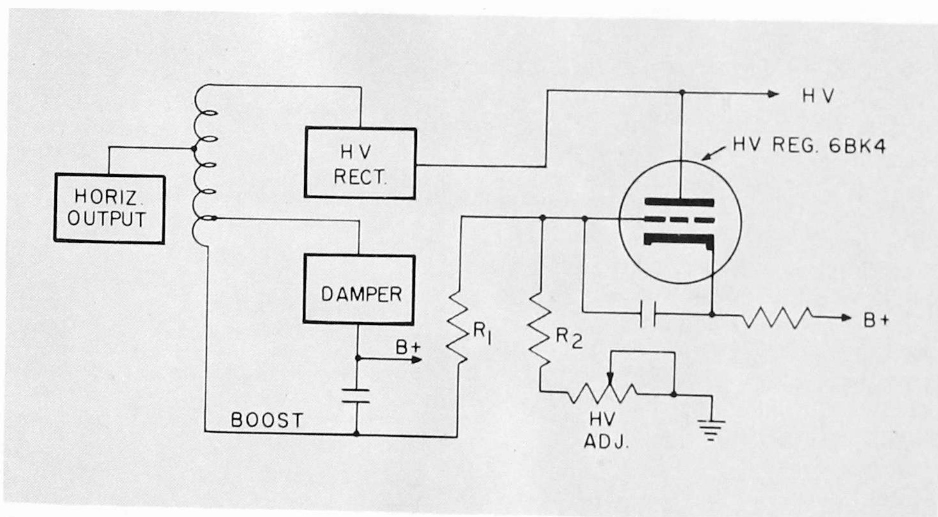
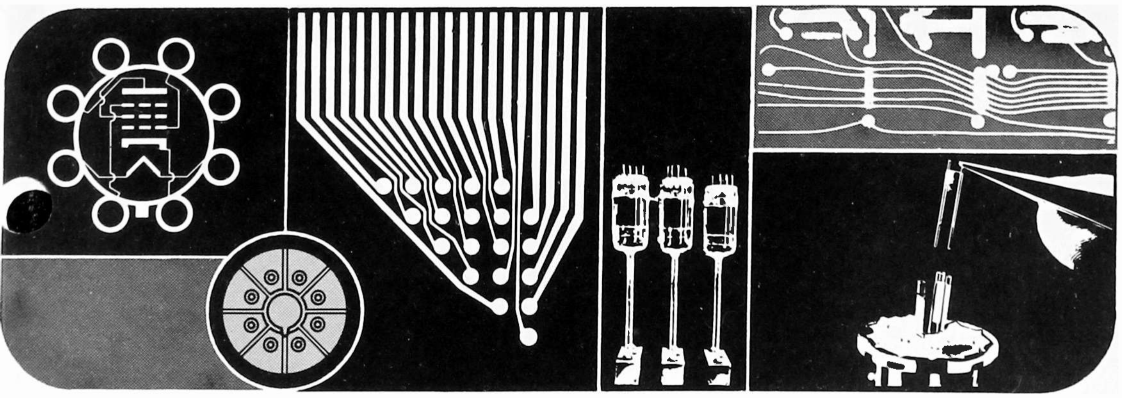


Figure 2—Simplified 6BK4 Shunt Regulator Circuit.



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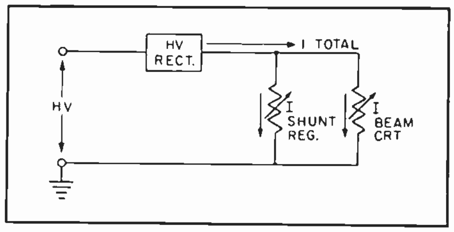

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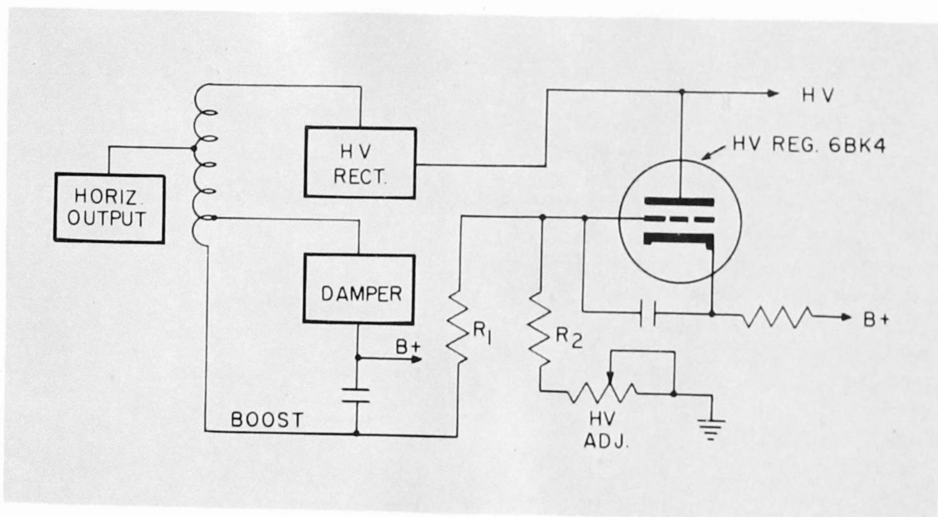

Figure 2—Simplified 6BK4 Shunt Regulator Circuit.

duction. The resultant increase in 6BK4 plate current is sufficient to lower the high voltage to its original and proper level. Further, a constant current through the HV rectifier is also maintained.

Conversely, as brightness increases, picture tube beam current increases, resulting in a decrease in dc high voltage and boost voltage. This causes less current to flow through 6BK4, resulting in the desired increase in high voltage.

Set-Up Procedures

Regardless which type of HV regulation system is used, each color set manufacturer has a prescribed high voltage set-up procedure. This procedure should be followed to insure optimum performance and component life. Most color sets use a high voltage of 25KV, but the appropriate set schematic or maintenance manual should be checked to be certain. A brief high voltage set-up procedure for the shunt HV regulation system is as follows:

(1) Turn the brightness control to minimum, extinguishing the picture—all the HV rectifier current now flows through the 6BK4.

(2) Then adjust the HV control for 25 KV, or the value shown on the set schematic—the HV control changes the bias of 6BK4.

The 6BK4 regulator current should also be checked. If it draws only 300 μa at zero beam current, the picture tube can only draw 300 μa before regulation is lost. In most sets using the shunt regulation circuit, for good regulation, the 6BK4 HV regulator current should be at least 850 μa and not more than 1400 μa . . . at zero beam and 120 volt line. Regulator current can usually be determined by measuring the voltage drop across the 1000 ohm resistor in the cathode circuit.

Some color deflection systems contain an efficiency coil. This coil should be adjusted to provide minimum horizontal output cathode current. Since the cathode current rarely exceeds 250 ma, a 0-500 ma DC-meter is adequate for the check. If the coil is not properly adjusted, the horizontal output may operate at excessive plate dissipation . . . resulting in shorter tube life and possible failure.

Troubleshooting

A defective 6BK4 and associated HV regulation circuitry can cause high voltage, focus, width, blooming and convergence problems. Monitoring the regulator current (as discussed in the set-up procedures) and the high voltage is one of the easiest ways to resolve these problems.

When working on the HV regulation circuit, it is recommended the following precautions be observed:

(1) Don't operate the set more than necessary if it has a blooming raster or no raster at all, and

(2) Don't pull an arc from the high voltage supply to determine the presence of high voltage. Use a high voltage probe capable of measuring at least 30 KV.

Failure to observe these precautions can result in serious damage to the various components, including the picture tube.

Common trouble symptoms and probable causes are given in the Troubleshooting Table. In addition, since the vertical oscillator is also returned to the boost supply in many color sets, malfunctions in the horizontal deflection system may also affect vertical scan. Also, if trouble has existed in the HV regulator circuit and has been corrected, the horizontal output tube should be checked for possible damage. Insufficient drive to the horizontal output tube can be disastrous. Further, after making HV regulation circuit repairs, make sure the efficiency coil (if applicable) is properly adjusted.

PULSE CONTROLLED HV REGULATION

There are two pulse controlled HV regulation circuits currently in use. They are identified by the type of HV regulator tube employed: 6HS5 or 17KV6. Although operation of these tubes differ, the principal of achieving HV regulation is the same. The 6HS5 is a compactron beam triode and the 17KV6 is a novar beam power pentode similar to a horizontal output tube.

General Description

Unlike the shunt HV regulation system, the pulse controlled regula-

TROUBLESHOOTING TABLE

<table>
<tr><th rowspan="2">TROUBLE SYMPTOMS</th><th colspan="3">PROBABLE CAUSES</th></tr>
<tr><th>6BK4</th><th>6HS5</th><th>17KV6</th></tr>
<tr><td rowspan="9">Reduced HV, Poor Focus, Short Scan, Blooming, Misconvergence</td><td colspan="3">HV control not properly adjusted</td></tr>
<tr><td colspan="3">Efficiency coil not properly adjusted</td></tr>
<tr><td colspan="3">Low grid drive to horizontal output</td></tr>
<tr><td colspan="3">Weak or inoperative tube (HV regulator, damper, HV rectifier, horizontal output)</td></tr>
<tr><td colspan="3">Change in resistance value of HV regulator grid circuit</td></tr>
<tr><td colspan="2">Leaky or shorted capacitor from HV regulator G1 to K</td><td></td></tr>
<tr><td></td><td>Decrease in timing pulse amplitude</td><td></td></tr>
<tr><td colspan="2"></td><td>Change in value of control and screen grid resistance (17KV6)</td></tr>
<tr><td colspan="2"></td><td>Leaky or shorted capacitor between G2 and plate (17KV6)</td></tr>
<tr><td>Excessive picture tube and focus voltage</td><td colspan="3">Inoperative HV regulator</td></tr>
<tr><td>Noise streaks in picture</td><td colspan="3">Corona or sputter arcing—poor lead dress. Inoperative tube</td></tr>
<tr><td>Arcing, horizontal deflection circuit</td><td colspan="2"></td><td>Open in plate to grid feedback circuit (17KV6)</td></tr>
</table>

tors act as a variable load on the primary of the horizontal flyback transformer. As shown in the simplified functional diagram of Figure 3, the pulse controlled HV regulator acts as an automatically variable resistor shunted across a portion of

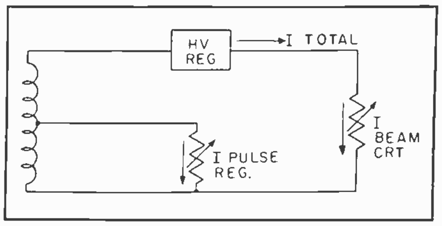

Figure 3—Simplified Functional Diagram—Pulse Controlled HV Regulation System.

the flyback transformer.

The pulse controlled HV regulator is based on the loading and unloading of the horizontal flyback transformer's primary winding . . . and reflects this change to the high voltage tertiary winding. Like the shunt regulator, the grid of the HV regulator is returned to boost. When the picture tube beam current increases due to a brightness increase, the high voltage and flyback pulse voltages of course tend to decrease. When this occurs, the automatic action of the pulse regulator will cause these voltages to increase to their original level. The opposite action takes place when brightness decreases.

Theory of Operation

6HS5 CIRCUIT—The operation of the 6HS5 pulse controlled HV regulation circuit of Figure 4 is controlled primarily by two parameters:

(1) A dc voltage obtained from the boost supply to vary conduction of HV regulator 6HS5, and

(2) Narrow timing pulses of constant width and amplitude, obtained from the horizontal oscillator to permit 6HS5 to conduct *only* during retrace. (During trace, the plate of 6HS5 is at less than B+ potential. With the cathode at B+ and the grid negative with respect to the cathode, the tube is cut off.)

As established previously, high voltage and boost voltage varies inversely with brightness . . . as brightness increases, high voltage and boost voltage will decrease. As with the shunt regulator, the boost voltage changes are used to control conduction of the HV regulator to achieve high voltage regulation. As shown in the simplified circuit of Figure 4, the timing pulses obtained from the horizontal oscillator, and the dc voltage obtained from boost, are applied to the grid of 6HS5. Conduction of this HV regulator tube during retrace is controlled by the amount the boost voltage exceeds the tube's preset bias level. Its cathode is at B+ potential and its plate, at this time, is at the same potential as the damper cathode.

As brightness decreases, the picture tube beam current of course decreases, and both the high voltage and boost voltage will tend to increase. This action is reversed since the boost voltage increase is reflected to the grid of 6HS5, causing it to go into conduction during retrace. As the 6HS5 conducts, the pulse voltage in the flyback transformer primary is lowered. This decrease is reflected to its tertiary winding, causing the high voltage to decrease to its original level.

Conversely, as brightness increases, high voltage and boost voltage will tend to decrease. Conduction of 6HS5 during retrace will decrease, increasing the pulse voltage in the flyback primary, which in turn is reflected to its tertiary, raising high voltage to normal. The picture tube loads the flyback tertiary directly and the pulse regulator loads the primary. Since the pulse voltage input to the HV rectifier is held relatively constant by the pulse regulator during retrace, the picture tube anode potential is also held relatively constant.

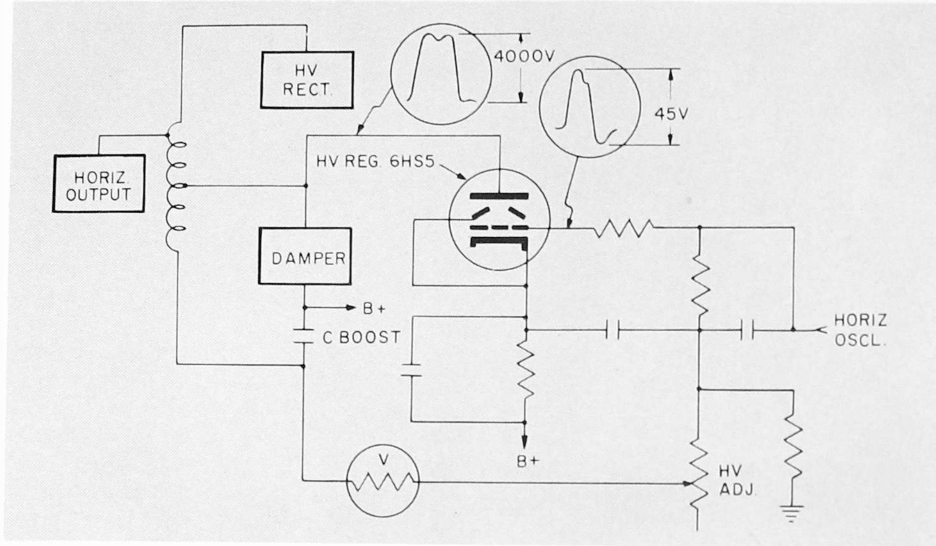

Figure 4—Simplified 6HS5 Pulse Controlled HV Regulation Circuit.

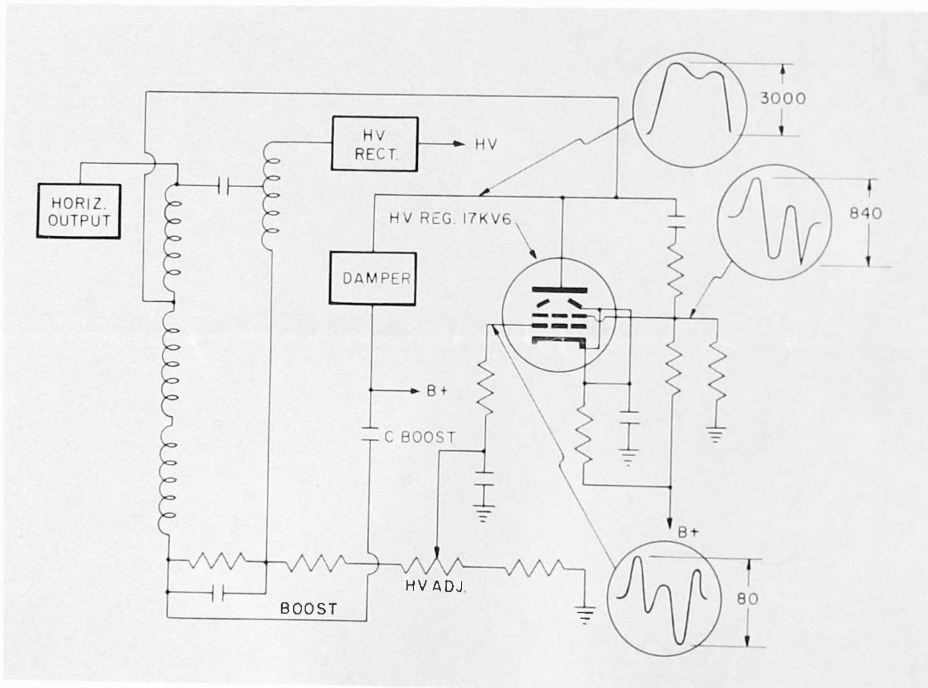

Figure 5—Simplified 17KV6 Pulse Controlled HV Regulation Circuit.

17KV6 CIRCUIT—As stated previously, HV regulation with the 17KV6 circuit is achieved in basically the same way as with the 6HS5 circuit. The significant difference is in the operation of the 17KV6 HV regulator and the additional circuitry required.

With the 17KV6 circuit, the timing pulse is obtained from the flyback transformer Figure 5, instead of the horizontal oscillator. It is applied to the screen grid and not the control grid. As with the 6HS5 circuit, the boost voltage is the primary regulation control factor and is applied to the control grid.

Set-Up Procedures

Set-up procedures for both the 6HS5 and 17KV6 pulse controlled HV regulation circuits are essentially the same as for the 6BK4 shunt system. However, when the picture is extinguished, there is no load on the system. This is because the HV regulator shunts the flyback transformer and not the high voltage power supply.

Troubleshooting

As with the 6BK4 shunt regulation system, a defective HV regulator (6HS5 or 17KV6) can cause high voltage, width, blooming and convergence problems. The same troubleshooting precautions are applicable. Also, if the horizontal deflection circuit has been defective, both vertical scan and the horizontal output should be checked. Further make sure the efficiency coil is properly adjusted. Common trouble symptoms and probable causes are given in the Troubleshooting Table.

CONCLUSION

HV regulation is essential for optimum color television operation. Of the three systems currently in use, we have discussed two: shunt and pulse controlled. The third, electronic bias feedback, will be the topic of Part II.

The shunt system acts as a variable load on the high voltage power supply to achieve HV regulation; the pulse controlled types act as a variable load on the flyback transformer. Set-up and troubleshooting procedures are essentially the same (exceptions are noted). Common trouble symptoms usually include loss of raster, narrow raster, blooming, poor focus or misconvergence.

With the shunt system, good HV regulation can be expected up to a beam current of 1400 μa. At this beam current, there is only an 800 volt change in high voltage. With the pulse controlled systems, relatively good regulation can be expected up to 1000 μa of beam current. A high voltage change of 1100 volts at this range is reasonable.

With all of the HV regulation systems used in color TV, the scan remains relatively constant until the beam current exceeds the system's limits. When this happens, blooming and defocusing of the raster occurs.

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SYLVANIA NEWS
DECEMBER, 1967

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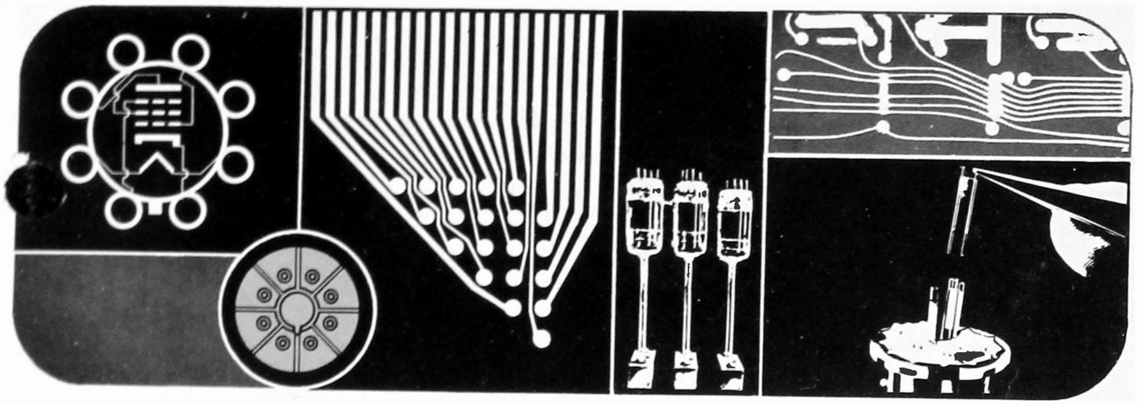

SYLVANIA NEWS

Technical Section

September, 1967 □ VOL. 34, NO. 3

RONALD L. CARR, TECHNICAL EDITOR . . . This information in Sylvania News is furnished without assuming any obligation.

TRANSISTOR TV . . . . TS & R TROUBLE-SHOOTING and REPAIR

by W. J. Sember

Transistor TV Sales Continue to Rise . . . Most major TV manufacturers are now marketing small screen, portable transistorized sets . . . where the transistor's small size and low power drain offer definite advantages. Also, transistors are being used in selected circuits of many larger sets.

Teenagers may discard a defective $10 transistor radio which has become defective, it's unlikely their parents will do likewise with a $100 TV receiver . . . Therefore, the TV Technician must adequately prepare for effective and efficient Transistor Television TS & R (troubleshooting and repair) if he is to obtain a fair share of this rapidly expanding market.

In Issue 1, Vol. 34 of SYLVANIA NEWS, we listed certain general "DO'S and DON'TS" to follow in effective Transistor TV troubleshooting. The service techniques in this article are intended to supplement those general recommendations.

FAILURE MECHANISM

How many times have you heard the statement: "transistors don't fail"? Sure, this may be true if failure is defined as a gradual decay or loss of characteristics similar to that encountered in a tube . . . where the cathode gradually loses emission over a long period of life. However, being practical, catastrophic failures ("open" or "shorted" devices) do occur. Possible causes are apparent by examination of the transistor unit's basic construction (Figure 1).

The active part of the transistor unit is a small slice of silicon or germanium 5 or 10 thousandths of an inch on a side and several thousandths of an inch thick. This active element is connected to the lead-out posts with fine wires which are only a few ten-thousandths of an inch in diameter. Breaks in these wires or open welds are, of course, possible causes of "open" devices. "Shorted" devices can result from overheating or applying excessive voltages to the active element causing the junctions to short.

Another possible failure mechanism is leakage in a coupling capacitor causing a change in bias voltage to the transistor stage. The bias voltage ranges over which transistors can operate are very narrow. A very small amount of capacitor leakage can produce a bias change large enough to render the transistor stage inoperative.

SMALL SIGNAL DEVICES

A review of transistor biasing methods will help to better understand the operation of transistors in small signal amplifiers (Class A).

Figure 2 shows the two main methods used to select the operating points of small signal amplifiers: the voltage divider (2A) and the constant current bias (2B). Remember, the transistor requires current in the base to cause it to operate, and these biasing methods provide the dc current to the base to "turn-on" the transistor. The batteries or supply voltages are shown in dotted line form, either in the emitter or collector circuit. The polarities shown are correct for the NPN devices (collector arrow pointing outward). If PNP devices are used (collector arrow pointing inward) the battery polarities would be reversed. The arrow in the transistor symbol follows the positive or conventional direction of current flow.

The voltage divider biasing arrangement (2A) provides the base with sufficient current to "turn-on" the transistor through the proper

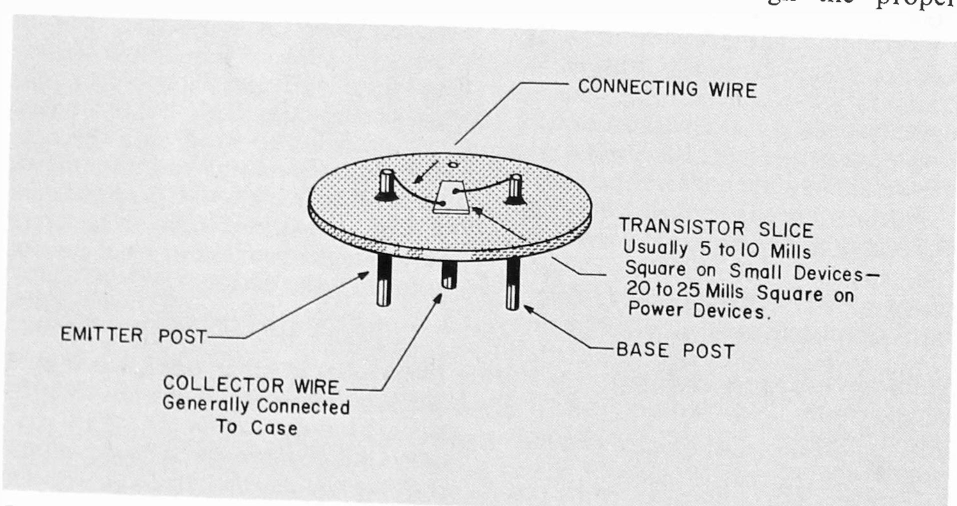

Figure 1—Internal Transistor Construction.

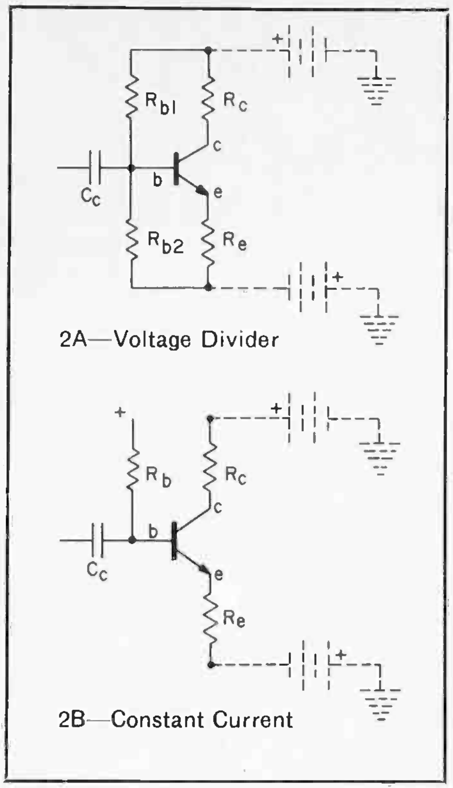

Figure 2—Transistor Biasing Methods —Small Signal.

selection of the ratio of Rbl and Rb2. Re is not a part of the biasing arrangement. This resistor (generally of low value) is used for circuit stabilization or protection against thermal runaway.

Silicon transistors require from 0.4 to 0.8 volts between base and emitter to "turn-on", while germanium types require only 0.2 to 0.4 volts. A 20 K ohms-per-volt meter connected directly between base and emitter is the best way to check transistor bias.

The constant current biasing arrangement (2B) is generally provided by a large-valued resistor from a high voltage supply, although sometimes the collector supply is used. This resistor is high enough in value to limit the base current to a safe level to provide reliable operation. The voltage drop across this resistor determines, of course, the base current operating point. As with the voltage divider arrangement, Re is not a part of the biasing network.

All small signal transistor amplifiers have these two basic biasing arrangements . . . so with this in mind, we can analyze their possible defects in a complete set.

Defective Stage Isolation — A small, hand held, battery operated signal injector provides a very convenient method of isolating the defective stage. These units generally provide a square wave of approximately 1000 Hz. This signal is rich in harmonics, extending into the lower TV channels. The signal can be seen on the screen even when it is impressed on the antenna terminals, and is audible through the entire sound system. Therefore, this injector unit is ideal for isolating which stage in the sound, IF or tuner is not functioning properly.

Stage Defect Isolation—Once the defective stage is found, the transistor in the circuit can be tested . . . but remember, the *Collector Voltage Should Never be Shorted Directly to the Base* . . . If the collector voltage is "on", even a momentary short between collector and base may destroy the transistor.

A voltmeter is all that is needed to check whether a transistor is operating properly. A 20 K ohms-per-volt meter will work very well. Refer to Figure 2A and consider the voltage drop across Rc as part of the metering circuit. If the voltage at the collector is below the supply voltage, the transistor is drawing current; therefore, we know the device is capable of being turned-on. However, the device may be shorted and still allow current to flow yet prevent the stage from operating properly. To check this possibility, keep the voltmeter connected to the collector and temporarily short the base and emitter wires. This should cancel the bias and "turn-off" the device. If the device is not shorted, the collector voltage will rise to near the supply voltage level.

Now, considering the possibility of the collector voltage being near the supply voltage when it is measured . . . either the transistor is intended to operate at this level or it may be "open", allowing no current to flow and causing the stage to malfunction. To check the "open" possibility, leave the voltmeter connected to the collector and temporarily short Rbl with a resistor near in value to Rb2. This should "turn-on" the device, and the collector voltage should fall. This "open" check method will also work with the constant current bias arrangement, except that Rb should be paralleled with a high-valued resistor to cause only a slight increase in base current to turn on the device.

CAUTION

When turning off a transistor with a base-emitter short in the above manner, first make certain the supply voltage is not high enough to cause voltage breakdown of the collector-emitter junctions . . . especially if Rc is a transformer primary. Generally the supply voltage will be low enough, and if a large resistor is used in the collector circuit, the device will not be damaged.

Once it has been determined whether a transistor is capable of being turned "on" and "off", it becomes a simple manner to determine what other elements in the stage may be defective. If the transistor is capable of proper operation, then a leaky coupling capacitor or changes in bias network resistor values are generally traced as causes of a stage malfunction.

AGC CONTROLLED CIRCUITS

Most of the transistor AGC-controlled circuits use a method of control directly opposite to that used with tubes. A review of these methods will help you in transistor TS & R.

Figure 3 shows the gain vs bias curves for both a transistorized and tube stage. The transistor circuit is generally operated in the forward AGC mode; i.e., the higher the collector current, the lower the gain . . . the tube circuit operates with reverse AGC; i.e., the lower the plate current, the lower the gain. Therefore, it should not be surprising to find an AGC controlled transistor in a set on a strong signal which is operating at a relatively high level of collector current, while if the signal is removed, the collector current decreases.

SCAN SECTIONS

The transistors in the scan sections of TV receivers are generally operated

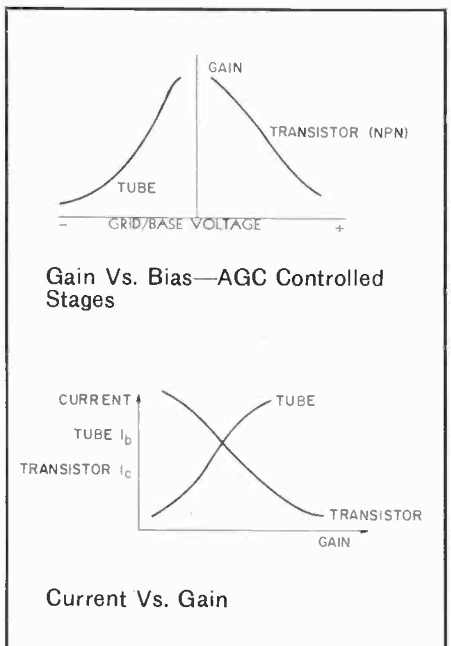

Figure 3—Gain Curves.

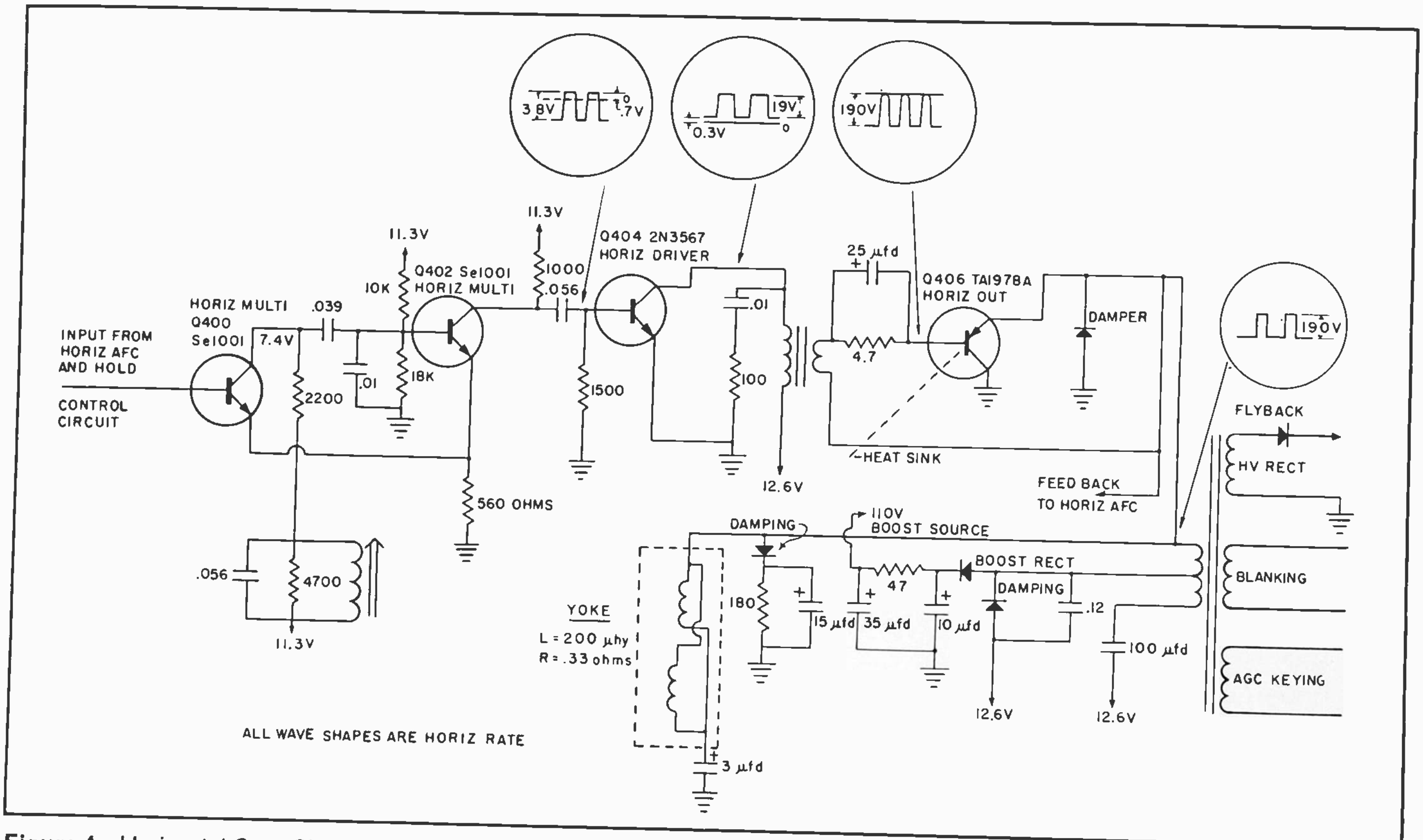

Figure 4—Horizontal Scan Circuit—Sylvania A02 Chassis.

Class C; i. e., pulses of current are used to turn-on and turn-off the devices for only parts of the cycle.

Signal tracing is generally possible in the scan circuits only with an oscilloscope, although quite often a visual inspection will locate the trouble. A typical horizontal scan circuit is shown in Figure 4. Extensive variation from the waveforms shown indicates that the circuit is malfunctioning. Note that the emitter and base waveforms on Q406 are practically identical. The horizontal output transistor is acting as an impedance transformer and is driving the yoke directly, without any impedance change in the flyback. The other windings on the flyback are used to provide horizontal rate pulses for other set functions. It should also be noted that Q402 is operated Class A with the 10 K and 18 K ohms resistors in the base circuit providing bias. Both the driver and output stages are operated Class C, with the driving voltage providing the bias.

CONCLUSION

The servicing of small screen transistor sets should not present any particular problems as long as a cautious, well planned approach is followed. It is not easy to remove a transistor from its soldered-in position, so first make certain the stage is malfunctioning and isolate the defect before using a soldering iron.

VENETION BLIND EFFECT

If an RCA KCS 159F TV has severe venetion blind effect that appears to indicate TVI or AGC trouble, turn the brightness down gradually . . . and, if the TVI effect decreases, check the 1 K ohm resistor from the anode of the picture tube to the filament of 1G3. It most likely will be charred and should be replaced.

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INTERMITTENTS

Isolating a defective tube, as every experienced service technician knows, can be a real problem if the trouble is intermittent.

For example, RCA Ch. KCS88BX and its variations, which use a 150 volt line to obtain bias and screen voltages in certain circuits, may develop intermittent trouble. . . One of these sets which passed through my shop had a history of frequent failure of the 6AS5 sound output with a simultaneous loss of the picture. A voltage divider and bleeder resistor in the 150 volt line had also been replaced.

When I serviced the unit there was no sound or picture . . . and, after a few moments with power on, the plate of 6AS5 became red hot. Suspected tubes were checked by substitution. When this didn't clear up the trouble, I removed the chassis.

A resistance check showed a low reading from an AC filter in the 150 volt line . . . where approximately 15,000 ohms would be normal. This pointed to a clear cut case of a shorted AC filter. However, the filters and all other sub-chassis components checked out satisfactorily.

The faulty component, not immediately suspected, was the 12AU7 (AGC and video output). The cathode of the AGC half was shorted to the heater . . . one side of which was grounded. This was the cause of the apparently defective power supply and the red hot sound output. The 6AS5 with a maximum plate voltage of 150 and a screen voltage of 117 was probably being operated at twice these ratings as a result of the virtual removal of the positive voltage from its cathode. The intermittent cathode short in the 12AU7 may of course have accounted for the previous sound output and resistor failures.

William Rittenour
Rittenour's Radio and Television Service
Huntington, W. Va.

HAT PIN ? ?

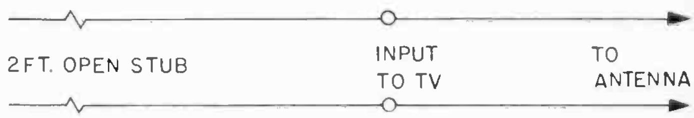
A long ladies hat pin with a bead on the end can be a useful tool around the shop. When removing and replacing components on a printed circuit board, I find it very handy for clearing the hole . . . Simply hold the pin by the beaded end and push it in and out while the solder is cooling. It leaves a nice clean hole . . . then insert the component, bend over the leads and resolder.

Skip Handy
Skip Handy TV
Medfield, Massachusetts

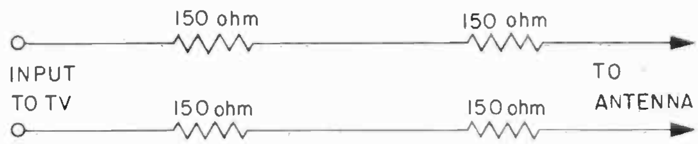
FM STATION INTERFERENCE

An FM station in our area on 90 MHz has been hashing up color pictures. We solved the problem using either of two methods.

(1) Using a piece of twin lead.



(2) Building four 150 ohm, ½ W carbon or non-inductive resistors in the line.



Both worked fine.

J. E. Buck
B and T Electronic Service
Glen Ellyn, Illinois

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SYLVANIA NEWS
SEPTEMBER, 1967

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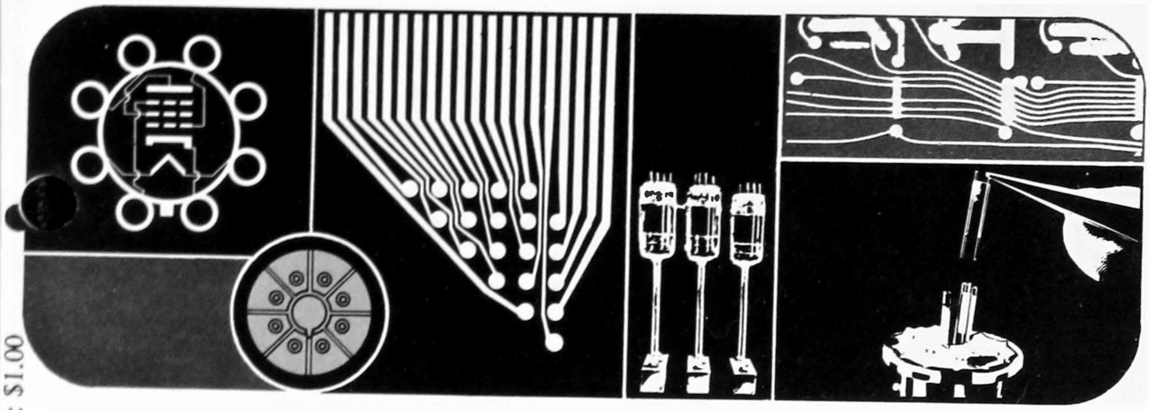
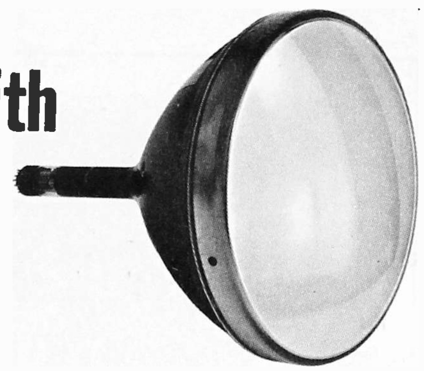


SYLVANIA NEWS
Technical Section
May, 1967 □ VOL. 34, NO. 2
R. A. HUMPHREYS, TECHNICAL EDITOR This information in Sylvania News is furnished without assuming any obligations.

Simplify Color Receiver Servicing With Sylvania 21-Inch Color Test Tube



In the Summer 1966, Vol. 33, No. 2 issue of Sylvania News, the feature article of the Technical Section introduced a new 19-inch 90° color test tube for convenient bench testing. The article provided complete instructions on how the TV technician could easily construct an economical bench housing unit for the test tube. It further explained how the TV technician could speed up the investigation and repair of various color receivers through its use. Mention was also made of the availability through authorized Sylvania Distributors of a 21-inch round color test tube that can be effectively used to troubleshoot and repair 70° color receivers.

Now, in response to many requests from our readers, we have prepared a similar article for our 21-inch 70° round color test tube. As with the 19-inch 90° rectangular tube, with the proper bench setup, the 21-inch 70° round test tube can be used to investigate and correct all problems associated with the receiver chassis.

The test tube eliminates the necessity of bringing the complete set to the shop when troubles have been isolated to the receiver chassis. Bringing in the complete set normally requires two men, considerable effort, plus the risk of damaging the cabinet or the picture tube. Now, one man can remove the receiver chassis for servicing, leaving the picture tube and neck components intact.

The round 21-inch 70° color test tube is electrically equivalent to its 3-gun counterpart used by all major color TV receivers. It is electrically and mechanically sound, having only slight physical screen defects that prevent its use in new sets and as a replacement.

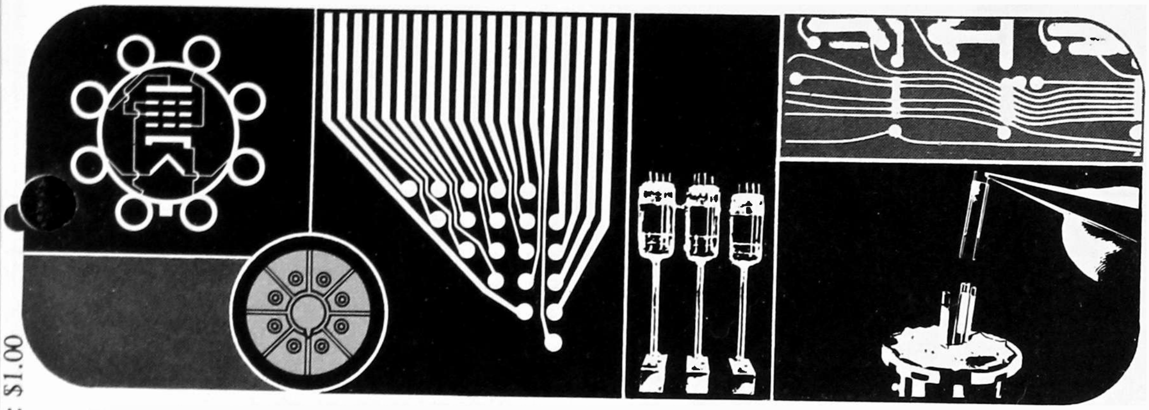
BENCH TEST SETUP

Each technician will have his own ideas on bench setups. One practical approach is to assemble a test unit. The test unit would be comprised of a suitable housing plus a complete set of neck components and appropriate leads. Plans are included in this article for the construction of an inexpensive cabinet should a ready made one not be available.

Let's first consider the electronic accessories for the test unit. The required neck components should include deflection and convergence yokes (complete with static magnets and convergence panel), and purity ring and blue lateral magnets. The components should, of course, be matched and intended for the 21-inch 70° tube. Variations in set designs makes it difficult to call out a specific set of components as being best suited. These differences will give slightly different performance results when the components do not exactly match the chassis being tested.

A broad array of connectors are used between the neck components and the chassis of different makes and models of receivers. This requires an assortment of adapters which also serve the purpose of extension leads from the test unit. The picture tube base extension leads should be the same for all 70° tubes.

When making up adapter leads, the circuits should be examined carefully. For example, yoke winding center taps must be included or eliminated as required by the chassis being tested. Also, the convergence



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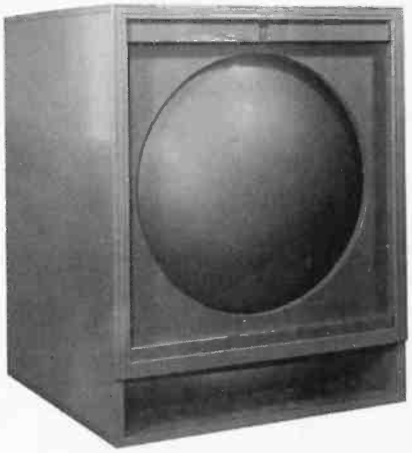
When making up adapter leads, the circuits should be examined carefully. For example, yoke winding center taps must be included or eliminated as required by the chassis being tested. Also, the convergence voltage sources must be traced through the convergence panels. Some receivers have the cathode of the vertical output tube in series with resistors contained in the convergence panel while others are in parallel.

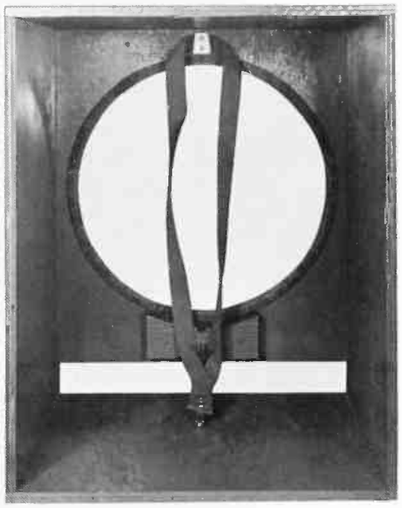
With the test assembly, scan and convergence of test tube picture may differ between various chassis models, but the serviceman can still effectively troubleshoot and make applicable repairs to all receiver circuits. When repairs or adjustments are made to the scan or convergence circuits, final adjustments may have to be made with the receiver installed in the owner's set. This is due to variations in circuits and circuit components between receivers.

The bench setup can also save the technician considerable time in isolating and repairing troubles in scan, or convergence circuits. Since malfunctions in these areas could result from faulty components in either the receiver chassis or the neck components, the entire set would normally be brought to the shop. Before disrupting the neck components, the receiver chassis can be removed and operated with the test assembly to determine where the trouble exists. If the trouble is in the chassis, the neck components would not have to be removed, eliminating the necessity of reconvergence, thus saving considerable time and effort.

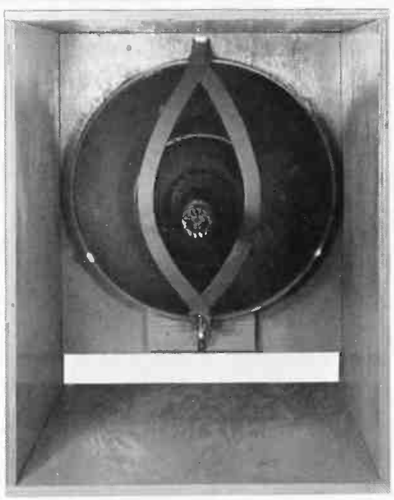
For repairs made on all receiver circuits other than scan or convergence, static convergence of the color test tube should be sufficient to provide satisfactory viewing of the picture. After servicing, the chassis can be reinstalled with confidence of correct performance.



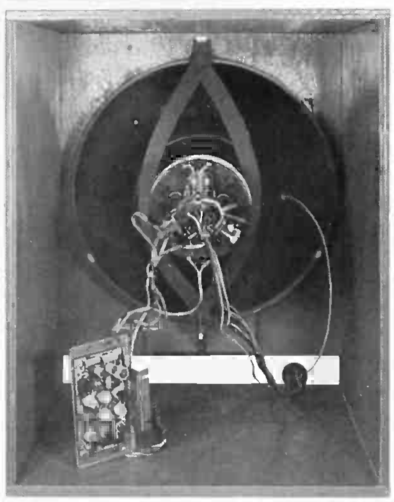
Cabinet—Front View



Cabinet—Rear View



Cabinet With Color Test Tube Installed



Cabinet With Color Test Tube and Neck Components Installed

TEST TUBE HOUSING

The ideal housing for the color test tube would be a discarded cabinet with picture tube mounting brackets that could be used as is or modified to serve the purpose. If not available through set manufacturers or other sources, a number of approaches could be taken to construct a suitable substitute. A typical construction is shown in the accompanying illustrations.

The materials chosen for the enclosure are readily available from the local building supplier and hardware. As with the 19-inch 90° test tube, excluding the cost of the protective glass, a functional housing for the round 21-inch 70° test tube can be built for under $10. Note that ⅝″ plywood is used for the base also sides and top to provide ample strength to withstand the strain of tightening the picture tube mounting straps (½″ plywood is marginal). The mounting supports (2″ x 2″) serve the double purpose of reenforcing the cabinet and providing a mount for the safety glass.

The cabinet design can, of course, be modified to suit individual needs. For example, the safety glass used was a ¼″ plexiglass; however, to keep cost to a minimum, discarded auto safety glass can be used.

Care should be taken in mounting the test tube. Make sure the mounted metal parts and screws do not contact the fragile glass picture tube. This could result in scratches or strains that could cause subsequent tube implosion. Note in the construction that the mounting screws are positioned with their protruding ends away from the tube. The construction uses a minimum of metal parts. All contacts between glass and mounting parts are cushioned with felt padding or weather stripping to minimize glass strain. This padding is held in place with a rubberized glue. The top surface of the padding is also coated with the glue, which upon drying, provides a slip free surface.

A ground wire or spring must connect the outside aquadag coating of the test tube to the receiver chassis being tested. Absence of this ground would cause arcing and be a shock hazard. It is advisable also to ground the neck components. The same ground lead can be used.

The convergence panel as shown in the photo may be more conveniently located within the color test tube cabinet. For example, an access hole can be made on the side of the cabinet to facilitate convergence adjustments.

The test unit layout shown provides an access hole in the front of the cabinet beneath the safety glass for the extension leads. This enables

SYLVANIA NEWS

Dealer Section

May, 1967 □ VOL. 34, NO. 2

D. JAMES McCUE, EDITOR—Published for the professional Radio-TV Service Dealer.

Sylvania tunes in color.

Sylvania engineer puts a color TV tube through rigorous testing, shown here testing shielding equipment inside a magnetic field simulator.

Today the key word in television production is color. And when people talk color they talk Sylvania because Sylvania has become synonymous with color TV. A pioneer in color, Sylvania developed europium red phosphor for greater picture brightness, clarity and stable, natural color. Now these same amazing, never-shift europium reds, greens and blues come alive in the rectangular tubes, producing truly realistic, rainbow hues that are the hallmark of *color bright 85®*. With color tube parts supplied by our own Parts Division plants and chemicals furnished by our Chemical and Metallurgical Division, Sylvania quality is guaranteed.

Sylvania's "secret" is the unique screening process which dusts phosphors onto the screen instead of flowing them on in the usual industry manner. This innovation enhances brightness and contrasts, contributing greatly to the overall quality of the tube performance. The heart of the *color bright 85®* tube is its electron gun assembly, three guns in one. These guns are assembled in air-conditioned dust free areas to assure optimum performance.

All *color bright 85®* tubes are subjected to complete tests for mechanical, electrical and screen characteristics before leaving the plant.

This special "know how" and dedication is why Sylvania *color bright 85®* tube sales reached record levels in 1966. So much so, that it was necessary to expand the manufacturing operations to supply the demand of eighteen of the country's twenty-three TV set manufacturers. As a result of this expansion, Sylvania's picture tube production is now at least twice the capacity of a year ago. And Sylvania's 1967 color TV tube features a further improved picture tube with increased brightness and greater color fidelity made possible through a unique process that utilizes computer controlled equipment for exact alignment of all major tube components. Manufactured in 19, 21, 22 and 25″ sizes, each *color bright 85®* tube is carefully packaged in an attractive carton for shipment.

Continuing our vigorous program of research and development, Sylvania will remain at the top in the color TV field, bringing major innovations along with continued high standards of quality and craftsmanship.

Color Types

For easy reference, the following compilation lists how often various tube types are used in the leading 1964-1967 *color TV chassis.*

Tube Type	No. of Tubes	Tube Type	No. of Tubes	Tube Type	No. of Tubes	Tube Type	No. of Tubes
1AD2	2	5MB8	3	6CD3	7	6GJ7	27
1AU2	2	6AC10	3	6CE3	7	6GK5	10
1DK27	1	6AD10	1	6CG3	11	6GK6	12
1K3	2	6AF4B	1	6CG8A	15	6GM6	130
1V2	36	6AF9	5	6CJ5	3	6GU7	200
2AF4B	1	6AH5	1	6CL8A	4	6GW8	2
2AV2	44	6AL5	11	6CS6	11	6GX6	2
2BA2	4	6AL11	1	6CW5	5	6GX7	21
2DZ4	1	6AO5A	109	6DK6	5	6GY6	225
2GK5	2	6AQ8	3	6DQ5	1	6HA5	45
2HQ5	1	6AU4GTA	1	6DQ6	6	6HB6	10
3A3A	250	6AU6A	55	6DS4	51	6HB7	40
3AT2	38	6AU8A	3	6DT6A	27	6HE5	19
3AW3	4	6AV6	1	6DW4A,B	268	6HF5	6
3BZ6	2	6AW8A	83	6DX4	1	6HL8	2
3CA3	2	6AY3	2	6DZ4	2	6HM5	6
3DT6	1	6BA6	2	6EA4	1	6HQ5	55
3HQ5	3	6BA11	18	6EA8	39	6HQ7	4
4AU6	1	6BC6	1	6EB8	2	6HS5	9
4BL8	4	6BH11	4	6EH7	56	6HS8	21
4BZ6	2	6BJ8	2	6EJ6	1	6HZ6	103
4CB6	10	6BK4A,B	262	6EJ7	151	6J10	12
4EH7	10	6BL8	46	6EM7	1	6JC6	55
4EJ7	10	6BM8	7	6EW6	187	6JD6	6
4GX5	1	6BN6	5	6EW7	4	6JE6A	74
4HA5	1	6BN8	14	6EZ5	4	6JH6	87
4LJ8	1	6BN11	9	6FG7	9	6JH8	35
5AQ5	1	6BQ5	10	6FM7	1	6JM6	14
5CG8	1	6BS3	2	6FQ7/6CG7	165	6JS6A	41
5GM6	2	6BX6	4	6GB5	2	6JT8	14
5GX7	3	6BZ6	30	6GC5	2	6JU8A	119
5JK6	4	6C4	1	6GF7A	109	6JW8	10
5KZ8	1	6CB6	3	6GH8A	381	6KA8	76
6KD6	7	6X9	9	10LB8	1	12MD8	2
6KE8	4	6Y9	9	10LE8	10	12RLL5	2
6KM6	2	6Y10	4	11BT11	2	12T10	2
6KN6	4	6Z10	3	11FY7	2	15CW5	2
6KT8	56	7GS7	1	11LQ8	10	15DQ8	3
6KZ8	27	7GV7	1	12AV6	10	15HB6	1
6LE8	11	8AC9	1	12AX3	2	15LE8	1
6LF8	20	8AR11	2	12AX7	16	16A8	2
6LJ8	10	8AW8	2	12AZ7	8	19AU4GTA	3
6LM8	20	8BQ11	2	12BF11	2	21LR8	14
6LN8	2	8BU11	2	12BH7	2	30AE3	1
6LT8	1	8FQ7	19	12BV11	2	31JS6A	10
6LU8	25	8JV8	11	12BY7A	86	34CD3	13
6M11	1	9AQ8	3	12GC6	2	34CE3	13
6MD8	5	9KC6	10	12GE5	2	42KN6	3
6ME8	6	9RHR2	2	12GN7	41	50C5	10
6MG8	2	10CW5	1	12HG7	41	5642	7
6RP22	12	10JT8	4	12HL7	3	PL-521	1
6U10	10						

The summer months can be even brighter with Sylvania's "Bright Guys" award program

the bright guys

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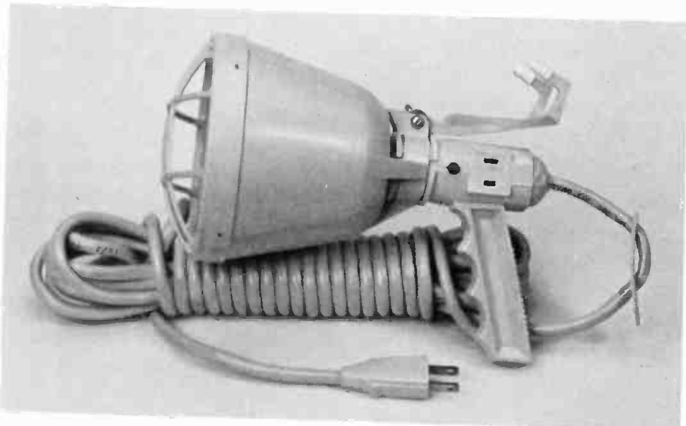

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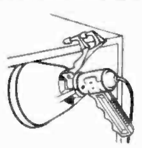
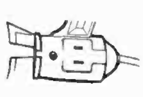
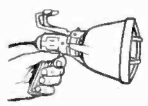
NEW SYLVANIA TV SERVICE WORK LAMP



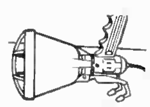
PLASTIC NON-MAR GRIPPERS PERMIT HANGING IN BACK OF TV CABINET



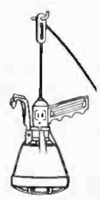
SOCKET TO ALLOW PLUG-IN FOR SOLDERING IRON, LINE CORD, ETC.



HOLD-IN-HAND PISTOL GRIP



USE AS A WORKBENCH SPOTLIGHT



USE AS A DROP LIGHT

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And the living is easier . . .
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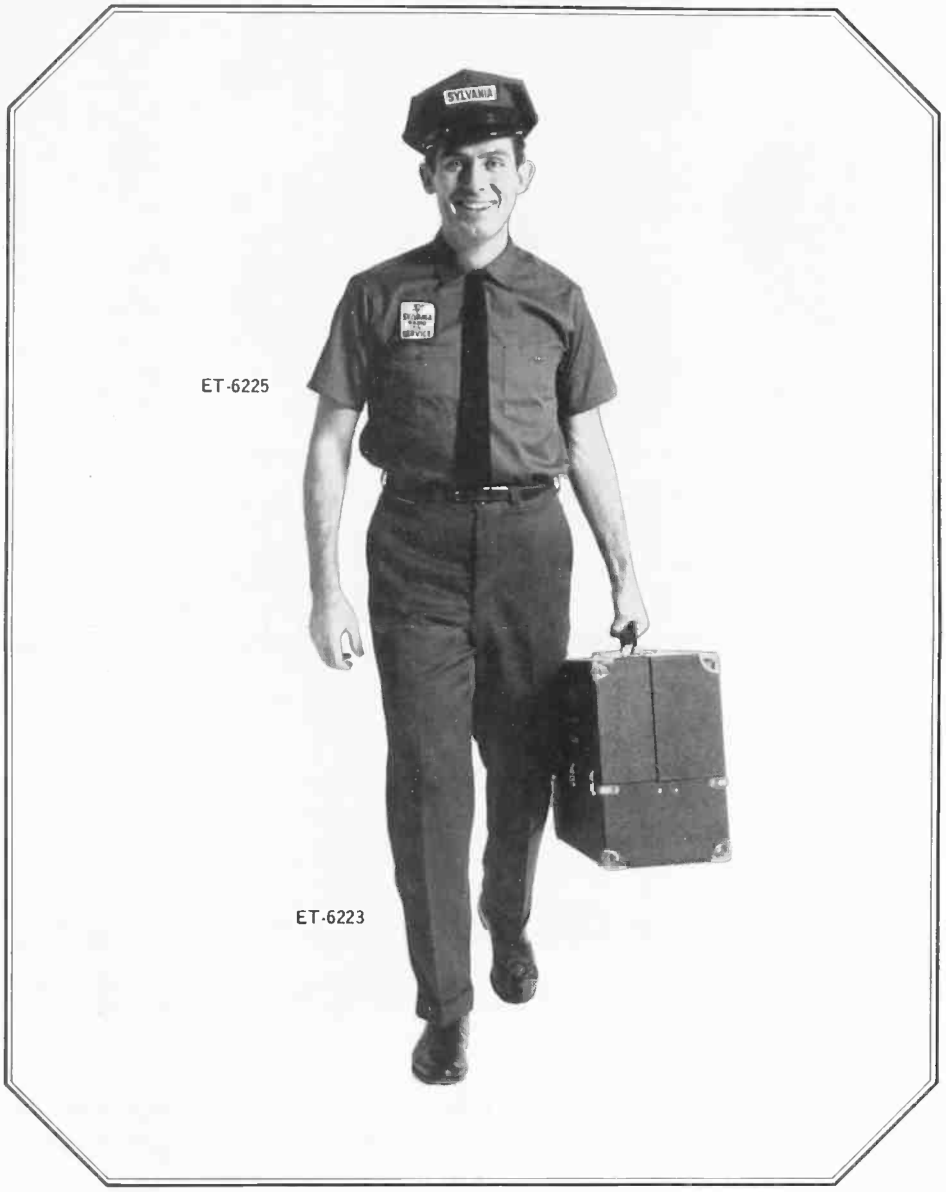

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ET-6225 Green Wash'n Wear short sleeve shirt—**$3.75**

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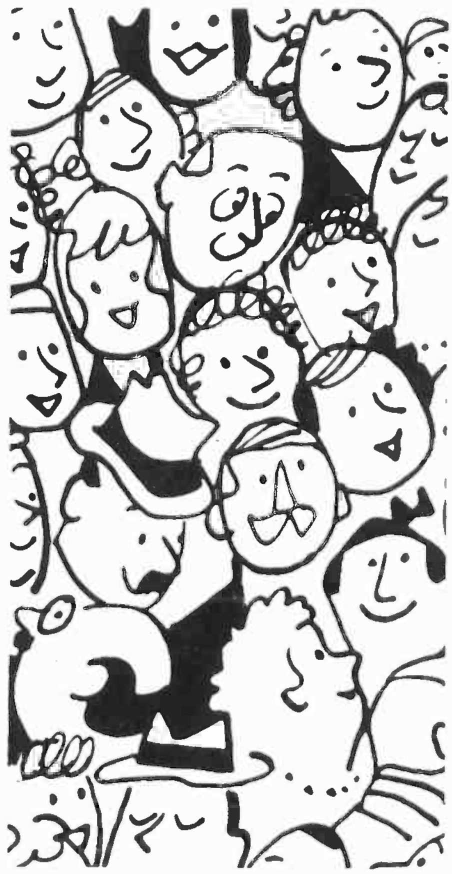
Order through your Sylvania distributor or write to Sylvania Electric Products, Inc., CADD, 1100 Main Street, Buffalo, New York 14209.

Enclose check or money order.

Dealers' Digest

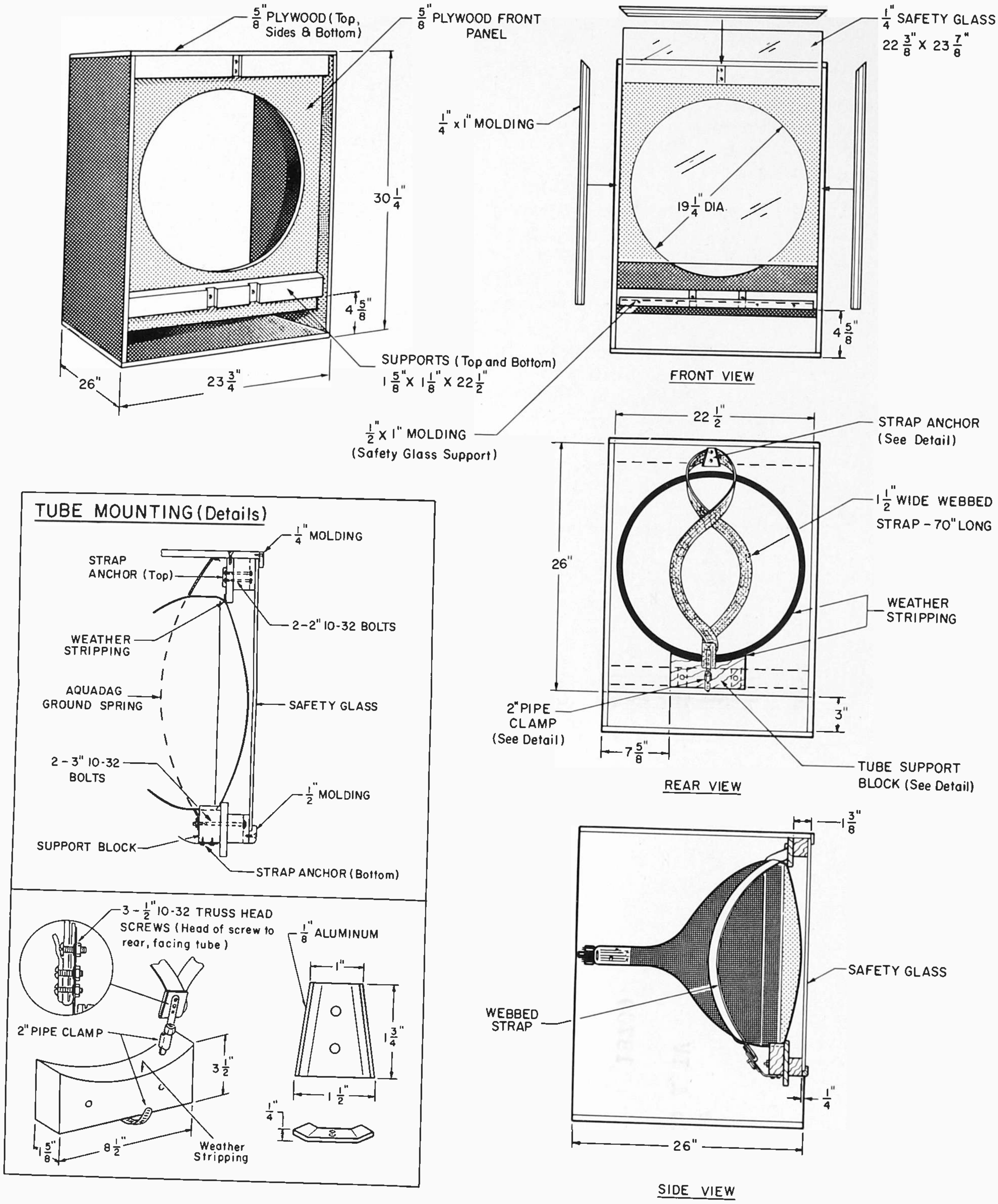


Sylvania will issue a $10.00 credit certificate for items published in Dealers Digest. All TV service dealers are invited to contribute items of general interest to fellow TV servicemen for publication in this column. Your certificate can be redeemed through your Sylvania distributor.

So send your items now! Areas of interest include innovations, service techniques that are useful, displays that you think are unusual, etc. It is suggested that articles be restricted to non-technical areas only.

We're sorry but unused items cannot be returned or acknowledged. Send to Editor, Sylvania News, 730 Third Avenue, New York, New York 10017.

TYPICAL CABINET CONSTRUCTION FOR 21″ COLOR TEST TUBE



PARTS LIST

5/8″ Plywood—2—23¾″ x 26″ (Top and Base)
2—26″ x 29″ (Sides)
1—26″ x 22½″ (Front Panel)
4 feet of 2″ x 2″ Wood
8½″ of 2″ x 4″ Wood
7 feet of ¼″ x 1″ Molding
2 feet of ½″ x 1″ Picture Frame Molding (Safety Glass Support)

70″ of 1½″ Wide Webbed Strapping
1—2″ Pipeclamp with Tightening Screw
7 feet of ¾″ Weather Stripping
1—⅛″ Aluminum 1¾″ sq. (Top Strap Anchor)

2—RH 10-32 Bolts 2″ long
2—RH 10-32 Bolts 3″ long

40—FH Wood Screws 1¼″ x 8″ (Cabinet)
2—RH Wood Screws 1″ x 12″ (Pipe Clamp to Mounting Block)
3—Truss Head 10-32 Screws ½″ long (Pipe Clamp to Webbed Strap)

4—⅝″ Flat Washers

22⅜″ x 23⅞″ Safety Glass, Plexi-Glass or Plate Glass ¼″ thick
1 Aquadag Grounding Spring

the technician to face the picture tube while making necessary repairs and adjustments.

It must be pointed out that the lead dressing of the picture tube socket extension will have an effect on video frequency response. Therefore, grid and cathode leads must be spaced well away from all other leads. A long yoke extension lead will cause lower anode voltage to the picture tube and increased scan because of added capacitances.

The color test tube should be adjusted for purity, convergence, and pincushioning as described in the alignment procedure for the receiver model whose neck components are employed.

CONCLUSION

Sylvania's decision to supply the 21-inch 70° round color test tube in addition to the 19-inch 90° rectangular is based on the growing need of technician for convenient 70° and 90° test jigs. The color test tubes will save him considerable troubleshooting and repair time.

In addition, Sylvania Distributors also have available 21-Inch Color Bright 85® and Color Screen 85 color tubes which may be used in 70° test jigs.

"SERVICE HINTS"

Readers—What's New? Have you solved any troublesome service problems lately? If so, won't you share it with others. Send it to us for publication consideration.

For each "SERVICE HINT" accepted, you receive $10.

Service Hints resulting from your personal experience are invaluable to other technicians. Sylvania, in response to many requests will resume its "Service Hints" column.

Perhaps you aren't quite sure what comprises a Service Hint. It should be nothing more than a simple method or device used to solve irritating or time-consuming service problems. It could be that you have obtained a simple, but unique, method for servicing a remote section of a chassis without removing it from the cabinet; maybe you have solved an electrical problem peculiar to a particular chassis—such as a remote component being responsible for the difficulty encountered in the section being serviced.

Any Service Hint YOU feel will be of value to others should be mailed to Sylvania Electric Products Inc., Technical Publications, Emporium, Pa. 15834.

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SYLVANIA ELECTRIC PRODUCTS INC.
1100 MAIN ST.
BUFFALO, N.Y.
SYLVANIA NEWS
MAY, 1967

Printed in U.S.A.